Systematic Review

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A review of Indian research on co-occurring cannabis use disorders & psychiatric disorders

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***Background & objectives*: Cannabis is a widely used illicit drug and its use is often associated with co-occurring psychiatric disorders. This systematic review was aimed to provide information on the published Indian studies on co-occurring cannabis use disorders and psychiatric disorders.**

***Methods*: An electronic search of available Indian literature using relevant search terms was carried out in May 2015 and 52 articles in English language published from India were included in the current review.**

***Results*: Studies on cannabis and associated psychotic disorders (n=16) chiefly described acute episodes with predominant positive symptoms, following cannabis use. Some studies (n=6) observed an overall increased prevalence of all psychiatric disorders and symptoms owing to cannabis use, while others (n=14) elaborated on high rates of substance use in those with psychiatric disorders. The effect of cannabis use on cognitive function was the focus of some of the Indian studies (n=7). All these studies barring one had all male subjects, and a single study described the service delivery model for those with dual diagnosis disorders in India. Most of the research used cross-sectional observational design and focussed on treatment-seeking population.**

***Interpretation & conclusions*: A review of Indian literature on cannabis use and its association with psychiatric disorders indicates a high co-prevalence of psychotic disorders, especially in vulnerable individuals as well as high rates of co-occurrence of other psychiatric comorbidities. However, there is limited focus on exploring the aetiological association between cannabis use and psychiatric disorders; understanding the neurobiology of this association and management-related issues.**

Key words Cannabis - comorbidity - dual diagnosis - dual disorders - psychosis - schizophrenia - substance use disorders

Cannabis is the most frequently used illicit psychoactive substance worldwide. In 2012, 125 to 227 million people were estimated to have used cannabis[1]. The National Survey on Extent, Pattern and Trends of Drug Use in India also found it to be the most common illicit substance of use in the country[2].

Cannabis use has been associated with a high incidence of psychiatric disorders[3,4]. Cannabis use has been found to have a strong association with psychotic illness including schizophrenia[5]. This co-occurrence, which could also present as dual disorder or dual diagnosis, has important clinical implications as it

is often associated with diagnostic challenges, poor treatment outcome, severe illness course and high service utilization. Hence, it is important to study co-occurring cannabis use disorders and psychiatric disorders. The objective of the current review was to highlight salient features of the relevant Indian literature, to discuss the findings of these studies and to highlight the strengths and limitations of the existing work.

Material & Methods

Search strategy: Electronic databases of PubMed and IndMed were searched for relevant publications. The search was carried out in May 2015 and included publications till the month of May 2015. The PubMed, Boolean search was carried out using the combination of 'diagnosis, dual (psychiatry)' AND 'India'. All publications listed using the search term 'diagnosis, dual (psychiatry)' were screened for Indian studies on co-occurring cannabis use disorders and psychiatric disorders. IndMed search was carried out using different search terms including 'alcohol', 'cannabis', 'opioids', 'inhalants', 'sedatives', 'hallucinogens', 'stimulants', 'cocaine', 'amphetamine type stimulants', 'buprenorphine', 'pentazocine', 'dextropropoxyphene', 'heroin', 'opium', '*afeem*', 'smack', 'morphine', '*bhang*', '*charas*', '*ganja*', '*hashish*', 'benzodiazepines', 'zolpidem', 'toluene', 'LSD', 'ketamine', 'caffeine', 'nicotine' and 'tobacco'. Electronic archives of Indian journals on psychiatry and psychology were also searched for relevant studies. Additional published material was identified from the bibliography of the studies screened and evaluated.

Study selection: Only English-language peer-reviewed studies from India conducted among human subjects were included. All published Indian researches on co-occurring substance use disorders and psychiatric disorders, irrespective of the type of substance and psychiatric disorder, were explored. The search was not restricted by the publication type, and various publication types such as original research articles, review articles, case reports, case series and trials (including randomized as well as open-label trials) were explored for the purpose of the current review. Studies that did not include cannabis use disorders were excluded. Further, experimental research not conducted at an Indian centre and animal studies were also excluded.

