Studying Relationships Tetrahydrocannabinol Consumption and Psychosocial Variables in a Campus: Potential Contributions to Policy Design. Why the Exponential Increase in Psychotropics?

Flor Ángela Tobón Marulanda (flor.tobon@udea.edu.co)
Universidad de Antioquia CIFAL https://orcid.org/0000-0002-7386-1333
Luis Alirio López Giraldo
Universidad de Antioquia Facultad de Enfermería
Cristian David Londoño Arroyave
Universidad de Antioquia Escuela de Idiomas

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Abstract

Background: For public health fields, it is fundamental to understand the exponential the reasons behind the consumption increase in 9-Delta-Tetrahydrocannabinol (THC) and other psychotropics. Estimate relationships between THC consumption and psychosocial variables (PSVs) among students and professors at a Colombian university.

Methods: This observational descriptive cross-sectional study was developed between 2016 and 2018 with a total of 160 university students and 60 professors from a Colombian public university of one pharmaceutical chemistry program. Using an instrument based on the Children's Depression Inventory (CDI) survey designed by Kovacs (1977), participants were surveyed directly, voluntarily, and anonymously about marijuana use and different psychosocial variables of everyday life. Correlation of variables was analysed using the Statistical Package for the Social Sciences (SPSS), version 24, 2016. In each variable, risk factors were analysed using "Chi-square" and "Odds Ratio".

Results: The findings show a significant relationship between THC consumption and PSVs in the students or the professors (S/P) group (59.8%): first time THC consumption (83%), low self-esteem (66.7%), decrease/loss of executive function (55.6%), no family support (55.6%), and no family communication (72.2%). These groups presented a relationship between risk and consumption of THC, which induces to neuro-psychosocial disorders.

Conclusion: THC consumption and PSVs are prevalent in the S/P group, thus inducing a neuro-cognitive disorder. Although consumption increases exponentially at an alarmingly early age and national regulations are poor, there exists an unpredictable multidimensional impact., more scientific research is needed with a serious focus, political will, and integrative intersectorial educational interventions. Also, there is little knowledge on the potential effects of Δ9-THC in university student and professor populations. The Δ9-THC cannabinoids may have therapeutic and adverse effects, which bears interest for public health.

Introduction

This article proposes a rationale for reflection toward the construction of public policies (PP) around the need to improve comprehensive education on the effects of the consumption of marijuana. Δ9 Delta Tetrahydrocannabinol (THC) is the scientific-technical term for the chemical molecule of the active principle (AP), which is present in comparatively greater quantity in the Cannabis sp. (marijuana) plant. This molecule is a psychotropic that alters the central nervous system (CNS), causing desired and undiagnosed pharmacological-clinical effects of impact in human productivity, commercial marketing, especially in young people. Lacking due control, monitoring, and integral evaluation of marijuana consumption issues, this impact must be analysed concerning the social realities to design PP focused on the well-being and [mental] health of people. Primordial attention to this impact is linked to issues that go beyond a diagnosis of consumption quantification and punitive intervention. In the sense of showing

the theoretical-investigative challenges of timely and effective regulation, it is required to identify the causes that conduce a person to marijuana consumption and how to prevent future drug dependence (Tobón, Gaviria, Ramírez, 2012; Tobón, López, Ramírez, 2013; Vallaeys, 2014).

In this perspective, this search for drug-dependence prevention and the integral evaluation of the problem is related to the fundamental rights of young people, which may be equated to the right to education. This demands rigorous scientific work that promotes the prevention of consumption and proposes comprehensive policy-based regulations since its impact is yet clearly and accurately unknown on the physical, mental, social, and environmental forms of health. In agreement with the posture of some authors, around one fifth of the population considers that the regular consumption of marijuana is not a risk factor (RF) for health since it causes possible adverse events (AEs). For instance, when marijuana is inhaled and enters the organism, one usually ignored AE is its capability to distress the CNS, thus causing depression. It may also injure the lungs.

There are advances in developed countries on technical-scientific studies based on the evidence of the therapeutic effects produced by other molecules, derivatives of Δ9-THC, and the so-called cannabinoid subtypes not produced by Δ9-THC. Cannabinoid subtypes are widespread in developing countries as Colombia. Nonetheless, popular beliefs have attributed therapeutic effects to the consumption of marijuana, which can foster AEs among the population, as well as short-term neurotoxic effects, and thereby become a multidimensional problem of public health (PH) (Atwoli, Mungla, Ndung' u, Kinoti, Ogot, 2011; Avello, Edgar, Fernandez, Cordova 2017; Crean, Crane, Mason 2011; Fajardo 2018; Eldreth, Matochik, Cadet, Bolla, 2004; Fernandez, Ortiz, Aguilar, Perez, and Serra 2017;).

Why education and prevention of pharmaco-dependence by Δ9-THC?

Δ9-THC Pharmaco-dependence must be treated as a critical problem of public health that demands a beneficial public policy (PP), for instance, the continued education of the human being and legal intervention throughout both the domestic and global chains of drug trafficking. It requires home and school forms of education throughout the stages of life. In each of these, capacities must be developed, and AEs must be understood in-depth.

While medicines based on cannabinoids sp. molecules require a complex chemical and biological processes that depend on diverse dynamics and elements such as the marijuana plant species, production sites, consumer manipulation, marijuana extracts and manipulation, and contaminant additives dangerously advocate for higher profitability. These constitute RFs that may increase unpredictable medicinal effects or AEs over time related with neurotoxicity, pneumotoxicity, cardiotoxicity. Its consumption cause brain disorders as irreversible behavioural changes in functions of physiological, psychic, and psychological types (Atwoli et al., 2011; Iversen, 2003; Posada et al., 2014; Tobón et al., 2013; Toro et al, 2009; UNODC 2014).

