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Research Article

Associations among Functional and Dysfunctional Impulsivity: Direct and Indirect Effects on Sensation Seeking in Youth (19-25 Years Old)

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Abstract

It is important to study the relationships between sensation seeking, functional and dysfunctional impulsivity to clarify the appropriateness and effectiveness of ways for seeking optimal stimulation. The aim of this study was to investigate if dysfunctional impulsivity had stronger direct and indirect effects on sensation seeking in youth with functional impulsivity as a mediator. Sensation seeking, functional and dysfunctional types of impulsivity were studied among 764 students from 19 to 25 years old by means of Radoslavova and Velichkov's (2005) questionnaire. The results indicated that sensation seeking, functional and dysfunctional impulsivity correlated significantly and positively. Dysfunctional impulsivity was directly related to sensation seeking, as well as indirectly related to sensation seeking mediated by functional impulsivity. The findings also revealed that functional impulsivity was directly related to sensation seeking, as well as indirectly related to sensation seeking mediated by dysfunctional impulsivity. Dysfunctional impulsivity had larger direct effects on sensation seeking than functional impulsivity. Dysfunctional impulsivity also had larger effects as a mediator on sensation seeking than the effects of functional impulsivity as a mediator on sensation seeking. These findings suggest some deficiencies in the speed and accuracy of processing information, and the effectiveness of made decisions and implemented actions in search of optimal stimulation among youth.

Keyword: Dysfunctional impulsivity; functional impulsivity; sensation seeking; youth.

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Importance of study

It is important to study sensation seeking and impulsivity in youth because of their developmental peculiarities and importance in this age group. Sensation seeking and impulsivity are the most strongly related to risk taking among older adolescents and young adults compared with other ages (Lauriola et al., 2013), for example, risk for substance use may peak during adolescence and early adulthood (Quinn & Harden, 2013). Impulsive sensation seeking peaks in adolescence and early adulthood (18–25-year-olds), and it is associated with risky decision-making and deleterious outcomes (Chase et al., 2017). The study of impulsivity and sensation seeking is crucial given their implications in multiple risk behaviors (Fernández-Artamendi et al., 2016). Sensation seeking is related to problematic online gaming (Blinka et al., 2016), pathological gambling (Estevez et al., 2015), smoking (Surányi et al., 2013), alcohol problematic drinking (Magid et al., 2007; Merchán-Clavellino et al., 2020; Noël et al., 2011; Quinn & Harden, 2013; Surányi et al., 2013; Zuckerman & Aluja, 2014), substance abuse (Hamdan-Mansour et al., 2018; Noël et al., 2011; Quinn & Harden, 2013; Surányi et al., 2013; Xiao, 2008; Zuckerman & Aluja, 2014), cheating at school (Surányi et al., 2013), antisocial behavior (Surányi et al., 2013; Zuckerman & Aluja, 2014), criminal behavior (Horvath & Zuckerman, 1993), aggression (Pérez Fuentes et al., 2016; Zuckerman & Aluja, 2014), risky driving (Bachoo et al., 2013), risky sexual behavior (Charnigo et al., 2013; Zuckerman & Aluja, 2014).

Impulsivity is linked to socially problematic behaviors, such as childhood conduct disorder and adult antisocial behavior (Dick et al., 2010), aggression, violence, delinquency and criminal behavior (Cross et al., 2011; Molero Jurado et al., 2020; O'Connor & Jackson, 2008; Pérez Fuentes et al., 2016), alcohol and substance abuse (Adams et al., 2012; Blinka et al., 2016; Daurio et al., 2018; Dick et al., 2010; Fernández-Artamendi et al., 2016; Gunn et al., 2018; Hamdan-Mansour et al., 2018; Kao et al., 2011; Magid et al., 2007; Merchán-Clavellino et al., 2020; O'Connor & Jackson, 2008; Quinn & Harden, 2013; Xiao, 2008), non-substance

addictions (Blinka et al., 2016) such as pathological gambling (Estevez et al., 2015; Maccalum et al., 2007; Tang & Wu, 2012) and problematic online gaming (Blinka et al., 2016), risky cycling behaviors (Zheng et al., 2019), and risky driving (Bachoo et al., 2013).

Impulsivity contributes to dysfunctional behaviors such as eating disorders, Attention Deficit and Hyperactivity Disorder, psychopathy, poor job performance (O'Connor & Jackson, 2008), risky sexual behavior (Charnigo et al., 2013; Netto et al., 2016). The people with some diseases typically tend to be more impulsive (Ahn & Vassileva, 2016; Dervic et al., 2015; Evren & Bozkurt, 2017; Maraz et al., 2016; Netto et al., 2016; Reas et al., 2016; Steele et al., 2017; Tamam et al., 2017; Zhao et al., 2017), but not always. For example, low impulsivity characterizes people with oncological diseases (Manova, 2014). Low or high impulsivity do not always have a negative connotation. Impulsivity does not always have only negative consequences (Netto et al., 2016). It is important to study impulsivity because it influences on the speed and accuracy of processing information, as well as on the effectiveness of taken decisions and implemented actions (Dickman, 1990). Such consequences are reflected in various definitions of impulsivity and its types.

Definitions of impulsivity

Impulsivity is a personality trait (Netto et al., 2016; Steele et al., 2017; Wang et al., 2017) explaining normal individual differences. Impulsivity is also a state (Molero Jurado et al., 2020; Pérez Fuentes et al., 2016) manifested in different situations.

Impulsivity is not a unitary construct (Adams et al., 2012; Maraz et al., 2016), but it is a multi-faceted (Evren & Bozkurt, 2017; Maccalum et al., 2007; Netto et al., 2016), multidimensional (Adams et al., 2012; Maccalum et al., 2007; Magid et al., 2007; Ramakrishnan et al., 2019), complex (Magid et al., 2007), heterogeneous (Dick et al., 2010) construct. Impulsivity is characterized by rapid, unpredictable, unplanned, spontaneous, rashly and sudden reactions to stimuli (Adams et al., 2012; Chase et al., 2017; Dick et al., 2010; Maccalum et al., 2007; Pérez Fuentes et al., 2016; Ramakrishnan et al., 2019), rapid decision-making and action (Magid et al., 2007; Patton et al., 1995), before complete processing of information, without considering all the information available (Maccalum et al., 2007; Molero Jurado et al., 2020; Pérez Fuentes et al., 2016), without adequate forethought, deliberation, premeditation or planning (Adams et al., 2012; Charnigo et al., 2013; Chase et al., 2017; Daurio et al., 2018; Dick et al., 2010; Gunn et al., 2018; Harden & Tucker-Drob, 2011; Johansen, 2014; Lynam, n.d.; Maccalum et al., 2007; Magid et al., 2007; Merchán-Clavellino et al., 2020; Molero Jurado et al., 2020; Patton et al., 1995; Ramakrishnan et al., 2019; Reas et al., 2016; Wan et