Data extraction and analysis: Information was extracted using a structured proforma from the studies that met the above-mentioned inclusion and exclusion criteria. Data were extracted pertaining to comorbid cannabis use disorders and psychiatric disorders. Two authors, using pre-defined criteria, extracted the information.

Results

Fifteen studies were found following search using Boolean search terms 'diagnosis, dual (psychiatry)' AND 'India', of which 10 were found relevant and included in the review. PubMed search with 'diagnosis, dual (psychiatry)' yielded 2957 studies, nine were relevant and included in the review. A search of IndMed archives led to 33 relevant studies. Twenty-eight studies on co-occurring cannabis use disorder and psychiatric disorders were included in the current review (Table I). Further, 24 studies on various psychoactive substances (including cannabis) and psychiatric disorders were included in the current review (Table II).

Types of studies: Thirty one studies included in the current review were cross-sectional observational studies[7-15,17-21,28,33-38,40-43,45,47,49,51,55,56]. Other study types included reviews (nine publications)[23,24,27,30-32,39,50,52], prospective observational studies (three publications)[22,29,44], retrospective chart reviews (three publications)[26,53,54], case-control study (one publication)[25], letter to editor (one publication)[48], case series (one publication)[10] and editorial (one publication)[46].

Study population: Most studies were conducted among male subjects and included treatment-seeking individuals. Two studies reported findings from general population[33,48]. One study reported on family members and treatment centre staff[47].

Psychoactive substances studied: Cannabis was the exclusive psychoactive substance studied in 27 Indian studies on dual disorders[6-32]. Twenty three studies reported findings on more than one psychoactive substances including cannabis[33-49,51-56].

Psychiatric disorders studied: Psychoses were studied in 27 publications[6-11,14-23,25,29-31,41-44,49,53,56]. Other psychiatric disorders studied included bipolar affective disorder (BPAD) (three publications)[38,45,49]. Cognitive functions were explored in eight publications[12,17-22,37]. More than one psychiatric disorder was explored in 14 publications[27,32-34,38-40,45,48,49,52,54,56,57].

Time trends in publications on co-occurring cannabis use disorders and psychiatric disorders: The first published journal article on co-occurring cannabis

Table I. Studies that have explored co-occurring cannabis use disorders and psychiatric disorders in Indian setting (arranged in ascending order of year of publication)

Study	Article type	Study description	Psychiatric disorder studied
Dhunjiboy, 1930[6]	Not available	A detailed account of behavioural changes following cannabis use was provided	Insanity
Grossman, 1969[7]	Cross-sectional observational study	Behavioural symptoms following prolonged cannabis use (n=6)	Psychosis
Chopra, 1971[8]	Cross-sectional observational study	Inpatients (n=200) with psychotic symptoms following cannabis use were assessed for personality features, type and duration of symptoms	Psychosis
Varma, 1972[9]	Cross-sectional observational study	Description of socio-demographic and illness variables of inpatients (n=1248) with cannabis psychosis. Elaboration of personality features and psychotic syndromes in cannabis users	Psychosis
Thacore, 1973[10]	Not available	Described cannabis intoxication	Psychosis
Chopra and Smith, 1974[11]	Cross-sectional observational study	Socio-demographic variables, substance use characteristics and psychotic illness variables of patients (n=200) were observed following intoxication	Psychosis
Agarwal *et al*, 1975[12]	Cross-sectional observational study	Detailed physical and psychological evaluation of long-term (>5 years) consumers of '*bhang*' revealed no physical abnormality and cognitive defects in some (20%)	Cognitive functions
Dube *et al*, 1975[13]	Cross-sectional observational study	Looked for rates of cannabis use (24%) in psychiatric inpatients (n=566) and found a high association between cannabis use and 'toxic psychosis' (96%)	Various disorders
Goel and Netto, 1975[14]	Retrospective study	Evaluation of clinical features, prevalence (14.4%) and pattern of cannabis use in psychiatric inpatients (n=334) with detailed description of regular users with induced psychosis	Psychosis
Thacore and Shukla, 1976[15]	Cross-sectional observational study	Comparison of behavioural manifestations of patients with cannabis psychosis (25) and those with paranoid schizophrenia (n=25)	Psychosis
Bagadia *et al*, 1976[16]	Cross-sectional observational study	Detailed evaluation of regular cannabis users (n=20) who were psychiatric inpatients. Nine of them developed schizophrenia	Various disorders
Wig and Verma, 1977[17]	Cross-sectional observational study	Cannabis users (n=23) were matched with non-users (n=11) to look for differences on physical and psychological evaluation. Cognitive changes were discernible	Cognitive functions
Chopra and Smith, 1974[11]	Cross-sectional observational study	Patients presenting with acute psychotic episodes (n=200) were assessed for cannabis use and related behavioural changes	Psychosis
Menhiratta *et al*, 1978[18]	Cross-sectional observational study	Long-term cannabis users (n=50) underwent psychological and cognitive testing and results were compared against matched controls (n=25) and cognitive deficit was found	Psychosis
Ray *et al*, 1978[19]	Cross-sectional observational study	Long-term use of cannabis and its cognitive effects (n=30) were measured and compared with matched controls (n=50)	Cognitive functions