Hence, it is important to explain to the community the pharmacological effects of THC and the effects of cannabinoid sp. synthesized from Δ9-THC, which imply multiple factors:

1. Skills development and education regarding the selection of the plant.
2. Chemical-analytical synthesis of the specific active metabolites (cannabinoids sp.)
3. Design, formulation, and development of a pharmaceutical form for cannabinoids sp., which requires developing state-of-the-art technology for the preparation of the desired medicine, under good manufacturing and quality control practices.
4. In vitro and in vivo tests in animals, as well as studies in healthy and sick volunteers with the identified antagonistic symptoms.
5. Post-marketing pharmaco-epidemiological studies in volunteers of the specific perfected therapeutic effect for human safety purposes.

These observations suggest little development in PPs that educate on social responsibility the promotion of self-care and self-control towards the prevention of consumption marijuana and drug addiction (DA). Although marijuana induces emotional states of relaxation and tranquillity, they have short-term effects. Habits over this psychotropic encourage consumption in greater quantity and more frequently over time, which varies in degree of severity from one person to other and from one population to other (Burns et al., 2007; Cáceres and Salazar, 2006; Castro et al., 2016; Cavuoto et al., 2007; Claudet et al., 2017; Crean et al., 2011; De Costa, 1991; Herkenham et al., 1990; Mackie, 2008; Schlaepfer et al., 2005; Sevy et al., 2008; Vallaeys, 2014).

Social responsibility and integral education

From a critical reflexive attitude of the social realities, social responsibility and integral education around the consumption of marijuana constitute a challenge and an opportunity to motivate more awareness and knowledge of what the human being means as a subject of rights while exercising self-control and self-care by conviction. This issue demands the construction of a comprehensive intersectoral beneficial public policy with human talent bearing the capabilities to expand the execution of both actions and coordinated procedures of individual and collective impacts. An intersectoral approach on how to address an issue of negative impact towards a positive effect may be helpful over time as an intervention given the exponential increase in marijuana consumption. For this, it is essential to approach the study of human behaviour, transcending individual transitory goals (Haidari, 2009; López et al., 2018; Sánchez, 2017; Posada et al., 2014; Tobón et al., 2013).

Considering the current local regulations, mission, vision, and ethical principles in a specific context of educational intervention from the family nucleus (FN), this intervention from an early age should be understood as the training of the conscious mind through learning based on civic values. This implies higher awareness of educational and government stakeholders and actors around the unpredictable effects of marijuana.

These are claims for the design and execution of a beneficial PP that develops analytical and integrative skills in human beings capable of understanding the magnitude of the impacts of marijuana consumption with knowledge-based decisions (Atwoli et al., 2011; Banich et al., 2008; Belda et al., 2016;

Claudet et al., 2017; Iversen, 2003; Nussbaum, 2012; Pellicer et al., 2016; Rivera & Parra 2016; Tobón & López 2011; Tobón et al., 2013; Rodríguez & Goldman, 1996; UNODC, 2014).

Is it relevant to differentiate the Pharmacological-clinical effects of marijuana and medications with cannabinoids?

Δ9-THC has different routes of use (oral, nasal, and dermal). It enters the organism rapidly and is absorbed through the physiological membranes, passing through the blood-brain barrier that protects the CNS. According to neuroscientific studies, THC reaches the maximum concentration in a short time, as compared with other psychotropics. When coupled with unspecific receptors, it stimulates the release of biochemical molecules throughout the organism (neurotransmitters), as Dopamine for instance. Dopamine increases the number of the neurotransmitter gamma-aminobutyric acid (GABA) specific receptors, as subtype A ($GABA_A$) in the union of neurons, wherein neurotransmitters trigger biochemical, neurocellular, or molecular modifications.

These changes cause disorders in neurobiological, neuropsychological, or neuropsychiatric brain processes when signalling and disrupting the nerve impulse to effector areas of the brain as the frontal lobe of the cerebral cortex. Here, it causes one neurotoxic AE, for example the cerebral hyperactivity that disrupts certain areas of the hippocampus (anterior cingulate cortex, front-lateral and front-medial), thus producing a reduction in the volume of this brain area, DA and cognitive deficits -attention disorders, concentration, analysis, learning, episodic memory, and executive function- and behavioural changes -unstable mood states, schizophrenia, intrapersonal and interpersonal conflicts-.

Then, THC is distributed throughout the organism and bio-transformed by endogenous biochemical reactions that convert this molecule into other active metabolites that induce therapeutic effects as well as other AEs. In fact, there is a risk of impaired lung functions and cardiotoxicity (Crean et al., 2011; Dervaux et al., 2014; Eldreth et al., 2004; Fernández et al., 2017; Flores & Ostrosky, 2008; Gómez et al., 2015; Pertwee et al., 1997; Sevy et al., 2008; Spanish Society of Dual Disease, 2009).

Other studies on cannabinoid THC subtypes indicate that it attaches to new specific receptors called cannabinoids sp. Here, types CB_1 and CB_2 predominate, and can be found in a high number of brain areas of the basal ganglia, hippocampus, cerebellum, frontal neocortical, cortex frontal, and the anterior cingulate. In this sense, research studied should focus on the development of medicines that act on receptors CB_1 and CB_2, as they seem to cause certain specific therapeutic effects, as the antiepileptic, analgesic, anti-inflammatory, among others (Avello et al., 2017; Burns et al., 2007; Castro et al., 2016; Cavuoto et al., 2007; Crean et al., 2011; Eldreth et al., 2004; Herkenham et al., 1991; Matsuda, 1990; Mackie, 2008; Sevy et al., 2008; Iversen, 2003)

For the reasons above exposed, the purpose of this exploratory reflective study emerges as a basis to foster higher awareness on the effects of THC consumption. The following research question is then posed:

- *What is the relationship between the consumption of Δ9-THC and PSVs in student and teaching staff of a university campus?*

Methods

This study followed the methodological model shown in Figure 1 and was approved by the Ethics Board of the Faculty of Pharmaceutical and Food Sciences.

