Implicit and explicit cognitions related to alcohol use in children

Sara Pieters a,⁎, Haske van der Vorst a, Rutger C.M.E. Engels a, Reinout W. Wiers b
a Radboud University Nijmegen, Nijmegen, The Netherlands
b University of Amsterdam, Amsterdam, The Netherlands

A R T I C L E  I N F O
Keywords:
Implicit cognition
Explicit cognition
Children's alcohol use
Parental alcohol use

A B S T R A C T
Research has indicated that implicit and explicit alcohol-related cognitions jointly predict alcohol use in adolescents and adults. Only few studies assessed these cognitions in children. Associations between alcohol cognitions and alcohol use were tested in two studies with 10 year olds (Study 1; N = 99) and 11–12 year olds (Study 2; N = 35). Furthermore, the role of parental alcohol use was examined. Implicit alcohol cognitions were assessed in an Implicit Association Test (IAT) using pictures of alcohol and soft drinks as target stimuli and happy versus angry faces as attribute stimuli (children's faces in Study 1, adults' faces in Study 2). Explicit expectancies and parental alcohol use were assessed with questionnaires. Children demonstrated a relatively stronger association between alcohol and negative facial expressions, and in Study 2, this association was negatively related to alcohol use. In Study 2, paternal drinking was related to implicit negative associations and explicit arousal associations. These studies show that young children have both implicit and explicit alcohol-related cognitions and both appear to play a role in explaining emerging alcohol use of elementary schoolchildren.

© 2009 Elsevier Ltd. All rights reserved.

1. Introduction

In the attempt to uncover motivational processes involved in the initiation and escalation of alcohol use in adolescents, scholars have made a distinction between explicit and implicit alcohol-related cognitions (Wiers et al., 2007). Explicit cognitions refer to cognitions that are intentional, can be accessed consciously, and are under a person’s cognitive control (Wiers et al., 2007). The general assumption that lies beneath these measures is that people are aware of the causes of their own behavior, as is proposed in theories of rational decision making (e.g. Azjen, 1991). Regarding explicit alcohol-related cognitions, people are directly asked about their attitudes towards, expectancies from and motives to drink alcohol. Thus, people have to introspect consciously on their thoughts, feelings and behavior concerning alcohol use. In contrast, implicit cognitions reflect associations in memory that influence cognitive and affective processes and behavior in a relatively automatic way (De Houwer, 2006; Greenwald & Banaji, 1995). The strength of activation of these automatically activated implicit associations determines the likelihood that a certain behavioral pattern will be activated and rendered salient in memory (Stacy, Ames, Sussman & Dent, 1996). In the context of alcohol, the general assumption is that the stronger alcohol is associated with positive affect or with a positive outcome, the greater the likelihood adolescents will drink alcohol.

This distinction between explicit and implicit cognitions is in line with dual process models, suggesting that addictive behaviors develop as a result of an imbalance between automatic, implicit or impulsive cognitive processes and conscious, explicit or reflective processes. Whereas the former become hypersensitive with repeated alcohol use, leading to automatic approach tendencies, the latter are negatively affected by alcohol consumption, ultimately resulting in decreased control over the addictive behavior (e.g., Bechara, Noel & Crone, 2006; Deutsch & Strack, 2006; Wiers et al., 2007).

In the Netherlands, 85% of Dutch adolescents attending regular high schools have drunk alcohol at least once in their life. While most adolescents drink their first alcoholic beverage around age 12, 19% of boys and 10% of girls reported being younger than 10 when they first drank alcohol (National Drugs Monitor (NDM), 2007). Statistics like these underline the need to investigate alcohol-related cognitive processes in children and early adolescents in the first stages of alcohol use, maybe even before adolescents experiment with alcohol for the first time. Hence, there is compelling evidence that alcohol-related cognitions might already be formed before the onset of drinking. That is, studies on explicit alcohol-related cognitions in young children have shown that children already acquire knowledge and expectancies about alcohol even before they actually engage in alcohol consumption (Cameron, Stritzke & Durkin, 2003; Wiers, Sergeant & Gunning, 2000; Dunn & Goldman, 1996; Jahoda & Cramond, 1972). Primary schoolchildren already view adult alcohol use as normative in social situations (Dalton et al., 2005) and are
already able to describe effects of alcohol, mostly negative effects like feeling sick (Casswell, Gilmore, Silva & Brash, 1988). Up to the age of ten years, children predominantly have negative attitudes towards and expectancies from alcohol use (Dunn & Golden, 1996; Jahoda & Cromond, 1972). Subsequently, a shift in expectancies is observed, in which positive expectancies gain strength as opposed to negative ones. This transition is thought to be either bipolar, where positive expectancies replace negative ones (Dunn & Golden, 1996, 1998), or to reflect ambivalence: both negative and positive expectancies exist side by side, possibly with positive expectancies becoming stronger in contrast to negative ones (Cameron et al., 2003).

