Research Article

Association Between Mindfulness, Impulsivity, and Neuropsychological Measures in a Non-Clinical Population: A Correlational Study

Karen Messas Cicuto[1], Ana Regina Noto[2], Marcelo Demarzo[1]

1. Mente Aberta – The Brazilian Center for Mindfulness and Health Promotion, Universidade Federal de São Paulo (UNIFESP), Brazil; 2. Department of Psychobiology, Universidade Federal de São Paulo (UNIFESP), Brazil

Impulsivity is a significant issue associated with many risky behaviors and mental disorders. Mindfulness-based interventions (MBI) and the improvement of mindfulness levels are becoming possibilities for prevention and complementary treatment. The present study is an exploratory cross-sectional and analytical study that evaluated the correlations among levels of mindfulness, self-compassion, psychological well-being, impulsivity, and neuropsychological measures in 84 healthy college students. Strong significant negative correlations were found between levels of impulsivity and mindfulness, suggesting that those who have higher levels of mindfulness tend to be less impulsive. Weak significant correlations among neuropsychological measures and the levels of mindfulness and impulsivity, especially among attention, working memory, and inhibitory control, were also found. The present study found important correlations among the constructs of impulsiveness and mindfulness, suggesting that a higher mindfulness level may be a protective factor against impulsive behaviors. Further studies concerning neuropsychological measures, impulsiveness, and mindfulness are suggested.

Corresponding author: Marcelo Demarzo, demarzo@unifesp.br

1. Introduction

Impulsivity is an important symptom of several psychiatric disorders, including pathological gambling[1] binge eating[2], borderline personality disorder, attention-deficit hyperactivity disorder, anti-

social disorder[3], and alcohol and drug misuse[4][5][6]. The trait of impulsivity is predictive of several alcohol-related risks and motoring outcomes such as driving errors, violations, and traffic collisions among college students[7][8].

One of the most popular definitions of impulsivity is "a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individuals or to others"[9]. [10] suggested a three-factor model: factor I – attentional impulsiveness (characterized by a difficulty in focusing on a task and quick decision-making); factor II – motor impulsiveness (characterized by low impulse inhibition and acting on the spur of the moment); and factor III – non-planning impulsiveness (characterized by behaviors directed to the moment without careful thought of the consequences and little planning or thinking before acting).

It is known that there are correlations between the operating of neuropsychological functions, especially executive functions (EFs), and impulsivity. In a study by Fino et al.[11], EFs were predicted by impulsivity and inhibitory control in adolescents in a structural equation model. [12], in their neuroimaging study, found that impulsivity and inhibition control are regulated in the same brain area, the prefrontal cortex, and Ochoa et al.,[1], noted the association between decision-making in pathological gambling, impulsivity, and EFs. Studying the relations between the sub-traits of the Barratt Impulsiveness Scale-11 (BIS-11)[10] and executive processes, KAM and colleagues[13] suggest that different sub-traits of impulsivity relate to different executive processes. In Keilp et al.[14] study, there was evidence of correlations among impulsivity ratings and EF measures and fluency, although the correlations were strongest for performance in a specialized impulsiveness task. Correlations were also seen among EFs and impulsivity in women who binge eat[2].

Interventions to cope with impulsivity are associated with its biological, social, and psychological etiologies. Among many diverse treatments, mindfulness-based interventions (MBI) are being seen as a possibility to treat disorders that involve impulsivity.

Mindfulness is an inherent state of consciousness that involves attention and being aware, and differs from individual to individual[15]. Kabat-Zinn[16] explains that mindfulness consists of the process of observing body and mind, allowing experiences to be as they are, and allowing the self to be in the present moment exactly as it is, without trying to change anything. According to the purposes of this study, the concept of mindfulness will be used as seen by Western psychology, in which mindfulness is a metacognitive skill[17].

There is evidence that mindfulness is correlated with positive psychological effects, including reduced psychological symptoms and emotional reactivity, an increase in subjective well-being, and improved behavioral regulation[18]. Murphy and MacKillop[5] investigated the interrelationships between impulsivity, mindfulness, and alcohol misuse and showed that the associations among mindfulness and alcohol consumption were entirely a function of impulsivity. Christopher et al.,[4] presented similar results referring to these same variables and suggested that having a disposition toward mindfulness may be a protective factor. Peters et al.[19] presented evidence suggesting that mindfulness skills could relate to the capacity to avoid maladaptive impulsive behaviors and that specific mindfulness skills could be helpful in addressing some specific types of impulsive behaviors, or even in preventing some types of impulsive behaviors.

