

The beneficial effects of LSD for the ultimate quantum machine: conflicting evidence-based inference from the cyberspace and the literature

Ahmed Al-Imam^{1,2}

Marek A. Motyka³

Salim Rasheed Al-Obaidi^{4,5}

¹ Department of Anatomy and Cellular Biology, College of Medicine, University of Baghdad, Iraq

² CERVO Brain Research Centre, Faculty of Medicine, University of Laval, Canada

³ Institute of Sociology, Faculty of Sociology and History, University of Rzeszów, Poland

⁴ Department of Pathology and Forensic Medicine, College of Medicine, University of Baghdad, Iraq

⁵ Baghdad Medical City Complex, Iraqi Ministry of Health, Iraq

Address for correspondence:

Ahmed Al-Imam
Department of Anatomy and Cellular Biology,
College of Medicine, University of Baghdad
Bab Al-Moadham
10053, Baghdad, Iraq
Tel.: +964 (0) 771 433 8199
E-mail: tesla1452@gmail.com; ahmed.al-imam.1@ulaval.ca

Abstract

Background: Psychoactive substances, including psychedelics and hallucinogens, can be of high-risk on public health and the economy. The human brain can get affected by an array of hallucinogenic chemicals including NBOMe and DMT. Other substances, like LSD (acid), are still under investigation. Many psychedelia enthusiasts opine positively about the use of LSD.

Materials and methods: This study is observational and explorative via retrospective analysis of the literature on the pharmacodynamic effects of LSD in parallel with thematic evaluation of opinion of users existing on Facebook e-platform. Comments of LSD users about the harmful and beneficial effects of LSD will be numerically quantified. Other parameters include age, sex, ethnicity, social relationship status, geographic mapping and nationality, and tendencies toward using

LSD. The inference will be based on an artificial numerical index known as the enthusiasm index.

Results: The majority of observed individuals were males, Caucasian, and from the United States. Others were geographically mapped to the European Union, UK, Eastern European countries, and Israel. Data signals from the majority of the developing world, including the Middle East, were lacking while carrying out literature review as well as the thematic analytic study. Data from the literature are conflicted in evidence when compared with data retrieved from Facebook. The existing body of the literature points out the adverse effects of LSD and as early as the 1950s soon after the discovery of LSD by Albert Hofmann. Hence, being precautionary (anti-LSD) while individuals interacting on Facebook opined positively (pro-LSD).

Conclusion: Future studies should attempt accessing larger sample size via clustering and stratification while exploring the surface web and the deep web. Concepts of automation, including those of machine learning, are vital to achieving rigour evidence and real-time statistical inference, and potentially predictive analytics of change in trends (pro-LSD and anti-LSD) in pre-specified populations of interest.

KEY WORDS: addiction medicine, psychoactive substances, hallucinogens, psychedelics, lysergic acid diethylamide.

Introduction

Psychoactive and novel psychoactive substances (NPS) represent a remarkable phenomenon of the 21st century that has been growing exponentially over the past two decades (1, 2). The electronic commerce (e-commerce) of these substances is highly profitable and engage many stakeholders including criminal organisations and terrorists, specific populations including psychedelia enthusiasts, chemists and drug designers, and other contributors (3-5). Electronic commerce is growing at a logarithmic pace paralleled only by the collateral growth within the discipline of information and communication technology (ICT) and data science (6, 7). Psychedelics and en-

theogens, better known within the scientific community as hallucinogenic substances, represent a unique subset of psychoactive chemicals (1, 2). Psychedelics are known to induce psychological, behavioural, and neurological effects including visual and auditory hallucinations (1, 2). Some hallucinogens are super-potent and even lethal including NBOMe compounds (8, 9).

The human brain, the most complex biologic quantum machine with elaborate neurotransmitters and biochemical machinery, can be easily affected by psychedelic drugs (1, 2). Psychedelic and hallucinogenic substances, including LSD and psilocybin, exert their pharmacodynamic effect via the modulation of the serotonergic pathways within the brain, including the visual and auditory processing pathways and cortical areas, primarily via acting as agonists for the 5-HT_{2A} receptor (1-3). Acid, scientifically known as Lysergic acid diethylamide (LSD), represents a potent hallucinogen that has pharmacodynamic properties within microdose range. Hence, the term “micro-dosing” is intimately linked with LSD, NBOMe, DMT and other potent chemicals (10-12). There is a consider-

able lack of studies of high level-of-evidence including randomised controlled trials, systematic reviews, and meta-analytic studies about the biohazards of the substance (Table 1) (4).

Ever since the discovery of LSD by Albert Hofmann, a Swiss scientist who described LSD as a “sacred drug”, it has been extensively used by a varied array of users albeit being enlisted as a potent illicit substance (13-15). Therefore, the topic of this study has paramount importance for (para)medical professionals, policymakers, legislators, and world-leading organisations responsible for the regulations and banning of psychoactive substances including novel ones. Such organisations include the United Nations Office on Drugs and Crime, the European Monitoring Centre for Drugs and Drug Addiction, and the World Anti-Doping Agency (5, 16). The “bicycle day” on the 19th of April marks the day commemorating when Hofmann had an intentional micro-dosing of LSD while he rode back home on a bicycle (14, 15). There have been few experimental studies in animals as well as trials on humans illustrating its risk, while several reports and retrospective studies validate cases

Table 1. Incidents of intoxication-death and the potential cases of death due to the use of LSD.