Studies have shown that both explicit and implicit cognitions are associated with alcohol consumption in adolescents (Stacy et al., 1996; Thush et al., 2007; Thush & Wiers, 2007), undergraduates (Houben & Wiers, 2007) and adults (Stacy & Newcomb, 1998; meta-analysis: Rooke, Hine & Thorsteinsson, 2008), each explaining a unique part of the variance in alcohol use. Therefore, it has been suggested that they are likely to reflect different processes (Strack & Deutsch, 2004; Thush et al., 2007; Stanley, Phelps & Banaji, 2008). These findings highlight the surplus value of including both explicit and implicit cognitions in studies related to alcohol use in children. Besides, it is valuable to assess implicit associations in children, because children are often not able to introspect on their behavior, which is a requisite of direct measures.

Although several studies have investigated implicit alcohol-related cognitions in (late) adolescence or adulthood, to our knowledge, only three studies have assessed implicit cognitions in younger age groups. O’Connor, Fite, Nowlin and Colder (2007) showed that 6–10 year olds had stronger implicit positive cognitions than negative cognitions towards alcohol. When negative targets were primed with alcohol as compared to non-alcohol primes, the reaction times were slower. They concluded that in children, negative implicit associations are weaker than positive ones. Thush and Wiers (2007), comparing twelve and fifteen year olds attending high school, examined whether implicit alcohol associations were related to alcohol use. Among the twelve year olds, they found that male drinkers associated alcohol more strongly with arousal than male abstainers, and these associations uniquely predicted binge drinking one year later, controlling for all variables in the model. Finally, a recent study by Van Der Vorst, Krank, Engels and Burk (submitted for publication) showed that in 13 year old abstaining Canadian adolescents, implicit associations predicted onset of alcohol use one year later. Overall, there is preliminary data revealing that children have implicit associations about alcohol, but it is still unclear whether and how implicit alcohol associations relate to young children’s experiences with alcohol, such as sipping or drinking their first glass.

Ample factors have been proposed to affect the development of explicit alcohol-related cognitions in children. As one of the most important sources of information about alcohol, besides media, children report their family (Casswell et al., 1988; Donovan & Molina, 2008; Fossey, 1993). Parents provide a great source of information regarding children’s knowledge about alcohol: 90% of children reported that they had been exposed to alcohol in their homes: either by the availability of alcohol or by watching their parents drinking alcohol (Dalton et al., 2005; Jahoda & Cromond, 1972). Children might acquire positive alcohol-related associations by watching their parents enjoying their alcoholic drinks (Dalton et al., 2005). So far, research has not concentrated extensively on the impact of parental drinking on implicit and explicit alcohol cognitions. To our knowledge, only one study showed that parental drinking predicted the level of implicit alcohol cognitions, measured in a word association task, in early adolescents who had not been drinking alcohol yet. In this study, parental drinking predicted stronger implicit alcohol cognitions, measured in a Word Association Test, in early adolescents who had not been drinking alcohol yet (Van Der Vorst, Vermulst, Meeus, Dekovic & Engels, 2009).

The aim of the present study is to investigate implicit memory associations and explicit cognitions related to alcohol use in elementary school children aged 10 (Study 1) and 11–12 (Study 2). This period in childhood can be regarded as a critical period when most Dutch children are first acquainted with alcohol (National Drugs Monitor, 2007), either by drinking themselves, or by observing parents or peers drinking alcohol.

In both studies, alcohol-related memory associations were measured with an Implicit Association Test (IAT; Greenwald, McGhee & Schwartz, 1998). We used pictures of drinks (alcoholic or soda drinks) and faces (of people with a happy or angry expression) as stimuli in the current IAT, since pictorial stimuli do not require children to read during the critical phases of the task. This makes the current IAT easy to administer in children. In the first study, we used pictures of happy and angry children; in the second study, we used pictures of adults’ faces, since we then assumed that children might associate alcohol more strongly with adult as opposed to children’s faces.

It is hypothesized that children’s alcohol use as well as their parents’ alcohol use are related to implicit and explicit alcohol-related cognitions. Based on previous studies, it is expected that the more positive explicit expectancies children have, the more alcohol they drink. On the other hand, it is hypothesized that negative explicit expectancies will be negatively related to children’s alcohol use. Regarding implicit alcohol-related cognitions, no clear hypotheses can be formulated because of the scarcity of research in childhood. To our knowledge, this is also the first study assessing the relation between parental drinking and explicit and implicit cognitions. Therefore no hypotheses will be formulated regarding these relations as well.

2. Method

2.1. Participants

In the first study, 51 of the children who filled in the questionnaire were boys (55%). The mean age of the children was 10.17 years (SDage = .45; age range 9–12). Of all children, 98% was born in the Netherlands. The majority of the children lived at home with his or her biological father and mother (82.6%), 4.1% lived only with their biological father, 3.1% lived only with their biological mother, 7.1% lived with their mother and stepfather, 2.0% lived with their father and stepmother and 1.0% lived with someone not previously mentioned. None of the children were adopted.

