

Tramadol abuse and its related factors among higher education students in the city of Damghan, Semnan province, Iran

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Received: 10 February 2019, Accepted: 21 February 2019, Published: 1 July 2019

Abstract

Tramadol is an opioid analgesic with the potential for addiction to other opioids, and one of the abused drugs in different countries including Iran. The present study was conducted to determine the prevalence and factors relating to tramadol abuse among higher education students in the city of Damghan in 2016. The present descriptive-analytical study enrolled 730 students from seven higher education centers in Damghan. The samples were selected by simple random sampling, and researcher-made questionnaires were issued to them, and collected immediately after completion. The extracted data were analyzed in STAT-13 using Likelihood Ratio Chi-Square and 2 independent sample T-test at $P < 0.05$ significant level. Of all students, 4.71% had a history of tramadol abuse, of whom, 25% were current users. The highest abuse was observed among single (72.73%), male students (88.24%), with a history of smoking (90.91%), and university educated mothers (32.14%), friends with a history of drug abuse (57.69%), and very good knowledge of drugs (59.23%), who were very happy with their academic discipline (33.33%). Tramadol abuse was found to have a significant relationship with the academic average score, gender, marital status, mother's education, history of smoking, drug abuse by friends, knowledge of drugs, and satisfaction with academic discipline (P -value < 0.05). Although the prevalence of tramadol abuse among Damghan's higher education students is rendered as low, given the growing trend of its abuse in the society, especially among the young and student strata, further studies and planning for the prevention of abuse are necessary.

Keywords: Tramadol; substance-related disorders; behavior; addictive; universities; students; Iran.

Introduction

Abuse of illicit drugs is not confined to a particular society. As maintained by the United Nations Office on Drugs and Crime in 2009, the number of users of several drugs was assessed approximately 149 to 279 million people, including 3.3 to 6.1 of the

world's inhabitants of 15 to 64 years [1,2]. Previous studies have shown that the risk of drug abuse among students is sometimes twice their non-student peers. Unfortunately, despite such prevalence, students show little desire for treatment [3].

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Drug use by adolescents and young adults can be due to their availability and ease of use, peer pressure, being away from the family, and university stresses [3,4]. In addition, the parents' lack of belief in adverse outcomes and the lack of serious efforts for prevention are other reasons for the increase in Tramadol abuse [5,6]. Substance misuse begins with an introductory experience of enjoyment use of alcohol, cigarette, and opioid analgesic and continues with consuming cannabis, marijuana, and other substances and stimulants [2, 5 and 6]. The ascending trend of drug abuse in developing countries is evident, and this can lead to economic, cultural, social, and health challenges for individuals and societies. Drug abuse is one of the most important and preventable diseases in the world today [5,6]. Knowing the trend of drug abuse complications among students (such as lack of motivation, academic problems, physical and mental disorders, and high-risk sexual behaviors) can be important to educational and health policy-makers [7]. Opioids such as tramadol are mainly used for managing moderate pains. The public desire for rapid and effective pain relief has popularized these drugs [8]. The prevalence of addiction in Iran is fairly high, reported unofficially at 8% in the general population [9]. Like other opioid analgesics, and as an agonist of μ receptors, tramadol reduces pain by blocking endorphin inhibitors [10]. Tramadol was marketed in Germany by Grunenthal in 1977 [11]. Tramadol has been sold in the US since 1990, and it was soon welcomed by physicians due to its fewer side effects as compared to similar drugs [12]. But, its abuse remained limited and unrecognized until 2003, when studies revealed its abuse [10]. Tramadol was first

marketed in China in the early 1990s [11]. Chemical and physical properties of tramadol are presented in Table 1.