Date	Gender	Age	Location	Number of death	Outcome
1985	M	25	UK	1	Pharmacological fatality?
1977	M	34	US	1	Pharmacological fatality?
1972	F	20	US	8	Near-death, Pharmacological fatality
		19			
		28			
		33			
	M	39			
		29			
		28			
1969	F	20	US	1	Suicide?
1953	M	43	US	1	Homicide (CIA assassination), suicide?
-1967	M, F	Not documented (ND)	US and Canada	19	Attempted suicide
				4	Attempted homicide
				11	Successful suicide
				1	Successful homicide
				9	Suicidal intentions
1956	ND	ND	US	2	Psychotherapy-induced suicide
1957					
1988	M	14	Canada	1	Behavioural fatality
1989	M	18	US	1	
2002	M	16	UK	1	
2008	M	17	US	1	
2007	M	26	US	1	
2007	M	19	US	1	

† Reproduced with permission (4).



Figure 1. Young psychedelics user with persistent mydriasis. † Reproduced with permission (18).

of intoxication and death due to LSD as early as the 1950s (Table 1, Figure 1) (4, 12, 17, 18). Our study represents an explorative observational analytic of the surface web, via a renowned social communication media platform, and a collateral review of literature aiming to conclude data about the benefits and hazards related to the use of LSD.

Materials and methods

This study has been ethically permitted by the Institute Review Board (IRB) of the College of Medicine at the University of Baghdad and in compliance with the authority of the IRB meeting number seven on the 20th of December 2016. It is a hybrid of a cross-sectional analytic of the surface web, via an internet snapshot, and a pertinent systematic review of the literature. The cross-sectional analysis was carried on a private group dedicated to psychedelia enthusiasts and psychedelic users. The group exists on an online

social media platform known as Facebook. The snapshot was taken during September 2017. It was in relation to an already existing thread of comments of the group members concerning their opinions and subjective experience regarding the beneficial and harmful effects of LSD.

Data from the internet snapshot, including comments from all the users of LSD, was used to construct a comprehensive database. Subsequent descriptive statistics and hypothesis testing were carried out to conclude an inference in connection with the beneficial (positive) and harmful (adverse) effects associated with the use of acid (LSD). Several demographic parameters were tabulated including age, sex, nationality, ethnicity, and social-marital relationship status (single or in-relation). In addition, the comments were further analysed based on the number of words per each comment written by an LSD user (WPC, reflecting his or her speech density), themes of comments (via thematic analysis), number of themes in relation to the positive opinions concerning LSD (pro-LSD),

and the number of negative opinions (anti-LSD) (19, 20). Finally, a scoring index, named as the Enthusiasm Index (EI) on a scale of 0-100, was created as a representative of the overall enthusiasm (tendency) towards using LSD. The EI was calculated using a combined weighted average (weighted mean) based on numerical values of speech density, comments with positive and negative themes, and the total number of themes per a comment made by each user. Our study will dare to answer whether LSD is marked as safe or harmful, by comparing evidence extrapolated from the snapshot and the retrospective data from the reviewed literature.

The level-of-evidence for this study is estimated to be of level-3 in compliance with the scheme of the hierarchy of evidence-based studies implied by the Oxford Center for Evidence-Based Medicine (21, 22). The literature review was conducted during August and September in 2017. It was carried out via medical and paramedical databases of NCBI-PubMed, the Cochrane Library, Embase, EBSCO, ResearchGate, and Academia. Online social media, media networks, blogs, and online drug communities (drug fora) were also investigated (23-26). Descriptives and statistical inferences were carried out via Microsoft Excel 2016 and the Statistical Package for Social Sciences (SPSS v.24). A confidence interval of 95% is adopted as the cut-off margin for statistical inference.

Results

The total number of individuals included in this snapshot was forty-seven ($n=47$). The majority were males ($n=39$, 83%). The number of those who were in a relationship was less than one-third (29.8%) while the remaining individuals were single. Themes of comments were either pro-LSD or anti-LSD, and individuals who opined negatively were a minority (10.64%). Those individuals reported having panic attacks and a sense of incompleteness while tripping (psychedelic trip), experiencing other pharmacological effects including hypersensitivity reactions, the impurity of purchased LSD due to the presence of contaminants, and committing behavioural misconduct (misdemeanour or a felony) under the influence of the substance. The majority of individuals had pro-LSD attitude and commented positively on LSD as it helped with resolving anxiety-panic attacks and phobias, combating conditions within the neurotic spectrum of psychiatric diseases including post-traumatic stress disorders (PTSD), enhancing artistic talents and creativity, boosting confidence, breaking cultural restraints and ethnic barriers, and inducing a sense of tranquillity as well as spiritualism. It also promoted extraversion while eliminating social anxiety and phobias (empathogenic properties), promoting ego dissolution, creating a "profound sense of motivations" and

a "purpose in life". LSD augmented boosting self-esteem as well as love and tolerance of others, and it helped to combat forms of addictions including alcoholism and drug misuse of high-risk substances that can induce dependence and pharmacological intoxication, including opioids.