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Study	Article type	Study description	Psychiatric disorder studied
Sethi *et al*, 1981[20]	Cross-sectional observational study	Chronic cannabis users (n=50) were evaluated for social, economic, physical and cognitive decline	Cognitive functions
Mendhiratta *et al*, 1988[21]	Cross-sectional observational study	Follow up after 9-10 yr of previous study[18] cases (n=30) and controls (n=15) to look for cognitive deficits after long-term use	Cognitive functions
Varma *et al*, 1988[22]	Prospective observational study	Heavy chronic cannabis users (n=26) were evaluated for social, occupational and cognitive dysfunction	Cognitive functions
Thomas, 1993[23]	Review	Discussed evidence on phenomenology of cannabis intoxication and reaction to cannabis use to create basis for cannabis use psychosis	Psychosis
Basu *et al*, 1994[24]	Review	Discussion of literature on specific phenomenology of cannabis use related psychiatric disorders	Various disorders
Basu *et al*, 1999[25]	Case-control study	Retrospective chart review to compare between cases of cannabis psychosis (n=20) and acute psychosis (n=20) on socio-demographic, illness and substance use variables	Psychosis
Sarkar *et al*, 2003[26]	Retrospective study	Psychiatric disorders, socio-demographic characteristics, substance use patterns of cannabis users (244) were recorded using retrospective chart review	Various disorders
Grover and Basu, 2004[27]	Review article	Review of the past 15 yr evidence on cannabis use and associated psychopathology	Various disorders, withdrawal syndrome and cognitive deficit
Chaudhury *et al*, 2005[28]	Cross-sectional observational study	Nature of psychiatric symptoms and socio-demographic variables of cannabis using psychiatric inpatients (n=67) have been described	Various disorders
Kulhalli *et al*, 2007[29]	Cross-sectional observational study	Treatment-seeking patients (n=20) specifically with psychosis following cannabis use were evaluated for psychopathology	Psychosis
Parakh and Basu, 2013[30]	Review article	Review of recent literature to assess strength of association between cannabis and psychosis with a special emphasis on genetic studies	Psychosis
Shrivastava *et al*, 2014[31]	Review article	Review of Indian literature on psychiatric comorbidity in substance use disorders	Psychosis
Ghosh and Basu, 2015[32]	Review article	Review of evidence on cannabis use and associated psychopathology (2003-2013)	Various disorders, withdrawal syndrome and cognitive deficit

use disorder and psychiatric disorders dated back to the 1930s. During the four decades from the 1960s to 1990s, the largest proportion of publications on dual disorders focussed exclusively on cannabis. However, the contribution of publication that focussed on cannabis use reduced during the 2000s and 2010s (Figure).