al., 2020; Whiteside & Lynam, 2001; Zhao et al., 2017; Zheng et al., 2019; Zuckerman & Aluja, 2014), unintentional reactivity (Johansen, 2014), acting without considering potential negative consequences (Adams et al., 2012; Chase et al., 2017; Daurio et al., 2018; Harden & Tucker-Drob, 2011; Maccalum et al., 2007; Molero Jurado et al., 2020; Pérez Fuentes et al., 2016; Quinn & Harden, 2013; Ramakrishnan et al., 2019; Wan et al., 2020), orientation towards present, a lack of future directedness (Patton et al., 1995), having poor foresight (Johansen, 2014), not paying attention to contextual variables that signal to change behavior (Molero Jurado et al., 2020; Pérez Fuentes et al., 2016; Wan et al., 2020), carelessness (Magid et al., 2007), a lack of reflectiveness (Chase et al., 2017; Magid et al., 2007), gratification or urgency in satisfying impulses (Merchán-Clavellino et al., 2020; Molero Jurado et al., 2020; Pérez Fuentes et al., 2016) that may be negative urgency, i.e. the tendency to experience strong impulses and act rashly under conditions of negative mood states, and positive urgency, i.e. the tendency towards rash actions in response to positive mood (Adams et al., 2012; Chase et al., 2017; Daurio et al., 2018; Dick et al., 2010; Gunn et al., 2018; Lynam, n.d.; Ramakrishnan et al., 2019; Reas et al., 2016; Wan et al., 2020; Whiteside & Lynam, 2001; Zhao et al., 2017), decreased sensitivity to negative consequences of behavior and decreased sensitivity to punishment (Cross et al., 2011; Maccalum et al., 2007; Merchán-Clavellino et al., 2020), decreased sensitivity to non-reward (Wan et al., 2020), preference for and sensitivity to immediate smaller reward (Chase et al., 2017; Cheng, 2020; Cross et al., 2011; Maccalum et al., 2007; Merchán-Clavellino et al., 2020; Molero Jurado et al., 2020; Pérez Fuentes et al., 2016; Wan et al., 2020), deficits in self-control, a repeated failure of self-discipline and self-regulation (Cross et al., 2011; Maccalum et al., 2007; Ramakrishnan et al., 2019; Zuckerman, 2014), lack of perseverance (Adams et al., 2012; Chase et al., 2017; Daurio et al., 2018; Dick et al., 2010; Gunn et al., 2018; Lynam, n.d.; Merchán-Clavellino et al., 2020; Ramakrishnan et al., 2019; Reas et al., 2016; Wan et al., 2020; Whiteside & Lynam, 2001; Zhao et al., 2017), proneness to risk taking (Ahn & Vassileva, 2016; Johansen, 2014; Maccalum et al., 2007; Molero Jurado et al., 2020; Wan et al., 2020). Some of these peculiarities of impulsivity are enumerated also in relation to sensation seeking.

Definitions of sensation seeking

Sensation seeking is a complex, multidimensional (Magid et al., 2007), multifaceted personality trait (Wan et al., 2020). Sensation seeking is a personality trait that expresses striving to pursue varied, unusual, novel, intense, interesting, adventurous and exciting experiences and situations (Adams et al., 2012; Charnigo et al., 2013; Chase et al., 2017;

Cross et al., 2013; Dick et al., 2010; Frenkel et al., 2019; Harden & Tucker-Drob, 2011; Johansen, 2014; Magid et al., 2007; Meng et al., 2020; Merchán-Clavellino et al., 2020; Molero Jurado et al., 2020; Noël et al., 2011; Pérez Fuentes et al., 2016; Quinn & Harden, 2013; Ramakrishnan et al., 2019; Russo et al., 2012; Surányi et al., 2013; Wan et al., 2020; Zheng et al., 2019; Zuckerman & Aluja, 2014), openness to new experiences (Ramakrishnan et al., 2019), thrill seeking (Charnigo et al., 2013; Chase et al., 2017; Dick et al., 2010; Magid et al., 2007; Merchán-Clavellino et al., 2020; Surányi et al., 2013; Wan et al., 2020; Zheng et al., 2019; Zuckerman & Aluja, 2014), seeking strong stimuli (Magid et al., 2007), striving for risky experiences and risk taking (Adams et al., 2012; Chase et al., 2017; Cross et al., 2013; Frenkel et al., 2019; Magid et al., 2007; Molero Jurado et al., 2020; Noël et al., 2011; Pérez Fuentes et al., 2016; Russo et al., 2012; Wan et al., 2020; Zheng et al., 2019; Zuckerman & Aluja, 2014) - for example in case of extreme sports (Cross et al., 2013; Frenkel et al., 2019; Surányi et al., 2013; Zuckerman & Aluja, 2014) or activities that are potentially addictive (Surányi et al., 2013) or dangerous (Wan et al., 2020), preference for change, novelty and unpredictability (Charnigo et al., 2013; Johansen, 2014; Magid et al., 2007; Surányi et al., 2013; Wan et al., 2020; Zuckerman & Aluja, 2014), susceptibility to boredom, disliking dull or repetitive activities, monotony and routine avoidance (Chase et al., 2017; Cross et al., 2013; Magid et al., 2007; Merchán-Clavellino et al., 2020; Molero Jurado et al., 2020; Pérez Fuentes et al., 2016; Russo et al., 2012; Surányi et al., 2013; Wan et al., 2020; Zheng et al., 2019; Zuckerman & Aluja, 2014), sensitivity to rewards (Chase et al., 2017; Daurio et al., 2018; Harden & Tucker-Drob, 2011; Johansen, 2014; Wan et al., 2020; Zhao et al., 2017), fun and entertainment seeking (Chase et al., 2017; Zuckerman & Aluja, 2014), disinhibition (Chase et al., 2017; Merchán-Clavellino et al., 2020; Molero Jurado et al., 2020; Pérez Fuentes et al., 2016; Surányi et al., 2013; Wan et al., 2020; Zheng et al., 2019; Zuckerman, 2014; Zuckerman & Aluja, 2014), i.e. inability to control own immediate response inclinations to engage in unconventional or illegal social behavior (Zuckerman & Aluja, 2014).

Relationships between sensation seeking and impulsivity

The literature review reveals some controversial theoretical assumptions regarding the relationship between impulsivity and sensation seeking. Some authors differentiate impulsivity and sensation seeking, others include sensation seeking in the structure of impulsivity or impulsivity in the structure of sensation seeking. According to one viewpoint, sensation-seeking is a component of impulsivity (Adams et al., 2012; Daurio et al., 2018; Dick et al., 2010; Gunn et al., 2018; Merchán-Clavellino et al., 2020; O'Connor & Jackson,

2008; Popov et al., 2016; Ramakrishnan et al., 2019; Wan et al., 2020; Whiteside & Lynam, 2001). According to another viewpoint, sensation seeking includes impulsivity (Zuckerman & Aluja, 2014). Biological markers for both sensation-seeking and impulsivity are augmenting of the evoked potential and testosterone, and low levels of the enzyme MAO-B (Zuckerman, 2014) that partly explains the connection between impulsivity and sensation seeking.

