The Effect of Pubertal Status on Employing Cognitive Emotion Regulation Strategies During Adolescence

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Abstract:

Puberty is a crucial stage of adolescence. Some empirical studies have reported a decline in cognitive performance at the onset of puberty. The current study aims to investigate the effect of pubertal status on the employment of adaptive and/or maladaptive cognitive emotion regulation strategies (e.g., positive reappraisal and self-blame). A sample of 55 male and 41 female adolescents aged between 10 and 16 were recruited and categorised into three pubertal groups: pre-pubertal, pubertal and post-pubertal using the Pubertal Development Scale. The pattern of their use of cognitive coping strategies was measured using the Cognitive Emotion Regulation Questionnaire. The results revealed no evidence of the effect of pubertal status on employing the adaptive and maladaptive cognitive coping strategies. However, in each of the pubertal groups, adaptive strategies were reported more than maladaptive strategies. No gender differences were found in the employment of cognitive emotion regulation strategies. It was found that a higher use of maladaptive strategies was associated with a higher level of emotion dysregulation, while no association was found between adaptive strategies and emotion dysregulation. These findings should be of interest to those designing intervention programs for adolescents with emotional issues.

Key words: adolescents, puberty status, cognitive strategies, emotion regulation, coping**.**

تأثير حالة البلوغ على توظيف الاستراتيجيات المعرفية لتنظيم الانفعالات خلال فترة المراهقة

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الملخص:

للبلوغ أهمية كبيرة في مرحلة المراهقة. وقد ذكرت بعض الدراسات أن هناك انخفاض في الأداء المعرفي في بداية سن البلوغ. لذا تهدف الدراسة الحالية إلى بحث تأثير حالة البلوغ على توظيف استراتيجيات تنظيم المشاعر المعرفية التكيفية و/أو غير التكيفية (مثلًا إعادة التقييم الإيجابي واللوم الذاتي). تكونت العينة من ٥٥ مراهق و٤١ مراهقة تتراوح أعمارهم بين ١٠ و١٦ عامًا، وتم تصنيفهم إلى ثلاث مجموعات في سن البلوغ: ما قبل البلوغ، والبلوغ، وما بعد البلوغ باستخدام مقياس حالة البلوغ. وقِيسَ أسلوب استخدامهم لاستراتيجيات المعالجة المعرفية باستخدام استبيان التنظيم المعرفي للانفعال. لم تكشف النتائج عن أي دليل على تأثير حالة البلوغ على توظيف استراتيجيات المعالجة المعرفية التكيفية أو غير التكيفية. رغم ذلك، ظهر في كل مجموعة استراتيجيات تكيفية أكثر من غير التكيفية. ولم تظهر فروق بين الجنسين في استخدام استراتيجيات التنظيم المعرفي للانفعال. وتبيّن أن هنالك ارتباط بين استخدام الاستراتيجيات غير التكيفية والمستوى المرتفع من خلل تنظيم الانفعال، بينما لم يظهر ارتباط بين الاستراتيجيات التكيفية وخلل تنظيم الانفعال. ستكون هذه النتائج ذات أهمية للمعنيين بإعداد برامج التدخل للمراهقين الذين يعانون من مشاكل انفعالية.

الكلمات الرئيسية: المراهقون، حالة البلوغ، الاستراتيجيات المعرفية، تنظيم الانفعالات، التكيف.

Introduction

Adolescence is a crucial stage in human development that has been widely studied by researchers to understand its diverse developmental dimensions. Definitions of adolescence vary, as it is a challenging concept to define precisely. The American Psychological Association (APA, 2002, p.1) describes adolescence as "the period of time from the onset of puberty until an individual achieves economic independence". It has also been defined by Sisk and Zehr (2005, p.163) as "the period between childhood and adulthood, encompassing not only reproductive maturation, but also cognitive, emotional, and social maturation".

Defining the age range of adolescence has been a challenge because of the complexity of adolescents' development (Geiger & Castellino, 2011). While most individuals enter adolescence around age 10, some may begin this stage earlier due to genetic or environmental factors. Similarly, the transition into adulthood often extends beyond the traditional age of 18, with many not achieving full economic, social, or psychological independence until their early to mid-20s, typically between ages 21 and 25 (APA, 2002, Arnett, 2000). Although puberty is generally considered to mark the beginning of adolescence, the end of this period varies, depending on social and cultural factors (Blakemore, 2008). According to Sisk and Zaher (2005), the term 'puberty' is often used as a synonym of the term 'adolescence'; however, they are not the same. Therefore, it is important to make a distinction between these two concepts.

Puberty results from a set of biological processes, which produce changes in the reproductive physiology and physical appearance of young people (Petersen & Taylor, 1980 as cited in Petersen, Crockett, Richards, & Boxer, 1988). The onset of puberty is characterised by hormonal changes that lead to biological and physiological characteristics such as breast growth and menstruation for girls, and increasing height and voice changes for boys (APA, 2002; Spear, 2010). The timing of puberty varies from one individual

to another (Dorn, Dahl, Woodward, & Biro, 2006). It generally starts earlier among girls than boys: for girls, the average age of puberty is 11, while the average of its onset amongst boys is 12 years old (Dubas, 1991; NHS, 2012).

Although chronological age is often positively correlated with pubertal maturation (Blakemore, Burnett, & Dahl, 2010), recent data from the United States and Canada has shown that adolescents nowadays are entering puberty 6 to 24 months earlier than in previous decades (Herman-Giddens et al., 2012) . This emphasises the importance of including measures to assess actual pubertal status, rather than depending on age alone, when studying the different aspects of adolescents' development.