Cannabis use disorders and psychotic disorders: Sixteen studies described comorbid cannabis use disorders and psychoses[6,9-11,14-16,23-25,29-31,42,44,53]. Dhunjiboy[6] described 'Indian hemp insanity' as an adverse reaction to cannabis use. Varma[9] described socio-demographic attributes 1248 inpatients receiving treatment for psychotic disorder associated with long-term use of cannabis. Thacore[10] described four long-term *bhang* users who developed schizophrenia-like psychosis associated with thought and perceptual disturbances in the absence of a state of confusion. Chopra and Smith[11] described the clinical and demographic findings of 200 Indian patients who presented with symptoms, suggestive of psychosis due to use of cannabis Five per cent individuals were found to have presented with a pre-existing psychiatric illness, while 58 per cent were found to have covert

Table II. Studies that have explored co-occurring various substance (including cannabis) use disorders and psychiatric disorders in Indian setting (arranged in ascending order of year of publication)

Study	Article type	Study description	Psychiatric disorder studied
Dubé and Handa, 1971[33]	Cross-sectional observational study	General population survey (n=16,725) to ascertain the prevalence of mental disorders and correlate with 'drug use habits' suggesting significantly high prevalence of mental disorders among users	Various disorders
Trivedi and Sethi, 1978[34]	Cross-sectional observational study	Psychiatric outpatients (n=1000) were screened for drug abuse prevalence (16.4%) and prevalence of substance use in each disorder was measured	Various disorders
Thomas *et al*, 1979[35]	Cross-sectional observational study	Drug use patterns and prevalence among adolescents (n=439) were determined and correlated with findings on personality tests	Personality
Kisore *et al*, 1994[36]	Cross-sectional observational study	Psychiatric comorbidity was measured in alcohol and opioid dependent individuals (n=43). High rates of mood disorders (20.9%) and other substance use disorders (16.3%) were observed	Various disorders
Bannerjee *et al*, 1997[37]	Cross-sectional study	Substance dependent individuals (n=96) were assessed on various tests to assess cognitive defect and emotional imbalance following drug use	Cognitive functions
Kumar and Raju, 1998[38]	Prospective observational study	Manic patients (n=100) were screened for substance use and high rates of use were recorded (52%). Course of illness was observed for next three months and compared with that of non-users	Mania
Basu and Gupta, 2000[39]	Review article	Authors have thrown light on aspects of dual diagnosis such as prevalence rates and management issues	Not applicable
Carey *et al*, 2003[40]	Cross-sectional observational study	AUDIT and DAST instruments were administered on inpatients (n=1349) with psychiatric and substance use disorders to assess psychometric properties	Various disorders
Goswami *et al*, 2003[41]	Cross-sectional observational study	Course of concurrent substance use disorders and schizophrenia in outpatients (n=22) were compared to look for association	Schizophrenia
Aich *et al*, 2004[42]	Cross-sectional observational study	Patients (n=38) with co-occurring schizophrenia and substance use were compared to those with schizophrenia alone (n=32) on illness and socio-demographic variables	Schizophrenia
Goswami *et al*, 2004[43]	Cross-sectional observational study	Evaluated reasons for substance use in patients of schizophrenia with dual diagnosis (n=22)	Schizophrenia
Aich *et al*, 2005[44]	Prospective observational study	Patients (n=38) with co-occurring schizophrenia and substance use were compared to those with schizophrenia alone (n=32) for resolution of symptoms three months after following treatment	Schizophrenia
Singh *et al*, 2005[45]	Cross-sectional observational study	Quality of life measures of dual diagnosis patients with BPAD was compared with BPAD patients and healthy controls and found to be significantly lower	BPAD
Desai, 2006[46]	Editorial	Comment on high rates of comorbidity among psychiatry disorders and discussion on possible explanations	Not applicable
Phillips, 2007[47]	Cross-sectional observational study	In-depth interviewing of nursing staff caring for dual disorder patients, challenges faced and perceptions	Various disorders
Thirthalli *et al*, 2008[48]	Letter to editor	Discusses the impact of sociocultural factors on prevalence of substance use disorders in those with psychotic illnesses	Psychosis