The aim of this study was to evaluate the correlations between levels of mindfulness, impulsivity, and cognitive measures in healthy college students. Based on the literature presented, the hypotheses were that a strong negative relation between mindfulness and impulsiveness would be found, and a positive association between mindfulness and well-being, and also, correlations concerning levels of mindfulness and neuropsychological measures.

2. Materials and methods

The present study was an exploratory cross-sectional and analytical study that evaluated the correlations among levels of mindfulness, self-compassion, psychological well-being, impulsivity, and neuropsychological measures in 84 healthy university students. This was a purposive sample from the baseline of a randomized controlled trial.

2.1. Participants

A total of 84 participants (85.7% female, 14.3% male), ranging in age from 19 to 44 years (M = 28.01; SD = 6.953) voluntarily applied for the research through e-mail. The research was publicized online on social networks and by flyers in the university. A triage using the Goldberg Health Questionnaire (GHQ-12) [20] was conducted to guarantee healthy individuals. Institutional ethics approval was obtained, and participants provided informed consent. The inclusion criteria were being from 18 to 45 years old, having Brazilian Portuguese as the mother language, being a university student (of any course), not having any psychiatric or organic pathology, and not being a neurological or neuropsychological patient. The exclusion criteria were the GHQ-12 results and having experience with neuropsychological tests.

2.2. Measures

Self-report questionnaires were used to assess the levels of impulsivity, mindfulness, self-compassion, and psychological well-being (symptoms of depression and anxiety). Neuropsychological tests were used to assess attention, executive function (inhibitory control), and working memory functioning.

The questionnaires used in the study were the following:

- *Mindful Attention Awareness Scale (MAAS)*[21]: developed by [15], which assesses levels of mindfulness through a 15-item questionnaire on a Likert scale. The Cronbach alpha was 0.83 for the Brazilian scale adaptation.
- *Barratt Impulsiveness Scale (BIS-11)*[22]: evaluates the levels of impulsiveness according to Barratt's impulsivity theory[23], dividing it into three subtypes of impulsiveness (attention, motor, and non-planning).
- *Beck Depression Inventory (BDI)*[24]: was used to investigate possible symptoms of depression. Its Cronbach alpha was 0.82.
- *Beck Anxiety Inventory (BAI)*[24]: was used to evaluate possible anxiety symptoms, with the Cronbach alpha for a university student sample being 0.87.
- *Self-Compassion Scale (SCS)*[25]: was developed by [26] and investigates the levels of self-compassion, an aspect of mindfulness. It divides the self-compassion construct into six subtypes: self-kindness (characterized by being gentle toward one's self and comprehensive); self-judgment (not being excessively critical and judgmental toward one's self); common humanity (to see one's personal experience as something shared with other human beings); isolation (to not see one's separation, isolation, or difference from other human beings); mindfulness (to relate to feelings or thoughts with awareness); and over-identification (to not identify one's self with feelings or thoughts). The Cronbach alpha of the Brazilian version was 0.92.

The neuropsychological tests used in the study were:

- *Digits* subtest from the *Wechsler Intelligence Scale for Adults (WAIS-III)*[27]: evaluates attention and working memory.
- *STROOP Test*[28]: evaluates the EFs, specifically attention and inhibitory control.
- *Rey Auditory Verbal Learning Test (RAVLT)* [29]: evaluates memory and learning.

- *Attention Psychological Evaluation Battery (BPA)*[30]: is an instrument that evaluates attention by dividing it into three types: concentrated attention (or sustained attention); alternated attention (ability to switch attention between stimuli); and divided attention (ability to pay attention to two or more stimuli at the same time).
- *Trail Making Test (TMT)*[31]: evaluates attention and executive function.
- *Five Digits Test (FDT)*[32]: evaluates EFs (inhibitory control, cognitive flexibility, and processing speed).

2.3. Procedures

All participants completed a demographic survey and the self-reported measures online a maximum of one week before the neuropsychological testing. All the neuropsychological evaluations were conducted in a silent room with only the participant and the evaluator present. All participants received a report with their results at the end of the research.

3. Results

The sample was composed of 59.5% from college and 40.5% from post-graduation courses (16.7% specialization, 11.9% master, 7.1% PhD, 4.8% post-PhD).

3.1. Data Analysis

The results were analyzed using IBM SPSS software. This involved descriptive analysis of the demographic data. The relationships among the variables of interest were assessed by Spearman correlations. A linear regression model was used to explain the mindfulness variable.