The biological developments are not the only changes that adolescents go through. There are also numerous social, emotional, cognitive and neural developments taking place during this period of life (Blakemore, 2008; Blakemore & Choudhury, 2006). These transitions result in other changes, for example to identity, self-esteem, independence and social relationships (Blakemore & Choudhury, 2006; Dempsey, 1996). It has been suggested that due to these alterations, adolescents become at risk of developing behavioural and emotional disorders (see Steinberg, 2005 for a review). Substance abuse, conduct disorders and depression are examples of issues commonly experienced during adolescence (Wolfe & Mash, 2006). Affective disorders, such as bipolar disorders, anxiety and depression, have been shown to be more common among adolescents aged 14 to 15 than those aged 10 to 11 years (Rutter, 1979 as cited in Garber & Dodge, 1991). Additionally, Weissman et al. (1987) found that adolescent females over the age of 12 exhibited a higher level of depressive symptoms compared with female children under the age of 10. A recent review has further supported the association between depression and adolescence (Rice & Rawal, 2011). As Irwin, Burg and Cart (2002) point out, issues such as these, usually arising at the pubertal stage of adolescence, have not been investigated as much as those found in children and adults.

The fact that anxiety and depression are emotional-related disorders suggests that emotional disturbance has a crucial role in

their development (Campbell-Sills & Barlow, 2007; Mennin, Holoway, Fresco, Moore, & Heimberg, 2007). Therefore, adolescents may find that they have to make more effort to effectively regulate their emotions as well as their behaviours in order to cope with the dramatic developmental changes experienced during this transitional period.

Emotion regulation has been defined as "the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features to accomplish one's goals" (Thompson, 1994, pp. 27-28). This definition indicates that our emotions can be regulated extrinsically (by others such as friends) as well as intrinsically (by ourselves). In general, the way in which we regulate our emotions changes over our life span, and during the early years of life, our emotions are often controlled and regulated by external sources, for example our parents (Southam-Gerow, 2013; Thompson, 1990). Subsequently, as we grow older and experience more mature cognitive and emotional development, we become able to self-regulate our emotional states. This implies that adolescents and adults develop strategies that help them to handle the negative as well as the positive situations they encounter during their life. However, the characteristics associated with the transition from child to adult and the increasing rate of stressors throughout this period put adolescents under a high level of stress and make it a demanding and more overwhelming time to adapt and to take control of their emotions (Arnett, 1999; Wolfe & Mash, 2006).

The lack of any of these abilities would reveal difficulties being experienced with emotion regulation, or 'emotion dysregulation'. Over 75% of diagnostic categories of psychopathology in the Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM–IV; American Psychiatric Association, 1994) are characterised by emotion dysregulation. A considerable amount of literature has found an association between some characteristics of emotion dysregulation and different forms of psychopathology, such as generalised anxiety disorder (e.g., Mennin, Heimberg, Turk, &

Fresco, 2002, 2005; Roemer et al., 2009), posttraumatic stress disorder (e.g., Tull, Barrett, McMillan, & Roemer, 2007), depression (e.g., Rottenberg, Kasch, Gross, & Gotlib, 2002), borderline personality disorder (Wagner & Linehan, 1999), and other anxiety disorders (e.g., Cox, Swinson, Shulman, & Bourdeau, 1995). These findings indicate the crucial role of emotion regulation in human well-being.

Therefore, more research is needed to investigate the mechanisms of emotion regulation and the related difficulties with is as experienced during adolescence. This will enhance our understanding of the common psychological issues associated with this period of life, and in turn, contribute to more effective therapeutic interventions. One way to understand the processes of emotion regulation is to know how our emotions are being controlled and what factors are underlying these processes.

Emotions can regulate behaviours and cognition, but it can also work the other way around: our emotional states can be guided and controlled by behavioural as well as cognitive strategies, and these strategies can be either adaptive (e.g., positive reappraisal) or maladaptive (e.g., rumination) (Cole, Martin, & Dennis, 2004; Mennin et al., 2007). Avoiding a situation that evokes negative emotions is an example of a behavioural coping strategy, whereas a cognitive strategy might involve someone attempting to distract their attention from the situation by thinking in a positive way to reduce distress. Thus, there are different ways of regulating our emotions after facing negative events, namely behavioural, cognitive and social strategies (Garber & Dodge, 1991; Gross, 2001; Martin & Dahlen, 2005). Suri, Sheppes, and Gross (2013) have emphasised the importance of cognitive strategies in controlling one's emotions. Some cognitive strategies are used subconsciously, such as selective attention or denial, while some can be used in a conscious way, such as blaming others or refocusing on the positive side of a negative event (Garnefski, Kraaij, & Spinhoven, 2001).

Following the work of Garnefski et al. (2001; 2002) and Perţe and Miclea (2011), the current study uses the terms 'cognitive emotion regulation' and 'cognitive coping' interchangeably. These

terms refer to how humans cognitively manage their emotional states, and to how they think, rather than to what they do, during or after encountering stressful life events (Thompson, 1991). In order to identify and measure coping strategies, different self-report instruments have been developed. The Ways of Coping Questionnaire (WCQ; Folkman & Lazarus, 1988) and the COPE Inventory (Carver, Scheier, & Weintraub, 1989) are examples of these instruments. Even though these measures have been shown to be useful tools for assessing coping strategies, most of them assess both the behavioural and cognitive aspects of controlling emotions (Martin & Dahlen, 2005). However, considering that thought precedes action, and therefore, that what we think may affect how we behave, it is important to differentiate between behavioural and cognitive coping processes (Gross, 1999).