For the screened and calculated parameters, the mean values were 31.72 years (age), 51.89 words (WPC), number of pro-LSD themes per comment (1.81), anti-LSD themes per comment (0.34), and 10.56 (EI). Statistical outliers were detected (Figure 2) for age (61 years old, male, from the United States, Caucasian, in-relation, 3 WPC, with a pro-LSD attitude, EI of 1.5), speech density and EI (31 years old, male, from Israel, Caucasian, single, 563 WPC, pro-LSD attitude, two themes, EI of 100). Most individuals were from the developed world (Figure 3) including the United States (74.5%), United Kingdom (4.3%), Romania (4.3%), Israel (4.3%), Poland (2.1%), Germany (2.1%), France (2.1%), Estonia (2.1%), Denmark (2.1%), and Belgium (2.1%). Ethnic grouping (Figure 3) included Caucasians (78.7%), Latins (8.5%), Black (6.4%), and Asians (6.4%). On the other hand, ethnic grouping based on the summative EI were allocated as Caucasians (84%), Asians (6%), Black (6%), and Latins (4%). Further, summative EI distributed those individuals to the US (56%), Israel (20%), Poland (5%), Romania (5%), Germany (4%), Belgium (3%), UK (3%), France (2%), Estonia (1%), and Denmark (1%) (Figure 4).

Concerning the social relationship status (single *versus* in-relation), there was a significant difference in connection with age (29.58 *versus* 36.79, p -value=0.041), while no differences were detected for WPC ($p=0.128$) and EI ($p=0.112$). Based on sex (male *versus* female), there were no differences between the three parameters (age, speech density, and EI). Concerning ethnic grouping, there was only a significant difference between Caucasians and Latins with regards to the EI (32.51 *versus* 28.25, $p=0.042$) and also for speech density (Table 2). Hence, Caucasians commented significantly more than Latins and had a stronger pro-LSD attitude. Based on the nationality, a significant difference was found for age for nationals of the US *vs* the UK ($p=0.001$), the US *vs* Romania ($p=0.095$), the US *vs* Israel ($p=0.057$), the UK *vs* Romania ($p=0.027$), and the UK *vs* Israel ($p=0.015$) (Table 3). Individuals from the US were in the early 30s (mean=32.17 years), those from the UK were in mid-40s (46.5), while those from Romania and Israel were in their 3rd decade of life. Linear Regression confirmed that there was no significant correlation neither for EI *versus* age (R^2 socre=0.0002) nor speech density *versus* age. The most robust significant association existed between EI and speech density ($R^2=0.996$) representing a pro-LSD tendency in individuals who commented with more words.

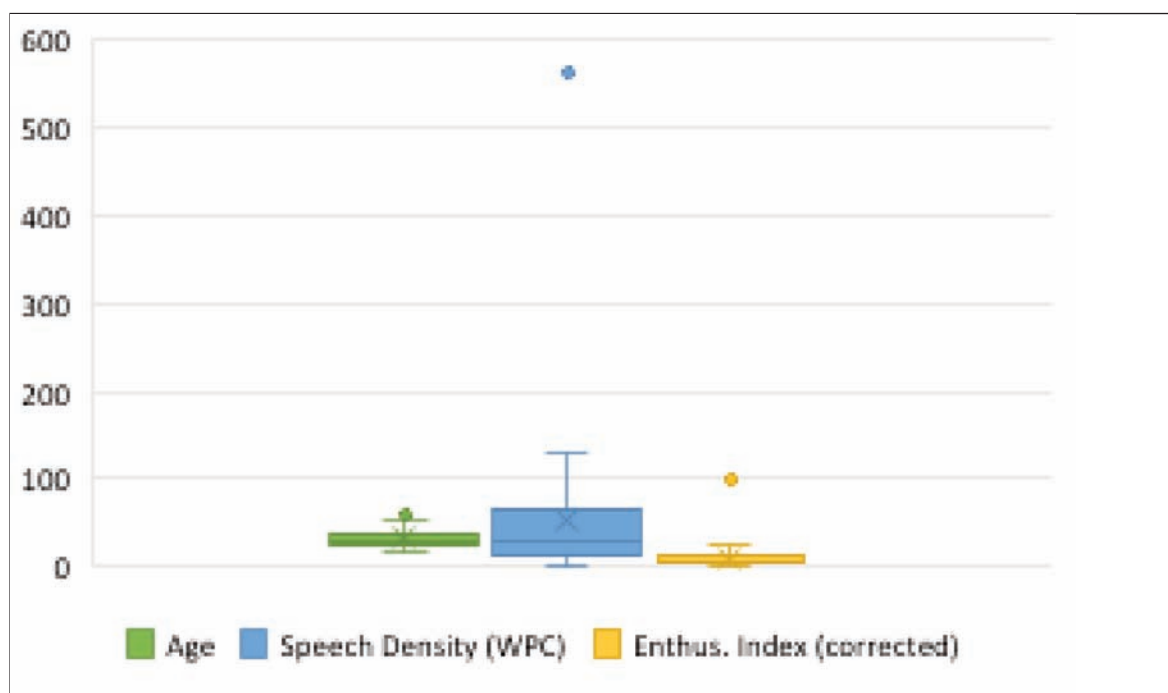


Figure 2. Boxplot presentation of the age, speech density, and the enthusiasm index of LSD users.

