Consumption of carbonated drinks in adolescents: a transtheoretical analysis

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Abstract

Background   Adolescents consume a high level of carbonated drinks and this may have significant adverse effects for their weight and oral health. Therefore, we examined the application of key constructs of the Transtheoretical Model (stages of change, decisional balance and self-efficacy) and health as a value (both general and oral) to adolescent carbonated drink consumption and to identify any gender differences.

Methods   A total of 399 adolescents (mean age 12.57 years, SD = 1.54) completed a questionnaire measuring: stage of change, decisional balance, self-efficacy, carbonated drink consumption and attitudes to health and healthy teeth.

Results   Over half of the adolescents (55%) were classified into one of the pre-action stages (i.e. precontemplation or contemplation) and males were more likely to be represented in the precontemplation stage than females. Significant associations with stage of change, decisional balance and self-efficacy were found, though there was no association with attitudes to health (general or oral).

Conclusion   The findings suggest that the Transtheoretical Model (and its key constructs) may be a useful framework through which more tailored health promotion interventions can be designed.

Keywords   adolescence, carbonated drinks, oral health, stages of change

Introduction

In the UK, more than 70% of young people consume carbonated drinks on a regular basis (Gregory & Lowe 2000). This level of consumption has a number of health implications. First, it may contribute to obesity levels, as children and adolescents who consume carbonated drinks on a daily basis have on average 10% more total energy intake than those who do not (Harnack et al. 1999). Second, recent research (Dugmore & Rock 2004) has shown that carbonated drinks can have serious adverse effects on teeth in terms of erosion (which is when the protective enamel on the teeth is worn away). Dugmore and Rock found that drinking even just one carbonated drink a day significantly increased an adolescent’s risk of developing tooth erosion.

Health promotion interventions

There is a clear need therefore for health promotion interventions designed to promote healthier drinking habits in children and adolescents. However, there have been few studies designed to reduce carbonated drink consumption specifically. One exception is a recent study on children (aged 7–11 years) which investigated whether a school-based educational programme aimed at reducing consumption of carbonated drinks could prevent excessive weight gain (James et al. 2004). The programme included quizzes, art presentations and composing songs with a 'healthy message' and was delivered through a 1-hour session for each class each term over a year. This resulted in a modest reduction in the number of carbonated drinks consumed, which was associated with a reduction in the num-
ber of overweight and obese children. These results are encouraging for child health, and demonstrate that health promotion interventions can have a significant impact.

In the case of adolescents, evidence from the social-psychological and developmental literature is arguably pertinent to the design and delivery of health promotion interventions. For example, adolescence is primarily a time of transition (Graber et al. 1996) where peer groups play an even greater role than they do in childhood, offering social comparisons between adolescents’ own actions, attitudes, and feelings and those of others. Adolescents also have more autonomy when it comes to food and drink choice, both within and away from school. Therefore, we need to identify the perceived advantages and disadvantages of drinking carbonated drinks that are relevant to adolescents specifically. There are several theoretical perspectives which could be used to examine this topic. For example, it may be useful to consider whether or not adolescents have thought about or tried reducing the amount of carbonated drinks they consume. A potentially useful framework in which this issue could be explored is the Transtheoretical Model.

**Stages of Model**

There has been a considerable amount of research conducted using the Transtheoretical Model (Prochaska et al. 1992) as a theoretical framework for behaviour change. This framework assumes that behaviour change is a dynamic, nonlinear process that involves a number of distinct stages. It proposes a sequence of five stages of change, the first three of which are motivational (precontemplation, contemplation and preparation) and the remaining two being action-based stages (action and maintenance) and through which an individual will pass through as they adopt a new behaviour or alter a current behaviour (Prochaska et al. 1992).

A common strategy to evaluate the usefulness of the stages of change construct is by means of examining the associations with a range of cognitive and motivational variables. One of these is a pair of perceptual or judgemental factors termed the pros and cons (Velicer et al. 1985). Comparing the strength of perceived positive aspects of the new behaviour (pros) with perceived negative aspects (cons) derives decisional balance. The decisional balance strategy of the model was drawn from the theoretical approach to decision-making developed by Janis and Mann (1997).