3.1.1. Associations between the self-reported measures: mindfulness, self-compassion, impulsiveness, anxiety, and depression

Table 1 presents descriptive statistics for the BIS-11, MAAS, SCS, BAI, and BDI. The correlations of all these variables with the MAAS and BIS-11 scores are also shown.

Self-Reported Measures	MAAS	BIS-11 total	BIS Non-Planning	BIS Attention	BIS Motor
	R (p)	*R* (p)	*R* (p)	*R* (p)	*R* (p)
MAAS					
BIS –Total	**-0.55** (***p*<0.001**)				
BIS Non-Planning	**-0.41** (***p*<0.001**)	**0.86** (***p*<0.001**)			
BIS Attention	**-0.55** (***p*<0.001**)	**0.67** (***p*<0.001**)	**0.36** **(0.001)**		
BIS – Motor	**-0.36** **(0.001)**	**0.82** (***p*<0.001**)	**0.66** (***p*<0.001**)	**0.31** **(0.004)**	
SCS total	**0.43** (***p*<0.001**)	**-0.27** **(0.013)**	-0.19 (0.070)	**-0.49** (***p*<0.001**)	-0.01 (0.895)
SCS isolation	**0.38** (***p*<0.001**)	**-0.25** **(0.021)**	-0.19 (0.082)	**-0.45** (***p*<0.001**)	-0.02 (0.837)
SCS Com. Humanity	**0.29** **(0.006)**	-0.23 (0.36)	-0.15 (0.165)	**-0.34** **(0.001)**	-0.08 (0.420)
SCS Over-identification	**0.37** (***p*<0.001**)	**-0.27** **(0.012)**	-0.17 (0.118)	**-0.46** (***p*<0.001**)	-0.07 (0.479)
SCS Mindfulness	**0.48** (***p*<0.001**)	**-0.38** (***p*<0.001**)	**-0.31** **(0.003)**	**-0.51** (***p*<0.001**)	-0.13 (0.210)
SCS Self-Judgment	**0.28** **(0.010)**	-0.15 (0.17)	-0.07 (0.478)	**-0.37** (***p*<0.001**)	0.02 (0.791)
SCS Self-Kindness	**0.41**	-0.17	-0.12	**-0.43**	-0.10

Self-Reported Measures	MAAS	BIS-11 total	BIS Non-Planning	BIS Attention	BIS Motor
	R (p)	*R* (p)	*R* (p)	*R* (p)	*R* (p)
	(*p*<0.001)	(0.110)	(0.263)	**(*p*<0.001)**	(0.348)
BAI	**−0.52** **(*p*<0.001)**	**0.30** **(0.005)**	0.20 (0.062)	**0.49** **(*p*<0.001)**	0.10 (0.342)
BDI	**−0.47** **(*p*<0.001)**	**0.33** **(0.002)**	**0.28** **(0.009)**	**0.49** **(*p*<0.001)**	0.06 (0.540)

Table 1. Correlation between self-reported measures.

Strong and negative correlations were seen between levels of mindfulness (MAAS) and all subtypes of impulsiveness measured by BIS-11 ($-0.55 < r < -0.36$; $p < 0.001$), and between the BIS-11 total score and MAAS ($r = -0.55$; $p < 0.001$), suggesting that those who have a higher level of mindfulness tend to be less impulsive generally. The strong and negative correlation between the level of mindfulness (MAAS) and the attention impulsiveness subtype suggests that those who have a higher level of mindfulness tend to be less impulsive when making decisions and are more capable of keeping attention on the task at hand. The same association was seen among the mindfulness subtype of the SCS, which was negatively correlated with the BIS-11 total score and with two subtypes of impulsiveness (attention and non-planning), reinforcing the correlations found between the MAAS and BIS-11 scales.

As expected, there were several correlations between the mindfulness scale (MAAS) and the SCS, as they are a linked construct. Additionally, there were negative and strong correlations between the mindfulness scale (MAAS) and the anxiety ($r = -0.52$; $p < 0.001$) and depression ($r = -0.47$; $p < 0.001$) inventories.

3.1.2. Correlations between impulsiveness, mindfulness, self-compassion, and neuropsychological measures

The statistically significant correlations ($p < 0.05$) found among the neuropsychological results and the mindfulness, impulsiveness, and self-compassion measures are shown in Table 2.