In Iran, tramadol is illegal, except in specific cases, supervised by a specialist. Nevertheless, it is easily sold illegally, without a physician's order or prescription, and used by young adults, adolescents, and individuals of other age groups [13]. According to a report by Iran's Ministry of Health, 24 million 100mg tramadol tablets were sold between March 21st 2004 and March 20th 2005, and two years later, this figure increased by 14.6-fold, reaching 350 million tablets [14]. Tramadol temporarily creates a sense of euphoria, self-esteem, kindness, and boosted energy. The important point is that tramadol can be the gateway to the use of other drugs [13]. The potential of tramadol abuse is regarded as a public concern. This is rather poignant in developing countries such as Iran, where its abuse is rapidly increasing [15]. Various studies have reported the prevalence of tramadol addiction among Iranian students between 4.7% and 36% [13,16]. Iran's Counter Narcotics Headquarters reported tramadol abuse as 26.5% among drug abusers [4].

According to reports in Iran, 55% of people who purchased tramadol from pharmacies were under 18 years of age, of whom, 65% had a history of addiction and 57% had at least one sign of abuse [9,15]. Studies have shown that the odds for addiction to other drugs are greater in those with a history of tramadol abuse [15,17]. Given the importance of the issue, the present study was conducted to determine the prevalence and factors related to tramadol abuse among Damghan's higher education students.

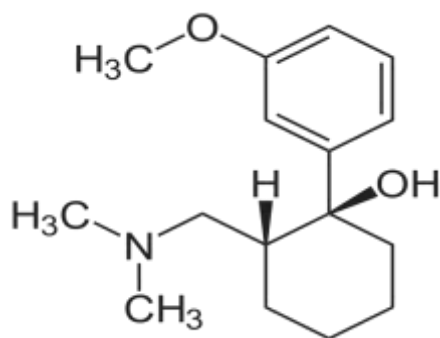


Figure 1. Chemical structure of Tramadol

Table 1. Chemical and physical properties of Tramadol

Property Name	Property Value
Molecular Formula:	C ₁₆ H ₂₅ NO ₂
Molecular Weight	263.381 g/mol
Hydrogen Bond Donor Count	1
Hydrogen Bond Acceptor Count	3
Rotatable Bond Count	4
Complexity	282
Topological Polar Surface Area	32.7 Å ²
Monoisotopic Mass	263.189 g/mol
Exact Mass	263.189 g/mol
XLogP3	2.6
Compound Is Canonicalized	true
Formal Charge	0
Heavy Atom Count	19
Defined Atom Stereocenter Count	2
Covalently-Bonded Unit Count	1

Methods

Study setting and time

The present descriptive-analytical study was conducted in 2016 in the city of Damghan. Damghan is a religious city located on Tehran-Mashhad route, 120Km from the provincial capital, Semnan. The population of Damghan in 2016 was reported 66000 people, of whom, 17000 were students at the time.

Sample Size and Sampling Method

A total of 730 students from seven higher education centers in Damghan were selected by stratified sampling. After obtaining the necessary permissions, the list of students was obtained from each of these centers, and the sample size for each center was proportionately determined to the total sample size. Next, each student was

given a certain code, and the participants were randomly selected by simple random sampling from each higher education center based on the calculated proportion. A replacement was found for every unwilling or unavailable student through simple random sampling. All cases who had used tramadol for any reason without doctor's prescription were regarded as abusers. Gender, academic grade, and discipline were also the criteria for entry of students into the study.

Questionnaire development

Data were collected using a researcher-made questionnaire. A set of questions was developed after reviewing the literature and consulting with interested experts. The draft questionnaire was sent to ten experts to confirm its

content validity after merging, eliminating, and modifying questions. After collecting their views, the questionnaire was issued to 100 individuals from the target population, and its reliability was confirmed through internal consistency by Cronbach's alpha method (after elimination of inconsistent items, Cronbach's alpha was found 0.821). The final 36-item questionnaire consisted of three parts: demographic details (16 items), the pattern of tramadol use (12 items), and factors predisposing to abuse (8 items).