In other behaviours, the stages of change have been found to correspond to differences in the pros and cons (Velicer et al. 1985). The model hypothesizes that persons in action and maintenance should have a decisional balance which favours the positive aspects (pros) of the behaviour and that persons in precontemplation should have decisional balance reflecting reasons not to change (cons), and that persons in contemplation should have a decisional balance falling between that of persons in precontemplation and that of persons in action (Prochaska et al. 1992).

Another construct that is sensitive to progress through the stages, and is often investigated in studies applying this model (e.g. Rapley & Coulson 2005) is self-efficacy. Self-efficacy is a person’s belief in their ability to change their behaviour (Bandura 1977) and scores have been found to be highly predictive for determining stage of change (e.g. Horacek et al. 2002).

**Transtheoretical Model and oral health promotion**

Reviews have criticized oral health promotion and dental health education for having no structured theoretical basis (Kay & Locker 1996; Watt & Fuller 1999). Although there have been some recent attempts to apply the Transtheoretical Model to adult oral health behaviours (e.g. Coulson & Buchanan 2002; Tillis et al. 2003), there has been a paucity of research considering the behaviours of adolescents. One notable exception is a study by Watt (1997), which assessed young people’s readiness to change both their sugar and fat intakes in a cross-sectional study. He identified that female adolescents may require support and assistance in the action and maintenance stages, in contrast male adolescents may need help moving into the contemplation stage. Watt concludes that oral health interventions need to recognize the various stages people may be in, in order to develop and tailor appropriate measures to meet needs.

In summary, then, adolescents consume a high level of carbonated drinks and that this may have significant adverse effects for their weight and oral health. The primary aim of our study is to apply key constructs of the Transtheoretical Model (stages of change, decisional balance and self-efficacy) to adolescent carbonated drink consumption. In addition, researchers have indicated that the value which is attached to health is an important variable as regards health behaviours for adolescents (e.g. Torres & Fernandez 1995) and evaluation of this concept should aid in the design of health education programmes. Therefore, we have included health as a value in the present study; moreover, as carbonated drink consumption has specific oral health implications (as well as general health), we included questions regarding attitudes to healthy teeth. The second aim of the study is to investigate these constructs with specific reference to gen-
adolescents, in order to assess whether there are different health promotion needs for males and females as previous research has suggested.

The results of this study should lead to an improved understanding of the process of change in carbonated drinking behaviour in adolescents and should therefore facilitate the future development of more appropriate, tailored and effective oral health promotion interventions.

**Methods**

Participants were 399 students from two state secondary schools in the East Midlands, UK. The participants were aged from 10 to 16 years with a mean age of 12.57 years (SD = 1.54) and 55% were male (25 participants did not report their gender). Participants were invited to complete a self-administered questionnaire, which took approximately 15 min to complete and which included instructions with examples.

**Carbonated drink consumption**

Participants were asked to report their level of carbonated drink consumption for a typical school day as well as a typical day at the weekend. Responses to each of these items were in terms of ‘Never’, ‘Once’, ‘Twice’, ‘3 times’, ‘4 times’, or ‘5 times or more’ (scored 0–5, respectively). In addition, they were asked which type of carbonated drinks they typically consumed. Responses were in terms of four categories: flavoured carbonated drinks (e.g. Coke, Fanta, Sprite, Lilt); diet/low calorie carbonated drinks (e.g. diet Coke); carbonated water and ‘Other’.