A weak but significant positive correlation was found between a working memory measure (RAVLT A6) and the mindfulness scale (MAAS) (r = 0.22; p = 0.03). There was also a weak but significant negative correlation between the number of mistakes on the TMT B and the mindfulness scale (MAAS) (r = −0.22; p = 0.003), suggesting that those who have higher levels of mindfulness tend to make fewer mistakes on this kind of task. A similar negative correlation was found between the number of mistakes on the STROOP task 2 and the SCS subtypes. Another similar weak and negative correlation was seen between the time on FDT and the “isolation” aspect of the SCS.

		BIS Total score	BIS Attention	BIS Motor	BIS Non-Planning	MAAS	SCS Total	SCS Over-Identification	SCS Isolation
RAVLT A6	*R* (p)					0.22 (0.03)			
TMT B ER	*R* (p)					-0.22 (0.03)			0.25 (0.02)
STR 2 TMP	*R* (p)							-0.22 (0.03)	
STR 2 ER	*R* (p)						-0.23 (0.03)	-0.33 (0.002)	
STR 3 ER	*R* (p)								0.21 (0.05)
BPA CON OM	*R* (p)	-0.33 (0.002)	-0.23 (0.03)	-0.32 (0.002)*	-0.21 (0.50)				
BPA ALT OM	*R* (p)	-0.21 (0.04)		-0.21 (0.04)					
FDT Choic Err	*R* (p)				-0.22 (0.03)				
FDT Choic Time	*R* (p)							-0.23 (0.02)	-0.28 (0.009)
FDT Count Time	*R* (p)							-0.25 (0.02)	

doi.org/10.32388/POS2E0

		BIS Total score	BIS Attention	BIS Motor	BIS Non-Planning	MAAS	SCS Total	SCS Over-Identification	SCS Isolation
FDT Read Time	*R* (p)							−0.26 (0.01)	

Table 2. Correlations among mindfulness (MAAS), self-compassion (SCS), impulsiveness (BIS-11), and neuropsychological measures.

Note: FDT Read Time = reading time of FDT in seconds; FDT Count Time = counting time at FDT in seconds; FDT Choic Time = FDT choice time in seconds; FDT Choic. Err = FDT choice errors; BPA ALT OM = omissions on BPA switching attention; BPA CON OM = omission on BPA concentrated attention; STR 3 ER = STROOP 3 errors; STR 2 ER = STROOP 2 errors; STR 2 TMP = STROOP 2 time in seconds; TMT B ER = errors on TMT B; RAVLT A6 = right answers on RAVLT A6.

Negative correlations appeared among the number of omissions on the BPA sustained attention and all of the BIS-11 subtypes of impulsiveness, suggesting that those participants who had a higher level of impulsivity had fewer omissions on this task, achieving better results.

3.1.3. Linear regression model

A linear regression was conducted with the aim to explain the mindfulness measure (MAAS) through other measures. The results are shown in Table 3.

Model	R	R square	R adjusted square	Standard error estimated
1	.566[a]	.320	.312	.71139
2	.635[b]	.403	.388	.67073
3	.670[c]	.449	.428	.64829
4	.659[d]	.434	.420	.65295
5	.688[e]	.474	.454	.63371
6	.723[f]	.523	.498	.60736

Table 3. Linear regression model summed up.

a. *Predictors: (Constants), BIS Attention;*

b. *Predictors: (Constants), BIS Attention and BAI;*

c. *Predictors: (Constants), BIS Attention, BAI and BIS Total Score;*

d. *Predictors: (Constants), BAI and BIS Total Score;*

e. *Predictors: (Constants), BAI, BIS Total Score and TMT A Errors;*

f. *Predictors: (Constants), BAI, BIS Total Score, TMT A Errors and RAVLT Recognition.*

The linear regression showed that the best measure to predict mindfulness level (MAAS) was BIS-11 attention impulsiveness. As predicted, measures of anxiety also appeared as mindfulness level predictors, as well as neuropsychological measures, such as TMT and RAVLT.

4. Discussion

The present study is unprecedented in Brazil. Its aim was to investigate the correlations among the levels of mindfulness, impulsivity, and neuropsychological measures in healthy college students.