In Study 2, a total of 35 elementary schoolchildren (23 boys) participated (Mage = 11.36; SDage = .54; age range 11–13). A total of 88.6% of the children was of Dutch origin, the remaining 11.4% came from Iraq, Curacao, Kurdistan and Turkey. This sample consisted of children from both rural and urban areas.

2.2. Measures

2.2.1. Children’s alcohol use

In Study 1, we asked the children whether they ever drank beer or wine. The answer category of this item was: (1) “No, never”, (2) “Yes, one sip”, (3) “Yes, several sips”, (4) “Yes, one glass”, and (5) “Yes, several glasses”. In Study 2, the question was basically the same, except that we used a version with less simplified linguistic usage. We asked children whether they ever drank alcohol. Children had to respond on a 5-point scale: (1) “no, never”; (2) “yes, I have tried a sip once”; (3) “yes, I have tried a sip more than once”; (4) “yes, I have tried a glass or more once”; and (5) “yes, I have tried a glass or more on multiple occasions”. In both studies, children were considered to be inexperienced with alcohol if they reported no never and experienced if they had tried alcohol at least a sip once. This decision was based on a recent study by Donovan and Molina (2008) which
states that sipping reflects children's first real involvement in alcohol use, which often arises in a family context.

2.2.2. Children’s implicit alcohol cognitions

For both studies, we adjusted the Implicit Association Test (IAT; Greenwald et al., 1998) into a child-friendly version for alcohol. Instead of using words, we chose visual stimuli for both targets and attributes, so children who were less capable of reading and writing could also complete the IAT. We translated the words used by Baron and Banaji (2006), for example happy and angry, in Dutch. We made pictures of child faces corresponding to the translated words of Baron and Banaji. In a next step, we asked 15 children in the age of 6–12 years old to pick those pictures that corresponded to the words. These pictures were used as stimuli in the IAT (8 pictures of happy faces representing positive emotional affect and 8 pictures of angry faces representing negative emotional affect along with pictures of a diversity of alcoholic and soft drinks [also 8 of each]). In Study 2, the test was the same, except that we used pictures of adults’ faces. Pictures of alcoholic beverages were the same.

To test whether children would actually be able to discriminate pictures of alcoholic and non-alcoholic beverages, we used an adjusted Visual Search Task for children (e.g., Schneider & Shifrin, 1977). It appeared that when children were asked to choose the picture with an alcoholic beverage out of a display (total of 5 displays) with non-alcoholic beverages (3 pictures), 88% of the times, children picked the right beverage. When asked to pick the soda picture from a display (total of 5 displays) of alcoholic beverages (3 pictures), 87% of the times, children picked the right beverage. In each display, the colors and sizes of bottles and cans in the pictures of the soda and alcohol beverages were as similar as possible. These percentages indicate that children were able to differentiate pictures of beer and wine from pictures of soda.

In the first block of the Implicit Association Test, the attribute practice block, pictures of happy and angry faces would appear one by one in the middle of a computer screen. Participants had to categorize pictures with two buttons, corresponding to happy versus angry faces. In the next block, the instructions remained the same, however, the pictures that were shown changed to beer/wine or soda pictures and the category labels were modified accordingly. In the first critical block, both pictures of faces as well as drinks were presented alternately and each member of the attribute labels shared a response button with a member of the target labels (e.g., beer/wine was paired with happy and soda with angry). In the next critical block (which was preceded by yet another practice block), the configuration of labels was changed (e.g., beer/wine was paired with angry and soda with happy). The task however, remained the same. The general idea behind the IAT is that whenever certain concepts (e.g., beer/wine and happy) are associated more strongly in memory than other concepts (e.g., beer/wine and angry), people will respond much faster on a reaction time task when these concepts share a response button. The IAT effect represents the mean difference in reaction time between compatible (e.g., beer/wine and happy) and incompatible (e.g., beer/ wine and angry) trials. Therefore, positive scores represent a relatively strong association between alcohol and happy faces (compared with soda – angry faces), whereas negative scores represent a relatively strong association between alcohol and angry faces (compared with soda – happy faces). The IAT used in this study was programmed in Inquisit 2.0 (Millisecond Software). Category labels were presented in the upper left and upper right side of the screen. Stimuli, colored photographs of faces and drinks, were presented in the middle of the screen. All practice blocks consisted of 20 trials except for the block in which participants had to learn the new, switched position of the target (40 trials). All test blocks consisted of 40 trials. The interstimulus interval was 250 ms. We used the D2SD penalty measure as IAT score, since this measure is often used in studies with adolescents (e.g., Thush et al., 2007) and is recommended by Greenwald, Nosek and Banaji (2003).