Discussion

Psychedelic users and some research papers assure the safety of micro-dosing with LSD, while other studies enlist cases of acute intoxication and death related to the use of the substance (23-26). The majority of these cases was strictly reported from the developed world, and the earliest reports go back in time to the 1950s although some of these incidents remain ambiguous and not entirely confirmed (4). A recent case report of a teenage female from New Zealand correlated the early use of LSD and other psychedelics with inducing some permanent pathophysiological changes including a persistent mydriatic effect (Figure 1) (17, 18). Additionally, it is well-known that several renowned individuals and scientist intentionally experimented with LSD including the eminent philosopher and novelist Aldous Huxley who requested his wife to administer LSD to him while he was on his deathbed suffering from an end-stage laryngeal cancer (11).

There have been some subjective and anecdotal reports concerning the perspectives of substance users on the safety of LSD tripping in public place (12). In 2017, Al-Imam extrapolated that psychedelics users, mainly from the developed countries, were favouring an acid trip in public places though knowing the potential risk of the substance (2-4). Data from online drug fora and prior studies by Smart and Batemen (1967), Eisner and Cohen (1958), Klock et al. (1975), Griggs and Ward (1977), as well as Fysh et al.

(1985), pointed out that several incidents that have been related to LSD-induced death or intoxication (Table 1) (4). Incidents included cases of death or near pharmacological fatality, behavioural fatalities, suicide and attempted suicide, pharmacological poisoning, and psychotherapy-related fatality (27-38). Most of these cases were mapped to the developed world specifically the US, UK, and Canada. Victims included both males and females. The majority were in their 2nd or 3rd decades of life, indicating that LSD is preferred by teenagers and young adults from the developed world.

Research should be designed to include the use of animal models and randomised controlled trials (RCTs) for rigour evidence. These studies are pivotal to (dis)prove the adverse effects and biohazards of LSD on body systems including the cardio-respiratory and the nervous system which are known to be affected by amphetamines in addition to myriads of other psychoactive substances including psychedelics and performance-cognitive enhancing substances (39-43). In 2017, Carhart-Harris RL and Goodwin reported that LSD was notably used as an adjunct to psychotherapy for the treatment of some forms of addictions and mood disorders, and it had an initial therapeutic success before the restrictive legislation in the 1960s that terminated all of the major psychedelic research programs (44). Nevertheless, during the 1990s, there has been a reemergence of those programs, and there were some reports including the first modern brain imaging study for LSD users as