This need to distinguish between cognitive and behavioural strategies has been recognised by the introduction of the Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001). Unlike other measures of its kind, this questionnaire is the first tool to assess the cognitive components of emotion regulation separately from the behavioural ones (Martin & Dahlen, 2005). Furthermore, CERQ identifies a wider range of cognitive strategies compared to other coping questionnaires. In this tool, nine cognitive coping strategies are assessed. Some of these strategies (e.g., acceptance and self blame) have been derived from previous questionnaires such as the Coping Inventory for Stressful Situations (CISS; Endler & Parker, 1990, 1994) and the COPE Inventory (Carver et al., 1989), while new strategies (e.g., catastrophizing and putting into perspective) have been introduced for the first time. These strategies can be divided into two categories: adaptive and maladaptive strategies (Garnefski & Kraaij, 2007). According to the manual of CERQ (Garnefski et al., 2002) adaptive strategies include: *positive refocusing*, thinking about the positive aspects of the threatening situation rather than the negative ones; *acceptance*, thoughts about accepting the fact that an event has happened and not trying to change the situation; *refocus on planning*, rethinking about how to deal and to overcome a negative event*; positive reappraisal*, reevaluating the situation in a positive

manner; and *putting into perspective*, downgrading the negative aspects of the stressful situation.

Maladaptive strategies included in CERQ are: *catastrophizing*, overestimating the negative outcomes of a situation; *self blame*, in which one blames oneself for being in an undesirable situation; *blaming others*, putting the blame on others as being responsible for the negative situation; and *rumination*, overthinking about the negative side of an experience.

Although the original manual of CERQ (Garnefski, et al., 2002) and other papers (e.g., Bishop et al., 2004; Jermann, Van der Linden, D'Acremont, & Zermatten, 2006) have categorised the strategy of acceptance as an adaptive strategy, it is questionable as to whether it is adaptive or maladaptive. Martin and Dahlen (2005) have argued that acceptance can be either an adaptive or a maladaptive way of coping, depending on the person's mood and on which context this strategy is used, as it has been positively correlated with emotional distress in their study. This finding was also confirmed by Garnefski and Kraaij (2006) where high scores on acceptance were reported by a psychiatric sample. As this strategy could affect the results of the current data, a preliminary analysis was conducted before running the main analysis of this study, in order to determine to which category the strategy of acceptance belongs.

Although employing these strategies varies across individuals as well as within one individual, depending on the situation or other factors (Garnefski, & Kraaij, 2006; Perţe & Miclea, 2011), consistent findings have shown a strong correlation between employing specific coping strategies and some forms of psychopathology. In children aged 9-11 years, *self-blame*, *catastrophizing* and *rumination* have been shown to be positively correlated to worry and fearfulness, while *positive refocusing* and *positive reappraisal* were negatively related to these problems (Garnefski, Rieffe, Jellesma, Terwogt, & Kraaij, 2007). Similar findings have been found in adolescents (Garnefski, Boon & Kraaij, 2003), adults (Garnefski & Kraaij, 2007; Omran, 2011) and older people (Kraaij, Pruymboom, & Garnefski, 2002). Despite the variance of the findings, in general these studies have demonstrated a significant negative correlation between adaptive

coping strategies (e.g., *positive reappraisal* and *refocus on planning*) and emotional problems, whereas maladaptive strategies (e.g., *catastrophizing*, *rumination* and *self-blame*) were positively related to symptoms of psychopathology. Moreover, significant gender differences in using these strategies have been reported (Garnefski & Kraaij, 2006; Garnefski, Teerds, Kraaij, Legerstee, & Van den Kommer, 2004). Garnefski et al. (2004) found that *rumination*, *catastrophizing* and *positive refocusing* have been reported more by females than by males.

Interestingly, a comparison between adolescents and adults has revealed that adolescents aged 12 to16 years have demonstrated less frequent use of cognitive coping strategies than adults (Garnefski et al., 2002). Garnefski and Kraaij (2006) also found that early adolescents (12-15 years) had significantly lower scores in using specific cognitive coping strategies than older adolescents (16-18) and adults (18-65), and that older adolescents also had lower scores in most of these strategies when compared with adults. This suggests that from adolescence to adulthood there is a positive relationship between the use of cognitive emotion regulation strategies and age, regardless of whether these strategies are adaptive or maladaptive. It could be argued that this pattern of employing cognitive strategies is an expected result of maturation: as we grow up, we use more strategies to regulate our emotions.

However, when trying to understand adolescents' development, more attention needs to be directed towards pubertal changes and their impact on other development processes. Indeed, these studies have divided adolescents in terms of their ages rather than their pubertal status, and no measure of puberty was used. Therefore, puberty timing was not accounted for in explaining the variance between the samples in employing the strategies. This is a surprising oversight as puberty has an impact not only on the physical development but also on the psychological, social and cognitive aspects of adolescents' development, as shown across much adolescence research (e.g., Brooks-Gun, Graber, & Paikoff, 1994; Brooks-Gun, Petersen, & Eichorn, 1985; Dorn et al., 2006; Dubas, Graber,& Petersen,1991). Dorn et al. (2006) have emphasised the

importance of including a reliable and appropriate measure of puberty when investigating adolescents' health and development. They believe that having such measures would enhance our understanding of adolescents' behaviours and disorders. In the context of coping strategies, pubertal status may form a part of the explanation of the decline in the use of certain strategies during adolescence.