2.2.3. Alcohol expectancies

In Study 1, we used the positive and negative subscales from the adjusted Dutch translation of the Alcohol Expectancies Scale for Children (Dunn & Goldman, 1996) to measure alcohol expectancies. Children were asked about their opinion about the effects of alcohol on adults, e.g.: “Do adults become friendly when they drink alcohol?” Responses were given on a 4-point scale: (1) “Never”, (2) “Sometimes”, (3) “Often”, and (4) “Always”. Factor analysis revealed two subscales, which we interpreted as positive (7 items: e.g. friendly or nice) and negative expectancies (7 items: e.g., mean or brutal). Factor loadings varied between .54 and .71 for the negative expectancies subscale and between .47 and .64 for the positive expectancies subscale. In our study, internal consistencies of both subscales were sufficient ($\alpha_{positive} = .60$, $\alpha_{negative} = .85$).

In Study 2, sedation and arousal expectancies of alcohol use were assessed in a 13 item questionnaire (Wiers, Van Woerden, Smulders & De Jong, 2002). Every item started with the phrase: “Drinking alcohol makes me…..” followed by an evaluation (e.g. active for arousal items or sleepy for sedation items). Participants indicated on a 10 point scale the degree to which they agreed with the statement (10 represented maximal agreement). Three items from the questionnaire (easy, relaxed and calm) were omitted after factor analysis because they did not theoretically belong (sedation) to the factor they loaded on (arousal). The remaining two factors represented arousal and sedation expectancies. Factor loadings varied from .66 to .89. Both the arousal and sedation expectancy scale had a sufficient internal consistency ($\alpha_{arousal} = .93$, $\alpha_{sedation} = .69$). In both studies, the mean scores on both subscales were used for further analyses.

2.2.4. Parental alcohol use

In Study 1, we asked the children about their perceived alcohol use of their fathers and mothers separately with the question “Did your father/mother drink beer or wine last week? (Van Der Vorst & Engels, 2008). Answer categories were: (1) “No”, (2) “Once”, (3) “A couple of times”, and (4) “Every day”. This questionnaire was based on the often used “Perceived frequency of parental alcohol use question” (e.g., Engels, Knibbe & Drop, 1999; Van Der Vorst et al., 2009; Van Zundert, Van Der Vorst, Vermulst & Engels, 2006) which is valid and suited for adolescents. The only modification in the current adaptation was that answer categories were simplified to ensure children would comprehend them.

In Study 2, parental alcohol use was assessed by asking children about the frequency of their fathers’ and mothers’ alcohol consumption over the last four weeks separately (Engels & Knibbe, 2000). Answers could be given on a 7-point scale: (1) “My father/mother and I are not in touch”; (2) “no alcohol”; (3) “1 to 3 days in four weeks”; (4) “1 to 2 days a week”; (5) “3 to 4 days a week”; (6) “5 to 6 days a week”; and (7) “every day”. The option “my father/mother and I are not in touch” was recoded into “no alcohol”.

2.3. Procedure

For the first study, we approached seven elementary schools in the Netherlands by mail. In the letter, we informed the school about the study and asked for the schools’ participation. One week later, we contacted the schools by phone asking again for their participation. Four schools agreed to collect data among children attending grade seven (10 years old). Before the study started, we asked for informed consent of the parents of the children. In the letter we explained the aim of the study and guaranteed that the data of the children would be treated confidentially. 99 parents of children of grade 7 of elementary school (4 schools) were asked for permission for their child’s
participation. A total of 93 parents agreed upon participation by returning the enclosed response form (94%). These 93 children filled in the questionnaire and completed the Implicit Association Test. However, the data of the implicit measure were excluded for 2 children. For the one child, data were excluded because of an error in the computer program, for the other child, data were excluded because reaction times on the majority of the trials exceeded 3000 ms. Eventually, we used data from the 91 children who completed both the questionnaire and the Implicit Association Test. The teachers of the participating classes were informed about the study and the procedure. A subject number was assigned to each child to guarantee anonymity. In the first session of the study, children completed a questionnaire in the classroom under guidance of a trained research assistant. Children were not allowed to discuss the questions or answers with each other or with their teacher. Children’s questions about the questionnaire were answered individually by the trained research assistant. One week after completion of the questionnaires at all the schools, children started with the computer tasks on a laptop. The computer tasks were completed individually in groups of 2 to 3 children under guidance of a trained research assistant in a separate room at the school. After completing the computer tasks, the children received a little token for their participation.

For the second study, we used the same procedure, except that only 2 schools were asked to participate in this study. Both schools agreed upon participation of their 8th graders. Because children were slightly older, we decided to let children complete the computer tasks in groups of 5 children. Furthermore, the order of assessments was reversed: in Study 2, children completed the computer tasks before filling out the questionnaire. The interval between completion of the computer tasks and the questionnaire was identical in both studies.