Some other authors (for example, Maccalum et al., 2007; Radoslavova & Velichkov, 2005; Zuckerman et al., 1964) consider sensation seeking and impulsivity as related, but different constructs, and they study sensation seeking independently on impulsivity. Although distinct from one another, sensation seeking and impulsivity are significantly positively correlated (Magid et al., 2007; Xiao, 2008) – correlation coefficients varied between .30 to .40 (Magid et al., 2007).

Supporting the idea of being two different constructs is the finding that impulsivity is not related to some components of sensation seeking such as thrill and adventure seeking, as well as impulsivity weakly correlates with disinhibition (Manna et al., 2013), i. e. with seeking of sensation through drinking, partying, and a variety of sexual behaviors (Leung, 2008; Zuckerman, 2005).

Sensation seeking and impulsivity are linked, so some scientists combine them into a single factor, while others conceptualize sensation seeking and impulsivity to be separate traits (Magid et al., 2007). To examine whether sensation seeking and impulsivity represent different phenomena or are two components of a general trait - behavioral disinhibition (Magid et al., 2007) or psychotism (Ahn & Vassileva, 2016; Radoslavova & Velichkov, 2005), a confirmatory factor analysis of six measures of either sensation seeking or impulsivity reveals that a two-factor model better fits the data than a one-factor model, i.e. sensation seeking and impulsivity appear to represent unique traits (Magid et al., 2007). Confirmatory factor analyses indicate that a model with impulsivity and sensation seeking as separate factors better fits data than a model combining them into one behavioral disinhibition factor (Magid et al., 2007).

Impulsive sensation seeking

Some authors (Chase et al., 2017; Kumar & Singh, 2015; Miller, 2007; Zuckerman, 2007; Zuckerman, 2014; Zuckerman & Aluja, 2014) use the term Impulsive sensation seeking to outline the connection between impulsivity and sensation seeking. Impulsive sensation seeking is a multidimensional part of personality that has two facets, two independent

constructs - impulsivity and sensation seeking (Zuckerman, 2007) or lack of premeditation as a component of impulsivity and sensation seeking (Miller, 2007).

Some other authors (Kumar & Singh, 2015) consider that impulsive sensation seeking is expressed as risk taking, corresponds to more risk taking - financial, health/safety and social risk (Kumar & Singh, 2015). Impulsive sensation seeking is related to overcoming bans, experience seeking, boredom intolerance, and psychoticism (Taneva, 2012). Impulsive sensation seekers are arrogant, non-conformist, and unconventional, with inadequate planning skills, not considering the probable negative consequences from risk (Taneva, 2012). Impulsive sensation seeking is linked to negative outcomes (Surányi et al., 2013), for example, risky decision-making, poor social and occupational function, accidental injury (Chase et al., 2017). Impulsive sensation seeking is related to lack of sociability (McDaniel & Zuckerman, 2003) that is why sensation seeking should be related more to dysfunctional impulsivity than to functional impulsivity.

Functional and dysfunctional impulsivity

Functional and dysfunctional impulsivity are distinguished on the basis of speed and accuracy of information processing (Zadravec et al., 2005), effectiveness of made decisions and their positive or negative outcomes. Functional and dysfunctional impulsivity correspondingly have positive or negative consequences (Blinka et al., 2016; Maccalum et al., 2007) in the context of quick and non-judicious decision-making (Maccalum et al., 2007). A part of individuals received some rewards for their rapid decision making despite lack of accuracy, while others experienced mainly negative outcomes (Maccalum et al., 2007). Impulsivity may contribute to positive outcomes such as stimulus-seeking curiosity, a desire to explore and learn about the environment, good workplace performance (O'Connor & Jackson, 2008). Some positive outcomes from impulsivity may follow, such that impulsivity may encourage proneness for business start and enterprising activities (Kazandzhieva, 2014), as well as that buying behavior is related to impulsivity (Jung, 2017). People prone to impulsiveness are oriented more towards hedonistic experiences (Slavchov & Virmozelova 2008). Under certain conditions, functional impulsivity may represent a protective trait by means of a series of quick adaptive decisions, but dysfunctional impulsivity results in harmful outcomes (Maccalum et al., 2007). Functional impulsivity is inversely associated with cigarette craving (Pitts & Leventhal, 2012). Dysfunctional impulsivity is associated with addiction (Molero Jurado et al., 2020), gaming addiction (Blinka et al., 2016), excessive gambling (Maccalum et al., 2007), criminality, delinquency, eating disorders, attention deficit

hyperactivity disorder, psychopathy, poor school performance, alcohol and substance use (Surányi et al., 2013).

Functional impulsivity is the tendency to make quick effective decisions (Pitts & Leventhal, 2012), optimal acting with relatively little forethought (Dickman, 1990), rapid information processing when such a strategy is appropriate and useful (Maccalum et al., 2007), doing things rapidly when there is a need to be quick (O'Connor & Jackson, 2008), quick and adequate reaction in extreme situations (Iancheva et al., 2018), acting fast with positive outcomes (Zadravec et al., 2005), responding quickly and taking advantages of unexpected opportunities (Cross et al., 2011). Functional impulsivity is related to risk taking, feeling of enthusiasm, bravery, and activeness (Cross et al., 2011; Iancheva et al., 2018; Maccalum et al., 2007).

Dysfunctional impulsivity is the tendency to make quick ineffective decisions (Pitts & Leventhal, 2012) creating difficulties, because of acting with less forethought (Cross et al., 2011; Dickman, 1990), acting without thinking about the outcomes (Zadravec et al., 2005), rapid information processing with negative consequences in situations where slower approaches are required, because of impaired control, a failure of premeditation, deficits in planning and inability to delay gratification (Blinka et al., 2016; Cross et al., 2011; Maccalum et al., 2007; O'Connor & Jackson, 2008), the tendency to ignore some facts (Blinka et al., 2016; Iancheva et al., 2018), lack of any restraints, hastiness and defiance of the rules (Iancheva et al., 2018), lack of concern, carelessness (Blinka et al., 2016; Maccalum et al., 2007), inattentiveness (Maccalum et al., 2007), disorderliness (Blinka et al., 2016).

Functional and dysfunctional impulsivity interact (Maccalum et al., 2007), but they are not highly correlated (Dickman, 1990). Functional and dysfunctional impulsivity correlated significantly and positively, but weakly, with Pearson correlation coefficient of r = .21, among Slovenian adolescents (Zadravec et al., 2005, p.43). Their interaction gives some reasons to investigate each of them both as an independent variable and as a mediator influencing on sensation seeking. The objective of the study was to establish if the most appropriate ways were tried to experience optimal stimulation in case of stronger connection between sensation seeking and functional impulsivity than a weaker connection between sensation seeking and dysfunctional impulsivity.

Why to study the relationships between functional, dysfunctional impulsivity and sensation seeking?

It is important to study the relationships between sensation seeking, functional and dysfunctional impulsivity to clarify the appropriateness and effectiveness of ways for seeking optimal stimulation. Establishing some connections between impulsivity and sensation seeking as striving for optimal stimulation would reveal if the most appropriate ways have been tried to experience optimal stimulation in case of stronger connection between sensation seeking and functional impulsivity than a weaker connection between sensation seeking and dysfunctional impulsivity. The aim of this study was to investigate if dysfunctional impulsivity had stronger direct and indirect effects on sensation seeking in youth with functional impulsivity as a mediator or functional impulsivity had stronger direct and indirect effects on sensation seeking in youth (19-25 years old) with dysfunctional impulsivity as a mediator.