The physical changes of puberty and the timing of its onset have been found to have direct and indirect influences on different aspects of adolescents' social and psychological development (see Crockett & Petersen, 1987; Dorn & Biro, 2011; Graber et al., 1997; Petersen, Tobin-Richards, & Boxer, 1983 for review). Additionally, pubertal status has been reported to have an effect on adolescents' performance in cognitive tasks, such as match-to-sample tasks (McGivern, Andersen, Byrd, Mutter, & Reilly, 2002) and face recognition tasks (Carey, Diamond, & Woods, 1980; Diamond, Carey, & Back, 1983). These studies found that adolescents' performance on such tasks showed a significant decline at the age of pubertal onset, compared to pre-pubertal and post-pubertal groups. The researchers in these studies suggested that the processes of synaptic proliferation in the frontal cortex and hormonal changes during the pubertal onset might be responsible for such a decline. Considering these findings and the fact that coping strategies have cognitive components (Perţe & Miclea, 2011), it could be assumed that the onset of puberty and its associated physical and hormonal changes may also play a role in adolescents' employment of these strategies. Thus, it is possible that pubertal status, rather than age, is an important factor in explaining the differences among adolescents' in employing coping strategies, and the differences in their vulnerability to develop certain forms of psychopathology. In order to address this gap, the current study measured the pubertal status and looked at whether it has an effect on employing cognitive strategies of emotion regulation.

Although these strategies have been extensively investigated in recent years, most of the existing work has focused on the use of these strategies in relation to psychopathology and ill-health, as discussed earlier. Yet, the development of cognitive coping strategies

during adolescence has not been fully addressed. Furthermore, less is known about the role of puberty status on the pattern of employing these strategies (Blakemore & Choudhury, 2006).

Exploring how pubertal development affects emotion regulation is crucial, as it could offer important insights for developing prevention and early intervention programs for adolescents. This research has the potential to guide the creation of strategies that help adolescents better manage their emotions during this key stage of development.

Aim and Questions

The primary aim of this study is to investigate the effect of puberty on employing the adaptive (e.g., putting into perspective and refocus on planning) and maladaptive (e.g., self-blame and rumination) coping cognitive strategies that regulate adolescents' emotions when encountering stressful life events. This investigation is unique in that it is categorising adolescents based on their pubertal status rather than their ages, measured using the Pubertal Development Scale (PDS). The questions this study attempts to answer are as follows:

1. Does pubertal status affect the pattern of employing adaptive and maladaptive coping strategies?
2. Is there a difference between the amounts of adaptive and maladaptive strategies reported by the adolescents in each group (pre-pubertal, pubertal, and post-pubertal)?
3. Are there any differences between males and females in employing specific type of strategies? If so, which of these strategies are most/least employed by each gender?
4. Is there a significant positive correlation between the use of maladaptive coping strategies and emotion dysregulation?
5. Is there a significant negative correlation between the use of adaptive coping strategies and emotion dysregulation?

Method

Participants

Ninety-six adolescents were recruited from the local community within North Wales to take part in this study, using posters and advertisements. The sample consisted of 55 males and 41

females aged between 10 to 16 years, allowing comparisons to be made across genders as well as stages of adolescence.

Research design

The study design was a combination of between-subject and within-subject designs. First, it aimed to compare the use of cognitive coping strategies across three groups of adolescents in three consecutive stages of pubertal development; pre-pubertal, pubertal, and post-pubertal. Second, it looked at the differences in employing the adaptive and maladaptive forms of these strategies within each pubertal group. Additionally, it compared between the male and female adolescents in employing these strategies. The pubertal status of the adolescents was determined based on each participant's response on the Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988). Additionally, correlations between difficulties in emotion regulation and the use of cognitive coping strategies were explored.

Measures

To collect the data needed for the current study, three measures were used as follows:

Cognitive Emotion Regulation Questionnaire (CERQ). This measure was used to assess cognitive emotion regulation strategies that participants tended to use when encountering negative or stressful events. This questionnaire was developed by Garnefski et al. (2001). It has been extensively used with adolescents (Garnefski, et al., 2002; Garnefski et al., 2003; Garnefski, Kraaij, & Etten, 2005). It consists of nine 4-item subscales, giving a total of 36 items. These subscales are*: self-blame* (example item:' I think that basically the cause must lie within myself'; *blaming others* (example item:' I feel that others are responsible for what has happened'; *acceptance* (example item:' I think that I have to accept the situation'; *refocus on planning* (example item:' I think about how I can best cope with the situation'; *positive refocusing* (example item:' I think about pleasant experiences'; *rumination* (example item:' I dwell upon the feelings the situation has evoked in me'; *positive reappraisal* (example item:' I think I can learn something from the situation'; *putting into perspective* (example item:' I think that other people go through much

worse experiences'; and *catastrophizing* (example item:' I keep thinking about how terrible it is what I have experienced'.

Items are measured using a 5-point Likert scale (1 = (almost) never; 2 = sometimes; 3 = regularly; 4 = often; 5 = (almost) always). By adding the scores for the four items of each subscale, each participant got a score ranging from four to 20. The higher the participants' score on each subscale, the higher their use of the specific coping strategy. For the purpose of this study, in addition to the individual score for each strategy, the average of the adaptive strategies and the average of the maladaptive ones were calculated (as they are made up of different number of subscales) to give two scores, one for each category. Garnefski et al. (2001) reported high internal consistencies for the CERQ subscales ranging from .68 to .85.