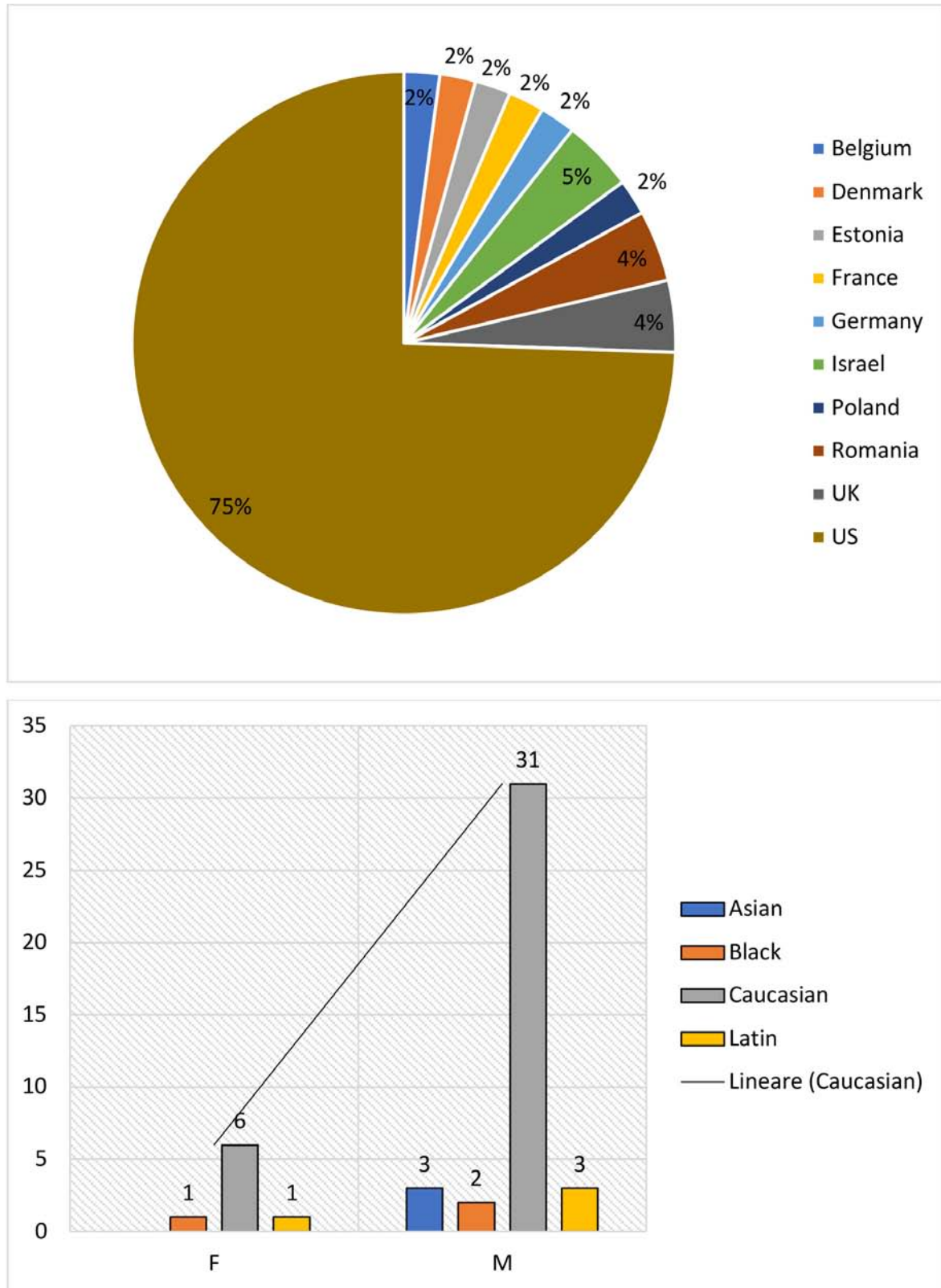


Figure 3. Geographic Mapping of LSD Users (above) and Ethnic Grouping Based on Sex (below).

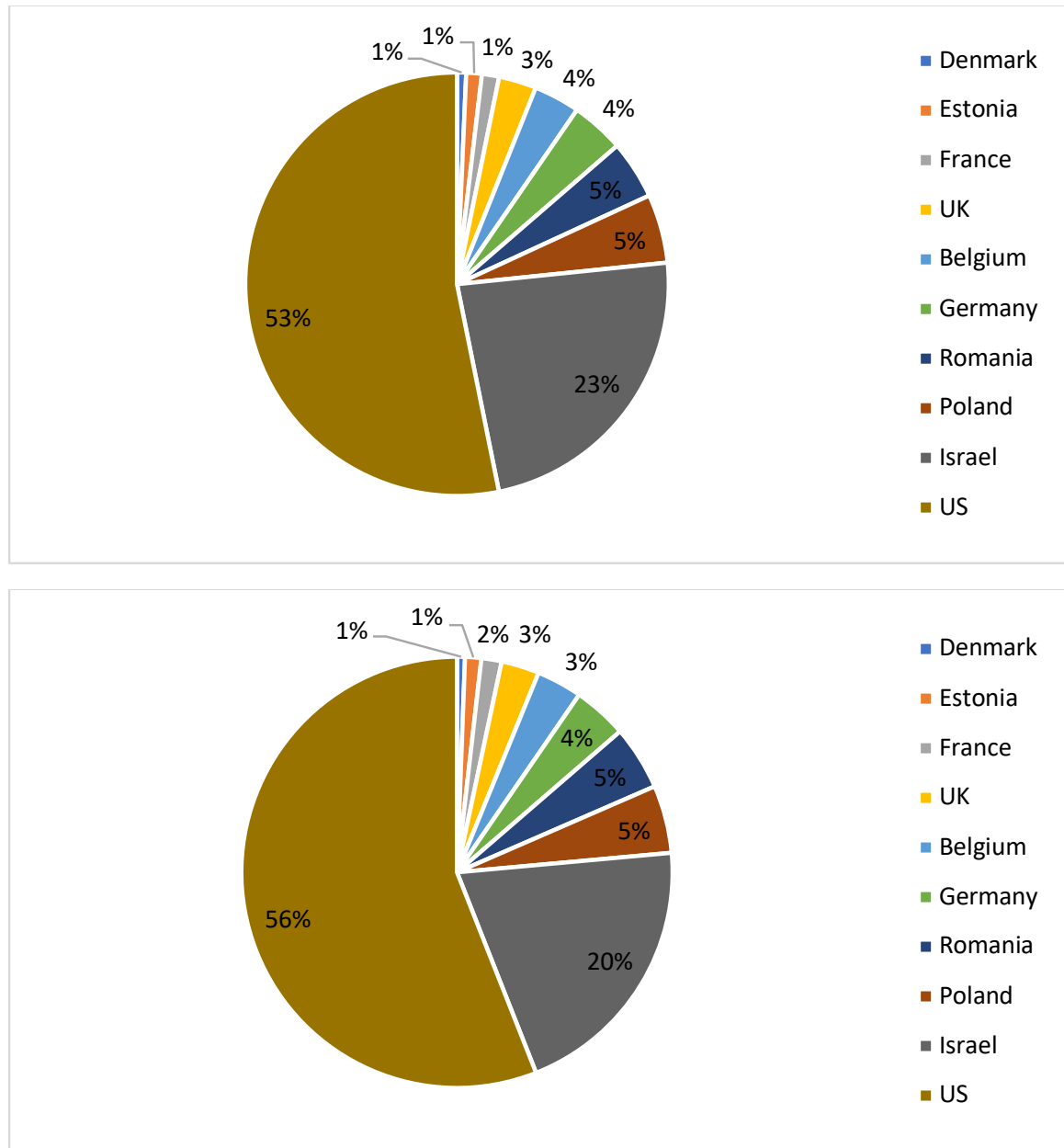


Figure 4. Geographic Mapping Based on the Summative Speech Density (upper chart) and the Summative Enthusiasm Index (lower chart).