One **hypothesis** of current research stated that dysfunctional impulsivity would be directly related to sensation seeking, as well as indirectly related to sensation seeking mediated by functional impulsivity.

Another **hypothesis** of present research stated that functional impulsivity would be directly related to sensation seeking, as well as indirectly related to sensation seeking mediated by dysfunctional impulsivity. The hypotheses are based on the findings by Kumar & Singh (2015), Miller (2007), Popov et al. (2016), Radoslavova & Velichkov (2005), Whiteside & Lynam (2001), Zuckerman (2007), Zuckerman et al. (1964) for relatedness between impulsivity and sensation seeking. However, the previous research has not specified which type of impulsivity is more closely directly and indirectly related to sensation seeking.

It has been found that sensation seeking correlates with functional and dysfunctional impulsivity in Bulgaria (Radoslavova & Velichkov, 2005). Sensation seeking correlates significantly positively with functional and dysfunctional impulsivity, but more strongly with functional impulsivity than with dysfunctional impulsivity among Bulgarian soldiers participating in international missions abroad (Iancheva & Kuleva, 2018). Sensation seeking correlates more strongly with functional impulsivity than with dysfunctional impulsivity in a sample consisting of Bulgarian soldiers in a military mission in Afghanistan and Bulgarian participants in the Antarctic expeditions (Iancheva et al., 2018). Functional impulsivity more strongly positively correlates to extraversion than to dysfunctional impulsivity or sensation seeking among Slovenian adolescents (Zadravec et al., 2005). Functional impulsivity more strongly positively and moderately correlates with thrill and adventure seeking as aspect of sensation seeking (with Pearson correlation coefficient of r =.47) than with experience seeking, boredom susceptibility and disinhibition as an aspects of sensation seeking (with

Pearson correlation coefficients of about *r* =.20) among Slovenian adolescents (Zadravec et al., 2005, p.43). Dysfunctional impulsivity more strongly positively and moderately correlates with boredom susceptibility as aspect of sensation seeking (with Pearson correlation coefficient of *r* =.32) than with disinhibition, experience seeking, and thrill and adventure seeking as aspects of sensation seeking (with Pearson correlation coefficients of about *r* = .20) among Slovenian adolescents (Zadravec et al., 2005, p.43). These findings suggest a stronger positive direct connection between sensation seeking and functional impulsivity than between sensation seeking and dysfunctional impulsivity. Functional impulsivity is closely related to sensation seeking, but because men are more prone to dysfunctional impulsivity than women (Cross et al., 2011), the strength of the direct connection between sensation seeking and functional impulsivity may differ, accordingly to social-demographic and cultural belonging.

It has also been established that sensation seeking directly predicts dysfunctional behavior related to anti-social and delinquent activities, as well as sensation seeking indirectly predicts functional workplace outcomes such as enterpreneurial intentions, workaholism, and job performance mediated by mastery goal orientation (Jackson, 2011). Functional and dysfunctional behavioral outcomes were studied by Jackson (2011) instead of functional and dysfunctional impulsivity. Besides, the above-mentioned study by Jackson (2011) was focused on sensation seeking as an independent variable, whilst in our model it was the dependent variable, because we are interested in the ways chosen to experience optimal stimulation.

Another study has also approached sensation seeking as an independent variable revealing that sensation seeking has both positive and negative outcomes resulting from either functional or dysfunctional behaviors (O'Connor & Jackson, 2008). Sensation seeking indirectly predicts functional and dysfunctional behavior mediated by Mastery Orientation (pursuing mastery goals, for example following a successful learning pattern and aiming to master new skills in the classroom, in sporting activities, in training and employment contexts) (O'Connor & Jackson, 2008). Mastery Orientation is positively associated with functional behaviors and negatively associated with dysfunctional behaviors (O'Connor & Jackson, 2008). Mastery Orientation more strongly mediates the relationship between sensation seeking and functional behavior than Mastery orientation mediates the relationship between sensation seeking and negative behavior (O'Connor & Jackson, 2008).

Scientific literature regarding direct and indirect effects of functional and dysfunctional impulsivity on sensation seeking is scarce. Some correlational studies (Cross et al., 2011;

Iancheva et al., 2018; Iancheva & Kuleva, 2018; Radoslavova & Velichkov, 2005; Zadravec et al., 2005) have been focused on direct connections between sensation seeking, functional and dysfunctional impulsivity. Other studies (Jackson, 2011; O'Connor & Jackson, 2008) have investigated the indirect effects of sensation seeking on functional and dysfunctional behaviors. As the authors of the present study are informed, the indirect effects of functional or dysfunctional impulsivity on sensation seeking have not been studied before. It is important to study the direct and indirect effects of functional or dysfunctional impulsivity on sensation seeking, because this investigation may clarify if search for optimal stimulation is more influenced by quick effective or non-effective decisions associated with functional and dysfunctional impulsivity correspondingly.

Method

Research background

Mediation analysis examines the process through which an independent variable exerts a direct effect on a dependent variable, as well as an indirect effect where the independent variable affects one or more mediators, and the subsequent change in the mediator affects the change in the outcome (Hayes, 2017; Hox et al., 2018; Montoya, 2018; Prado et al., 2014). Mediation analysis tries to explain why (Montoya, 2018) or how the direct, indirect, and total effects occur (Hayes, 2017; Montoya, 2018). The total effect is interpreted as how much two groups differing in one unit of the independent variable are likely to differ in the dependent variale (Prado et al., 2014). The indirect effect is the difference between the total effect and the direct effect (Prado et al., 2014).

Mediation analysis is a causal model assuming that the causal order of the variables is correctly specified, so experimental manipulation of independent variable (when possible and ethical) is highly recommended, as well as a randomly assigned independent variable, because then the strength of causal inference is greater (Montoya, 2018). Mediation analysis may be applied for data collected using between-subjects experimental designs, two-instance repeated-measures design, and cross-sectional designs (without experimental manipulation, when all variables are only measured) (Montoya, 2018). The researchers often rely on theory or experiments to support the assumption of causality in a mediation model (Montoya, 2018). Mediation analysis represents a causal explanation assuming causal relationships such that the independent variable causes the mediator, and the mediator causes the dependent variable, but mediation analysis can be applied on correlational data collected at a single time point without experimental manipulation to understand and model

the relationships between the variables (Hayes, 2017). In our study, mediation analysis was applied on correlational data collected at a single time point without experimental manipulation to understand if dysfunctional impulsivity had stronger direct and indirect effects on sensation seeking in youth with functional impulsivity as a mediator or functional impulsivity had stronger direct and indirect effects on sensation seeking in youth (19-25 years old) with dysfunctional impulsivity as a mediator.

