# Cannabis use, cognitive functioning and behaviour problems

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# Summary

Cannabis use has been associated with a wide range of mental health problems, including psychotic disorder, aggressive and delinquent behaviour (externalizing behaviour problems), depression and anxiety (internalizing behaviour problems). To a lesser extent, cannabis use has been associated with specific social skills deficits, including low social self-control, self-esteem problems and lower social competence. Also, there are reports of cannabis users experiencing cognitive difficulties, including memory problems, slower processing speed, specific deficits in complex planning and other executive dysfunctions.

For the present thesis, the temporal order of associations between cannabis use and internalizing and externalzing behaviour as well as psychosis vulnerability was investigated. Furthermore, interrelations between possible cognitive dysfunctions and behavioural and mental health problems among cannabis users were examined. Also, the cognitive and social profiles of cannabis users were examined in more detail. Different hypotheses have been proposed in order to explain associations between cannabis use and mental health problems or behaviour difficulties. The damage hypothesis proposes that cannabis use precedes behavioural difficulties. Conversely, the self-medication hypothesis proposes that behavioural difficulties precede cannabis use. The shared causes hypothesis argues that the linkage between cannabis use and mental health problems is largely non-causal and may be explained by other factors associated with the use of cannabis and mental health problems. Finally, the vulnerability hypothesis states that the linkage between cannabis use and mental health problems might be particularly evident in individuals who are, due to their biological, personal or familial make-up, particularly sensitive to the damaging effects of cannabis or more likely to use drugs for their soothing effects.

The first aim was to determine the temporal order of cannabis use and mental health problems during (early) adolescence. Secondly, we focused on social parameters in association with cannabis use. The third aim was to investigate several cognitive correlates of cannabis use, namely social perception and inhibitory control, thereby specifically focusing on their contribution to in cannabis-behaviour associations.

The five main research questions of this thesis were outlined in the general introduction (**chapter 1**):

1. Is there a relationship between cannabis use and both internalizing and externalizing behaviour problems in early adolescence? And if so, what is the temporal order of these relationships?
2. Is there a relationship between cannabis use and vulnerability for psychosis, as measured by social problems, thought problems and attentional problems, in adolescence? And if so, what is the temporal order of this relationship?
3. Are the social skills cooperation, assertiveness and self-control precursors of cannabis use during early adolescence? Specifically, are these social skills precursors of (early) cannabis initiation and the frequency of use?
4. Do cannabis users experience problems with motivational inhibitory control, cognitive inhibitory control or both? Also, do cannabis users experience problems in behavioural impulsivity, and is this related to motivational and/or cognitive inhibitory control?
5. Do cannabis users experience problems with respect to social perception? Also, are cannabis users with problems in social perception more likely to experience psychological problems?

Research questions 1-3 were investigated using data from a large prospective cohort study of Dutch adolescents named TRAILS; Tracking Adolescents Individual Lives Survey. With respect to temporal associations the following results were obtained (described in **chapter 2** and **chapter 3**). Cannabis use was not related to internalizing behaviour problems. In contrast, externalizing behaviour problems were related to cannabis use, where externalizing problems (measured at age 11 and 13) predicted cannabis use (measured at age 13 and 16, respectively). Cannabis use did not predict externalizing behaviour. These findings supported the self-medication hypothesis, where mental health issues precede cannabis use. Vulnerability for psychosis at age 13 and 16 predicted cannabis use at age 16 and 19, respectively. An important difference with the results of the analyses of cannabis-externalizing behaviour associations was that cannabis use (at age 16) also predicted mental health problems (i.e. vulnerability for psychosis at age 19). Hereby, evidence was provided for both the self-medication hypothesis and the damage hypothesis, which suggests that

cannabis use induces neurobiological changes leading to different forms of psychopathology.

With respect to research question #3, on whether social skills could predict (different aspects of) cannabis use, results showed that both cooperation and assertiveness could predict cannabis use, although in different ways. Low levels of cooperative behaviour at age 11 were associated with cannabis use at age 16, whereas higher assertiveness at age 11 predicted cannabis use at age 16 (**chapter 4**). Cooperative and assertive behaviour did not discriminate between early and late onset of cannabis use or predict frequency of cannabis use, and, unexpectedly, self-control was unrelated to cannabis use.

Research questions 4 and 5 were addressed using data from two samples of (mostly) undergraduate students. Cannabis users differed from non-users with respect to motivational inhibition, but not with respect to inhibitory control without a motivational component. Also, cannabis users reported higher levels of impulsive behaviour in daily life. This behaviour was related to motivational control, but not to inhibitory control without the motivational component (see **chapter 5)**. Cannabis users also performed relatively poorly when social perception was required (**chapter 6**). This was observed in two tasks, one involving the ability to recognize faces and the other involving the ability to recognize and match facial emotions. Differences compared with non-using controls were particularly evident for the task involving emotion recognition. Also, cannabis users reported more psychological problems, namely more insufficiency of thoughts and actions, hostility, anxiety and psychoneuroticism. Quality of social perception as measured by the task involving emotion recognition, moderated associations between cannabis use and psychological problems, in that only relatively heavy users with relatively poor social perception reported significantly elevated levels of psychological problems.

Whereas findings reported in chapters 2 and 3 provided (partial) evidence for the self-medication hypothesis and the damage hypothesis, the findings regarding social perception provide some evidence supporting the vulnerability hypothesis. No evidence was found for the shared-causes hypothesis, although it should be noted that we were necessarily limited to a relevant but selective number of potentially confounding variables. These and other limitations as well as possible implications for prevention and intervention programs are discussed in **chapter 7**.