Difficulties in Emotion Regulation Scale (DERS). This is a self-reporting measure that evaluates emotional dysregulation, developed by Gratz and Roemer (2004). Like CERQ, DERS has 36 items measured on a Likert scale, ranging from 1 (*almost never*) to 5 (*almost always*). A high score indicates a high level of difficulty in controlling one's emotions. Six aspects of emotion regulation are assessed: non-acceptance, goals, impulse, awareness, strategies, and clarity. In addition to the total score on the scale, an individual score for each subscale can be calculated. However, only the total scores were used in the current analysis. In the adolescent population, DERS has previously demonstrated high internal consistency (.93) for the overall scale, and good to excellent internal consistencies ranging from .76 to .89 for the subscales (Weinberg & Klonsky, 2009). This scale has been found to be a useful tool to assess emotion dysregulation among adolescents. This measure was used in the current study to analyse the association between difficulties in regulating emotions and cognitive coping strategies.

The Pubertal Development Scale (PDS). This scale was used in order to determine the pubertal status of the participants. PDS is a 5-item self-rating scale developed by Petersen et al. (1988) in an interview form, which was then adapted by Carskadon and Acebo (1993) into a self-report scale. Because of the slight differences in the pubertal characteristics between males and females, there are two

versions of this scale. For the boys' version, *growth spurt*, *body hair growth*, *skin changes*, *voice deepening*, and *facial hair growth* are measured. While in the girls' version, the same characteristics are measured except *voice deepening*, and *facial hair growth* that are replaced by *breast growth* and *menstruation*. The response options for all items on the boys' version as well as the first four items on the girls' version range from (*not yet started*= 1 point) to (*seems completed*= 4 points). For the menstruation item (in the girls' version), there are two options: *yes* (4 points) and *no* (1 point). The average value of all items' scores gives a Pubertal Development Score. In order to measure the consistency of the participants' responses, the participants' parents also filled out a version of the questionnaire and the average of their scores was compared to their adolescent's score. PDS classifies adolescents into five pubertal status categories: pre-puberty, early puberty, mid-puberty, late puberty, and post-puberty. To classify the participants into these categories, Puberty Category Score were measured according to the criteria of Crocket (1988, as cited in Carskadon & Acebo, 1993). For boys, this score were computed from their scores on *body hair growth*, *voice change* and *facial hair growth* items as follows: pre-pubertal = 3; early Pubertal = 4 or 5 (no 3-point response); mid-pubertal = 6,7 or 8(no 4-points); late pubertal = 9-11; post-pubertal = 12, while for girls, it was calculated from their scores on *body hair growth*, *breast development* and *menstruation* items as follows: pre-pubertal = 3; early pubertal = 3 and no menstruation; mid-pubertal = 4 and no menstruation; late pubertal ≤ 7 and menstruation; post-pubertal = 8 and menstruation.

Because of the slim differences between the category scores, the current study shrunk these categories from five to three by combining early and pre-puberty categories to give the 'pre-puberty' group; late and post-puberty categories to make the 'post-puberty' group, and the third group was the mid-pubertal, which is referred to as 'pubertal group' in the current study.

This questionnaire has been found to have high internal consistency, as reported by Carskadon and Acebo (1993) with

Cronbach's coefficient alpha values ranging from 0.67 to 0.70 for the adolescent versions and from 0.68 to 0.78 for the parent versions.

Research procedures

Participants and their parents were asked to come into the School of Psychology at Bangor University to take part in this study. Once they arrived at the university, both the adolescent and their parents were taken to the test room. The information sheet (see Appendix A & B) was given to the adolescents and their parents to read and they were asked to fill out the consent form (see Appendix C). Parents were then taken to another room, which is located near the test room, and were asked to fill out the Pubertal Development Scale (see Appendix D) about their child. Parents were told that only the participant's number would appear on the questionnaires without their names, to protect confidentiality. After they had completed the questionnaire, they were asked to place it in a sealed envelope. This had the aim of reassuring the parents that their child would not see their answers. Meanwhile, the participant, in the test room, were also asked to fill out the Pubertal Development Scale (see Appendix E) and to place it in a sealed envelope, again to reassure them that their parents would not see their answers. Additionally, adolescents were asked to fill out the Cognitive Emotion Regulation Questionnaire (see Appendix F) as well as the Difficulties in Emotion Regulation Scale (see Appendix G). The experiment took about one hour, however, participants were told that they could take a break whenever they needed to. They also were informed about their right to withdraw from the study at any time if they feel uncomfortable or for any other reasons. When they finished, they were asked if they have any concerns or questions. Parents then joined their child in the test room and both were debriefed. Each participant was paid an amount of £10 for their participation. Additionally, they were provided with a debrief letter (see Appendix H) as well as the experimenters' information in case they would like to contact us again about the study results. Data collection was not commenced until ethical approval was granted by the School of Psychology Ethics Committee at Bangor University.

Results

Preliminary Data Analyses

The sample consisted of 55 males (57%) and 41 females (43%), with a mean age of 12 years and 7 months (*SD* = 2.02).

Based on the responses given on the PDS to access puberty status, there were a small number of participants in the pre-pubertal and post-pubertal categories (only five in each). As stated previously in the method section, there are slight differences between the scores of categories. Therefore, the pre-pubertal and early-pubertal groups were combined to make up the pre-pubertal group, and the post-pubertal and late-pubertal were combined to make up the post-pubertal group, while the pubertal group was maintained as it is. Once the data were collapsed, we had three groups: pre-pubertal, pubertal, and post-pubertal. The number of males and females in each of the three pubertal groups in addition to the age ranges are displayed in Table 1.