Study Design

This research was an observational descriptive cross-sectional study. It was developed between 2016 and 2018 at a Colombian public university.

Setting

It included students and professors of one pharmaceutical chemistry program. The Depression Inventory for Latin America (CDI-LA) instrument, designed by Kovacs (1977), was used in this study. At the Pharmaceutical Chemistry Program (PCP), University of Antioquia (Medellín, Colombia).

Participants and study size

Participants were 160 students between 16 and 28 years of age out of a population of 445 student staff enrolled in the academic year (2016) and 60 teaching staff between 25-66 years of age out of 155 professors of the same academic program. The selection criteria were: 1) random and proportional for each level, from the first semester to the tenth semester of the pharmaceutical of the pharmaceutical chemistry program curriculum. 2) holding an active link with the university during the study, and 3) affirmative consent for direct, voluntary, and anonymous purveyance on marijuana use and psychosocial variables of everyday life.

Variables and bias

Controllable factors included direct and indirect mental health self-care of the population studied. The independent variables (experimental) were associated to a cut-off group (CG), which included the relationship between student (S) and professor (P) samples and THC consumption. Criteria for the exclusion variable (bias) were: 1) being S or P that did not belong to the pharmaceutical chemistry program (PCP), 2) non-acceptance of the informed and understood consent. For either S or P of the PCP, the definition of the inclusion variables was done using a cluster method for subjects who fulfilled exclusion variables.

Data sources

For each variable, risk factors were analysed using the statistical parameters "Chi-square" and "Odds Ratio" with a statistical significance of $p \leq 0.05$ in the population risk estimate, in accordance with the dominant or the dependent psychosocial variable. In addition, variable crossing was related to risk factors and protective factors between students and professors. Data were obtained with the following actions: 1) request of informed and understood consent to participants; 2) pilot test on 10 students for instrument adjustment; and 3) direct, voluntary, and anonymous application of the instrument to the participants.

Quantitative variables

Controllable factors included direct and indirect mental health self-care of the population. The independent variables (experimental) were associated to a cut-off group (CG), which included the relationship between S and P samples and THC consumption to ultimately compare the results between S and P groups.

Statistical methods

This study followed a random statistical strategy. By means of Pearson's Chi-square (X^2) and Odds ratio (OR) for *the disparity index*, the bivariate analysis of consumption between the S/P group and the age, sex, academic semester, and socio-economic stratum variables was carried out using the Statistical Package for the Social Sciences (SPSS), Version 24, 2016. The confidence values (p) were $p \geq 0.05$, non-significant; $0.01 < p < 0.05$, significant statistical difference; $0.001 < p < 0.01$, strong statistically significant difference; and $p < 0.0001$, very high statistically significant difference.

Ethics standards and consent to participate

This publication did not require approval by an ethics committee. All the procedures carried out in this study with human participants, complied in accordance with the ethical standards of institutional Colombia and with the Declaration of Helsinki of 1964 and its subsequent modifications or comparable ethical standards.

The authors obtained written informed consent from all volunteer participants included in the study and the research data is anonymous and has not been publicly disclosed.

The authors' individual contributions to the manuscript

they meet the criteria for authorship of the manuscript: FATM, in the design, formulation, academic coordination and, research during the study process. Also, in the writing of the manuscript. LALG and CDLA, in the support during the study process, and in writing the manuscript.

Results

In total, 160 students and 60 professors answered the survey. Descriptive data gathered included age, sex, academic level, socioeconomic status, THC chronic use, THC first-time use, communication with the family, family nucleus functionality, and mental health status.

The results reported here are in accordance with the prevalence and importance of the statistical significance of the crossing PSVs and THC consumption (see Table 1).

Table 1. Cross-sectional multi-factor analysis of Δ9-THC consumption relationships Per Student

Consumption risk factor Δ9-THC	OR[1] Y RF[2]/FP[2]		% Prev.[3]		Chi[2]-P[4]	p[5]
	S	P	S	P		
There is easy communication in the FN	0.708, RF	3.949, PF	72.2	27.8	21.429	0.0001
Consumed Δ9-THC for the first time	1.291, RF	0.05, PF	83.3	16.7	19.853	0.0001
I think that facts will be positive	1.3,0, PF	0.33, RF	47.8	52.2	19.842	0.0001
Consumes Δ9-THC	1.291, RF	0.05, PF	59,8	10,2	19.841	0.0001
I have a lot of fun at the University	0.782, RF	3.343, PF	72.2	27.8	13.173	0.0001
I have high self-esteem	0.745, RF	4.114, PF	66.7	33.3	14.063	0.0001
The executive function is not lost	0.702, PF	2.651, RF	55.6	44.4	17.693	0.0001
In my FN we ask for help	0.787, RF	3.095, PF	55.6	44.4	12.419	0.0001
I thought I was special, but I am not	0.757, PF	3.0, RF	83.3	11.1	12.629	0.00.0001

Data source: Research database. 1) Odds Ratio, S/P Group versus Δ9-THC consumption factor. 2) Risk/Protective factor according to the OR in the S/P Group. 3) Percentage of the prevalence of the CG consuming Δ9-THC. 4) Pearson Chi^2 estimation higher than a value of 11. 5) p-value on the population risk estimate of 0.05 or less. S: Students. P: Professors. FN: family nucleus.