3. Results

3.1. Study 1

3.1.1. Participant characteristics

A frequency analysis was performed on the data of the alcohol variable: 25.8% of the children in Study 1 had never drunk alcohol in their lives, 31.5% had tried a sip, 29.2% tried multiple sips, 9% tried one glass of alcohol and 4.5% tried multiple glasses of alcohol. Figures resemble those of the general Dutch population (Monshouwer, Verdurmen, Van Dorselaer, Smit, Gorter & Vollebergh, 2007). Alcohol use by the child was dichotomized to differentiate between children that had never drunk any alcohol in their lives and those that had tried at least a sip once, or more. This decision was based on a recent study by Donovan and Molina (2008) which states that sipping reflects children’s first real involvement in alcohol use, which often arises in a family context. In Study 1, 23 children in the sample were considered non-drinkers, 66 children were considered drinkers. Further, several ANOVAs were performed to investigate differences between both groups. Drinkers and non-drinkers did not differ in their implicit associations (t (87) = .19, p > .05) in Study 1. Means showed that both drinkers and non-drinkers associated alcohol more strongly with angry faces than with happy faces, since both D2SD scores were negative. With regard to positive expectancies, drinkers anticipated more positive effects of alcohol use (M = 2.01, SD = .6) than non-drinkers in Study 1 (M = 1.65, SD = .43; t (86) = −2.65, p < .01). Drinkers and non-drinkers did not differ in the degree to which they expected negative consequences of alcohol use (t (87) = −1.07, p > .05).

3.1.2. Correlations

In order to examine associations between all variables, Pearson’s correlation coefficients were calculated for each pair of variables.

Correlations between all variables are shown in Table 1 for Study 1. In Study 1, alcohol use was positively associated with positive expectancies, suggesting that the more children drank the more positive effects they expected from drinking alcohol. Alcohol use by the father was positively associated with alcohol use by the mother. Other correlations were not significant.

3.1.3. Hierarchical logistic regression analysis

In order to investigate the associations between alcohol-related cognitions and alcohol use in more detail, a hierarchical regression analysis was performed. Although the direction of the association between alcohol use and alcohol-related cognitions is unknown and we do not aim to imply a direction, alcohol-related cognitions were treated as independent variables, and alcohol use was treated as the dependent variable.

Alcohol use was dichotomized and used as a dependent variable in a hierarchical logistic regression analysis (see Table 2). In step 1 of a hierarchical logistic regression analysis predicting alcohol use by children, gender and age were entered into the equation. In step 2, positive and negative expectancies and implicit associations were added. The regression analysis of Study 1 revealed the following: results from the first step of the hierarchical logistic regression showed no effects for sex and age. The second step showed an effect for positive expectancies (OR = 5.20, p < .05): the more explicit positive expectancies the child had, the more likely he or she drank alcohol.

3.1.4. Multiple regression analysis

Alcohol use by father and mother was included as predictors in three additional multiple regression analyses with implicit associations and positive and negative explicit expectancies as dependent variables (see Table 3). After correcting for sex and age, results showed that neither paternal drinking nor maternal drinking significantly predicted implicit associations, explicit positive expectancies or explicit negative expectancies in Study 1.

Table 1

<table>
<thead>
<tr>
<th>Model variables</th>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sex</td>
<td>0.70</td>
<td>1.00</td>
<td>0.70</td>
</tr>
<tr>
<td>2. Age</td>
<td>0.14</td>
<td>0.15</td>
<td>0.12</td>
</tr>
<tr>
<td>3. Alcohol use</td>
<td>0.57</td>
<td>0.68</td>
<td>0.57</td>
</tr>
<tr>
<td>4. Alcohol use of father</td>
<td>0.75</td>
<td>0.80</td>
<td>0.75</td>
</tr>
<tr>
<td>5. Alcohol use of mother</td>
<td>0.63</td>
<td>0.68</td>
<td>0.63</td>
</tr>
<tr>
<td>6. Positive expectancies</td>
<td>0.88</td>
<td>0.93</td>
<td>0.88</td>
</tr>
<tr>
<td>7. Negative expectancies</td>
<td>0.62</td>
<td>0.62</td>
<td>0.62</td>
</tr>
<tr>
<td>8. Implicit associations</td>
<td>0.68</td>
<td>0.71</td>
<td>0.68</td>
</tr>
</tbody>
</table>

Note. Positive and negative expectancies are calculated as mean scores. Implicit associations represent D2SD scores on the Implicit Association Test. Gender was coded as follows: 1 = male, 2 = female.

Table 2

<table>
<thead>
<tr>
<th>Odds ratio estimates</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Odds ratios</strong></td>
<td><strong>ORs</strong></td>
<td><strong>Lower</strong></td>
</tr>
<tr>
<td>Sex</td>
<td>.46</td>
<td>.17</td>
</tr>
<tr>
<td>Age</td>
<td>1.83</td>
<td>.53</td>
</tr>
<tr>
<td>Implicit associations</td>
<td>.89</td>
<td>.37</td>
</tr>
<tr>
<td>Positive expectancies</td>
<td>5.29</td>
<td>1.38</td>
</tr>
<tr>
<td>Negative expectancies</td>
<td>1.28</td>
<td>.49</td>
</tr>
</tbody>
</table>