It is possible one variable to affect another variable and the latter to affect the former as, for example, in case of self-fulfilling prophecy described in the social psychological literature (Aronson, 2011) – an individual's expectations about another person's behavior modify own behavior in such a way that they provoke the other person to act confirming the initial expections that in turn strengthens them further. Functional and dysfunctional impulsivity as two types of impulsivity may be related in such a way that strengthening one of them might increase proneness to the other kind of impulsivity. It has been found that functional and dysfunctional impulsivity correlated significantly and positively (Zadravec et al., 2005) that gives some reasons to consider the same variable as an independent variable and as a mediator in different mediation models.

Two simple mediation model were applied. The simple mediation model consists of a causal antescedent variable (*X*) linked to a consequent variable (*Y*) through an intermediary variable (*M*) where the independent variable (*X*) is supposed to influence both on the mediator (*M*) and the dependent variable (*Y*), and the mediator (*M*) is supposed to influence on the outcome (*Y*), but mediation analysis does not impose evidence of simple association between the independent variable *X* and the dependent variable *Y* as a precondition (Hayes, 2017).

The first simple mediation model consisted of functional impulsivity as a causal antescedent variable, sensation seeking as a consequent variable, and dysfunctional impulsivity as an intermediary variable. The second simple mediation model consisted of dysfunctional impulsivity as a causal antescedent variable, sensation seeking as a consequent variable, and functional impulsivity as an intermediary variable.

Procedure

A cross-sectional study was conducted in 2018-2019 academic year in several Bulgarian universities. The sample was purposefully selected to consist of Bulgarians in youth age as most students are. Children are up to 18 years old (UNICEF, 1990), and youth age range

varies between 18 and 25 years old (Augustus-Horvath & Tylka, 2011; Nikolov et al., 2007, p.90) or early adulthood varies between 21 and 25 years old (Anan'ev, 2001).

Participants

Seven hundred and sixty-four university students were studied by means of a questionnaire. All students participated voluntarily. Their social and demographic characteristics are presented in Table 1. Their age ranged from 19 to 25 years old. Their mean age was 21.35 years, *SD* = 1.43 years. Their age was normally distributed (skewness = 0.267, kurtosis = -0.404). Most students participating in the study were 19-21 years old – 54.6%.

The female students prevailed, as well as the students in their 3rd year of study, from the scientific area of social sciences and humanities, with medium income, living in the cities above 50,000 inhabitants (see Table 1). They were from different parts of Bulgaria, mainly from the regions of Blagoevgrad (*n* = 218), Sofia (*n* = 124), Kyustendil (*n* = 52), Vratsa (*n* = 41), Plovdiv (*n* = 35), Pazardzhik (*n* = 29), Pleven (*n* = 25), Pernik (*n* = 21), Vidin (*n* = 21), Haskovo (*n* = 10), Smolyan (*n* = 10), and some other regions in Bulgaria.

Table 1.
Social and demographic characteristics of the participants studied with a paper-and-pencil questionnaire.

Social category	Sub-group	*n*	%
Gender	Male	264	34.55
	Female	500	65.45
Year of study	1st year of study	148	19.37
	2nd year of study	189	24.74
	3rd year of study	248	32.46
	4th year of study	179	23.43
Income	Low income	185	24.21
	Medium income	401	52.49
	High income	178	23.30
Type of place of living in dependence on the size and density of population	Village	103	13.48
	Town	172	22.51
	City	344	45.03
	Capital	102	13.35
	Bulgarians living abroad	43	5.63
Scientific areas	Arts	65	8.51
	Social sciences and humanities	282	36.91
	Economy	64	8.38
	Education	51	6.67
	Sport	106	13.87
	Medical care	99	12.96
	Technical sciences	97	12.70

Instruments

One paper-and-pencil questionnaire measuring sensation seeking, functional impulsivity and dysfunctional impulsivity was used. It was created in Bulgarian by Radoslavova and Velichkov (2005) based on Zuckerman et al.'s (1964) ideas, as well as on Dickman's (1990) ideas. Radoslavova and Velichkov's scale of sensation seeking consists of 24 dichotomous items (for example, item 1 "I often buy some new and unfamiliar goods to find something interesting in them", and item 10 "The monotonous methodical work bores me very quickly"), whose Cronbach's alpha was .80 (Radoslavova & Velichkov, 2005). Radoslavova and Velichkov's scale of functional impulsivity consists of 10 dichotomous items (for example, item 2 "People admire the speed with which I twig", and item 13 "I know how to take advantage of unexpected opportunities when something has to be done immediately so as not to miss the chance"), whose Cronbach's alpha was .75 (Radoslavova & Velichkov, 2005). Radoslavova and Velichkov's scale of dysfunctional impulsivity consists of 18 dichotomous items (for example, item 5 "I often say the first thing that comes to my mind without prethought how it would sound for the other people", and item 8 "I often act hastily, without taking the time to think about my situation"), whose Cronbach's alpha was .81 (Radoslavova & Velichkov, 2005). The possible answers are "Yes" or "No". This questionnaire also includes 27 neutral items (such as item 3 "As a whole, I am very hesitating and indecisive") intended to hide the real goal of measurement. They are not any part of any scale (Radoslavova & Velichkov, 2005).

Radoslavova and Velichkov (2005) validated their instrument by means of indicating that sensation seeking negatively correlated with need for security and safety, i. e. with striving to avoid dangers and looking for defense. The need for security stimulates functional impulsivity and is related to a decrease in dysfunctional impulsivity (Iancheva et al., 2018).

Other findings related to validity of this instrument established that functional impulsivity correlated positively with cognitive engagement (active coping, planning, suppressing competent activities, positive reappraisal) as a coping strategy, and dysfunctional impulsivity correlated positively with emotional and cognitive disengagement (denial, use of alcohol and drugs) as a coping strategy among Bulgarian soldiers participating in international missions abroad (Iancheva & Kuleva, 2018), Bulgarian soldiers in a military mission in Afghanistan and Bulgarian participants in the Antarctic expeditions (Iancheva et al., 2018).

Mountaineers and climbers, as representatives of sports directed to challenge, new impressions and experiences, risky and adventurous performances, manifest high levels of

sensation seeking (Iancheva et al., 2018). Mountain climbers score higher on sensation seeking, functional and dysfunctional impulsivity than Bulgarian soldiers participating in international missions abroad (Iancheva & Kuleva, 2018).

Data analysis

Data collected in this study is available in Mendeley public data repository (Stoyanova, 2020). Statistical power (sensitivity, according to Glen, 2015) was calculated by means of the software GPower 3.1.9.2 (Faul et al., 2007).

Data were statistically processed by means of SPSS 20.0 (IBM Corp., 2011) applying descriptive statistics for establishing the frequency distributions of functional impulsivity, dysfunctional impulsivity, and sensation seeking; Pearson correlation coefficient and linear regression analysis for examining the connections between the studied variables. Mediation analysis using bootstrapping with 5000 sub-samples of data and maximum-likelihood method was applied with the software JASP 0.11.1.0 (JASP Team, 2019). The data was processed with bootstrapping not requiring normal distribution (Prado et al., 2014; Zarbova, 2019), neither supposing any distributional assumptions (Preacher & Leonardelli, 2001). Bootstrapping for mediation analysis is recommended by Fairchild & McQuillin (2010), MacKinnon et al. (2007), Prado et al. (2014), Zarbova (2019). For applying a mediation model with bootstrapping, the assumptions are that: (1) an independent variable affects a mediator, (2) the independent variable directly affects a dependent variable without the mediator, (3) the mediator affects the dependent variable in the presence of the independent variable (Jackson, 2011; Montoya, 2018), and (4) the effect of the independent variable on the dependent variable is changed when the mediator is added to the model (Jackson, 2011).

