Prediction of Substance Abuse Potential Based on Alexithymia and Executive Dysfunctions in Employees
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The negative consequences of addiction among employees for individuals and organizations is severe, so understanding the underlying factors of substance abuse potential in these individuals are very important. The present study aimed to investigate the effects of alexithymia and executive dysfunctions on employees' addiction potential. It was a cross-sectional study. Using self-report tools and random sampling, 128 employees participated based on Cochran's sample size formula in this research. To collect the data, the Addiction Potential Scale (APS-1992), Toronto Alexithymia Scale (TAS-20: 1994), Stroop tests and Dual two back Computerized Test were used. Based on statistical analysis, there was a significant correlation between the variables of difficulty in emotion recognition, difficulty in emotion description, selective attention, working memory(reverse) and substance abuse potential (p<.05). The multiple regression results indicate that the predictor variables together explain 17% of the variance of the adjusted addiction potential index. According to the results, the speed of selective attention (p <.05, t = -2.11, t=-.10), accuracy of working memory (p <.05, t = -.247, B= -.053), and emotion recognition difficulty (p = .05, t = 2.07, B= .157), predict significantly the addiction potential index. examining the simultaneous correlation of alexithymia and executive dysfunctions with the employees' addiction

potential can be a practical step in predicting substance abuse in workplaces.

Keywords: substance abuse, alexithymia, executive dysfunctions, working memory, workplace, employees.

Substance abuse disorder and medication could be considered as the fourth global health crisis after poverty and population growth, environmental destruction, and nuclear threats. In Iran in 2021, about 2.8 million regular drug users have been diagnosed. It is estimated that about 22.3% of these individuals are among the employees in workplace (Shoghoshoara, 2021). It is impossible to ignore the damage caused by the addiction to organizations. Medical treatment requests from substance users are three times higher than those from other employees. Additionally, they account for 25 to 30% of workplace problems and devote less than 60% of their energy to work, significantly reducing workplace productivity (Mohammadi & Asgari, 2017). Therefore, it is imperative to identify factors that contribute to substance abuse.

The main feature of different types of drug related addictions and disorders is a set of cognitive, behavioral, and physiological symptoms indicating that an abuser still keeps on drugs despite the considerable problems that abounds (Ahmadi, Basharpoor & Narimani, 2019) One of the components that can be effective in this regard is alexithymia. A major characteristic of alexithymia is the tendency to use inefficient emotion regulation strategies. People with alexithymia have problems with introspection, or observing their own mental and emotional processes, experience confusion around bodily sensations connected to emotions and also, they struggle to communicate their emotions to other (Morie & Ridout, 2018), So in response to these emotional deficiencies and emotion regulation problems, turn to drugs, medication or

alcohol to moderate their emotions (Biolcati, Mancini, Andrei & Trombini, 2021). People with illegal sedate utilize habitually (45% to 50%) show alexithymia (Haviland, Hendryx, Shaw & Henry, 1994). Research proposes a relationship between alexithymia and craving for drugs and/or alcohol (Junghanns, Tietz, Dibbelt, Kuether, Jurth, Ehrenthal, 2005, Pombo, CNF, Ismail, Cardoso, Figueira, 2015).

High alexithymia in heavy alcohol users is associated with increased craving and compulsive urge to drink, and obsessive thoughts about alcohol (Thorberg, Young, Sullivan, Lyvers & Connor, 2011). Several mechanisms have been proposed to explain the neurobiological basis of alexithymia in addiction, ranging from aberrant hypothalamic-pituitary-adrenal axis functioning associated with chronic stress to a lack of interceptive and emotional awareness. (Morie, Yip, Nich, Hunkele, Carroll & Potenza, 2016) It seems that people with alexithymia seem to have difficulty coping with stressful situations and are more likely to use "addictive" behavior as a coping strategy to deal with potentially distressing situations (Orsolini, 2020). The inability to regulate emotions, due to complex cognition, may explain the higher levels of impulsive and compulsive behaviors such as addiction that have been observed there (Orsolini, 2020). Thus, Alexithymia refers to a group of weaknesses in emotional processing. Etiological theories using neuroscientific techniques suggest frontal lobe impairment characterized by emotional incompetence, implying corresponding executive dysfunction. Although a model of frontal lobe brain function in alexithymia is emerging, the problem is that most studies to date have largely ignored co-occurring cognitive deficits with frontal lobe dysfunction. Cognitive functions of the frontal lobes, known as executive functions, are a set of cognitive processes necessary for cognitive control of behavior, including basic cognitive processes