According to that prediction, strong and moderate negative correlations were found among mindfulness measures and impulsiveness measures, dialoguing with the literature that points to negative correlations between these constructs[4][5][19], suggesting that those who have a higher level of mindfulness tend to

be less impulsive. These correlations were seen among all the subtypes of impulsiveness and were stronger between the mindfulness level measured by MAAS and the attention impulsiveness measured by BIS-11, associating the level of mindfulness with less difficulty in sustaining attention on a task and at the present moment, abilities that are already associated with mindfulness[33][21][17]. Both of these constructs, mindfulness and impulsiveness, share a focus on the present moment. However, the way of being in the present moment varies significantly between them[5]. Mindfulness, associated with attentional control and emotional regulation[17][34], may be a protective factor referring to impulsiveness[4], creating the possibility of a higher awareness of thoughts and feelings, and benefiting the relationship between those by developing a non-identification with them, promoting, thus, a space between the stimuli and action[33][21], giving one a better choice opportunity. In this way, it is believed that non-identifying with thoughts and feelings by being aware of them may enable one to improve impulse control, inhibitory capacity, and decision-making ability. Therefore, according to[5], the level of mindfulness should be investigated when impulsivity is one of the main issues. Mindfulness and impulsivity are complex constructs, and comprehension of them may grow in future studies with the use of other scales, such as the Five Facets Mindfulness Questionnaire Scale (FFMQ)[35] and the Impulsive Behavior Scale (UPPS-P)[36].

In agreement with that discussed, the correlations among levels of impulsiveness and self-compassion, suggesting that individuals who have higher levels of self-compassion tend to have lower levels of attention impulsiveness ($r = -0.49$; $p < 0.01$), may be aspects that also can be interpreted as protective. Since self-compassion, and all of its subtypes, are very close to the concept of mindfulness and are related to a better relationship with one's self, it can be hypothesized that the self-compassion construct may relate to impulsiveness in the same way as mindfulness. Furthermore, it is assumed that the abilities associated with self-compassion, such as being gentle toward one's self and relating to thoughts and feelings without identifying with them, can benefit emotional regulation when it comes to reacting to negative stimuli, lowering the need to behave impulsively to avoid them.

The results are similar to those found in the literature when it comes to correlations between levels of mindfulness and anxiety ($r = -0.52$; $p < 0.001$) and depression ($r = -0.47$; $p < 0.001$)[15][37], reinforcing that those who have a higher level of mindfulness, being more aware of thoughts and feelings, and relating to them without identifying with them, tend to have lower levels of depression and anxiety.

Different from what was predicted, the correlations found among the neuropsychological results and the self-reported measures were weak, even if significant. In contrast to that found by Keilp et al.,[14], who found weak but significant correlations between the TMT B (r = 0.26; p < 0.05) and BIS-11, this study did not find significant correlations between these two measures (r = 0.017; p = 0.87). The two studies are similar, referring to the STROOP task results, which were not significant in either of them (r = -0.13 in the present study, and r = -0.16 in Keilp and colleagues' study). In the present study, however, a weak significant correlation was found between the non-planning impulsiveness and the number of errors on the choice of FDT (r = -0.22; p < 0.05), an executive measure, indicating a possible relation between this ability and the executive capacity related to it, in agreement with that shown in the literature[38].

Some unexpected and curious results were found negatively correlating all of the impulsiveness subtypes and the number of omissions on the BPA test. Although they were weak and modest correlations (r varying from -0.33 to -0.21; and p varying from 0.001 to 0.05), they still draw attention by their frequency, suggesting that a higher level of impulsivity in those people is associated with a better result in an attention subtest; in other words, individuals with higher levels of impulsivity made fewer mistakes by omission. It is possible to hypothesize that, in those people, impulsiveness can act in a pre-alert way that protects them from mistakes by omission, but it is not high enough to make them have a low inhibitory control, since they do not have pathological impulsivity.

It is seen in the literature that higher levels of mindfulness are associated with better cognitive functioning[39][40][41]. As predicted, correlations were found among levels of mindfulness and neuropsychological results. However, different from what was imagined, these correlations were weak or modest ($\pm$ 0.21 $\leq r \geq \pm$ 0.33). A negative correlation was found between the level of mindfulness (MAAS) and the number of errors on TMT B (r = -0.22; p < 0.05), suggesting that a higher level of mindfulness may be a protective factor against these types of mistakes that involve attention and executive functioning. However, these results should be carefully interpreted since they are weak correlations. In the same way, a positive correlation was found between the RAVLT A6, which requires attention and working memory, and levels of mindfulness (r = 0.22; p < 0.05), suggesting better working memory associated with a higher mindfulness level.

Modest and weak correlations among neuropsychological measures and the subtypes of self-compassion, especially the over-identification subtype, related to non-identifying one's self to thoughts and feelings, and the measures of FDT and STROOP task, tests that evaluate the same cognitive functions: the EFs, attention, and inhibitory control, were also found. Even though these correlations were modest

and weak, they were statistically significant and may suggest the hypothesis that the ability of non-identifying with thoughts and feelings, seeing them as mental events, and being able to "stop" ruminative thinking, without losing one's self to thoughts, can develop a metacognitive capacity related to attention, which benefits the executive process. Reinforcing these results and hypotheses, moderate correlations among the same subtype of self-compassion and results from the STROOP task 2, which also involve attention, were found.