well as three clinical trials on the use of psilocybin for the management of depression (44). Hence, there is a historical as well as recent evidence on the potentials for LSD, psilocybin, and other psychedelics to manage cases of treatment-resistant depression. However, Steeds and colleagues reported the role of LSD and hallucinogens as drug models of schizophrenia, as some of those substances interact with different neurotransmitter systems involved in the pathogenesis of schizophrenia via the modulation of the dopaminergic, glutamatergic, serotonergic,

cannabinoid, GABA, kappa opioid, and cholinergic system (45). Besides, individuals with a family history of schizophrenia are at higher risk of developing early-onset schizophrenia following the use of LSD and psilocybin (45, 46). In 2018, Martinotti and coworkers re-studied a rare condition known as Hallucinogen Persisting Perception Disorder (HPPD) which is a poorly understood condition in connection with the consumption of hallucinogens. HPPD manifests as a total or partial recurrence of perceptual disturbances that appeared during previous hallucinogenic “trips”

Table 2. Statistical inference based on the ethnic groupings of LSD users.

	Age		Speech Density		Enthusiasm Index	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Asian	29	3.61	8.94	7.83	10.40	8.77
Black	29.33	7.64	8.53	6.10	9.99	6.10
Caucasian	32.51	10.45	9.86	16.47	11.23	16.47
Latin	28.25	8.46	4.04	2.50	4.94	2.50
<i>p-value</i>						
	Asian vs Black	Asian vs Caucasian	Asian vs Latin	Black vs Caucasian	Black vs Latin	Caucasian vs Latin
Age	0.950	0.245	0.881	0.555	0.867	0.403
Speech Density	0.945	0.871	0.393	0.771	0.316	0.054
Enthusiasm Index	0.951	0.894	0.395	0.793	0.285	0.042

Table 3. Statistical inference based on the nationality of LSD users.

Mean						
	Age	Speech Density			Enthusiasm Index	
US	32.17	6.58			7.94	
UK	46.50	6.22			7.08	
Romania	23.50	9.68			11.94	
Israel	28	50.80			50.78	
p-value						
	US vs UK	US vs Romania	US vs Israel	UK vs Romania	UK vs Israel	Romania vs Israel
Age	0.001	0.095	0.057	0.027	0.015	0.297
Speech Density	0.957	0.735	0.534	0.735	0.530	0.556
Enthusiasm Index	0.912	0.643	0.544	0.640	0.536	0.574

without a recent psychedelic use including that of LSD, DMT, and psilocybin (47). The condition has been neurobiologically attributed to the chronic disinhibition of visual neuronal processors, and it has been linked to an LSD-induced intense current affecting the cortical serotonergic inhibitory interneurons with GABA outputs (47).

Anticipated studies of the future should integrate accurate epidemiological and digital epidemiological

analyses for geographic mapping of the diffusion and e-commerce of LSD. Trends databases should be combined with parallel data from blogs, e-commerce websites, and online drug fora, in addition to confirmed meta-analytic studies on confirmed cases of intoxications and fatality induced by the substance. Besides, the geography and chronology of the reports should be correlated with data extrapolated from of the trends database (2, 8, 48). Researchers should

promote their study design and the accuracy of statistical analyses and hypotheses testing via the deployment of multivariate analysis and regression models. Effective true interdisciplinary collaboration with ICT professionals should be attempted with an aim to eliminate information biases related to data gathering and interpretation. Future studies should also incorporate the exploration of appendices of the deep web and its darknet marketplace to reach an accurate inference concerning the harmful-beneficial effects of LSD, the e-commerce of LSD, and the extent of diffusion on the internet. Real-time and predictive analytics can assume the role of the *Rosetta stone* for informative and resources-sparing prospective studies. Predictions based on big data can be achieved by investing in the principles of automated data collection via machine learning algorithms (49-51).

Conclusion

Our study is the first of its kind to explore the safety of LSD via an inferential thematic analysis in combination with retrospective data retrieved from the body of literature. Data were limited to countries from the developed world including the United States, states of the European Union, as well as a smaller contribution from Eastern Europe and Israel. Hence, the Middle East and other developing regions of the world are under-represented. Literature review points out the hazards of the substance in contradiction to the opinions of web users analysed via Facebook. Our study has some limitations including a relatively small sample size with an imposed restriction upon subgrouping and blocking based on ethnicity and citizenship. Only the surface web was explored via one social communication media platform, while only one group existing on Facebook was studied for thematic expressions and related parameters. Sampling was not based on systematic stratification and clustering. No data were retrieved from the surface web via trends database, while the deep web and the darknet marketplace were never explored. Thematic evaluation can be faulty due to interpretation and information biases. No quasi-experimental or high-evidence experimental approach was incorporated in this study which is purely observational and based on a snapshot in time. Finally, data from this study can not provide a continuous stream for inference and future projection of trends. Therefore, concepts and results from this study tend to be soon obsolete unless combined with real-time and predictive analytics by deploying the use of automated algorithms and the principles of machine learning.

Acknowledgements

None

Conflicts of interest

The Authors have nothing to be declared.

Source of funding

This study is entirely self-funded.

Availability of data

The raw data and the detailed statistical analysis will be made available upon request from the corresponding Author. These data will also provide a comprehensive explanation of the scoring system implemented in this study.