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Study	Article type	Study description	Psychiatric disorder studied
Saddichha *et al*, 2010[49]	Cross-sectional observational study	Lifetime course of substance use was compared between dual diagnosis patients with schizophrenia (n=31), dual diagnosis patients with BPAD (n=31) and matched controls (n=32) with only substance dependence to attempt to find aetiological correlation between the two co-morbid disorders	Schizophrenia, BPAD
Srivastava *et al*, 2010[50]	Review	Review of 6 decades of Indian literature on comorbid substance use and psychiatric disorders	Various disorders
Lavania *et al*, 2012[51]	Cross-sectional observational study	Clinical and socio-demographic variables of substance dependent individuals with history of deliberate self-harm (n=30) and those without it (n=30) and were compared	Deliberate self-harm
Murthy and Chand, 2012[52]	Review	Evidence on treatment approaches of dual diagnosis patients and illness outcomes were discussed	Not applicable
Aggarwal *et al*, 2012[53]	Retrospective chart review	Patients records of those with substance use disorders for 13 years were analyzed and a modest rate (1.4%) of substance-induced psychotic disorders was seen with the majority being cannabis users	Psychosis
Basu *et al*, 2013[54]	Retrospective chart review	Reported that 13.2% of those seeking treatment at a tertiary level de-addiction clinic (n=5116) over an 11-yr period had dual diagnosis	Various disorders
Gupta *et al*, 2013[55]	Cross-sectional observational study	Observation of significantly high rates of psychiatric disorders (54%) in HIV-positive patients with substance use disorders. Poorer art outcomes and high rates of suicide attempts were also seen in those with triple diagnosis	Various disorders
Chand *et al*, 2014[56]	Cross-sectional observational study	First-time treatment seekers with psychotic disorders (n=139) were objectively screened for substance abuse and a high prevalence of substance use was noted	Psychosis

AUDIT, alcohol use disorders identification test; DAST, drug abuse screening test; BPAD, bipolar affective disorder

psychopathology or a previous history of psychiatric disorders.

Goel and Netto[14] reported that regular cannabis users presented with hyperactivity, mood changes, delusions and hallucinations. Thacore and Shukla[15] reported similar presentations. Bagadia *et al*[16] explored the causes for vulnerability to psychiatric disorders in daily cannabis users (n=20). Thomas[23] reported the phenomenology of cannabis use disorders to be vague and of fleeting nature of symptoms. Basu *et al*[24] classified the psychological effects of cannabis into three separate syndromes *viz*. intoxication syndrome, cannabis psychosis syndrome and amotivational syndrome. Basu *et al*[25] did a retrospective case control review of 22 patients with cannabis psychosis and 20 control patients of acute psychotic episode to find an association.

Aich *et al*[42] reported a prevalence rate of 54.3 per cent. Sixty per cent of them were using cannabis along with tobacco while 42 and 5 per cent were using alcohol and opioids, respectively. On a longitudinal examination of the same sample, it was seen that the substance-using group presented with predominantly positive symptoms (63.2%) in comparison and also had a faster rate of remission of these symptoms upon treatment. The non-substance-using group showed significantly more negative symptoms[44]. Similarly, Kulhalli *et al*[29] examined 20 inpatient cases of psychosis following cannabis use during a weeklong period of abstinence. On further assessment, seven patients were diagnosed with schizophrenia, 12 were diagnosed with BPAD mania with psychotic symptoms while one had psychotic symptoms not amounting to a diagnosis. The subjects showed increased psychomotor activity, multiple delusions and hallucinations along with unusual thought content. Shrivastava *et al*[31] and Grover and Basu[27] discussed the theories of an association between cannabis use and schizophrenia such as self-medication hypothesis, vulnerability hypothesis,

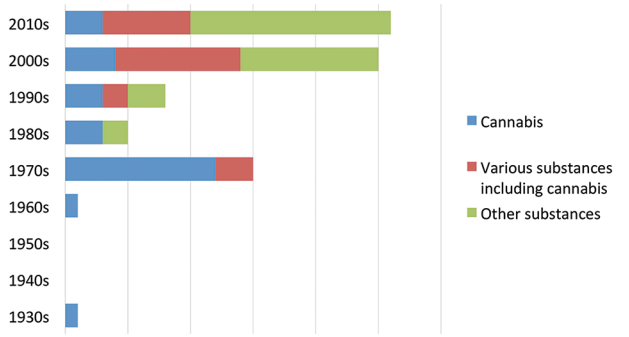

Figure. Time trends of publications on co-occurring cannabis use disorder and psychiatric disorders from India.

acute psychotic effect of cannabis use and occurrence of common socio-demographic and genetic factors in those affected by cannabis use and psychosis.