such as attentional control, cognitive inhibition, inhibitory control, working memory, and cognitive flexibility. (for review, see Roth, Randolph, Koven & Isquith, 2006). Executive dysfunction occurs with conditions that disrupt the brain's ability to control thoughts, emotions, and behaviors. Dysfunction in working memory can lead to substance dependence by causing defects in information processing and decision making (Castellanos-Ryan & Conrod, 2020) and affect the person's willingness to choose a high-risk situation, including druges (Miller, Lundqvist & Bastos, 2018. Khurana, Romer & Betancourt, 2017. Vassileva & Conrod, 2019. Miller, et al, 2018. Sepahvand, 2018), especially when they are faced with high-risk situations. Some researchers showed that executive dysfunctions can increase an individual's substance abuse potential (Lechner, Sidhu, Kittaneh & Anand, (2019), Rezaee, Baradaran & Soltani Shal, 2019).

Current studies mainly deal with the effects of substance abuse on executive functions (Verdejo-Garcia & Albein-Urios, 2020. Brooks et al., 2017. Butler Le Foll, 2019), and only a few studies have addressed the role of executive dysfunction and alexithymia as predictors of substance abuse potential.

While some studies reveal neuropsychological indices of executive dysfunction in conjunction with alexithymia in specific clinical populations in addiction and other disorders (Henry, Phillips, Crawford, Theodorou & Summers, 2006, Bogdanova, Díaz-Santos & Cronin-Golomb, 2010) very few studies have investigated patterns of executive functioning and alexithymia in addiction among non-clinical samples (Koven & Thomas, 2010). Addiction is a disorder that causes distress, functional defects and creating psychological and social problems for employees and organizations. The latest assessment of the state of addiction in

the country shows that about 70% of drug addicts in the country are employed, and about 10% of them have started using drugs in the workplace, so it will be very important to consider the factors that predict addiction in employees. As a result, the society and Specially organizations must prevent it in order to reduce the mentioned problems.

More importantly, considering the high rate of addiction, especially in the workplaces, only a few researches have been performed to predict the addiction potential among employees.

To address this gap, this study uses empirically-derived facets of alexithymia and a computerized measure of executive dysfunction in a non-clinical sample of employees. Therefore, the problem statement of the present study considers whether it is possible to predict the substance abuse potential among employees based on executive dysfunctions and alexithymia? And which specific aspects of executive function deficit and alexithymia are implicated more in addictive behavior?

Method

The study has been designed as a cross-sectional study conducted on gas employees in Hormozgan province. to collect data, The STROBE checklist for cross-sectional studies was followed to improve methodological rigor. It is worth noting that in 2020-2021, the statistical population comprised all of company employees. 128 employees were randomly selected based on Cochran's sample size formula in this research. In carrying out the research ethical principles were highly respected, the most significant of which include vividly informing the participants of the research objectives, gaining their consent to participation, assuring them of confidentiality of their personal information. Questionnaires were used for collecting data are comprehensively depicted below:

Instruments

This study analyzed participants' sociodemographic characteristics.

Dual two back Computer Test: The dual-task n-back task is a variation that was proposed by Susanne Jaeggi et al. in (2003), Measures executive functions and includes data retention and manipulation. This test is used to measure the potential to maintain performance level in tasks that require various factors under normal conditions. This is called the working memory at high workload in the cognitive psychology literature. So, it is suitable for measuring working memory and has wide applications (Chen, Mitra & Schlaghecken, 2008). In this test, a number of visual and auditory stimuli are presented consecutively through a computer screen, and according to the type of the task, the subject should press the key Ni. 1 of the keyboards if any of the stimuli is similar to the previous two stimuli, and the key No.2 if they are not similar. The interval between the presentation of each stimulus and the previous stimulus is two seconds (Li, 2021. Khayyer, Nejati & Fathabadi, 2014). The reliability of this test was calculated as .80 by Jaeggi et al. in (2003) .83 in Khayyer et al (Khayyer, Nejati & Fathabadi, 2014) first in Iran and 0.85 in this study and Its face validity was confirmed by two psychologists and one neurologist.