The data reveals more RFs than PFs related to THC consumption, in both S and P. These results reveal evidence close to previous studies (Eldreth et al., 2004; Bravo et al., 2005; Caceres and Salazar, 2006;

Atwoli et al., 2006; Claudet et al., 2017; Tobón, López, and Ramírez, 2013; Tobón, Ramírez, and Jiménez, 2013; Toro et al., 2010; Varela et al., 2007). The main findings of this study are presented below:

1. A statistically significant difference can be observed in the relationship of THC consumption in S with first-time consumption (83.3%) and chronic consumption, as compared to the first-time consumption in P (16.7%), and PSVs identified in highest percentages, respectively ($X^2 = 19.85$, OR = 1.29; $p < 0.0001$). This means that the Ss who consumed THC for the first time present a risk 1.29 times higher as compared with the risk of Ps who consumed THC for the first time.

2. The prevalence of THC chronic consumption in S (59.8%) is a PSV of higher risk as compared to chronic consumption in P (10.2%). That is to say, low consumption of P and PSV represents a 0.05 times lower RF of chronic THC consumption ($X^2 = 19.85$, OR = 0.05, $p < 0.0001$). Other remarkable relationships found between THC consumption and PSVs were:

(2.1), the perception of 72.2% of the Ss regarding the inadequate communication in the FN as PSV is 0.708 times more significant statistical RF very high to consume by the Ss compared to the RF of the Ps ($X^2 = 21.43$, OR = 0.708, $p < 0.0001$)

(2.2.), 55.6% of the S does not ask for help from any member of their FN, and the RF is 0.79 times higher than for the P ($X^2 = 12.42$, OR = 0.79, $p < 0.0001$); which affirms that this PSV can induce little harmonious relations of the Ss with themselves, with others and with their environmental; and in turn, leads these Ss to consume the THC.

(3.3), in contrast, only 11.11% of the Ps describes that the familiar communicative relationship helps them to think of themselves as special human beings, and they are 3.0 times more likely to consume THC than the Ss (X2 = 12.63, OR = 3.0, $p < 0.0001$).

3. 44.4% of the Ps revealed not to lose their executive function due to THC consumption, and they exhibit 2.65 times a lower RF to present this neurotoxic effect versus S consumers ($X^2 = 19.68$, OR = 2.65, $p < 0.0001$). However, this PSV of attitude and practice of consumption THC revealed in the Ps shows some effects in the executive function, linked to the highly statistically significant RF for the mental health of the consumers. 55.6% of them show a loss of executive function and represent a RF 0.702 times more significant, which could lead Ss to the consumption of THC, as compared with the risk of Ps ($X^2 = 19.68$, OR = 0.702, $p < 0.0001$).

4. On the relationship between THC consumption and self-esteem, it was found that 33.3% of Ps consider having high self-esteem and this represents 4.11 times more a PF for the Ps than for 66.7% of the Ss. Ss reveal not having high self-esteem and present a 0.745 times greater RF of having low self-esteem ($X^2 = 14{,}063$, OR = 0.745, $p < 0.0001$); compared with the high value that the Ps conceive of self-esteem (X2 = 14,063, OR = 4.1, $p < 0.0001$).

5. 72.2% of the Ss does not have fun on campus, and it represents a 0.78 times higher RF that induces them to the consumption of THC, as compared with the RF of Ps ($X2 = 13.17$, $OR = 0.78$, $p < 0.0001$). Figure 2 illustrates the aforementioned findings.

Discussion And Interpretations

Key psychosocial variables (Key-PSVs) in Ss can be associated to a transitional period in life that perhaps induces high Δ9-THC consumption. Although Ps show a significantly lower consumption tendency, this is a latent RF that may affect overall health mental, for instance executive and cognitive functions. This depends mainly on biological variability, dose size, and consumption frequency.

This study reveals a very high statistically significant value when comparing first-time and chronic S and P consumers of Δ9-THC. After comparing the relationship of the Key-PSVs and first-time or active consumption among Ps, it is reasonable to think that Ps may achieve more favourable PFs than Ss, as many of Ps present more experience, maturity, higher psycho-emotional stability, and better psychosocial and economic conditions. In other words, Ps display more capabilities and mental resources for processing both PSVs and RFs derived from internal and external conflicts.

Among students, the most vulnerable population in this study, it is necessary to strengthen their protective factors associated to self-esteem, executive function, family nucleus support, and more decent conditions based on human ecology and art (e.g. education, employment, and home). If these PFs are reinforced, it is likely that THC student consumers be far from serious drug addiction that involve intoxication or chronic use with serious AEs.

Moreover, the S/P ratio suggests paying attention and raising more awareness that the THC consumption may have from one consumer to another, and on the possible implications of what a generous institutional and public policy implies. In this sense, timely interventions should be made in an efficient manner within a public health policy framework in order to tackle the structural causes that may induce consumption, for instance extreme poverty, lack of comprehensive health care, and lack of attention to the poorest.

Among students in higher education stages, these causes may lead to poor academic performance and student attrition or to professional performance of poor quality. The actions of a beneficial public policy for the neediest must also strengthen the protective factors, which should permanently include comprehensive psycho-bio-social education and openly bidirectional university-family communication.