Cannabis use disorders and various psychiatric disorders: Five studies[7,13,26,28,32] assessed the comorbid cannabis use disorders and various psychiatric disorders. Grossman[7] described psychiatric symptoms in six individuals who were regular users of cannabis. Dube *et al*[13], Sarkar *et al*[26] and Chaudhury *et al*[28] reported a rate of 24-52 per cent of cannabis misuse in psychiatric hospital admissions. Sarkar *et al*[26] found that the common psychiatric comorbidities with cannabis use were other substance use disorders (34%), cannabis psychosis (21%), schizophrenia (14%), mania with psychosis (12%), and unspecified psychosis (7%). Ghosh and Basu[32] reported a high strength of association between cannabis use and psychiatric disorders, chiefly schizophrenia.

Cannabis use disorders and cognitive function: Seven studies[12,17-22] assessed cognitive functioning of cannabis users. Agarwal *et al*[12] & Wig and Varma[17] reported cognitive disturbances such as poor attention span and memory deficits in *bhang* users. Mendhiratta *et al*[18] reported delayed reaction time, poor concentration and poor time estimation in long-term (>10 years) cannabis users. Marked deterioration in cognitive functioning continued to persist in a follow up study[21]. Similar findings were reported by Ray *et al*[19] in frequent cannabis users.

Conversely, Sethi *et al*[20] and Varma *et al*[22] found no significant cognitive deficit, physical health, social functioning or work performance in long-term daily cannabis users. Bannerjee *et al*[37] compared the cognitive functioning of opioid users, cannabis users and matched controls and reported most deficit in opioid users.

Studies on various substance use disorders (including cannabis use disorders) and psychiatric disorders: Fourteen studies on dual disorders were included[33,34,37-41,43,45,48,49,52,54,57]. Dubé & Handa[33] showed a five per cent prevalence rate of dual diagnosis in a community survey (n=16,725). Trivedi & Sethi[34] reported 16.4 per cent prevalence of substance misuse in psychiatric outpatients (n=1000). Kumar and Raju[38] reported cannabis abuse in 26.7 per cent individuals with mania. Carey *et al*[40] reported lower prevalence of cannabis use in people with mental illness in India as compared to other countries. Thirthalli *et al*[48] also highlighted low prevalence of cannabis dependence in patients of schizophrenia (n=258) in a rural Indian community. Reviews on issues related to the management of dual diagnosis disorders recommended that psychosocial interventions should be implemented along with pharmacotherapy and that the integrated treatment approach is superior[39,52].

Goswami *et al*[41] mapped the course of schizophrenia onto the course of substance use in a retrospective study design. Goswami *et al*[43] contrasted the psychopathology of patients with schizophrenia who used psychoactive substances [alcohol (n=22), cannabis and opioids (n=22)] with patients of schizophrenia who did not use these substances. Alcohol was found to be used more commonly as a self-medicating agent than opioids and cannabis. In general, patients with dual diagnosis reported lesser emotional distress and mitigation of certain symptoms as one of the purposes of using substance.

Singh *et al*[45] reported the findings on quality of life and associated parameters in patients with dual diagnosis of BPAD and substance dependence. However, the findings of the cannabis users have been presented clubbed together with opioid users and prescription drug users that comprised 37.5 per cent of the study group. Saddichha *et al*[49] did a comparative analysis of patients with dual diagnosis and 'pure' substance use disorders. All patients with schizophrenia and 80 per cent of patients with BPADs were diagnosed with cannabis dependence while 28 per cent of the participants with 'pure' substance use disorders had cannabis dependence.