Table 1

The Number of Participants in Each Pubertal Group and The Age Ranges

Pubertal Status	Male	Female	Total	Age Range (Years)
Pre-pubertal	19	5	24	10-14
Pubertal	20	14	34	10-15
Post-pubertal	16	22	38	14-16
Total	55	41	96	10-16

All participants answered the CERQ except two of the male participants. Means and standard deviations of the CERQ subscales are shown in Table 2. In general, the adaptive cognitive strategies (such as *refocus on planning* or *positive reappraisal*) were reported more often than the maladaptive strategies (such as *self-blame* or *blaming others*), with the strategy of *refocus on planning* being most employed and *blaming others* being least employed by all the participants.

Table 2

Means and Standard Deviations of The CERQ Subscales (N = 94)

CERQ subscales	Mean	*SD*	95% Cl [LL, UL]
Self-blame	9.48	2.75	[8.92, 10.04]
Acceptance	12.37	3.12	[11.73, 13.01]

Rumination	10.30	3.23	[9.64, 10.96]
Positive refocusing	11.80	3.60	[11.06, 12.54]
Refocus on planning	12.88	3.50	[12.17, 13.60]
Positive reappraisal	12.33	3.85	[11.54, 13.12]
Putting into perspective	12.43	3.28	[11.75, 13.10]
Catastrophizing	8.22	2.65	[7.68, 8.77]
Blaming others	8.20	2.74	[7.64, 8.76]

Note. CERQ = Cognitive Emotion Regulation Questionnaire. SD = standard deviation. CI = confidence interval; LL = lower limit; UL = upper limit.

In order to distinguish between the adaptive and maladaptive cognitive coping strategies in the current sample, and to confirm which category the strategy of acceptance belongs to, a principle component analysis (PCA) was conducted on the nine subscales of the CERQ (*positive reappraisal, putting into perspective, refocus on planning, positive refocusing, catastrophizing, self-blame, rumination, acceptance, and blaming others*) with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO = .73 ('good' according to Field. 2009). Bartlett's test of sphericity χ^2 (36) = 267.74, p < .001, indicating that correlations between subscales were sufficiently large for PCA. An initial analysis was run to obtain eigenvalues for each subscale in the analysis. Two components had eigenvalues over Kaiser's criterion of 1 and in combination explained 56.21% of the variance. The scree plot (see Appendix I) showed inflexions that would also justify retaining two components. Table 3 displays the factor loadings after rotation. The subscales that clustered on the first component (*positive reappraisal, putting into perspective, refocus on planning,* and *positive refocusing*) represent the adaptive strategies, and the subscales that clustered on the second component (*catastrophizing, self-blame, rumination, acceptance,* and *blaming others*) represent the maladaptive strategies. The eigenvalue, the percentage of variance that each group of strategies explains, and internal consistency is also presented in Table 3. Both the adaptive and maladaptive strategies showed good reliability.

Table 3

Factor Loadings Based on a Principal Components Analysis (PCA) with orthogonal rotation (varimax) of the Nine CERQ Subscales (*N* = 94)

Rotated Factor Loadings

CERQ subscales	Adaptive strategies	Maladaptive strategies
Positive Reappraisal	.85	
Putting into Perspective	.75	
Refocus on Planning	.75	
Positive Refocusing	.66	
Catastrophizing		.80
Self-blame		.78
Rumination		.75
Acceptance		.58
Blaming others		.44
Eigenvalues	2.60	2.46
% of variance	28.87	27.35
□□	.74	.78

Note. Factor loadings < .4 are suppressed. CERQ = Cognitive Emotion Regulation Questionnaire.

As shown in the results of the PCA, there were four adaptive and five maladaptive strategies. For the purpose of this study, the averages of each category of emotion regulation strategies (adaptive and maladaptive) were calculated. The reason behind this calculation is that the two categories of strategies are not made up of the same number of subscales, which may affect the comparisons. Therefore, having an average score for each participant on adaptive and maladaptive strategies will allow subsequent comparisons to be made.

Main Data Analyses

Question 1: Does puberty status significantly affect the types of coping strategies employed by adolescents?

To answer this question, one-way multivariate analysis of variance (MANOVA) was conducted by having both the adaptive and maladaptive strategies as dependent variables, and the puberty status as (between subject) fixed factor. A significant result was based on a significance value of less than .05. Using Pillai's trace, there was no significant effect of puberty status on the type of coping strategies reported by adolescents, $V = 0.04$, $F(4, 182) = 0.98$, $p = .42$. Means (and standard deviations) of the use of adaptive and maladaptive strategies, as shown in Table 4, indicate that post-pubertal adolescents employed the largest amount of maladaptive strategies followed by the pubertal and then the pre-pubertal groups. The pre-pubertal group

was employed the largest amount of adaptive strategies followed by the post-pubertal and then the pubertal group. However, the differences were not significant, which might be due to the relative small sample size in each group.

Table 4

Means and Standard Deviations of Adaptive and Maladaptive Coping Strategies for Each Group

	Pre-pubertal (n = 23)	Pubertal (n = 33)	Post-pubertal (n = 38)
Type of coping strategies	*M (SD)*	*M (SD)*	*M (SD)*
Maladaptive strategies	9.28 (2.06)	9.60 (2.04)	10.08 (1.99)
Adaptive strategies	12.67 (2.55)	12.15 (2.88)	12.35 (2.85)

Note. n = number of participants, M = mean SD = standard deviation.

Question 2: Are there significant differences in the use of adaptive versus maladaptive coping strategies within each pubertal group?