Generalisability

The results of the multi-factor analysis are similar to those found in other studies, both in the S population and in the overall population. Also, the analysis presents an optimal match with the research question: What is the relationship between the consumption of Δ9-THC and PSV on a university campus? In this perspective, there is a relationship between the consumption of marijuana and different psychosocial variables that possibly derive from a stressful academic environment, sources of violence, and a dysfunctional family dwelling. From this viewpoint, the humanistic educational intervention, aside from being early and permanent, requires the promotion of psycho-affective development linked to vital aspects of the human being. Among these aspects, there are educational, social, affective, cognitive, cultural, and even sexual processes that accompany people throughout their life cycle (Bravo et al., 2005; Cáceres and Salazar, 2006; Varela et al., 2007; Spanish Dual Pathology Society 2009; Toro et al., 2010; Gómez et al., 2010; Rivera and Parra 2016; Fernández et al., 2017).

Conclusions

This study evinces a significant statistical correlation between the consumption of Δ9-THC and different PSVs in the study population. The Key-PSVs in the S/P cut-off group suggests that punitive or permissive intervention to prevent consumption of marijuana in this public university. This scenario may be similar to other universities in the world. This requires imminent actions toward more beneficial institutional and public policies that re-invent the conventional educational interventions and the punitive frameworks. This study calls for young people to understand that the consumption of marihuana has more negative than positive effects. Therefore, they will be able to choose to whether to consume it or not with informed knowledge, since punitive interventions seem not to have a significant social impact in preventing structural RFs.

To this end, it is necessary to design, formulate, and execute plans, programs, and projects led by interdisciplinary professionals of biomedical sciences. These must be deployed as strategies for the configuration of intersectoral educational interventions articulated and coordinated with the pedagogical processes. This may allow a more rigorous typification of the THC consumption phenomenon, its effects, and the identification of public health opportunities that cast potential lines of action aimed at improving the curricular proposal of universities around comprehensive education with a focus on health promotion and the prevention of drug addiction, rather than punitive and inefficient actions.

This study suggests further analysis and reflections on the structural causes that induce to initial/chronic consumption of marijuana among student and teaching staff, as well as its multidimensional impact on human capacities. These causes may also be associated with a lack of biological knowledge, a distorted landscape over the THC consumption culture, and poor assimilation of psychosocial variables among students and institutions, which may constitute a critical PH problem that mainly affects the young population. Identifying and tackling the structural causes should find roots in the mission, vision, and social responsibility of the educational centres. This should be understood as a joint commitment to

contribute to a sustainable development of collective actions for academic actors in line with the search for healthier human beings.

Abbreviations

AP
active principle
Δ9-THC
9 Delta Tetrahidrocannabinol
Cannabinoids sp
AP derived from of others of Δ9-THC
CNS
central nervous system
CDI instrument
Children's Depression Inventory
CDI-LA instrument
Depression Inventory for Latin America
DA
drug addiction
DEP-PSVs
Dependent PSVs
DOM-PSVs
Dominant PSVs
DEP-PF
Dependent-PF
DEP-PF
Dependent Protective factor
DEP-FR
Dependent Risk Factor.
FN
family nucleus
$GABA_A$
gamma-aminobutyric acid specific receptor, subtype A
CG
Cut-off group
PCP
Pharmaceutical Chemistry Program
PSVs
psychosocial variables
PF

protective Factor
PP
public policies
Ps
professors
Ratio
RF/PF
RF
risk factor
SPSS
Statistical Package for the Social Sciences
S/P
ratio students/professors group
Ss
students

Declarations

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Competing interest

The authors declare having no conflict of interest. This article did not require approval by the ethics committee. We made a voluntary and anonymous agreement in writing this article through informed and understood consent. The identifiable research data is not provided due to the participants' anonymity expressed in the informed consent.

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References

Atwoli, L., Mungla, P., Ndung' u, M., Kinoti, K., Ogot, E. (2011). Prevalence of substance use among college students in Eldoret, western Kenya. *BMC Psychiatry*, 11-34. From: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3053226/

Avello, M., Edgar, P., Fernández, P., Córdova, P. (2017). Potencial uso terapéutico de cannabis. *Revista Médica de Chile,* 145 (3), pp. 360-367. From: http://dx.doi.org/10.4067/S0034-98872017000300010

Banich, M., Mackiewicz, K., Depue, B., Whitmer, A., Miller, G., Heller, W. 2009. Cognitive control mechanisms, emotion and memory: a neural perspective with implications for psychopathology. *Neuroscience & Biobehavioral*, 33 (5), pp. 613-30. From: http://doi.10.1016/j.neubiorev.2008.09.010

Bravo, P., Bravo, S., Porras, B., Valderrama, J. (2005). Prevalencia de sustancias psicoactivas asociadas con muertes violentas en Cali. *Revista Colombia Médica*, 36 (3), 146-152.

Burns H., Van L., Sanabria S., Hamill T., Bormans G., Eng W. et al. (2007). [^{18}F]MK-9470, a positron emission tomography (PET) tracer for in vivo human PET brain imaging of the cannabinoid-1 receptor. *Proceedings of the National Academy of Sciences*, 104 (23), pp. 9800-9805. From: http://doi.10.1073/pnas.0703472104

Cáceres, D., Salazar, I. (2006). Consumo de drogas en jóvenes universitarios y su relación de riesgo y protección con factores psicosociales. *Universidad Psicológica de Bogotá*, 5 (3), 521-534.

Castro, J., Daniels, M., Martínez, A. (2016). Receptores Canabinoides y vías de modulación del dolor. *Revista Ciencias Biomédicas*, 7, pp. 93-103.

Cavuoto, P., McAinch, A., Hatzinikolas, G., Janovska, A., Game, P., Wittert, G. (2007). The expression of receptors for endocannabinoids in human and rodent skeletal muscle. *Biochemical and Biophysical Research Communications,* 364 (1), pp. 105-110.