Note. * = p < .05 two-tailed tests. Gender was coded as follows: 1 = male, 2 = female.
Table 3
Multiple regression analysis predicting implicit associations and explicit expectancies from alcohol use of father and mother in Study 1.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>−.02</td>
<td>−.11</td>
<td>−.16</td>
</tr>
<tr>
<td>Age</td>
<td>−.04</td>
<td>.01</td>
<td>.13</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use of father</td>
<td>.12</td>
<td>.10</td>
<td>−.10</td>
</tr>
<tr>
<td>Alcohol use of mother</td>
<td>−.04</td>
<td>.17</td>
<td>.05</td>
</tr>
</tbody>
</table>

Abbreviations Expl. pos. and Expl. neg. represent explicit positive expectancies and explicit negative expectancies respectively. Gender was coded as follows: 1 = male, 2 = female.

3.2. Study 2

3.2.1. Participant characteristics

In Study 2, 41% of children never drank alcohol, 23.1% had tried a sip and 35.9% of children had tried multiple sips of alcohol. In Study 2, a total of 15 children in the sample were considered non-drinkers, 20 children were considered to have experiences with alcohol (drinkers). Regarding implicit alcohol-related associations in Study 2, drinkers associated alcohol more strongly with angry faces (M = −.81, SD = .81) than non-drinkers (M = −.32, SD = .5; t (33) = 2.45, p < .05). However, both groups associated alcohol more strongly with angry faces than with happy faces, since both D2SD scores were negative. In Study 2, with regard to arousal expectancies, drinkers expected to be more aroused as a consequence of alcohol use (M = 2.80, SD = 1.77) than non-drinkers (M = 1.25, SD = .69; t (35) = −3.28, p < .01). Drinkers and non-drinkers did not differ in the degree to which they expected to be sedated as a result of alcohol (t (35) = −1.42, p > .05). Non-drinkers expected more sedation than arousal effects of alcohol (M_{arousal} = 1.26, SD_{arousal} = .69, M_{sedation} = 2.04, SD_{sedation} = 1.44; t (15) = −2.17, p < .05). For drinkers, no difference between arousal and sedation expectancies was found (t (20) = .19, p > .10).

3.2.2. Correlations

Correlations between all variables are shown in Table 4 for Study 2. In Study 2, alcohol use was positively associated with paternal alcohol use, suggesting that the more fathers drink, the more the child drinks. Alcohol use also was positively correlated with implicit associations, suggesting that the more children drank, the stronger alcohol was associated with angry adult faces as opposed to happy adult faces. Paternal alcohol use was positively associated with arousal expectancies and negatively with implicit associations. This last finding indicates that the more fathers drink, the more children associated alcohol with angry faces than with happy faces.

Table 4
Correlations of all model variables in Study 2.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>.30</td>
<td>−.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>−.30</td>
<td>−.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use of father</td>
<td>−.26</td>
<td>−.10</td>
<td>.58***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol use of mother</td>
<td>−.01</td>
<td>.29</td>
<td>.08</td>
<td>.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arousal expectancies</td>
<td>−.12</td>
<td>−.14</td>
<td>.49**</td>
<td>.52**</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>Sedation expectancies</td>
<td>−.02</td>
<td>−.09</td>
<td>.04</td>
<td>.03</td>
<td>−.20</td>
<td>.19</td>
</tr>
<tr>
<td>Implicit associations</td>
<td>.00</td>
<td>−.01</td>
<td>−.39*</td>
<td>−.38*</td>
<td>−.07</td>
<td>−.18</td>
</tr>
</tbody>
</table>

Note. Arousal and sedation expectancies are calculated as mean scores. Implicit associations represent D2SD scores on the Implicit Association Test. Gender was coded as follows: 1 = male, 2 = female. ** = p < .01; *** = p < .001.

3.2.3. Hierarchical logistic regression analysis

Alcohol use was dichotomized and used as a dependent variable in a hierarchical logistic regression analysis (see Table 5 for Study 2). In step 1 of a hierarchical logistic regression analysis predicting alcohol use by children, gender and age were entered into the equation. In step 2, arousal and sedation expectancies and implicit associations were added. Results from the first step of the hierarchical logistic regression of Study 2 showed no associations between sex and alcohol use (see Table 5). The second step showed a relationship between alcohol use and implicit associations (OR = .094, p < .05): the stronger alcohol was associated with angry adult faces as opposed to happy adult faces, the more likely the child was drinking alcohol. The second step also showed an association with arousal expectancies (OR = 3.106, p < .05): the more explicit arousal expectancies the child had, the more likely he or she drank alcohol.

3.2.4. Multiple regression analysis

Alcohol use by father and mother were included as predictors in three additional multiple regression analyses with implicit associations and arousal and sedation explicit expectancies as dependent variables (see Table 6). In Study 2, after correcting for sex and age, results showed that paternal drinking significantly predicted implicit associations (β = −.373, p < .05). The more children observe their father drinking alcohol, the more alcohol is associated with angry adult faces as opposed to happy adult faces. Furthermore, paternal drinking predicted explicit arousal expectancies (β = .45, p < .01): the more fathers drank, the more their children expected arousal effects from drinking alcohol.