Results

Table 2 presents the average scores on the scales of Sensation seeking, Functional impulsivity, and Dysfunctional impulsivity, as well as check for normality distribution of the scores on these scales. Statistical power (sensitivity, according to Glen, 2015) was above 0.95 for all three studied variables and it was calculated by means of the software GPower 3.1.9.2 (Faul et al., 2007) comparing the means of the sample in our study with 764 participants to the means of the sample in the study by Radoslavova & Velichkov (2005) when the questionnaire was created and validated.

Table 2.

Mean scores, standard deviations, skewness, and kurtosis on the scales of Sensation seeking, Functional impulsivity, and Dysfunctional impulsivity.

	Functional impulsivity	Dysfunctional impulsivity	Sensation seeking
Mean	5.68	8.44	13.74
Standard Deviation	1.98	3.92	4.64
Skewness	-0.29	-0.11	-0.53
Kurtosis	-0.12	-0.69	-0.24

The test scores on the three scales were normally distributed (see Table 2). The coefficients of skewness and kurtosis of test scores on the three scales varied between -1 and +1, i. e. their distribution approximated the normal distribution (Hair et al., 2016).

Increase of sensation seeking was related to increase in functional impulsivity (r (762) =.387; p < .001; N = 764; 95% CI varied berween .325 and .446) and increase in dysfunctional impulsivity (r (762) =.409; p < .001; N = 764; 95% CI varied between .349 and .467). Increase of dysfunctional impulsivity was related to small increase in functional impulsivity (r (762) =.271; p < .001; N = 764; 95% CI varied berween .204 and .336). Sensation seeking, functional and dysfunctional impulsivity were interrelated. Statistical power (sensitivity, according to Glen, 2015) was above 0.95 for correlations between all three studied variables and it was calculated by means of the software GPower 3.1.9.2 (Faul et al., 2007).

Mediation analysis with predictor functional impulsivity, mediator dysfunctional impulsivity and outcome variable sensation seeking specified the relationships between these variables – see Table 3, Table 4, Table 5, and Figure 1.

Table 3.

Direct effects of functional impulsivity on sensation seeking.

Predictor		Outcome	Estimate	Standard error	*z*-value	*p*	95% bias – corrected bootstrap confidence interval	
							Lower	Upper
Functional impulsivity	→	Sensation seeking	0.151	0.016	9.150	< .001	0.117	0.183

Functional impulsivity directly influenced on sensation seeking – see Table 3. Increase in functional impulsivity augmented sensation seeking.

Table 4.

Indirect effects of functional impulsivity on sensation seeking mediated by dysfunctional impulsivity.

Predictor		Mediator		Outcome	Estimate	Standard error	*z*-value	*p*	95% bias – corrected bootstrap confidence interval	
									Lower	Upper
Functional impulsivity	→	Dysfunctional impulsivity	→	Sensation seeking	0.045	0.007	6.168	< .001	0.032	0.061

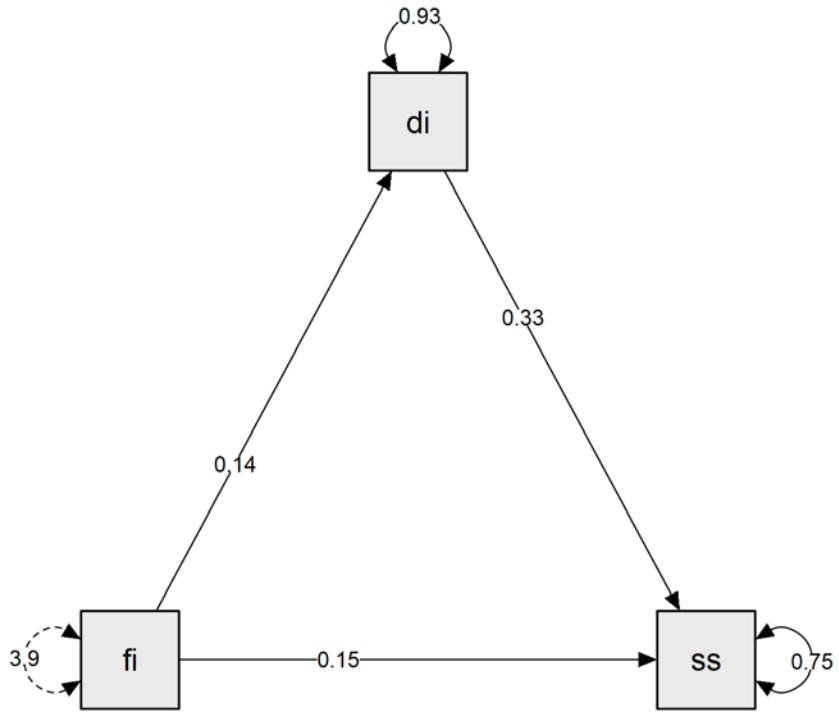
Functional impulsivity influenced indirectly on sensation seeking mediated by dysfunctional impulsivity – see Table 4. Increase of functional impulsivity augmented dysfunctional impulsivity that increased also sensation seeking – see Figure 1.

Table 5.

Total effects of functional impulsivity on sensation seeking.

Predictor		Outcome	Estimate	Standard error	*z*-value	*p*	95% bias – corrected bootstrap confidence interval	
							Lower	Lower
Functional impulsivity	→	Sensation seeking	0.196	0.017	11.602	< .001	0.160	0.231

Total effects include combination of direct and indirect effects. Increase in functional impulsivity augmented sensation seeking – see Table 5 and Figure 1. Coefficient of determination for change in sensation seeking was R^2 = .250, i. e., the model explained 25% of variance (Zarbova, 2019) in change of sensation seeking that was medium effect size (Awang, 2015). Coefficient of determination for change in dysfunctional impulsivity was R^2 = .074, i. e., the model explained 7.4% of variance (Zarbova, 2019) in change of dysfunctional impulsivity that was small effect size (Awang, 2015). Increase in functional impulsivity augmented sensation seeking and dysfunctional impulsivity. Increase in dysfunctional impulsivity augmented sensation seeking.



Note: fi means functional impulsivity, di means dysfunctional impulsivity, ss means sensation seeking

Figure 1. *Direct and indirect effects of functional impulsivity on sensation seeking mediated by dysfunctional impulsivity.*

Mediation analysis with predictor dysfunctional impulsivity, mediator functional impulsivity and outcome variable sensation seeking specified the relationships between these variables – see Table 6, Table 7, Table 8, and Figure 2.

Table 6.

Direct effects of dysfunctional impulsivity on sensation seeking.