Ethical Considerations

A non-member trained questioner collected the data. Ethical considerations were notified in writing and verbally, and included the right to know the study results, the right to withdraw, and obtaining necessary permissions. The code of ethics (IR.SEMUMS.REC.1397.135) was obtained from the ethics committee of Semnan University of Medical Sciences.

Statistical Methods

Data were analyzed in STATA-13 at a significant level of 0.05, using descriptive statistics (dispersion and central indices), and 2 independent sample T-test, and likelihood ratio chi-square tests. The fitness of the model was assessed by AIC method, and the model with the lowest AIC was considered the final model.

Results and discussion

Of all the students, 4.71% had a history of tramadol abuse, of whom, 25% were current users. The mean age at the onset of tramadol use was 19.2 years. The mean age of participating students was 24.78 years, 49.42% were male and 50.58% were female. Students' mean academic average was 15.78 at the time of study. Mean household size was

5.12, and 6.4% of students were in advanced diploma level, 78.92% in bachelor's degree level, 13.08% in master's degree level, and 1.6% were in Ph.D. level. Most students (69.48%) were single, 29.07% married, and 1.45% were either divorced or widowed. Most students (55.01%) were native to the province and 44.99% were non-native. About half of them (44.91%) lived in private houses with their parents, 21.54% lived in dormitories, 10.61% shared their homes, and 16.92% lived in other places. Of students' mothers, 7.64% were illiterate, 23.57% had primary school education, 18.05% had junior high school education, 33.66% high school education, and 17.07% university education. A history of smoking was reported in 19.69% of the students, 24.72% had drug users in the family, and 27.76% had one among their friends. Most of the students (80.74%) rated their knowledge of drugs high and very high, 13.9% rated their satisfaction with their university as very high, 24.43% as high, 39.59% as moderate, and the rest as poor and very poor. With regard to academic discipline, 35.33% of the students rated their satisfaction as very high, 34.22% as high, 24.24% as moderate, and the rest as poor and very poor (Table 2).

A significant relationship was observed between the academic average score and tramadol use, such that students with a history of tramadol use had lower average scores as compared to others ($P=0.04$). More male students had a history of tramadol use than female students, with a significant difference between them ($P=0.001$). A significant difference was observed between single and married students in tramadol abuse ($P=0.01$). Students' mother's education and tramadol abuse were significantly but inversely related

($P=0.04$), such that a history of tramadol abuse was higher in students with university educated mothers. A significant relationship was observed between students' history of smoking and a history of tramadol use, such that more students with a history of smoking had a history of tramadol use ($P=0.001$). Students with drug-using friends had more history of tramadol use compared to others, with a

significant difference between them ($P=0.003$). More students with a history of tramadol use rated their knowledge of drugs as high and very high, and the difference was significant ($P=0.001$). A negative and significant relationship was found between satisfaction with academic discipline and history of tramadol use, such that more satisfied students reported higher history of tramadol use ($P=0.000$).

Table 2. The study variables and Tramadol use status in Damghan's higher education students in 2018