Stroop Computer Test

This test was first developed and used by Stroop in 1935 to assess selective attention and cognitive flexibility (Mamsharifi, Jamebozorg & Takjoo, 2020. MacLeod, 1996). Among the different standardized versions, the test proposed by Golden (1978) is one of the most extensive, owing to its relatively large

number of specific norms for individuals from different sociodemographic conditions and cultures (e.g., Lubrini et al., 2014; Strauss et al., 2006). The test consists of three steps: In the first step, after observing the names of the four main colors that appear in black on the screen, the subject must press one of the yellow, red, blue and green keys on the keyboard in the shortest possible time. In the second step, the names of the four main colors, each shown in its own color, appear in the center of the computer screen, and the subject must press the key corresponding to each color on the keyboard as quickly as possible. Finally, in the third step, the names of the four main colors, each shown in a different color than their own, appear on the screen, and the subject must press the corresponding key on the keyboard as soon as possible according to the word shown (Bahrami, Nejati & Poureatemad, 2012). The indices measured in this test are: 1. Accuracy (number of correct answers) 2. Speed (average reaction time of correct answers to the stimuli in thousandths of a second). In addition to its widespread use for measuring the ability to prevent cognitive interference, it has also been used for measuring other cognitive functions such as attention, processing speed, cognitive flexibility, and working memory (Scarpina & Tagini, 2017). Golden (1978) reported that the psychometric properties of this tool were appropriate. Bahrami, Nejati and Poure-Etemad (2012) also calculated its Cronbach's alpha to be .55, .68 and 0.71 in each stage, respectively and .72, .75, .78 in each stage in this research and Its face validity was confirmed by two psychologists and one neurologist

Addiction Potential Scale (APS): The Addiction Potential Scale, designed by Weed, Butcher, McKenna & Ben Porat (1992), is widely used to measure addiction risk or potential. The Addiction Potential Scale was developed as a measure of personality factors

associated with addictive disorders (Ghodrati, Mohammadipour & Mafakheri, 2021). It consists of 38 items, the answers to which include two options: "True = Score 1" or "False = Score 0" (Weed, Butcher, McKenna & Ben-Porath, 1992). Some items are scored in reverse. The final score of the scale is the sum of the scores of all items (Rostami, Nosratabadi, Mohammadi, 2007). Weed et al. (1992) obtained the reliability coefficient of APS in a normal sample (with an interval of one week) in men and women, respectively, .69 and .77, in their opinion, this reliability is acceptably high. Weed et al. (1992) have reported that there is a lot of common variances between the AAS scale (Addiction Acceptance Scale) and the APS scale. Their correlation in the whole sample was .57. The reliability and validity of this scale were obtained .78 and .65, respectively, in Rostami et al. (2007). Ghodrati, Mohammadipour and Mafakheri (2021) also calculated its Cronbach's alpha be .75 and, in this research, it was .78. In Minoui and Salehi's research (2003), its validity was calculated as .53 through the dichotomization method.

Toronto Alexithymia scale (TAS-20)

The Toronto Alexithymia scale was first developed by Bagby, Parker, and Taylor in 1994 (Parolin, et al, 2018. Bagby, Parker, Taylor, 2020). This questionnaire has 20 item and aims at the assessment of the degree of alexithymia or difficulty expressing emotions and its various dimensions (difficulty in emotion recognition, difficulty in emotion description, objective thinking). The questionnaire has a response range in the Likert scale and is scored from 1 (strongly disagree) to 5 (strongly agree). A total score is also calculated for all three scales. The psychometric properties of the Toronto Alexithymia scale -20 have been reviewed and validated in numerous studies (Parolin, et al, 2018.

Bagby, Parker & Taylor, 2020). The psychometric properties of the Toronto Alexithymia Scale have been confirmed in numerous studies (Parker, Taylor and Bagby, 2001, 2003; Taylor and Bagby, 2000). Bagby et al. (1994) have calculated reliability of the mentioned tool using Cronbach's alpha coefficient 0.85. In the Persian version of this questionnaire, Besharat (2007) considers Cronbach's alpha coefficients for total alexithymia, and three subscales of difficulty in emotion recognition, difficulty in emotion description, and objective thinking scored .75, 0.82, .85 and .72, respectively, indicating acceptable internal consistency of the scale (Besharat, 2007). The reliability of the questionnaire was also confirmed from .8 to .87 with a sample size of 60 in two periods with a time interval of four weeks for alexithymia and its subscales (Besharat, 2007). In this research Cronbach's alpha was .83. Mohammad (2008) reported the validity of the whole scale in the Iranian sample as .74 and .72 and the validity of the scale as .85 using the method of halving and retesting.