Claudet, I., Le Breton, M., Bréhin, C. (2017). A 10-year review of cannabis exposure in children under 3-years of age: do we need a more global approach. *European Journal of Pediatric*, 176 (4), pp. 553-556. From doi: 10.1007/s00431-017-2872-5

Crean, R., Crane, N., Mason, B. (2011). An Evidence-Based Review of Acute and Long-Term Effects of Cannabis Use on Executive Cognitive Functions. *Journal of Addiction Medicine*, 5 (1), pp. 1–8. From doi: 10.1097/ADM.0b013e31820c23fa

Eldreth, D., Matochik, J., Cadet, J., Bolla, K. (2004). Abnormal brain activity in prefrontal brain regions in abstinent marijuana users. *Neuroimage*, 23 (3), pp. 914-20.

Fajardo P. 2017: Entre la implementación y la incertidumbre. Revista de Ciencia Política 38 (2): 233-258. From: http://dx.doi.org/10.4067/s0718-090x2018000200233

Fernández, Y., Ortiz, M., Aguilar, J., Perez, D., Serra, S. 2017. Hábitos tóxicos en adolescentes y jóvenes con problemas de aprendizaje, 2011-2013. *Revista Cubana de Salud Pública*, 43 (1), pp. 27-40. From: https://www.scielosp.org/article/rcsp/2017.v43n1/27-40/

Flores, J., Ostrosky, F. (2008). Neuropsicología de lóbulos frontales, funciones ejecutivas y conducta humana. *Rev. Neuropsicología, Neuropsiquiatria y Neurociencias*, 8 (1), pp. 47-58.

Gómez, J., Rojas, V., Osorno, G., Gómez, E., Crepy, M., Buitrago, D. (2015). Grupo de Adicciones del Hospital Universitario de San Vicente Fundación. Las adiciones: enfermedades que pueden ser tratadas. Experiencias y Enfoque. Medellín: Editorial Zuluaga.

Grupo Base Estrategia Municipio Escuela Saludable (2009). La mediación como eje transformador de las relaciones escolares. Universidad de Antioquia: Boletín número 11.

Haidar, V. (2009). "Reseña crítica (Varias Obras): Biopolíticas post-foucaultianas. Pensar el gobierno de la vida entre la filosofía política, la sociología y la cartografía del presente". CEIC (Centro de Estudios sobre la Identidad Colectiva), Universidad del País en Papeles del CEIC (Revisión Crítica), 2 (7). From de Vasco: http://www.ehu.es/CEIC/pdf/critica7.pdf

Herkenham, M., Lynn, A., Johnson, M., Melvin, L., De Costa, B. (1991). Characterization and localization of cannabinoid receptors in rat brain: a quantitative in vitro autoradiographic study. *The Journal of Neuroscience*, 11(2), pp. 563-583.

Iversen, L. (2003). Cannabis and the brain. *Brain,* 126, pp. 1252-1270.

Kovack, M., Beck, A. (1977). *An empirical clinical approach toward a definition of childhood depression*. En*:* Diagnosis, Treatment and Conceptual Models. Schulterbrand J, Raskin G (Eds). New York: Raven Press, pp. 1-26.

Krishnakumar, J., Nagar, A. (2008). On Exact Statistical Properties of Multidimensional Indices Based on Principal Components, Factor Analysis, MIMIC and Structural Equation Models. *Social Indicators Research*, 86 (3), pp. 481-496.

Mackie, K. (2008). Cannabinoid receptors: where they are and what they do. *Journal of Neuroendocrinology*, 20, p. 1014.

Matsuda, L., Lolait, S., Brownstein, M., Young, A., Bonner, T. (1990). Structure of a cannabinoid receptor and functional expression of the cloned cDNA. *Nature,* pp. 561-564.

López, H.; Miquel, L.; Casajuana, C.; Balcells, M. (2018). Posverdad del consumo de cannabis: de regreso a la medicina basada en la evidencia. *Adicciones*, 30 (4). 237-242. From: https://doi.org/10.20882/adicciones.30.4

Pellicer, V., Belda, S., López, A. y Boni, A. 2016. Exploring connections between social innovation, grassroots processes and human development: An analysis of alternative food networks in the city of Valencia (IngenioWorking Paper Series). Valencia: Ingenio (CSIC-UPV).
From: http://www.ingenio.upv.es/sites/default/files/working-paper/2016-04.pdf

Posada, I.; Puerta, E.; Alzate, E.; Oquendo, P. (2014). Percepción de la comunidad universitaria sobre el consumo de sustancias psicoactivas en la Universidad de Antioquia, Medellín, Colombia. *Rev Cienc Salud*, 12 (3), 411-22. From: http://www.scielo.org.co/pdf/recis/v12n3/v12n3a10.pdf

Rivera, V., Parra, M. (2016). Cannabis: efectos en el sistema nervioso central. Consecuencias terapéuticas, sociales y legales. *Revista Médica del Instituto Mexicano del Seguro Social*, pp. 26-34.

Rodríguez, R. & Goldman, A. (1996). La conexión salud-desarrollo. Washington, D.C.: Organización Panamericana de la Salud OPS/OMS.

Sánchez J. (2017). "Del artificio natural de la política", en Anales del Seminario

de Historia de la Filosofía 34 (3), 551-569.

Schlaepfer, T., Lancaster, E., Heidbreder, R., Strain, E., Kosel, M., Fisch, H., Pearlson, G. (2005). Decreased frontal white-matter volume in chronic substance abuse. *International Journal of Neuropsychopharmacology*, 8, pp. 1–7.