Variable	History of Tramadol use		Total participants	P-value	
	With (35 students)	Without (695 students)			
Age	Mean \pm SD	24.08 \pm 5.3	24.81 \pm 6.4	24.78 \pm 6.3	0.516
Average score	Mean \pm SD	15.1 \pm 1.6	15.82 \pm 1.8	15.78 \pm 1.85	0.048
household size	Mean \pm SD	5.54 \pm 1.8	5.1 \pm 1.69	5.12 \pm 1.7	0.158
Birth order	Mean \pm SD	2.51 \pm 1.8	2.57 \pm 1.7	2.57 \pm 1.7	0.843
Gender	Male	30(88.24)	312(47.42)	342(49.42)	0.001
	Female	4(11.76)	346(52.58)	350(50.58)	
Academic grade	Advanced diploma	4(12.12)	40(6.11)	44(6.40)	0.426
	Bachelor's degree	24(72.73)	519(79.24)	543(78.92)	
	Master's degree	5(15.15)	85(12.98)	90(13.08)	
	PhD	0	11(1.68)	11(1.60)	
Discipline	Medical Sciences			66(9.68)	0.170
	Humanities	6(18.18)	66(9.24)	272(39.88)	
	Math and	10(30.30)	262(40.37)	256(37.54)	
	Engineering	10(30.30)	246(37.90)	88(12.90)	
	Other	7(21.21)	81(12.48)		
Marital status	Single	24(72.73)	454(69.31)	478(69.48)	0.015
	Married	6(18.18)	194(29.62)	200(29.07)	
	Other	3(9.09)	7(1.07)	10(1.45)	
Place of residence	Native	15(45.45)	358(55.50)	373(55.01)	0.259
	Non-native	18(54.55)	287(44.50)	305(44.99)	
Residential status	With parents	12(38.71)	288(45.21)	300(44.91)	0.183
	Dormitories	9(29.03)	175(27.47)	184(27.54)	
	Single's house	7(22.58)	64(10.05)	71(10.63)	
	Other	3(9.68)	110(17.27)	113(16.92)	
Income	Private	12(38.71)	170(26.48)	182(27.04)	0.324
	Parents	17(54.84)	435(67.76)	452(67.16)	
	Other	2(6.45)	37(5.76)	39(5.79)	
Father's job	Self-employed	13(41.94)	321(51.28)	334(50.84)	0.544
	Employee	10(13.26)	152(24.28)	162(24.66)	
	Retired	6(19.35)	134(21.41)	140(21.31)	
	Deceased	2(6.45)	19(3.04)	21(3.30)	
Mother's job	Housewife	22(73.33)	540(86.96)	562(86.33)	0.136
	Employee	7(23.33)	65(10.47)	72(11.06)	
	Other	1(3.33)	16(2.58)	17(2.61)	
Father's education	Illiterate	2(6.67)	26(4.35)	28(4.46)	0.478
	Primary school	8(26.67)	112(18.73)	120(19.11)	
	Junior High	4(13.33)	112(18.73)	116(18.47)	
	Senior high	6(20)	189(31.61)	195(31.05)	
	University	10(33.33)	159(26.59)	169(26.91)	

Mother's education	Illiterate	5(17.86)	42(7.16)	47(7.64)	0.045
	Primary school	6(21.43)	139(23.68)	145(23.58)	
	Junior High	3(10.71)	108(18.40)	111(18.05)	
	Senior high	5(17.86)	202(34.41)	207(33.66)	
	University	9(32.14)	96(16.35)	105(17.07)	
History of smoking	Yes	30(90.91)	111(16.25)	141(19.69)	0.001
	No	3(9.09)	572(83.75)	575(80.31)	
Family drug use	Yes	14(42.42)	142(23.74)	156(24.72)	0.051
	No	15(45.45)	394(65.88)	409(64.81)	
	Don't know	4(12.12)	62(10.36)	66(10.45)	
Drug use by friends	Yes	15(57.69)	93(25.61)	108(27.76)	0.003
	No	6(23.07)	162(44.62)	168(43.18)	
	Don't know	5(19.23)	108(29.75)	113(29.04)	
Knowledge of narcotics	Very high	19(59.23)	155(26.31)	174(41.13)	0.001
	High	7(21.87)	161(27.33)	168(39.71)	
	Moderate	5(15.62)	215(36.50)	220(5.20)	
	Low	0(00.00)	42(7.31)	42(9.92)	
	Very low	1(3.12)	6(1.03)	17(4.01)	
Satisfaction with the city of study	Very high	8(24.24)	120(20.00)	128(20.22)	0.185
	High	2(6.06)	125(20.83)	127(20.06)	
	Moderate	10(30.30)	182(30.83)	192(30.33)	
	Low	5(15.15)	78(13.00)	83(13.11)	
	Very low	8(24.24)	95(15.83)	103(16.27)	
Satisfaction with University	Very high	4(11.76)	83(13.92)	87(13.98)	0.33
	High	4(11.76)	148(24.83)	152(24.43)	
	Moderate	14(41.67)	232(38.92)	246(39.59)	
	Low	45(14.70)	76(12/75)	80(12.86)	
	Very low	7(20.58)	57(9.56)	64(9.16)	
Satisfaction with Discipline	Very high	11(33.33)	213(35.44)	224(35.33)	0.000
	High	7(21.21)	210(34.94)	217(34.22)	
	Moderate	8(24.24)	147(24.45)	155(24.44)	
	Low	0(00.00)	18(2.99)	18(2.83)	
	Very low	7(21.21)	13(2.16)	20(3.15)	