**Stages of change**

In order to classify participants into a stage of change, participants were asked to indicate which of the five statements best reflected their behaviour with regards to carbonated drink consumption. For the purposes of the questionnaire, the commonly used term ‘fizzy’ was used, instead of carbonated. The statements included: ‘I am not thinking about cutting down or stopping drinking fizzy drinks’ (Precontemplation); ‘I am thinking about cutting down or stopping drinking fizzy drinks’ (Contemplation); ‘In the last month I have tried to cut down the amount of fizzy drinks I have’ (Preparation); ‘In the last 6 months, I have cut down the amount of fizzy drinks I have/ stopped drinking fizzy drinks’ (Action) and ‘I have cut down the amount of fizzy drinks/stopped drinking fizzy drinks for more than 6 months (Maintenance). This type of stage algorithm has been used previously for various health behaviours, including oral health (e.g. Coulson & Buchanan 2002).

**Decisional balance**

A 16-item decisional balance measure assessed eight pros and eight cons of carbonated drink consumption. Participants rated the extent to which they agreed with each item on a 5-point Likert scale ranging from (1) ‘strongly disagree’ to (5) ‘strongly agree’. A high score on the ‘pros’ scale indicated a greater belief in the benefits of consuming carbonated drinks; a high score on the ‘cons’ scale indicated a greater belief in the costs of consuming carbonated drinks. Cronbach’s alpha for both of these scales was satisfactory (pros = 0.71; cons = 0.70).

**Self-efficacy**

Participants who reported consuming carbonated drinks were asked to indicate how confident they would be that they could (i) cut down carbonated drinks; and (ii) cut out carbonated drinks completely. Responses for both these items ranged from (1) ‘Not at all confident’ to (5) ‘Very confident’.

**Health as a value**

The ‘health as a value’ scale (Lau et al. 1986) comprised four items: ‘There is nothing more important than good health’, ‘Good health is only of minor importance in a happy life’, ‘If you don’t have your health, you don’t have anything’ and ‘There are many things I care more about than my health’. Responses were on a 7-point Likert scale ranging from (1) ‘strongly disagree’ to (7) ‘strongly agree’, with a higher score indicating a more favourable attitude (items 2 and 3 were reversed). The authors recommend using an average score; in other words dividing the total score by 4. The Cronbach’s alpha (0.70) was satisfactory.

**Importance of healthy teeth**

The importance of healthy teeth was assessed by two items: ‘Healthy teeth are only of minor importance in a happy life’ and ‘There are many things I care about more than the health of my teeth’. Responses were on a 7-point Likert scale ranging from (1) ‘strongly disagree’ to (7) ‘strongly agree’ with a higher score indicating a more favourable attitude (both items were reversed). As with the ‘health as a value’ scale, we calculated an average score. The Cronbach’s alpha (0.72) was satisfactory.
Results

Consumption of carbonated drinks

Figure 1 reports the frequency of consumption of carbonated drinks during school days and weekends. As can be seen, the overwhelming majority of adolescents are consuming carbonated drinks regularly, with reported levels increasing at weekends.

The majority of the adolescents (63%) reported that they mostly consumed flavoured carbonated drinks with 22% reporting that they mostly consumed diet/low calorie flavoured carbonated drinks. Fewer adolescents (7%) reported mostly drinking carbonated water with the remaining 8% being classified into the ‘Other’ category. There was no gender difference in the type of drinks consumed ($P > 0.05$).

Stage of change and consumption of carbonated drinks

The classification of participants according to their stage of change is presented in Table 1. Over half of the adolescents (55%) were classified into one of the pre-action stages (i.e. precontemplation or contemplation). Chi-squared analyses highlighted a gender difference across the stages; males were more likely than females to be at the precontemplation stage ($P < 0.001$).

Stages of change and decisional balance

A 2 (gender) × 5 (stage) between-subject multivariate analysis of variance was performed on the scores for the pros and cons of consuming carbonated drinks. As directed by Velicer and colleagues (1985), the raw scores for the pros and cons were transformed into standardized T scores ($M = 50$, $SD = 10$).