4. Discussion

Regarding the main question whether explicit and implicit alcohol-related cognitions would predict alcohol use of children, results from Study 1 showed that explicit positive expectancies were significantly
associated with alcohol use. Explicit negative expectancies did not explain any of the variance in alcohol use. The latter finding is in contrast with results found by Thush and Wiers (2007), who showed that explicit negative expectancies negatively predicted binge drinking in adolescents. However, our results could be explained by the notion that positive expectancies have a stronger effect on alcohol use than negative expectancies since alcohol use is influenced more strongly by immediate (more positive) effects than by delayed (more negative) effects (Jones, Corbin & Fromme, 2001; Rohsenow, 1983). Another explanation could be that only positive expectancies are associated with behavior since children primarily observe positive effects of alcohol use (Dalton et al., 2005). That is, children observe, for example, their parents' (primarily moderate) drinking behaviors in social situations such as family gatherings or parties (Verdurmen, Smit, Van Dorsseelaer, Monshouwer & Schulten, 2008). Further, brain regions associated with control over behavior such as alcohol use are not fully developed yet in childhood and adolescence (Spear, 2002). Therefore, children have too little resources to consciously inhibit alcohol use. This might explain why negative expectancies are not correlated with actual alcohol consumption by children. Children have negative expectancies of alcohol use, but in order to become associated with behavior, there have to be enough resources such as a properly developed frontal cortex, as well as motivation to inhibit alcohol use, to do so (Wiers et al., 2007).

Implicit alcohol-related cognitions were not associated to alcohol use of children in Study 1. This is remarkable, since the study by Thush and Wiers (2007) did find an association between implicit associations and alcohol use in adolescents. However, Thush and Wiers used a ST-IAT with verbal stimuli. Where Thush and Wiers used words depicting alcoholic beverages and positive, negative, arousal and sedation effects, pictures were used in our study. A relatively new aspect, in the field of alcohol research, is the use of pictures displaying faces with a happy or angry expression. That we did not find any relation between the IAT scores and alcohol use in this group of children could be due to the fact that we used faces of children as stimuli. It could however be that children have no clear association between children and alcohol use, since they predominantly observe adults drinking alcohol. The results of Study 2 support this assumption.

In Study 2 we did find an association between implicit cognition and alcohol use by children. Involvement in alcohol use was associated with a stronger association between alcohol and angry faces as opposed to alcohol and happy faces. Since this is the first study using pictures of faces as stimuli in an IAT, we hypothesize that this outcome might reflect a social norm towards alcohol use. Children who drink alcohol already at a young age might have some personal experience with negative reactions (i.e. angry faces) of parents or other adults (e.g., family members, teachers) as a result of their alcohol use. These experiences are apparently stored as associations in memory, and therefore are likely to be tapped in this IAT. In this line of reasoning, it is understandable that these results were not found in Study 1, which used faces of peers as stimuli. In these age groups observing peer drinking is rather uncommon and therefore expressing social norms towards peers is less likely to occur (Donovan & Molina, 2008).

Regarding explicit cognitions, it was found that alcohol use was positively associated with explicit arousal expectancies, while no relation with sedation expectancies was found. It should be noted that these arousing expectancies referred to more positive feelings of arousal, for example being cheerful or excited, which makes the explanation for these findings in line with Study 1. Sedation expectancies were not correlated with alcohol consumption. An explanation for these results could be that the children in this study have not been drinking enough to experience sedative consequences of alcohol use.

To summarize, both studies found that children have associations between alcohol and its evaluation. Moreover, we showed that children can consciously introspect about expectancies of alcohol. In the explicit expectancies literature, it is stressed that both positive and negative explicit effects from alcohol exist side by side (Cameron et al., 2003; Wiers et al., 2000), while others suggest that they are represented on the same continuum starting in childhood with negative expectancies becoming more positive over time (Dunn & Goldman, 1998). Our results showed that children expect positive as well as negative consequences of alcohol use which is more in line with the study of Cameron et al. (2003). Moreover, it has been suggested that children can also implicitly have both positive and negative associations (Thush & Wiers, 2007). By using a bipolar IAT we are not able to test this assumption. However, upon inspecting the mean scores on the IAT in the current studies, drinkers and abstainers associate alcohol relatively more with angry than with happy faces, but this does not necessarily mean that children only associate alcohol with negative affect. It might be that children associate alcohol simultaneously with positive affect; however, this association was weaker than the negative association. To test this hypothesis, a unipolar IAT can be used in future research. In that way, all attribute categories (positive and negative) are contrasted with a neutral attribute. This might make it easier to examine specific associations with single attributes.