History of tramadol use in Damghan higher education students had no significant relationship with age, household size, birth order, academic grade, place of residence, residential status, living expenses, parents' occupation, father's education, or satisfaction with the city and the university (Table 2).

The present study was conducted to determine the prevalence of tramadol abuse among Damghan's higher education students, which was found to be 4.7%. Given that various studies have reported the prevalence of tramadol abuse among Iranian students between 4.7% and 36% [2,3, and 13-16], the prevalence is categorized as low among Damghan's higher education students. Bashirian *et al.*

(2014) reported the prevalence of tramadol abuse among students of the city of Hamedan in western Iran 12.5% [4], and Taremian *et al.* reported a prevalence of 5% among students in Tehran in 2005 [18]. Meanwhile the prevalence of tramadol abuse by students in the US was reported by Dart *et al.* in 2011 less than 2 in 100000[19]. Such a difference can be due to the difference in the sampling methods, as we used simple random sampling while Dart *et al.* used non-random convenience sampling. In addition, this difference can be attributed to cultural, social, economic issues and drug distribution rules and regulations. Another study conducted by Lord *et al.* (2009) among pharmacy students in the US reported total prevalence of various

analgesic opioids including tramadol less than 2% [20], which is less than that found in the present study, and could be due to pharmacy students' access to other drugs with similar effects. In a study conducted in Egypt by Bassiony *et al.* (2015), the prevalence of tramadol abuse among adolescents was reported 4.8% [21], which is almost the same as that found in the present study.

In the present study, a significant relationship was observed between gender and tramadol abuse ($P=0.001$), which concurs with the results obtained in studies by Lord *et al.* (2011), McCabe *et al.* (2007), and Abbasi-Ghahramanloo *et al.* (2015) [20, 22, and 23]. Furthermore, the relationship between tramadol abuse and marital status was also significant, which disagrees with the results obtained by Abbasi-Ghahramanloo *et al.* (2015) [22]. The difference may be attributed to the categories of marital status in these two studies. In the present study, marital status was categorized as single, married, and others (divorced and widowed), while Abbasi-Ghahramanloo *et al.* (2015) used only single and married groups. In the present study, the relationship between history of tramadol abuse and mother's education was positive and significant ($P=0.04$), which meant that university educated mothers had more children who abused tramadol. This is similar to the results obtained by Nemati *et al.* (2017) in relation to internet addiction among students [24]. This is also confirmed in Bassi *et al.* (2017) study of students' opioid addiction in Nigeria [25]. It appears that the professional engagement of educated people rather frees children to experiment with illicit drugs.

Tobacco use is globally regarded as one of the key behaviors among

users of various illicit drugs and alcohol. Many studies investigating the effect of tobacco use on abuse of various illicit drugs reveal the vital role of this behavior in drug abuse [26-29]. In the present study, tramadol use was reported significantly higher in students with a history of tobacco use compared to others ($P=0.001$). Users of various types of tobacco seem to be more exposed to opioids or illicit drugs and alcohol. People belong to different peer groups because of their social life. Same age and same gender groups, occupational groups and academic groups are part of people's daily lives. Individuals can learn many positive or negative things in the context of their groups [30]. In the present study, students with drug-using friends were reported as more likely to abuse tramadol ($P=0.003$). This finding agrees with the results obtained in studies by Forster *et al.* (2015) and Huang *et al.* (2014) [30-32]. The facilitating role and group norms seem to be an important cause.