References

1. Dargan P, Wood D, editors. Novel psychoactive substances: classification, pharmacology and toxicology. Academic Press; 2013 Aug 6.
2. Al-Imam A. Monitoring and Analysis of Novel Psychoactive Substances in Trends Databases, Surface Web and the Deep Web, with Special Interest and Geo-Mapping of the Middle East. info:eu-repo/semantics/masterThesis [dissertation on the Internet]. United Kingdom: University of Hertfordshire; 2017. DOI: 10.13140/RG.2.2.27636.24961.
3. Al-Imam A, AbdulMajeed BA. Novel Psychoactive Substances: Systematic Review and Evidence-Based Analysis of Literature. Global Journal of Health Science. 2017 Sep 18;9(11):1.
4. Al-Imam A. Retrospective Analyses of High-risk NPS: Integrative Analyses of PubMed, Drug Fora, and the Surface Web. Global Journal of Health Science. 2017 Sep 18;9(11):40.
5. Al-imam A, Santacroce R, Roman-Urrestarazu A, Chilcott R, Bersani G, Martinotti G, Corazza O. Captagon: use and trade in the Middle East. Human Psychopharmacology: Clinical and Experimental. 2017 May 1;32(3).
6. Ginter KL, Shear VH, Spahn FJ, Van Wie DM, Weber RP, inventors; Intertrust Technologies Corp, assignee. Trusted infrastructure support systems, methods and techniques for secure electronic commerce transaction and rights management. United States patent US 8,751,793. 2014 Jun 10.
7. Turban E, King D, Lee JK, Liang TP, Turban DC. Overview of electronic commerce. In Electronic Commerce 2015 (pp. 3-49). Springer, Cham.
8. Al-Imam A, AbdulMajeed BA. NBOMe Compounds: Systematic Review and Data Crunching of the Surface Web. Global Journal of Health Science. 2017 Sep 18;9(11):126.
9. Suzuki J, Dekker MA, Valenti ES, Cruz FA, Correa AM, Poklis JL, Poklis A. Toxicities associated with NBOMe ingestion—a novel class of potent hallucinogens: a review of the literature. Psychosomatics. 2015 Mar 1;56(2):129-39.
10. Johnstad PG. Powerful substances in tiny amounts: An interview study of psychedelic microdosing. Nordic Studies on Alcohol and Drugs. 2018 Feb;35(1):39-51.