The data of the present study were analyzed using descriptive statistics (the mean, standard deviation), Pearson's coefficient of correlation, and multiple linear Regression analysis, all of which were analyzed on a significance level ($\alpha = .05$) using the 22nd version of SPSS.

Results

The total number of analyzable questionnaires in this study was 128. The age range of participants is between 26 and 59. Among the participants, 4 (3.1%) had diploma degree, 7 (5.5%) had associate degree, 72 (56.3%) had bachelor's degree, 42 (32.8%) had master's degree and 3 (2.3%) also had a doctoral degree.

Table 1
Correlation Analysis of Predictor Variables and Substance Abuse Potential

No.	Variable	Mean	SD	Substance abuse potential
Substance abuse potential	Substance use potential	19/91	3/71	1
Alexithymia	difficult in emotion recognition	40/14	4/47	-.31**
	Difficulty in emotion description	53/11	3/42	-.26**
Selective attention	Objective thinking	46.87	5.700	-.32**
Working Memory	Reaction time of the Stroop-1st stage	47.84	5.660	-.24**
	Reaction time of the Stroop-3rd stage	44.59	4.642	-.18*
	Accuracy	35.75	7.946	.08
	Speed	34.71	8.640	-.13

Source: research findings *=p<.05   **= p<.01

As can be observed in Table 1, there is a significant correlation between the variables of difficulty in emotion recognition, difficulty in emotion description, selective attention, working memory and substance abuse potential. In order to predict the substance abuse potential based on alexithymia and executive functions, simultaneous multiple regression analysis was used.

Table 2
The Predictive Correlation of Alexithymia Components and Executive Functions on Substance Abuse Potential

Variables		B	S. E.	Beta	t	P	R	R^2	F	
	Constants	26.572	2.938		9.045	.01				
Selective attention	Reaction time of the Stroop-1st stage	.006	.004	.150	1.349	.18				
	Reaction time of the Stroop-3rd stage	-.010	.005	-.233	-2.115	.037				
Working memory	Accuracy	-.053	.021	-.225	-2.467	.015	.41	.17	3.09	.01*
	Speed	-.093	.223	-.037	-.417	.67				
Alexithymia	Difficulty in emotion recognition	-.157	-.089	-.192	-2.07	.049				
	Difficulty in emotion description	-.190	.116	-.182	-1.637	.10				

Note*: Source= research findings   *=p<.05 **= p<.01

The results of multiple regression (Table 2) indicate that the predictor variables together explain 17% of the variance of the adjusted index of addiction potential. The results on the significance of the predictive model of the adjusted index of substance abuse potential show that at least one of the predictor variables has a significant predictive effect (p <.01, F (7, 110) = 3.09). Among the predictor variables, speed of selective attention (p = .05, t = -2.115, Beta=-.233), accuracy of working memory (p <.05, t = -2.47, Beta = -.225) and difficulty in emotion recognition (p <.05, t = 2.07, Beta = -.192), had a significant predictive effect on addiction potential index.

Discussion

The present study aimed at finding the relationship between drug abuse potential and components of alexithymia and executive dysfunction among the employees of a Company in Iran. Findings indicate that there is a significant correlation between executive dysfunctions, alexithymia and substance abuse potential. This is consistent with Rueda Ruiz, Larracoechea, Herrero & Estévez (2022), Junghanns et., al (2005), Edens, Kasprow, Tsai & Rosenheck (2011), and Haviland, Hendryx, Shaw & Henry (1994) and also these findigns were not consistent with Thorberg, Young, Rsullivan & Lyvers, M. (2009) and Coriale et al., (2012). Several mechanisms have been proposed to explain the neurobiological basis of alexithymia in addiction, ranging from aberrant hypothalamic-pituitary-adrenal axis functioning associated with chronic stress to a lack of interceptive and emotional awareness. This prevents individuals from regulating their emotions effectively, making them addicted to substances to cope with challenging times. Regarding the alexithymia variable,