Sevy, S., Smith, G., María, Y., Dhawan, V., Chaly, T., Kingsley, P. et al. (2008). Cerebral glucose metabolism and D2/D3 receptor availability in young adults with cannabis dependence measured with positron emission tomography. *Psychopharmacology* (Berl), 197(4), pp. 549-56.

Sociedad Española de Patología Dual (2009). Patología Dual: Protocolos de Intervención.
From: http://www.psiquiatria.com/noticias/patologia_dual/43422/

Tobón, F., Gaviria, N., Ramírez, J. (2012). La lúdica como método psicopedagógico: una experiencia para prevenir la farmacodependencia en jóvenes. *Avances en Psicología Latinoamericana*, 30 (1), 81-92.

Tobón, F., López, L., Ramírez, J. (2013). Acompañamiento psicosocial a jóvenes marginados para prevención de la farmacodependencia. *Humanidades Médicas,* 13 (2), 348-371.

Tobón, F., López, L., Ramírez, J. (2013). Características del estado de salud mental de jóvenes en condiciones vulnerables. *Revista Cubana de Salud Pública*, 39 (3), pp. 462-473.

Tobón, F.; López, L. (2011). *El desarrollo a escala humana un referente para el diseño de planes de desarrollo local*. En: Abriendo espacios flexibles en la escuela. (2a ed). Lopera I, Builes LF (Eds). Grupo Base Estrategia Municipio Escuela Saludable. Medellín: Universidad de Antioquia, 16-25.

Tobón, F.; Ramírez, J.; Jiménez, C. (2013). Percepción de estudiantes universitarios consumidores de psicotrópicos sobre las políticas que abordan esta problemática en Medellín, Colombia. *Rev Costarr Salud Pública,* 22, pp. 119-126.

Toro, D.; Paniagua, R.; González, C.; Montoya, B. (2009). Caracterización de adolescentes escolarizados con riesgo de suicidio, Medellín 2006. *Revista Facultad Nacional* Salud Pública Universidad de Antioquia,

27(3), 302-8.

Torres, Y.; Posada, J.; Bareño, J.; Berbesí, D. (2010). Trastornos por abuso y dependencia de sustancias en población colombiana: su prevalencia y comorbilidad con otros trastornos mentales seleccionados. *Revista Colombiana Psiquiatría*, 39 (Suplemento).

UNODC 2014. Informe mundial sobre las drogas [Internet]. p. 10. Retrieved on January 15, 2018 from: http://www.unodc.org/documents/wdr2014/V1403603_spanish.pdf

Vallaeys, F. (2014). La responsabilidad social universitaria: un nuevo modelo universitario contra la mercantilización. *Revista Iberoamericana de Educación Superior*, 5 (12), 1-8.
From: https://ries.universia.net/rt/printerFriendly/137/315

Varela, M.; Salazar, I.; Cáceres, D.; Tabares, J. (2007). Consumo de sustancias psicoactivas ilegales en jóvenes: Factores Psicosociales Asociados, Cali-Colombia. *Rev Pensamiento Psicológico,* 3 (08), 31-45.