Predictor		Outcome	Estimate	Standard error	*z*-value	*p*	95% bias – corrected bootstrap confidence interval	
							Lower	Upper
Dysfunctional impulsivity	→	Sensation seeking	0.084	0.008	10.093	< .001	0.069	0.101

Dysfunctional impulsivity directly influenced on sensation seeking – see Table 6. Increase in dysfunctional impulsivity augmented sensation seeking.

Table 7.

Indirect effects of dysfunctional impulsivity on sensation seeking mediated by functional impulsivity.

Predictor		Mediator		Outcome	Estimate	Standard error	*z*-value	*p*	95% bias – corrected bootstrap confidence interval	
									Lower	Upper
Dysfunctional impulsivity	→	Functional impulsivity	→	Sensation seeking	0.021	0.003	5.932	< .001	0.014	0.029

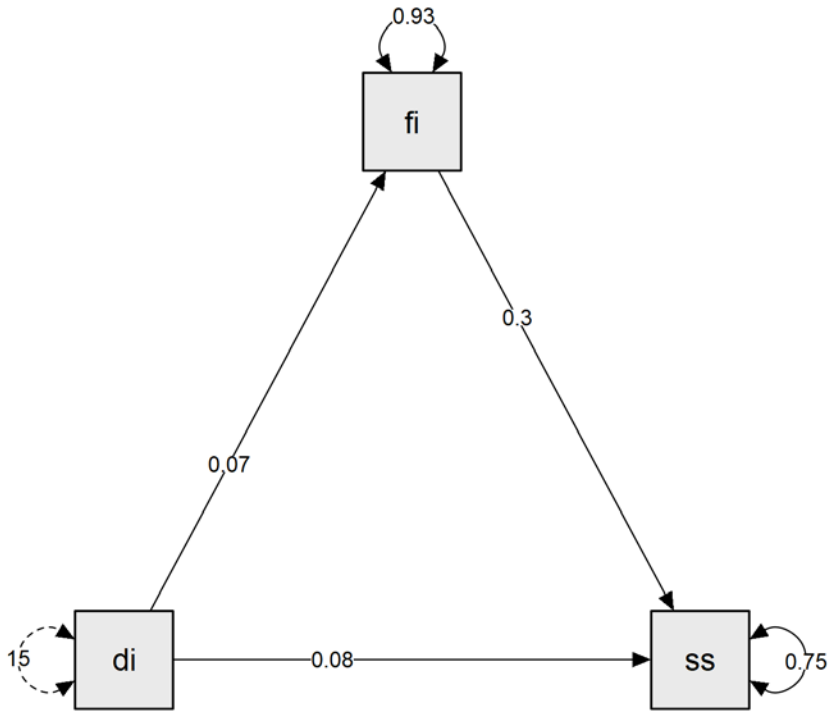
Dysfunctional impulsivity influenced indirectly on sensation seeking mediated by functional impulsivity – see Table 7. Increase of dysfunctional impulsivity augmented functional impulsivity that increased also sensation seeking – see Figure 2.

Table 8.

Total effects of dysfunctional impulsivity on sensation seeking.

Preditor		Outcome	Estimate	Standard error	*z*-value	*p*	95% bias – corrected bootstrap confidence interval	
							Lower	Lower
Dysfunctional impulsivity	→	Sensation seeking	0.104	0.008	12.404	< .001	0.087	0.120

Total effects include combination of direct and indirect effects. Increase in dysfunctional impulsivity augmented sensation seeking – see Table 8 and Figure 2. Coefficient of determination for change in sensation seeking was R^2 = .250, i. e., the model explained 25% of variance (Zarbova 2019) in change of sensation seeking that was medium effect size (Awang, 2015). Coefficient of determination for change in dysfunctional impulsivity was R^2 = .074, i. e., the model explained 7.4% of variance (Zarbova, 2019) in change of dysfunctional impulsivity that was small effect size (Awang, 2015). Increase in dysfunctional impulsivity augmented sensation seeking and functional impulsivity. Increase in functional impulsivity augmented sensation seeking.



Note: fi means functional impulsivity, di means dysfunctional impulsivity, ss means sensation seeking

Figure 2. *Direct and indirect effects of dysfunctional impulsivity on sensation seeking mediated by functional impulsivity.*

Mediation analysis established that both models described in Figure 1 and Figure 2 explained an equal part of variance of sensation seeking – 25% each of them. Functional impulsivity (z-value = 9.150, see Table 3) had smaller direct effect on sensation seeking than dysfunctional impulsivity (z-value = 10.093, see Table 6). Functional impulsivity (z-value = 6.168, see Table 4) had stronger indirect effect on sensation seeking than dysfunctional impulsivity (z-value = 5.932, see Table 7). Direct effects of functional and dysfunctional impulsivity on sensation seeking were stronger than their indirect effects. Functional impulsivity (z-value = 11.602, see Table 5) had smaller total effects on sensation seeking than dysfunctional impulsivity (z-value = 12.404, see Table 8). These findings mean that it could not be stated categorically that the most appropriate ways, neither the least appropriate ways were tried to experience optimal stimulation, because of stronger direct effects of dysfunctional impulsivity on sensation seeking than the direct effects of functional impulsivity on sensation seeking on the one hand, but on the other hand there were established stronger indirect and total effects of functional impulsivity on sensation seeking than the indirect and total effects of dysfunctional impulsivity on sensation seeking.

The raw correlation for the *a* path (independent variable - mediator) and the partial correlation for the *b* path (mediator-dependent variable) are effect size measures for mediation models (MacKinnon et al., 2007). For the mediation model in Figure 1. Direct and indirect effects of functional impulsivity on sensation seeking mediated by dysfunctional impulsivity, the raw correlation between the independent variable functional impulsivity and the mediator dysfunctional impulsivity was r (762) = .271, and the partial correlation between the mediator dysfunctional impulsivity and the dependent variable sensation seeking controlled for functional impulsivity was r (761) = .343, p < .001; 95% CI varied berween .280 and .404. For the mediation model in Figure 2. Direct and indirect effects of dysfunctional impulsivity on sensation seeking mediated by functional impulsivity, the raw correlation between the independent variable dysfunctional impulsivity and the mediator functional impulsivity was r (762) = .271, and the partial correlation between the mediator functional impulsivity and the dependent variable sensation seeking controlled for dysfunctional impulsivity was r (761) = .314, p < .001; 95% CI varied berween .243 and .379. Computed in this way, the first effect size in both mediation models was the same, and the second effect size in these mediation models revealed stronger effect of dysfunctional impulsivity as a mediator on sensation seeking than the effect of functional impulsivity as a mediator of sensation seeking. In this way, it became clear that dysfunctional impulsivity stimulated slightly more sensation seeking than functional impulsivity, i. e., quick ineffective decisions accompanied seeking for optimal stimulation.