This question was answered by performing a paired-samples t-test for each group. To account for multiple comparisons, Bonferroni's correction was applied. Therefore, the significant result, for this question, was based on a significance value of less than .017. On average, adolescents in each group reported significantly more adaptive strategies than the maladaptive ones (see Table 4). The t-tests results were: $t(22) = -9.06$, $p < .001$ (two tailed), $r = .89$ for pre-pubertal; $t(32) = -5.24$, $p < .001$ (two tailed), $r = .68$ for pubertal group; and $t(37) = -4.70$, $p < .001$ (two tailed), $r = 61$ for post-pubertal group.

Question 3: Do males and females differ significantly in their use of adaptive and maladaptive coping strategies? If so, which of these strategies are most/least employed by each gender?

In order to investigate the potential differences between males and females in the way they employ adaptive and maladaptive coping strategies, one-way multivariate analysis of variance (MANOVA) was conducted by having both the adaptive and maladaptive strategies

as dependent variables, and the gender as a fixed factor. A significant result was based on a significance value of less than .05. Using Pillai's trace, there was no significant effect of gender on the type of coping strategies reported by adolescents, $V = 0.02$, $F(2, 91) = 0.94$, $p = .40$. This indicates that both male and female adolescents may employ the adaptive and maladaptive cognitive coping strategies to the same level.

Questions 4 and 5: Is there a significant correlation between emotion regulation and the cognitive coping strategies.

The fourth question of this study explores whether there is a significant positive correlation between the use of maladaptive strategies and the emotion dysregulation that adolescents experience. To answer this question, Pearson's correlation coefficient was computed. A significant result was based on a significance value of less than .05. The result showed a significant positive correlation between the two analyzed variables, $r = .39$, *p (one-tailed)* $< .001$, $r^2 = .15$. This correlation indicates that the higher use of maladaptive coping strategies, the higher level of difficulties in emotion regulation (or emotion dysregulation).

The final question of the current study examined whether there is a significant negative correlation between the use of adaptive strategies and the level of emotion dysregulation. To answer this question, Pearson's correlation coefficient was also computed on these two variables. Although the results revealed a negative correlation between the variables (the higher use of adaptive strategies, the less emotion regulation difficulties are experienced), this correlation was small and not significant, at $r = -.025$, *p (one-tailed)*$= .41$.

Discussion

The present study aimed to investigate the effect of pubertal status on the employment of cognitive emotion regulation strategies among adolescents. Unlike previous adolescence studies, instead of categorising adolescents based on their chronological age, the current study classified them based on their pubertal status, to look at the

potential effect of puberty, rather than age, on the development of cognitive emotion regulation. Interestingly, it was found that the use of cognitive coping strategies (adaptive and maladaptive) does not significantly differ across the three groups (pre-pubertal, pubertal, and post-pubertal). This is inconsistent with previous findings (Carey et al., 1980; Diamond et al., 1983; McGivern et al., 2002; Juraska, J. M., & Willing, J., 2017), which reported a decline in the cognitive performance at the age of pubertal onset compared to younger and older groups, suggesting that this decline might be a result of the processes of synaptic proliferation that occur in the frontal cortex during the pubertal onset. Their findings imply that pubertal status may play an important role in adolescents' cognitive development. However, the results of the current study showed no difference between adolescents in different pubertal groups in their employment of cognitive strategies for emotion regulation. This could imply that puberty may have nothing to do with this aspect of cognitive development. On the other hand, we do not know for sure whether there are other factors that could influence the pattern of employing these strategies, such as parenting style, friendships or other environmental and social factors. Indeed, these factors were recently suggested to have a potential influence on the development of cognitive emotion regulation (Suri et al., 2013).

It is important to note that in the current study, the means of the three groups differ slightly, showing that the pubertal group seem to employ less adaptive strategies than pre- and post-pubertal groups. Although this difference was not statistically significant, recruiting a larger sample size in future studies could clear up whether such a difference exists.

Furthermore, it could be possible that the different nature of the variable measured in the current study (emotion regulation strategies) and that of the previous studies (face recognition) plays an important role in detecting changes in cognitive and emotional development during puberty. Although it is suggested that the neural mechanisms underlying emotional development might be associated to the ones underlying cognitive development (Bell & Wolfe, 2004), the cognitive regulatory processes might not be affected by pubertal

changes in the same way as the cognitive processes employed in the face recognition tasks are affected. This could be addressed in future studies by investigating these two variables in one study. Future studies may also consider the other factors that could influence cognitive emotion regulation to enrich our understanding of this aspect of adolescents' development, and to try to explore the relationship between the development of emotion regulation and face recognition in different pubertal groups.

Another possible explanation for what seems to be inconsistency between the current results and the ones found in the face recognition studies might be that the previous studies did not include any tool to assess the pubertal status of the participants due to different reasons. For example, McGivern and his colleagues (2002) were not allowed to measure puberty either directly or via questionnaires because of the school policy. Therefore, they have estimated the age of pubertal onset based on a national data of American children, whereas participants of the current study have been categorised into pubertal groups using the Pubertal Development Scale. This scale has been shown to be reliable and to have an adequate internal consistency in a number of adolescence longitudinal studies (e.g., Marshall & Tanner, 1969; Marshall & Tanner, 1970; Petersen et al., 1988). The same principle applies to the significant differences found between early and late adolescents in employing cognitive emotion regulation strategies in Garnefski and Kraaij' study (2006). Researchers in this study also did not include any puberty measures, instead classifying the adolescents' groups based on their age, which makes it difficult to compare with the current results. However, this could lead us to doubt that it is not the puberty status that influences cognitive strategies use; rather, it might be the age factor or other confounding factors that need to be explored by future studies.