Figures

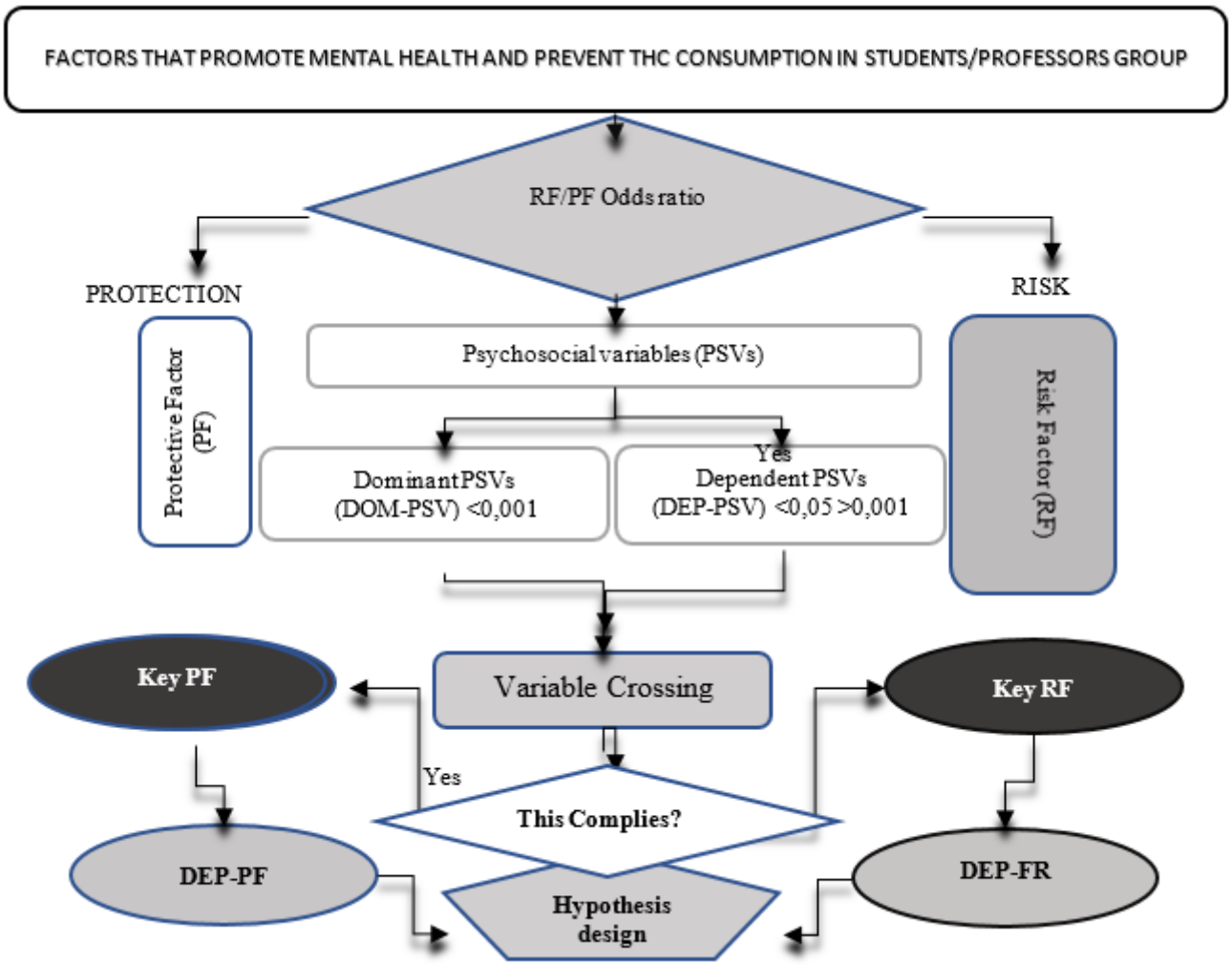

Figure 1

Relationships: Δ9-THC consumption with dominant and/or dependent PSVs

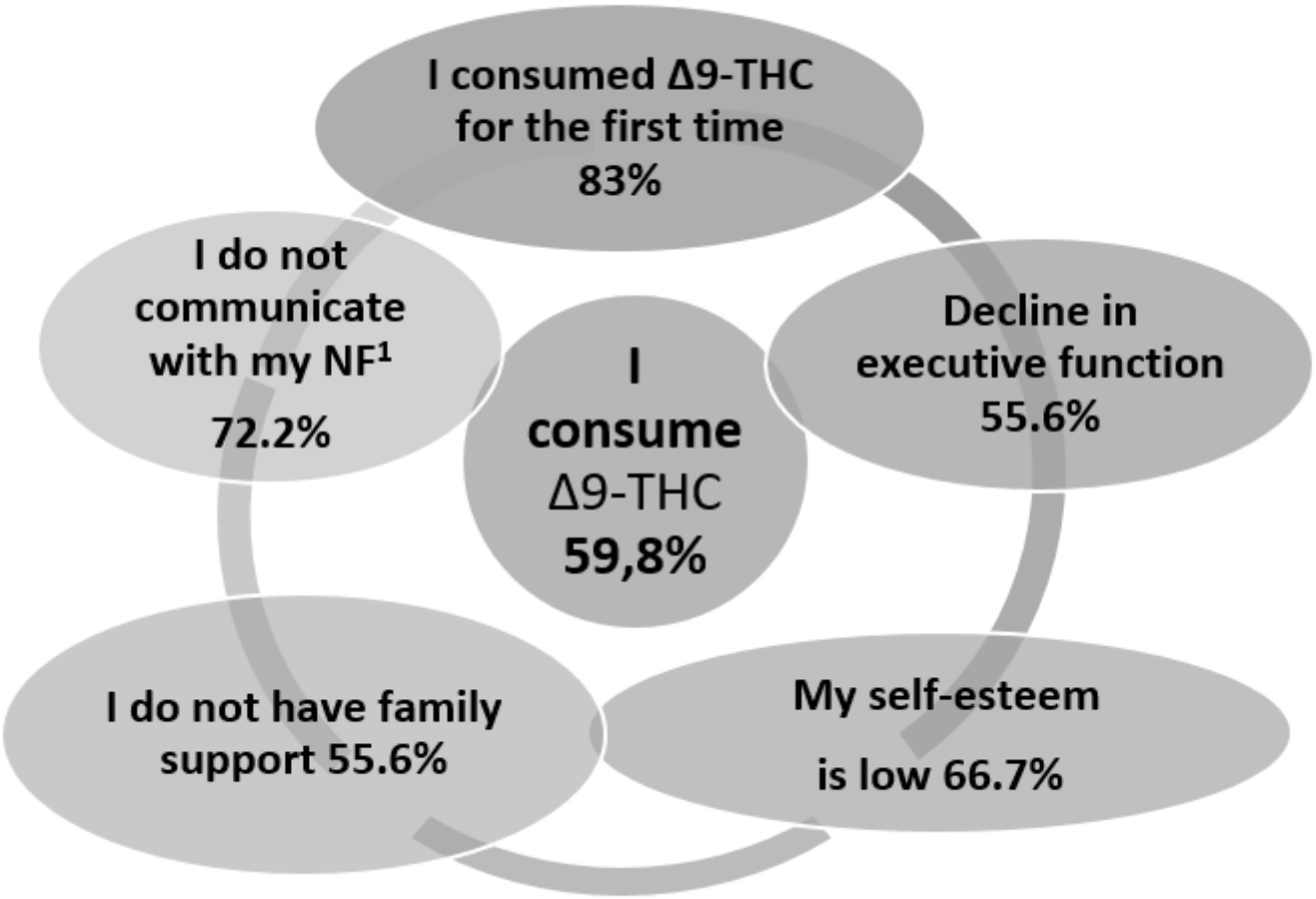

Figure 2

Δ9-THC consumption relationships and dominant/dependent PSVs Source: research database. 1FN: family nucleus. The percentage of prevalence in the student cut is supported by Table 1 (X2 greater than 11.5 times and p <0.001 of statistical significance).

Supplementary Files

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- BCMSTROBERelationshipTHCconsumptionPSVs.docx