Satisfaction with life is recognized across the world as an important factor for preventing drug use. For example, a study by Rooks (2010) demonstrated the role of quality of life in the prevention of drug use in the general public in the UAE [33]. However, studies like Mahadzirah *et al.* (2018) reported no relationship between satisfaction with life and drug use [34]. In the present study, the individual's statement about satisfaction with academic discipline was cited as a question, and the result showed that more students with interest in their discipline had a higher history of non-medical tramadol use. The way this question was raised may have affected its result. Non-medical use meant tramadol use without doctor's

prescription, for non-therapeutic intentions, and for feeling better [19].

Conclusion

Regarding the significant relationship between several variables such as the average score, marital status, mother's education, history of smoking, and history of drug abuse with Tramadol abuse clarified that these variables need to be more considered by the authorities. Although Tramadol abuse among Damghan's higher education students was lower than the national average, it can be regarded by educational and health policy-makers as a health problem. The complex pattern of the use of opioids and illicit drugs begets further studies on the subject.

Acknowledgments

Research reported in this publication was supported by a grant [number: A-10-87-1] from the Semnan University of Medical Sciences, Semnan, Iran. We would like to thank the Research and Technology Deputy of Semnan University of Medical Sciences for funding this study. Damghan's higher education centers are also thanked for allowing the presence of a questioner and completion of questionnaires in these centers.

References

- [1] A.G. de Andrade, V. Duarte L.P. Barroso, R. Nishimura, D.G. Alberghinde, LG. Oliveira, *Revista Brasil. de Psiquiatria.*, **2012**, 34, 294-305.
- [2] A. Mohammadpoorasl, A.A. Ghahramanloo, H. Allahverdipour, C. Augner, *Asian. J. Psychi.*, **2014**, 9, 41-44.
- [3] Y. Kazemzadeh, M. Shokoohi, M.R. Baneshi, A.A. Haghdoost, *Int. J. High. Risk. Behav. & addict.*, **2016**, 5, 1-5.

- [4] S. Bashirian, M. Barati, Y. Fathi, *Avicenna J. Neuro Psych Physiology.*, **2014**, 1, 1-6.
- [5] O. Mehrpour, P. Karrari, A. Sheikhezadi. *J. Foren. legal Med.*, **2013**, 20, 1078-1081.
- [6] S. Mohanty, R. Tripathy, S.K. Palo, D. Jena, *J. Foren. legal Med.*, **2013**, 20, 1057-1062.
- [7] F. Jalilian, B. Karami Matin, M. Ahmadpanah, M. Atae, T. Ahmadi Jouybari, A.A. Eslami, *J. Res Health Scie.*, **2015**, 15, 42-56.
- [8] J.P. Kelly, S.F. Cook, D.W. Kaufman, T. Anderson, L. Rosenberg, A.A. Mitchell, *Pain.*, **2008**, 138, 507-513.
- [9] E. Zabihi, A. Hoseinzaadeh, M. Emami, M. Mardani, B. Mahmoud, M.A. Akbar. *Res. Trea.*, **2011**, 5, 11-15.
- [10] S. Babalonis, M.R. Lofwall, P.A. Nuzzo, A.J. Siegel, S.L. Walsh. *Drug. Alco. Depend.*, **2013**, 129, 116-124.
- [11] H. Zhang, Z. Liu, *BioMed research international.*, **2013**.
- [12] S. Gioia, M. Lancia, M. Bacci, F. Suadoni. *The Amer. J. fore. Med. Path.*, **2017**, 38, 345-358.
- [13] M. Nazarzadeh, Z. Bidel, E. Ayubi, A. Bahrami, F. Jafari, A. Mohammadpoorasl, *Addict. Behavior.*, **2013**, 38, 2214-2218.
- [14] H. Hassanian-Moghaddam, A. Kolahi, *Sixth Annual Congress of Asia Pacific Association of Medical Toxicology.*, **2007**.
- [15] M. Nazarzadeh, Z. Bidel, K.V. Carson, *Addict. Behaviors.*, **2014**, 39, 333-347.
- [16] A. Ansari-Moghaddam, F. Rakhshani, F. Shahraki-Sanavi, M. Mohammadi, M. Miri-Bonjar, N.M. Bakhshani, *Child. Youth. Servi. Rev.*, **2016**, 60, 68-79.
- [17] S. Lord, J. Brevard, S. Budman. *Substance. Use. Misuse.*, **2011**, 46, 66-76.