There was a significant main effect of gender ($F_{2,349} = 11.04$, $P < 0.001$) and stage ($F_{8,700} = 7.66$, $P < 0.001$), but no significant interaction. There was a significant effect of gender only for the pros ($F_{1,360} = 21.66$, $P < 0.001$) with males scoring higher on this measure as compared with females (Mean = 51.45 vs. 46.55). In terms of stage, there was a significant effect for both pros ($F_{4,360} = 9.21$, $P < 0.001$) and cons ($F_{4,360} = 10.29$, $P < 0.001$). Post hoc tests using Tukey’s Honestly Significant Difference (HSD) revealed that those classified into precontemplation scored significantly higher on the pros scale than those classified into the contemplation ($P < 0.01$), preparation ($P < 0.05$), action ($P < 0.001$) or maintenance ($P < 0.001$). Conversely, those classified into precontemplation scored significantly lower on the cons scale than those classified into contemplation ($P < 0.01$), preparation ($P < 0.001$), action ($P < 0.001$) and maintenance ($P < 0.001$).

Stages of change and self-efficacy

A 2 (gender) × 5 (stage) between-subject multivariate analysis of variance was performed on the scores for each of the self-
efficacy items. There was a significant main effect of gender ($F_{1,345} = 6.42, P < 0.01$) and stage ($F_{4,690} = 3.73, P < 0.001$), but not gender–stage interaction ($F_{4,690} = 0.48, \text{n.s.}$).

There was a significant effect of gender in terms of confidence in the ability to cut down carbonated drink consumption ($F_{1,345} = 9.14, P < 0.01$) with males reporting lower levels of confidence than females (Mean = 3.60 vs. 4.01).

In terms of stage, there was a significant effect on scores reflecting confidence in the ability to cut down carbonated drink consumption ($F_{4,345} = 6.68, P < 0.001$). Post hoc tests using Tukey’s HSD revealed that those classified into precontemplation scored significantly lower on this item than those classified into preparation ($P < 0.05$), action ($P < 0.001$) and maintenance ($P < 0.01$).

In addition, there was a significant effect on scores reflecting confidence in the ability to stop drinking carbonated drinks ($F_{1,345} = 5.37, P < 0.001$). Post hoc tests using Tukey’s HSD revealed that those classified into precontemplation scored significantly lower on this item than those classified into action ($P < 0.01$) and maintenance ($P < 0.01$).

**Health as a value and the importance of healthy teeth**

A 2 (gender) × 5 (stage) between-subject analysis of variance was performed on the ‘health as a value’ score, but this revealed no significant main effect of either gender ($F_{1,365} = 1.09, \text{n.s.}$) or stage ($F_{4,365} = 1.17, \text{n.s.}$) nor any gender–stage interaction ($F_{4,365} = 1.03, \text{n.s.}$). Overall, the mean score for the ‘health as a value’ scale was 4.3 (SD = 1.10).

A 2 (gender) × 5 (stage) between-subject analysis of variance was performed on the ‘importance of healthy teeth’ score, but this revealed no significant main effect of either gender ($F_{1,378} = 1.99, \text{n.s.}$) or stage ($F_{4,378} = 1.39, \text{n.s.}$) nor any gender–stage interaction ($F_{4,378} = 0.87, \text{n.s.}$). Overall, the mean score for the ‘importance of healthy teeth’ scale was 4.3 (SD = 1.46).

**Discussion**

According to their own self-report, the majority of adolescents were regularly consuming carbonated drinks. This finding mirrors that of Gregory and Lowe (2000) and reaffirms the need for health interventions directed specifically at this problem behaviour among this age group. It is interesting to note that consumption increased at weekends; this may be because the schools in our study did not have vending machines. A recent study in the UK has shown that secondary schools do tend to have vending machines (Hunter et al. 2004); therefore, the schools used in our study may not reflect the wider UK school community. It may be the case that the highlighting of vending machines as a potential health risk for children has resulted in some schools (including those in this study) deciding against their presence, which is encouraging. However, the relatively high level of consumption shown in our study and the indication that this increases at the weekend demonstrate that health promotion needs to extend beyond consumption in school time and may indicate the need for involvement of parents.