Adding to the previous results and according to the literature, the linear regression also showed an important association between the mindfulness construct and the impulsiveness construct, when it pointed to attention impulsiveness as the best variable to predict the mindfulness level measured by MAAS. Additionally, it is important that the linear regression also points to neuropsychological results (TMT and RAVLT) to predict mindfulness levels, pointing, once again, to the association between these functions (attention, working memory) and mindfulness.

In relation to practical matters, the results of the present study reinforce the potential contribution of mindfulness practices to health in the college environment. Mindfulness practices, besides promoting well-being and stress reduction, may have an effect on impulsivity and risky behaviors, as suggested in other studies with the same population[42][6].

5. Limitations

Although this study is unprecedented in Brazil, it also has some limitations due to the limited number of participants and the neuropsychological tests used, which may not be the best since they were developed for a clinical population and may not be sensitive enough for some subtle differences in the healthy population of this study. This fact may reinforce some of the neuropsychological findings that were presented, even with less sensitive tests. However, it is suggested that the construct of mindfulness is added to studies that investigate impulsivity and disorders associated with it, and that more modern and sensitive tests are used.

6. Conclusion

This study identified significant negative correlations between mindfulness and all dimensions of impulsivity, as well as modest associations between mindfulness, self-compassion, and specific neuropsychological measures. These findings suggest that higher levels of mindfulness may serve as a

protective factor against impulsive traits, even in non-clinical populations. While the correlations with neuropsychological performance were generally weak, they support the growing body of evidence linking dispositional mindfulness with cognitive control and emotional regulation.

These results underscore the relevance of incorporating mindfulness-related constructs into research and interventions targeting impulsivity and executive functioning. Despite its limitations, including the sample size and the use of cognitive tests primarily designed for clinical populations, this study offers novel contributions to the understanding of the behavioral and cognitive correlates of mindfulness. Future research with larger samples and more sensitive neuropsychological instruments is recommended to expand on these findings and explore potential mechanisms of action.

Statements and Declarations

Funding

This study was supported by the Coordination for the Improvement of Higher Education Personnel (CAPES), through a Master's scholarship granted to Ms. Karen Messas Cicuto. Dr. Marcelo Demarzo is supported by the National Council for Scientific and Technological Development (CNPq), Brazil, through a research productivity fellowship (Level 1D).

Acknowledgments

We would like to thank all the participants who generously dedicated their time to this study. We are also grateful to the research assistants and collaborators who supported the neuropsychological data collection and participant recruitment.

References

1. [a], [b]*Ochoa C, Álvarez-Moya EM, Penelo E, Aymami MN, Gómez-Peña M, Fernández-Aranda F, Granero R, Vallejo-Ruiloba J, Menchón JM, Lawrence NS, Jiménez-Murcia S (2013). "Decision-making deficits in pathological gambling: The role of executive functions, explicit knowledge and impulsivity in relation to decisions made under ambiguity and risk." Am J Addict. 22(5):492–499. doi:10.1111/j.1521-0391.2013.12061.x.*
2. [a], [b]*Kelly NR, Bulik CM, Mazzeo SE (2013). "Executive functioning and behavioral impulsivity of young women who binge eat." Int J Eat Disord. 46(2):127–139. doi:10.1002/eat.22096.*