both components, namely difficulty in emotion recognition and difficulty in emotion description, have a correlation with substance abuse potential, and among these components, difficulty in emotion recognition has played an effective predictive role in substance abuse potential. In explaining this finding, it can be said that characteristics of people with difficulty in emotion recognition is reflecting defects in the cognitive-experiential field, emotional response and interpersonal relationship. So, inability to accurately identify emotions, great weakness in the verbal transmission of emotional helplessness to others, and failure to get help from others may causes them to be shunned and in general, they have a high readiness for addiction (Gao, Zhang, Gao, Kong, Hu, 2018). The inability to moderate emotions along with executive dysfunction may lead to higher levels of impulsivity and coercive behavior, which can be a contributing factor to addiction (Orsolini, 2020). Explaining this finding, it can also be said that employees who can correctly identify their negative emotions are less likely to use drugs in order to escape from these feelings and problems, and instead, they solve their problems by correctly identifying their emotions. Conversely, workers who do not correctly recognize and interpret their negative emotions use inappropriate coping strategies, such as drug use, to address these emotions. This often causes these negative emotions and feelings to recur and create a vicious cycle that causes the individual to depend heavily on substance abuse. The results of other studies have also confirmed this interpretation of the findings (Afshari, 2019. Mohammadi & Asgari, 2017. Morie & Ridout, 2018. Kamkar, Farrokhi, Salimi Bajestani & Mardani Rad, 2020. Morie, et al, 2016). Various morphological studies on the centers of the cerebral cortex of people with addiction have discovered this mechanism (Zhou, Li, Zhu, 2013). One of the characteristics of addicted people is the loss of self-

control in behavior, which is related to defecate in executive functions. Because these are executive functions that enable people to restrain your desires and related behaviors

limit happiness and pleasure under adverse conditions (Tripathi, 2017).

On the other hand, the results show that among the various types of executive functions, there is a negative correlation between selective attention and working memory and substance abuse potential. The findings of Gernrad et al. (2008) confirm these findings. In cognitive studies, addiction is usually the result of a defect in the two executive functions of problem-solving and decision-making (Grenard et al., 2008). Working memory is an essential component of executive functions that temporarily stores information and involves attention control, reaction control, and decision-making (Castellanos-Ryan & Conrod, 2020). The results showed that poor working memory performance could lead to substance dependence by creating defects in information processing and decision-making (Grenard et al., 2008. Castellanos-Ryan & Conrod,2020. Miller, Lundqvist & Bastos, 2018). In addition, to explain this finding, it can be said that when employees have low accuracy in working memory, they cannot consider various options or the far-reaching consequences of their decision during decision-making or information processing. Therefore, they choose the option with the reward sooner and move on to riskier alternatives such as substance abuse. Findings also showed that the speed of selective attention has a negative and significant predictive effect on substance abuse potential.

Faster performance in selective attention causes people to quickly shift their attention from undesirable options, such as

substance abuse, to desirable ones and appropriate coping strategies. So, they do not succumb to negative emotions and substance abuse when faced with problems. In addition to these interpretations, another explanation is that the shorter a person's reaction time to the Stroop test, which measures selective attention, the higher the impulsivity trait. As a result, it has the higher level of impulsivity which leads to the tendency to use drugs because, impulsivity is equivalent to weakness in inhibitory control. Some studies have considered impulsivity as one of the predictors of addiction tendency (Rezayi, Baradaran & Soltani Shal, 2019. Sepahvand, 2018. Verdejo-Garcia, Albein-Urios, 2020. Kozak et al., 2019). In addiction's current concepts, impulsivity is a chronic recurrent brain disease. It is characterized by uncontrollable craving and desire for drugs, even in the face of adverse health and social consequences (Kozak et al., 2019). When a person is more impulsive, he has less control over his desire for drugs to get rid of problems and does not pay much attention to its negative consequences.

According to the results of the present study, it can be claimed that executive dysfunction and alexithymia in employees can result to drug abuse potential.

Based on the findings of the research, it is suggested that managers and employers use the findings of the current research to identify employees at risk of addiction and prevent it in order to increase well-being. In addition, in case of facing problems such as defects in executive functions, they can benefit from cognitive empowerment program and use intervention programs to treat alexithymia.

Due to the important role of addiction in various harms to the organization, this study suggests that managers of organizations to pay more attention to screening before selecting newcomers to prevent future problems.

This research had some limitation, including lack of homogenization of subjects based on intervening variables, cultural level of the family and other demographic variables can be considered as limitations. The current study is a cross-sectional study, so causal inferences cannot be made from the correlation between variables. It is suggested that in future studies, by strengthening the executive functions and treating alexithymia, the tendency to addiction should be re-examined.

Due to the importance of the role of employees in advancing the goals of organizations and the impact of substance abuse on employees' performance, considering effective factors on the tendency of substance abuse among employees and long - term planning to control these factors can be helpful to organizations development. According to the findings of this research and effective factors including executive dysfunction and Alexithymia, organizations can greatly prevent substance abuse among their employees by doing effective interventions.

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