- [18] F. Taremian, J. Bolhari, H. Pairavi, M. Ghazi Tabatabaeii, *Iran. J. Psychi. clin. Psych.*, **2008**, *13*, 335-342.
- [19] R.C. Dart, B.B. Bartelson, E.H. Adams, *The Clinic. J. Pain.*, **2014**, *30*, 685-692.
- [20] S. Lord, G. Downs, P. Furtaw, A. Chaudhuri, A. Silverstein, A. Gammaitoni, *J. Americ. Pharma. Assoc.*, **2009**, *49*, 519-528.
- [21] M. M.Bassiony, G.M.Salah El-Deen, U. Yousef, Y. Raya, M.M. Abdel-Ghani, H. El-Gohari, *The Americ. J. Drug. Alco. Abuse.*, **2015**, *41*, 206-211.
- [22] A. Abbasi-Ghahramanloo, A. Fotouhi, H. Zeraati, A. Rahimi-Movaghar, *Int. J. High. Risk. Beha. Addict.*, **2015**, *4*, 47-52.
- [23] S.E. McCabe, M. Morales, J.A. Cranford, J. Delva, M.D. McPherson, C.J. Boyd, *J. Ethn. Subst. Abuse.*, **2007**, *6*, 75-95.
- [24] Z. Nemati, H. Matlabi, *Psych. Res. Behav. Manag.*, **2017**, *10*, 39-45.
- [25] A. Bassi, L. Idoko, T. Ogundeko, M. Ramyil, A. Abisoye-Ogunniyan, E. Ogbole, *World J. Res. Review.*, **2017**, *5*, 11-16.
- [26] L. Barateau, I. Jaussent, R. Lopez, B. Boutrel, S. Leu-Semenescu, I. Arnulf, *Sleep.*, **2016**, *39*, 573-580.
- [27] S. Lai, H. Lai, J.B. Page, C.B. McCoy, *J. Addic.Diseas.*, **2000**, *19*, 11-24.
- [28] S.C. Lemon, P.D. Friedmann, M.D. Stein, *Addict. Behav.*, **2003**, *28*, 1323-1331.
- [29] A. Mojahed, N. Bakhshani. *Zahedan J. Res. Med. Scie.*, **2004**, *6*, 59-65.
- [30] R. Ramirez, A. Hinman, S. Sterling, C. Weisner, C. Campbell, *J. Nurs. Scholar.*, **2012**, *44*, 36-44.
- [31] M. Forster, T.J. Grigsby, A. Bunyan, J.B. Unger, T.W. Valente, *J. School Health.*, **2015**, *85*, 82-89.
- [32] G.C. Huang, J.B. Unger, D. Soto, K. Fujimoto, M.A. Pentz, M. Jordan-Marsh, *J. Adoles. Health.*, **2014**, *54*, 508-514.
- [33] L. Rooks. Ed.S. Thesis, University of South Florida. **2010**.
- [34] M. Mohamad, M. Mohammad, N.A. Mat Ali, Z. Awang, *Int. J. Adoles.Youth.*, **2018**, *23*, 25-35.

How to cite this manuscript: Behrad Pourmohammadi, Mohammad Ali Jalilvand. "Tramadol abuse and its related factors among higher education students in the city of Damghan, Semnan province, Iran". *Eurasian Chemical Communications*, 2019, 369-377.