3. ^ American Psychiatric Association (2000). Diagnostic and statistical manual of mental disorders. 4th ed. W ashington, DC: American Psychiatric Association.
4. a, b, c, d Christopher M, Ramsey M, Antick J (2013). "The role of dispositional mindfulness in mitigating the i mpact of stress and impulsivity on alcohol-related problems." Addiction Research & Theory. 21(5):429–434. doi:10.3109/16066359.2012.737873.
5. a, b, c, d, e Murphy C, MacKillop J (2012). "Living in the here and now: Interrelationships between impulsivity, mindfulness, and alcohol misuse." Psychopharmacology (Berl). 219(2):527–536. doi:10.1007/s00213-011-257 3-0.
6. a, b Vinci C, Peltier M, Waldo K, Kinsaul J, Shah S, Coffey SF, Copeland AL (2016). "Examination of trait impul sivity on the response to a brief mindfulness intervention among college student drinkers." Psychiatry Res. 242:365–374. doi:10.1016/j.psychres.2016.04.115.
7. ^ LaBrie JW, Kenney SR, Napper LE, Miller K (2014). "Impulsivity and alcohol-related risk among college stu dents: Examining urgency, sensation seeking and the moderating influence of beliefs about alcohol's role in the college experience." Addict Behav. 39(1):159–164. doi:10.1016/j.addbeh.2013.09.018.
8. ^ Pearson MR, Murphy EM, Doane AN (2013). "Impulsivity-like traits and risky driving behaviors among col lege students." Accid Anal Prev. 53:142–148. doi:10.1016/j.aap.2013.01.009.
9. ^ Moeller FG, Barratt ES, Dougherty DM, Schmitz JM, Swann AC (2001). "Psychiatric aspects of impulsivity." Am J Psychiatry. 158(11):1783–1793. doi:10.1176/appi.ajp.158.11.1783.
10. a, b Patton J, Stanford M, Barratt E (1995). "Factor Structure of the Barrat Impulsiveness Scale." J Clin Psycho l. 51:768–774.
11. ^ Fino E, Melogno S, Iliceto P, D'Aliesio S, Pinto MA, Candilera G, Sabatello U (2014). "Executive functions, im pulsivity, and inhibitory control in adolescents: A structural equation model." Adv Cogn Psychol. 10:32–38. d oi:10.2478/v10053-008-0154-5.
12. ^ Horn NR, Dolan M, Elliott R, Deakin JFW, Woodruff PWR (2003). "Response inhibition and impulsivity: An fMRI study." Neuropsychologia. 41(14):1959–1966. doi:10.1016/S0028-3932(03)00077-0.
13. ^ Kam JWY, Dominelli R, Carlson SR (2012). "Differential relationships between sub-traits of BIS-11 impulsivi ty and executive processes: An ERP study." Int J Psychophysiol. 85(2):174–187. doi:10.1016/j.ijpsycho.2012.05.0 06.
14. a, b Keilp JG, Sackeim HA, Mann JJ (2005). "Correlates of trait impulsiveness in performance measures and n europsychological tests." Psychiatry Res. 135(3):191–201. doi:10.1016/j.psychres.2005.03.006.

15. ^a, b, cBrown KW, Ryan RM (2003). "The benefits of being present: mindfulness and its role in psychological well-being." J Pers Soc Psychol. 84:822–848.

16. ^Kabat-Zinn J (2003). "Mindfulness-Based Interventions in Context: Past, Present, and Future." Clinical Psychology: Science and Practice. 10(2):144–156. doi:10.1093/clipsy/bpg016.

17. ^a, b, cBishop SR, Lau MA, Shapiro S, Carlson L, Anderson ND, Carmody J, Segal ZV, Abbey S, Speca M, Velting D, Devins G (2004). "Mindfulness: A Proposed Operational Definition." Clinical Psychology: Science and Practice. 11(3):230–241. doi:10.1093/clipsy/bph077.

18. ^Keng SL, Smoski MJ, Robins CJ (2011). "Effects of mindfulness on psychological health: A review of empirical studies." Clin Psychol Rev. 31(6):1041–1056. doi:10.1016/j.cpr.2011.04.006.

19. ^a, bPeters JR, Erisman SM, Upton BT, Baer RA, Roemer L (2011). "A Preliminary Investigation of the Relationships Between Dispositional Mindfulness and Impulsivity." Mindfulness (N Y). 2(4):228–235. doi:10.1007/s12671-011-0065-2.

20. ^Pasquali L, Vv G, Wb A, Fj M, Alm R, Saúde Q De, Qsg G (1994). "Goldberg's General Health Questionnaire (GHQ): Brazilian adaptation." Psicol Teor e Pesqui.

21. ^a, b, cBarros VV de, Kozasa EH, Souza ICW de, Ronzani TM (2015). "Validity evidence of the Brazilian version of the Mindful Attention Awareness Scale (MAAS)." Psicologia: Reflexão e Crítica. 28(1):87–95. doi:10.1590/1678-7153.201528110.

22. ^Malloy-Diniz LF, Fuentes D, Vasconcelos AG, Tavares H, de Paula JJ, Coutinho G, Abreu N, Leite WB, Mattos P (2010). "Translation and cultural adaptation of the Barratt Impulsiveness Scale (BIS-11) for application in Brazilian adults." J Bras Psiquiatr. 59:99–105.

23. ^Barratt ES (1965). "Factor Analysis Of Some Psychometric Measures Of Impulsiveness And Anxiety." Psychol Rep. 16:547–554.