In addition, implicit cognitions and explicit cognitions were inversely related to alcohol in the sense that negative implicit cognitions were related to alcohol use, while positive explicit cognitions were related to alcohol use. There is research suggesting disparate roles of explicit and implicit cognitions in relation to alcohol consumption (Swanson, Rudman & Greenwald, 2001; Wiers et al., 2002). It has been proposed that explicit and implicit cognitions reflect different sources of attitudes. Nevertheless, future research should examine the unique meaning of implicit and explicit alcohol-related cognitions in childhood more in depth.

Regarding parental drinking, no association with implicit and explicit cognitions was found in the first study. In the second study, paternal drinking was associated with explicit arousal expectancies, but also associated with negative implicit cognitions. Since this is the first study assessing the relation between the valence of implicit cognitions and parental alcohol use (father and mother separately), only a speculative explanation can be given. It might be, besides observing the positive social aspects of drinking, that children also observe the negative consequences of their parents' alcohol use, for example, more incidents where parents are drunk. As children more often observe their father drinking (Verdurmen et al., 2008), and fathers generally drink more alcohol than mothers (Van Der Vorst, Engels, Meeus & Dekovic, 2006), this might explain why the result is only found for fathers and not for mothers.

Remarkably, we did not find an association between children's alcohol use and maternal or parental alcohol use in Study 1 or between children's alcohol use and maternal alcohol use in Study 2. We believe that this lack of association is due to the fact that we used small, convenience samples. Although studies on implicit cognitions often use small samples (for an overview, see Rooke et al., 2008), we think that larger, epidemiological studies are needed to investigate the relation between parental and children's drinking in more detail. Furthermore, the absence of an effect, especially in Study 1 with the younger children, could be explained by the fact that these children are early onset drinkers. It has been shown that early onset drinking is often more problematic and genetically predisposed than is later onset drinking (Poelen et al., 2008). As a result, the lack of an association between parental drinking and alcohol use of the child could be explained by the fact that the early onset drinkers are more sensitive to other, e.g. genetic, factors that drive drinking behavior.

Some limitations should be addressed. First of all, based on the cross-sectional design of these studies, no statements can be made regarding directions between variables. A longitudinal study should reveal how both explicit and implicit alcohol-related cognitions...
develop when alcohol use is initiated. Second, a longitudinal design might shed more light on the role of the social environment, such as parents and peers, in forming explicit and implicit alcohol-related cognitions. Regarding the IAT used in this study, it would be valuable to further explore the relation between associations between alcohol and facial expressions and behavior in children. We provide support for the hypothesis that an implicit social norm might be present in children, which can be tapped in an easy to understand IAT designed especially for use by children. Moreover, a single target IAT or a bipolar IAT using a neutral contrasting target category (as opposed to soda) might be relevant to use in future research. Thereby, possible confounding effects of using soda as an opposing concept are overcome: children’s positive associations with soda might be that strong that positive associations with alcohol are overruled. Another limitation of this study is that the Cronbach’s alpha of the positive expectancies scale in Study 1 is low. Our interpretation of the associations between positive expectancies and alcohol use in Study 1 should therefore be taken with caution. Nevertheless, findings in Study 1 resemble those of Study 2, in which a more reliable positive arousal expectancies scale was used. One could argue that this provides evidence that positive expectancies are associated with alcohol use in children. Furthermore, questionnaires with a limited amount of items, with a relatively low reliability, have been used before in research with children (Wiers et al., 2000).

Despite these limitations, this study is the first to find that both explicit and implicit cognitions are already important correlates of alcohol use in children. Also in accordance with adults, children have simultaneously positive and negative expectancies of alcohol. Future research should reveal a) how implicit and explicit alcohol cognitions develop from childhood to adolescence, b) how the social environment affects the development of these cognitions and c) how these cognitions are affecting and affected by children’s own alcohol use. Findings of these studies tap a new direction for alcohol prevention programs targeted at children. One could argue that these programs should focus on both explicit and implicit cognitive processes related to alcohol use. Explicitly, reducing positive and arousal expectancies might postpone children’s involvement in alcohol use. This could for instance be achieved by emphasizing the adverse consequences of alcohol use, for instance at schools or in the media. On an implicit level, studies have already shown that implicit conditional biases towards alcohol cues can be reduced during a re-training program (e.g. Wiers, Schoenmakers, Houben, Thush, Fadardi & Cox, 2008). These results are promising and imply that implicit alcohol associations could be changed as well. In that way, by measuring for instance implicit positive attitudes towards alcohol, at-risk children can be identified early on in childhood. Moreover, these children could benefit from programs that aim at changing these implicit associations, e.g. by reducing positive associations with alcohol.

Role of Funding Sources

Funding for this work was provided by the Behavioural Science Institute (BSI) in Nijmegen. The BSI had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

Contributors

All authors have been actively involved in designing the study and writing the protocol. Sara Pieters carried out the data collection for the study. Rutger Engels, Haske van der Vorst and Reinout Wiers have all assisted in the statistical analyses. Sara Pieters wrote the first draft of the manuscript and Rutger Engels, Haske van der Vorst and Reinout Wiers approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

References