Standardized regression coefficients may serve as effect size measures for individual paths in the mediation model (MacKinnon et al., 2007). Linear regression analysis with independent variable functional impulsivity and dependent variable sensation seeking was performed (standardized coefficient β = .387, t (763) = 11.587, p < .001, r^2 =.150, F(1, 762) = 134.264, p < .001), as well as linear regression analysis with independent variable dysfunctional impulsivity and dependent variable sensation seeking was performed (standardized coefficient β = .409, t (763) = 12.387, p < .001, r^2 =.168; F(1, 762) = 153.447, p < .001). Dysfunctional impulsivity had larger direct effect on sensation seeking than functional impulsivity, because of higher standardized coefficient Beta for dysfunctional impulsivity, as MacKinnon et al. (2007) explained. Dysfunctional impulsivity played more important role in sensation seeking than functional impulsivity.

Discussion

The findings supported the hypothesis that dysfunctional impulsivity would be directly related to sensation seeking, as well as indirectly related to sensation seeking mediated by functional impulsivity. The findings also supported the hypothesis that functional impulsivity would be directly related to sensation seeking, as well as indirectly related to sensation seeking mediated by dysfunctional impulsivity.

Direct positive connections between functional and dysfunctional impulsivity on the one hand and sensation seeking on the other hand were established by means of correlation analysis that revealed stronger direct connection between dysfunctional impulsivity and sensation seeking than between functional impulsivity and sensation seeking. Direct positive connections between functional and dysfunctional impulsivity on the one hand and sensation seeking on the other hand were also established by means of mediation analysis that revealed stronger direct connection between dysfunctional impulsivity and sensation seeking than between functional impulsivity and sensation seeking. Regression analysis indicated that dysfunctional impulsivity had larger direct effects on sensation seeking than functional impulsivity.

Direct effects of functional and dysfunctional impulsivity on sensation seeking were stronger than their indirect effects. Indirect positive connections between functional and dysfunctional impulsivity on the one hand and sensation seeking on the other hand were established by means of mediation analysis that revealed stronger indirect connection between functional impulsivity and sensation seeking than between dysfunctional impulsivity and sensation seeking. Partial correlations revealed larger effects of dysfunctional impulsivity as a mediator on sensation seeking than the effects of functional impulsivity as a mediator of sensation seeking.

Functional impulsivity had smaller total (direct plus indirect) effects on sensation seeking than dysfunctional impulsivity. Dysfunctional impulsivity played more important role in sensation seeking than functional impulsivity. Dysfunctional impulsivity stimulated slightly more sensation seeking than functional impulsivity, i. e., quick ineffective decisions accompanied seeking for optimal stimulation. It seems that less appropriate ways were tried to experience optimal stimulation, because of stronger connection between sensation seeking and dysfunctional impulsivity than a weaker connection between sensation seeking and functional impulsivity. Dysfunctional impulsivity means being prone to make quick

ineffective decisions (Pitts & Leventhal, 2012), acting without thinking about the outcomes (Zadravec et al., 2005). Dysfunctional impulsivity may mean some attention deficits as suggested by Schalling & Åsberg (1985), Popov et al. (2016), Whiteside & Lynam (2001), as well as lack of accuracy and precision of information processing (Schalling & Åsberg, 1985; Zadravec et al., 2005). Sensation seeking influenced by dysfunctional impulsivity could have some negative outcomes. Among them, dysfunctional impulsivity implies more frequent antisocial and deviant behavior (Kalchev, 2016; Radoslavova & Velichkov, 2005) and aggression (Radoslavova & Velichkov, 2005; Raine et al., 1998). Connection between dysfunctional impulsivity and sensation seeking may partly explain deviant behavior and attention deficits in youth, as it has been found that impulsivity indicates some difficulties in concentrating and focusing attention on the task at hand (Chase et al., 2017; Cross et al., 2011; Ramakrishnan et al., 2019), as well as impulsivity (Cross et al., 2011; Dick et al., 2010; Molero Jurado et al., 2020; O'Connor & Jackson, 2008; Pérez Fuentes et al., 2016) and sensation seeking (Horvath & Zuckerman, 1993; Surányi et al., 2013; Zuckerman & Aluja, 2014) both may contribute to deviant behavior.

Because of the existence of dysfunctional impulsivity and its negative consequences, some various techniques and approaches have been offered to overcome impulsivity. The strategies to promote mental health aim at managing impulsivity (Netto et al., 2016) by applying such methods to overcome impulsivity as reward substitution and precommitment (Garza et al., 2016), as well as therapy focusing on mood instability (Peters et al., 2016), group narrative therapy and group play therapy that are effective in reducing impulsivity and aggression (Kasmaei, & Asghari, 2017).

Control over impulsivity is related to mentalization – understanding of one's needs, intentions, thoughts, as well as understanding the other person's needs, intentions, and thoughts (Mihova, 2014). It has been found that impulsivity correlates positively with alexitimia (Popov et al., 2016), i. e. the impulsive people have some difficulties in processing information regarding their own emotions and recognizing them that further impede their decision-making and social functioning. The studies and interventions focused on impulsivity contribute to the scientific knowledge regarding its essence and its consequences for social functioning.

As some other authors state, impulsivity should not be regarded as a single construct, but different types of impulsivity should be considered instead, because they have a variety of behavioral and psychosocial consequences (Strickland & Johnson, 2020). The present study confirmed the grounds of such theoretical conception.

Limitations and further implications of the study

This study had some limitations related to possible social desirability in answering. Self-report measures of impulsivity tend to over-estimate it (Maraz et al., 2016). Social desirability includes hyperbolisation of positive self-description and denial of negative self-description that are the most weakly expressed in Bulgarian students among students from 20 countries (He et al., 2015) that is why sincere answers may be expected in our sample of Bulgarian students. The results were checked applying several statistical tests – correlation analysis, regression analysis, and mediation analysis to estimate the relationships between the studied variables more precisely. Applying more instruments for data collection may further improve objectivity of results.

The findings are limited within the range of the age of the sample (inclusion of youth people only aged from 19 to 25 years old). Only students were studied, and the sample did not include unemployed people between 19 and 25 years old who did not study. Research among more representatives of different social groups would give opportunity for generalizing the results. Further cross-cultural studies on the link between impulsivity and sensation seeking may reveal more about its nature, while longitudinal studies may contribute to establish the tendencies in its development and manifestations.

Conclusion

This was the first study that compared the direct and indirect contribution of functional and dysfunctional impulsivity on sensation seeking. It revealed that sensation seeking as a search for optimal stimulation may be realized by means of some inappropriate ways that may have some negative outcomes, because of stronger influence of dysfunctional impulsivity on sensation seeking than the influence of functional impulsivity. The inappropriate ways of sensation seeking related to dysfunctional impulsivity might be dangerous for personal health and could impede some social norms. The negative outcomes from sensation seeking influenced by dysfunctional impulsivity may concern personal dissatisfaction, significant others' negative feelings, ineffective decisions, personal and professional failures, etc. However, functional impulsivity mediated the effect of dysfunctional impulsivity on sensation seeking, that is why sensation seeking should have also some satisfactory results and may enrich personal experience. This study also contributed to the scientific literature by giving some evidence that different types of impulsivity should be more meaningfully investigated instead of a single construct of impulsivity. Future research may

further clarify if the above findings regarding the relations between impulsivity and sensation seeking are supported in different contexts and in different age groups.

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Competing Interests

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