We set out to apply the Transtheoretical Model to the consumption of carbonated drinks among adolescents and in so doing provide an overview of the distribution of stages of change in terms of cutting down or eliminating such drinks from their diet. Although it is a concern that 55% of the adolescents in this sample were not engaging in any concrete attempts to change their drinking behaviour, an encouraging 45% did report some efforts to modify behaviour. In addition, it was found that males were more likely to be in the precontemplation stage than females. This indicates that gender should be considered when designing health education programmes for reducing carbonated drink consumption in this population; young men may need help to move into the contemplation stage.

A pool of items was generated from which to assess the relative strength of perceived benefits and costs of cutting down or stopping drinking carbonated drinks. As the model predicts, the balance between the pros and cons varied depending on which stage of change the individual was in, that is, the benefits of drinking carbonated drinks decrease with advancing stage and the potential losses increase with stage. As would be expected, there were lower self-efficacy scores in the precontemplation stage. That is, those who are not considering cutting down or stopping drinking carbonated drinks have reduced confidence in their ability to do so. This finding is consistent with other studies which have applied the Transtheoretical Model to adolescent health behaviour (e.g. Rapley & Coulson 2005) and suggests that activities designed to boost confidence should be integrated within health interventions for this age group (e.g. confidence in choosing non-carbonated drinks such as water, diluted fruit juice and milk).

There were some interesting gender differences, pertinent to the decisional balance construct and self-efficacy, which merit comment. Males reported higher scores on the pros scale, indicating that they see more potential benefits in drinking carbonated drinks, and they also have less confidence than females in their ability to cut down or stop drinking them. This finding supports the results from Horacek and colleagues (2002) who found that young men appear to need increased confidence in their ability to increase their fruit and vegetable consumption. Designers of oral health and weight management interventions
should strive to increase young men’s confidence to cut down or eliminate carbonated drinks from their diet. As males were also more likely to be in the precontemplation stage, explaining and endorsing the adverse effects of drinking carbonated drinks may be helpful in progressing them on to the contemplation stage where it may be more useful to discuss specific activities (e.g. topping up water bottles at school water fountains).

We included health as a value and attitudes to healthy teeth scales to investigate whether the stage of change that adolescents are in, and/or gender affected the value they placed on these concepts. However, there were no gender or stage effects for either of these scales. The mean scores indicate that the adolescents do not particularly endorse health as a value, either generally or for their teeth specifically. Trying to increase the value and importance attached to health (including healthy teeth) should be an additional goal of health promotion.

It is important to note that there are limitations with the present study. We have used a cross-sectional design; therefore, we cannot clarify whether the differences between the stages were antecedents or consequences of behaviour change. Furthermore, although the sample was relatively large, it may not be considered representative of the wider adolescent population as they were recruited from only two state secondary schools in the East Midlands of England (and which did not have vending machines at the time of the study).

Conclusion

The majority of adolescents in this study were consuming carbonated drinks on a regular basis. By exploring the associations between stages of change and a range of cognitive and attitudinal variables, it may be possible to offer guidance on tailoring intervention strategies. This is done not only to support those adolescents who have yet to either acknowledge the need for behaviour change or make a commitment to change but also to support those who have already changed their behaviour in order to cut down or eliminate carbonated drinks. Watt (1997) reports that many health education campaigns have wrongly assumed that all individuals are ready and disposed to changing their behaviours, leading to poor results and wasted resources. This model can help the development of effective health promotion programmes by ensuring that interventions are designed to target the particular needs and beliefs of individuals and groups; for example, the over-representation of young men in the precontemplation stage may need tailored assistance (targeting self-efficacy, highlighting disadvantages of carbonated drinks and endorsement of healthy alternatives) in order to move on to the contemplation stage. Programmes could be developed and administered in schools, though there is also clearly a role for parents in helping to reduce carbonated drink consumption indicated by the increased consumption at weekends. However, the role of parents’ influence and control in adolescents’ patterns of carbonated drink consumption remains unclear and warrants further investigation. Healthy alternatives to carbonated drinks should be highlighted (such as water and diluted fruit juices or milk) and the advantages of cutting down carbonated drinks endorsed. Conversely, the negative effects of carbonated drink consumption should be emphasized.

References