The additive effect of substance use as well the occupational distress faced by female commercial sex workers seeking psychiatric treatment has been studied by Pandiyan *et al*[57]. Most common substances used were alcohol (100%), tobacco (74%), opioids (14%), cocaine (6%) and cannabis (6%).

Retrospective studies by Aggarwal *et al*[53] and Basu *et al*[54] on substance-induced psychotic disorders implicated cannabis as one of the chief causative agents for psychosis. Chand *et al*[56] noted a 20 per cent prevalence of substance dependence among treatment naive first episode psychosis patients.

Studies on service delivery for individuals with co-occurring cannabis use disorders and psychiatric disorders: In a qualitative study of care providers of dual diagnosis patients Phillips[47] reported that depressive and anxiety disorders commonly co-occurred in patients with alcohol use, while schizophrenia was usually observed in cannabis-dependent individuals.

Discussion

There is limited published literature on co-occurring cannabis use disorders and psychiatric disorders from India[50,58,59]. Most studies have used cross-sectional observational design and there are only a few studies that have followed up study subjects prospectively, while some have done a retrospective chart review. The existing literature on co-occurring cannabis use disorders and psychiatric disorders has explored only limited domains. This is despite cannabis being one of the most commonly used substances among those with psychiatric disorder. An update on the progress on exploring the detrimental and sometimes beneficial effects of cannabis use on various psychiatric disorders suggests that we still have a long road of exploration ahead of us[60].

Most of the studies on comorbid cannabis use disorders and psychiatric disorders have focussed on psychoses. Reviews on the subject uphold the phenomenology described in the reviewed literature following long-term and short-term cannabis use[61]. The information gathered indicates an association of psychiatric comorbidity and cognitive decline in individuals with cannabis use disorders. A collective analysis on the data generated on behavioural changes associated with cannabis use suggests similar findings[62]. Studies in recent years among patients with co-occurring schizophrenia and substance use disorders have supported the 'vulnerability hypothesis model' to explain the association between cannabis use and schizophrenia. Research reiterates that cannabis use could interact with pre-existing genetic and environmental factors to lead to symptoms of schizophrenia[63]. It is to be mentioned here that antipsychotic potential of cannabidiol is being explored while support for vulnerability of cannabis users to develop psychosis gathers ground[64].

Cognitive effect of cannabis is a commonly explored area in Indian studies. The studies have commonly chosen chronic users of cannabis and compared the deficits between weaker and stronger preparation users to substantiate their findings. The reports suggested a decline in performance among those with long-term cannabis use. The predominant cognitive deficit observed in these studies was poor attention and concentration along with memory impairment. The preponderance of developing cognitive defects and psychotic disturbances in younger and more frequent users of cannabis is a finding of recent research as well[65].

Overall, the literature review points towards a high frequency of psychiatric symptoms in those with substance use disorders with a specific preponderance of cannabis-associated comorbidity of both psychotic and affective disorders with a higher strength of association with psychotic syndromes. A systematic review of worldwide literature echoes these findings[66]. Another longitudinal study on patients with mood disorders found a lack of association between course of the illness and cannabis use[67].

In conclusion, several Indian studies have described the adverse effects of cannabis use, and the review of research suggests a high prevalence of psychiatric disorders among those with cannabis use disorders. The psychiatric comorbidity usually found in cannabis users was schizophrenia and other psychotic disorders. Research suggests that cannabis use alters the age of onset, course and presentation of psychotic illness in vulnerable individuals. Further high-quality research on cannabis use-associated psychosis is desired to understand impact of one on the other. Findings suggest that cannabis use has an association with other mental disorders indicating a modest strength of association with mood and anxiety spectrum disorders. Cognitive deficits are frequently reported among chronic and heavy cannabis users. Exploration of neurobiological aspects of dual disorders of cannabis use and psychiatric disorders has been inconclusive and Indian literature on this aspect is scarce.

***Conflicts of Interest*:** None.

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