11. Dyck E. LSD: a new treatment emerging from the past. Canadian Medical Association Journal. 2015 Oct 6;187(14):1079-80.
12. Al-Imam A. Let's Go Out For A Day Trip? Perspectives of Psychedelics (Ab) Users on the Safety of Acid (LSD) Tripping in Public Places. Global Journal of Health Science. 2017 Sep 18;9(11):156.
13. Fusar-Poli P, Borgwardt S. Albert Hofmann, the Father of LSD (1906–2008). Neuropsychobiology. 2008;58(1):53-4.
14. Hofmann A. The discovery of LSD and subsequent investigations on naturally occurring hallucinogens. Discoveries in Biological Psychiatry. 1970:91-106.
15. Hofmann A. How LSD originated. Journal of psychedelic drugs. 1979 Jan 1;11(1-2):53-60.
16. Dargan PI, Wood DM. Recreational drug use in the Asia Pacific region: improvement in our understanding of the problem through the UNODC programmes. Journal of Medical Toxicology. 2012 Sep 1;8(3):295-9.
17. Al-Imam A. Google Trends Analyses and Case Report: A Persistently Dilated Pupil in Psychedelics' User. Global Journal of Health Science. 2017 Sep 18;9(11):168.
18. Al-Imam A. Could Hallucinogens Induce Permanent Pupillary Changes in (Ab) users? A Case Report from New Zealand. Case Reports in Neurological Medicine. 2017;2017.
19. Clarke V, Braun V. Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. The Psychologist. 2013;26(2):120-3.
20. Fereday J, Muir-Cochrane E. Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. International Journal of Qualitative Methods. 2006 Mar;5(1):80-92.
21. Howick J, Chalmers I, Glasziou P, Greenhalgh T, Heneghan C, Liberati A, Moschetti I, Phillips B, Thornton H. Explanation of the 2011 Oxford Centre for Evidence-Based Medicine (OCEBM) Levels of Evidence (Background Document): Oxford Centre for Evidence-Based Medicine [Webpage]. 2011. Accessed May. 2016;16.
22. Greenhalgh T, Howick J, Maskrey N. Evidence based medicine: a movement in crisis?. BMJ. 2014 Jun 13;348:g3725.
23. Drugs-forum.com. Available at <https://drugs-forum.com/index.php> (accessed 17 April 2018).
24. Erowid. Erowid.com. Available at <https://www.erowid.org/> (accessed 17 April 2018).
25. Officialbenzofury.net. Available at <http://officialbenzofury.net/> (accessed 18 April 2018).
26. Reddit.com. Available at <https://www.reddit.com/> (accessed 18 April 2018).
27. Fysh RR, Oon MC, Robinson KN, Smith RN, White PC, Whitehouse MJ. A fatal poisoning with LSD. Forensic Science International. 1985 Jun 1;28(2):109-13.
28. Griggs EA, Ward M. LSD toxicity: a suspected cause of death. The Journal of the Kentucky Medical Association. 1977 Apr;75(4):172-3.
29. Klock JC, Boerner U, Becker CE. Coma, Hyperthermia, and Bleeding Associated with Massive LSD Overdose: a Report of Eight Cases. Clinical Toxicology. 1975 Jan 1;8(2):191-203.
30. Snopes.com. Death of Diane Linkletter. Available at <http://www.snopes.com/horrors/drugs/linkletter.asp> (accessed 07 March 2017).
31. Risen J. Suit Planned Over Death of Man C.I.A. Drugged. Available at http://www.nytimes.com/2012/11/27/us/family-of-frank-olson-man-drugged-by-cia-plans-suit.html?_r=0 (accessed 07 March 2017).
32. Eisner BG, Cohen S. Psychotherapy with lysergic acid diethylamide. The Journal of Nervous and Mental Disease. 1958 Dec 1;127(6):528-39.
33. The Toronto Star. Young rock fan found drowned. Available at <http://cdn.thegridto.com/wp-content/uploads/ts-88-05-19-front-page-1.jpg> (accessed 07 March 2017).
34. Bedford Today. Teenager on LSD thought he could fly. Available at <http://www.bedfordtoday.co.uk/news/teenager-on-lsd-thought-he-could-fly-1-1090735> (accessed 07 March 2017).
35. Sicherman A. A father's plea: Be scared for your kids. Available at http://www.startribune.com/templates/Print_This_Story?sid=11517466 (accessed 07 March 2017).
36. Redwood Curtain CopWatch. Peter Stewart, Martin Cotton, Hans Peters. Available at <http://redwoodcurtaincopwatch.net/node/232> (accessed 7 March 2017).
37. Turner K. A father's plea: Be scared for your kids. Available at http://blog.cleveland.com/metro/2008/01/coroners_office_blames_drug_us.html (accessed 07 March 2017).
38. Erowid. LSD (Acid) Fatalities / Deaths. Available at https://erowid.org/chemicals/lsd/lsd_death.shtml (accessed 07 March 2017).
39. Catalani V, Prilutskaya M, Al-Imam A, Marrinan S, Elgharably Y, Zloh M, Martinotti G, Chilcott R, Corazza O. Octodrine: new questions and challenges in sport supplements. Brain Sciences. 2018 Feb 20;8(2):34.
40. Al-Imam A, Simonato AP, Corazza O. Haloperidol, an old antipsychotic with potential use by NPS users in Iraq. Research and Advances in Psychiatry. 2016;3(3):81-4.
41. Al-Imam ML, Al-Imam A. Knowledge and (Ab) Use in Connection with Novel Psychoactive Substances: A Cross-Sectional Analysis of Psychedelic Users Existing on Online Platforms. Global Journal of Health Science. 2017 Sep 18;9(11):51.
42. Al-Imam A, Al-Mukhtar F, Shafiq A, Irfan M, Saleh MM. Knowledge and (Ab)Use in Connection with Novel Psychoactive Substances: A Cross-Sectional Analysis of Iraqi Medical Students. Global Journal of Health Science. 2017 Sep 18;9(11):61.
43. Al-Imam A. Adverse Effects of Amphetamines on the Cardiovascular System: Review and Retrospective Analyses of Trends. Global Journal of Health Science. 2017 Sep 18;9(11):102.
44. Carhart-Harris RL, Goodwin GM. The therapeutic potential of psychedelic drugs: past, present, and future. Neuropsychopharmacology. 2017 Apr 26;42(11):2105.
45. Steeds H, Carhart-Harris RL, Stone JM. Drug models of schizophrenia. Therapeutic Advances in Psychopharmacology. 2015 Feb;5(1):43-58.
46. Breakey WR, Goodell H, Lorenz PC, McHugh PR. Hallucinogenic drugs as precipitants of schizophrenia. Psychological Medicine. 1974 Aug;4(3):255-61.
47. Martinotti G, Santacrose R, Pettoruno M, Montemiro C, Spano MC, Lorusso M, di Giannantonio M, Lerner AG. Hallucinogen persisting perception disorder: etiology, clinical features, and therapeutic perspectives. Brain Sciences. 2018 Mar 16;8(3):47.

48. Al-Imam A. 25b-NBOMe: A Case Report of Sudden Death and Insightful View of Google Trends Data. *Iranian Journal of Psychiatry and Behavioral Sciences*. 2018 Mar 1;12(1).
49. Al-Imam A, Khalid U, Al-Hadihi N, Kaouche D. Real-time Inferential Analytics Based on Online Databases of Trends: A Breakthrough Within the Discipline of Digital Epidemiology of Dentistry and Oral-Maxillofacial Surgery. *Modern Applied Science*. 2019; 13(2): 81-94.
50. Al-Imam A. A Gateway Towards Machine Learning: Predictive Analytics and Neural Networks in IBM-SPSS (SPSS v.24). Retrieved on 03 January 2019. Available at https://www.researchgate.net/publication/329029699_A_Gateway_Towards_Machine_Learning_Predictive_Analytics_and_Neural_Networks_in_IBM-SPSS_SPSS_v24. <https://doi.org/10.13140/RG.2.2.20885.99041/3>
51. Al-Imam A, Rasheed Al-Obaidi S. The Electronic Commerce and Diffusion of LSD On the Surface Web and The Deep Web: A Snapshot Study Based on Analyses of Google Trends Database and The Darknet. *Research and Advances in Psychiatry*. 2018; 5(3).