24. ^a, bCunha JA (2011). Manual of the Portuguese version of the Beck Scales. São Paulo: Casa do Psicólogo.

25. ^Souza LK, Hutz CS (2016). "Adaptation of the Self-Compassion Scale for use in Brazil: Evidences of construct validity." Temas em Psicol. 24(1):159–172. doi:10.9788/TP2016.1-11.

26. ^Neff K (2003). "The development and validation of a scale to measure self-compassion." Self Identity. 2:223–250. doi:10.1080/15298860390209035.

27. ^Wechsler D (2014). WAIS-III: Wechsler Adult Intelligence Scale: Technical manual. São Paulo: Casa do Psicólogo.

28. ^Campanholo KR, Romão MA, Machado M de A R, Serrao VT, Cunha D G, Benute GR, Lucia MCS de (2014). "Performance of an adult Brazilian sample on the Trail Making Test and Stroop Test." Dementia & Neurops

ychologia. 8(1):26–31. doi:10.1590/S1980-57642014DN81000005.

29. ^ *Magalhães SS, Hamdan AC (2010). "The Rey Auditory Verbal Learning Test: Normative data for the Brazili an population and analysis of the influence of demographic variables." Psychol Neurosci. 3(1):85–91. doi:10. 3922/j.psns.2010.1.011.*
30. ^ *Rueda FJM (2013). Psychological Battery for Attention Assessment (BPA). 1st ed. São Paulo: Vetor.*
31. ^ *Tombaugh TN (2004). "Trail Making Test A and B: Normative data stratified by age and education." Arch Clin Neuropsychol. 19(2):203–214. doi:10.1016/S0887-6177(03)00039-8.*
32. ^ *Sedó M (2015). The 5-digit test. São Paulo: Hogrefe CETEPP.*
33. a, b *Baer RA (2003). "Mindfulness Training as a Clinical Intervention: A Conceptual and Empirical Review." Clinical Psychology: Science and Practice. 10(2):125–143. doi:10.1093/clipsy/bpg015.*
34. ^ *Teper R, Inzlicht M (2013). "Meditation, mindfulness and executive control: The importance of emotional a cceptance and brain-based performance monitoring." Soc Cogn Affect Neurosci. 8(1):85–92. doi:10.1093/sca n/nss045.*
35. ^ *Barros VV, Kozasa EH, Souza ICW, Ronzani TM (2014). "Validity evidence of the Brazilian version of the Fiv e Facet Mindfulness Questionnaire (FFMQ)." Psicologia: Teoria e Pesquisa. 30(3):317–327. doi:10.1590/S0102- 37722014000300009.*
36. ^ *Cyders MA, Littlefield AK, Coffey S, Karyadi KA (2014). "Examination of a short English version of the UPP S-P Impulsive Behavior Scale." Addict Behav. 39(9):1372–1376. doi:10.1016/j.addbeh.2014.02.013.*
37. ^ *Segal Z, Williams M, Teasdale J (2013). Mindfulness-Based Cognitive Therapy for Depression. New York: T he Guilford Press.*
38. ^ *Rogers RD (2003). "Neuropsychological investigations of the impulsive personality disordres." Psychol Me d. 33:1335–1340.*
39. ^ *Chambers R, Lo BCY, Allen NB (2008). "The impact of intensive mindfulness training on attentional contr ol, cognitive style, and affect." Cognitive Therapy and Research. 32(3):303–322. doi:10.1007/s10608-007-911 9-0.*
40. ^ *Chiesa A, Calati R, Serretti A (2011). "Does mindfulness training improve cognitive abilities? A systematic r eview of neuropsychological findings." Clinical Psychology Review. 31(3):449–464. doi:10.1016/j.cpr.2010.11.0 03.*
41. ^ *Tang Y-Y, Hölzel BK, Posner MI (2015). "The neuroscience of mindfulness meditation." Nat Rev Neurosci. 16 (4):1–13. doi:10.1038/nrn3916.*

42. ^ *Mermelstein LC, Garske JP (2015). "A Brief Mindfulness Intervention for College Student Binge Drinkers: A Pilot Study." Psychol Addict Behav. 29(2):259–269. doi:10.1037/adb0000040.*

Declarations

Funding: This study was supported by the Coordination for the Improvement of Higher Education Personnel (CAPES), through a Master's scholarship granted to Ms. Karen Messas Cicuto. Dr. Marcelo Demarzo is supported by the National Council for Scientific and Technological Development (CNPq), Brazil, through a research productivity fellowship (Level 1D).

Potential competing interests: No potential competing interests to declare.