Although the results of the present study found no difference between the pubertal groups in reporting cognitive coping strategies (both adaptive and maladaptive), it was found, as hypothesised, that adolescents in the three groups reported significantly more adaptive than maladaptive strategies. So far, all the previous CERQ studies

with adolescents' population (Garnefski et al., 2001; 2002; 2003; 2005; 2007; Garnefski & Kraaij, 2006) have only investigated the between-, but not the within-, subjects differences in reporting the strategies. However, the data of these studies shows that adolescents, generally, reported more adaptive than maladaptive strategies. . Yet, as these differences were not analysed in these studies, it is difficult to reach a conclusive judgment about the trend of employing cognitive strategies among adolescents. The current results may suggest that pubertal status does not influence either the frequency of employing the strategies, in general, or the frequency of employing a specific type of strategies within a specific pubertal group. The trend of employing more adaptive than maladaptive strategies might be explained by the assumption that individuals during adolescence develop more advanced regulatory and cognitive abilities (Aldwin, 2007). As the current data was obtained from a non-clinical sample, future investigations may explore this trend amongst clinical samples, especially those with emotional disorders, alongside with a non-clinical sample to examine any differences may exist.

Another interesting but unpredicted finding of the current study is the non-significant differences between adolescent males and females in employing the adaptive and maladaptive strategies. As mentioned earlier, CERQ is a relatively new questionnaire in the field of emotion regulation, and it is the first and, so far, the only tool measuring the cognitive components of emotion regulation separately from the behavioural ones. Therefore, gender differences in the cognitive coping strategies have not been fully explored. Only two studies (Garnefski et al., 2004; Garnefski & Kraaij, 2006) have used this questionnaire to investigate the differences between males and females in employing these strategies. Both studies found significant differences between males and females, which seem inconsistent with the current results. The first study (Garnefski et al., 2004) was conducted among adults, and it revealed that females reported higher use of the strategies *rumination*, *catastrophizing* and *positive refocusing* than males did; however, no differences were found in the remaining six strategies. The other study (Garnefski & Kraaij, 2006) compared five samples (ranging from adolescents to elderly) and

found significant gender differences; however, it was not clear from their data among which of the five samples, and in which strategies, the differences existed.

When considering this hypothesis, the results of the current study, however, are somewhat in line with other studies that used different self-report tools to measure coping strategies among adolescents. Silk, Steinberg, and Morris (2003) found no differences between males and females in reporting some coping strategies (such as cognitive restructuring, acceptance, distraction, and positive thinking), which theoretically are considered as cognitive strategies; however, the differences were evident in other strategies like impulsive action, involuntary action, and problem solving, which are thought of as behavioural coping strategies. Taken together, these findings suggest that gender differences in employing cognitive coping strategies may start to emerge with entering adulthood. However, more studies need to be undertaken with adolescents and adults to confirm such a hypothesis. It also seems possible that the current study was unable to detect any gender differences due to the relatively small sample size recruited in each gender, which was because of the limited recruiting time for the study.

The last aim of the current study was to investigate the relationship between the cognitive emotion regulation strategies and the difficulties in emotion regulation (or emotion dysregulation) that adolescents go through in their life. First, there was a moderately positive correlation between the use of maladaptive coping strategies (e.g., *catastrophizing* or *blaming others*) and emotion dysregulation, as the more maladaptive strategies that were reported, the higher the level of emotion dysregulation there was displayed. Previous studies (e.g., Cox et al., 1995; Mennin et al., 2002; Tull et al., 2007) have demonstrated the crucial role that emotion dysregulation plays in the development of different forms of psychopathology, such as depression and anxiety disorders. Also, the higher level of these emotional disorders were positively associated with the higher use of maladaptive strategies (e.g., Garnefski et al., 2001; 2002; 2003; 2005; 2007; Garnefski & Kraaij, 2006).

The relationship found in the current study between emotion dysregulation and maladaptive forms of cognitive coping strategies adds new and valuable knowledge to the existing literature; and suggests an interaction between the three variables (emotion dysregulation, psychopathology and maladaptive cognitive coping strategies) that need to be considered in future studies. One of the possible suggestions is that the higher the use of maladaptive strategies, the higher the level of emotion dysregulation that, in turn, would increase the probability of developing some emotional disorders. However, as the current study is a cross-sectional study and it had no data about the participants' emotional problems, such an assumption could not be established. It is important to note that we cannot make any inferences about whether a higher use of maladaptive strategies leads to more difficulties in regulating one's emotions or that more difficulties in emotion regulation lead to a higher use of maladaptive strategies. Further experimental and longitudinal studies could investigate and provide more explanations about the nature and direction of the relationships between these variables.

Second, the current study found no significant relationship between the adaptive coping strategies (e.g., *putting into perspective* or *refocus on planning*) and emotion dysregulation. It hypothesised that a negative relationship between these two variables would exist, but this was not found. This suggests that the higher use of adaptive strategies does not necessarily reduce the difficulties in emotion regulation one has; neither does the lower level of difficulties in emotion regulation increase the use of adaptive strategies. Although this result was not expected, it could be explained by the multidimensional nature of emotion regulation processes (Weinberg & Klonsky, 2009) and the complexity of adolescents' development (Geiger & Castellino, 2011). The use of cognitive coping strategies and the experience of emotion dysregulation during the period of adolescence might be influenced by various factors such as the adolescent's personality, social life, or the intensity of certain stressful events. Controlling for such factors may lead to different results. This could be done by re-studying the relationship between

the use of adaptive strategies and emotion dysregulation, using different methods such as semi-structured interviews with the adolescents and their parents. This would allow us to deeply understand the different factors that could affect such relationships. An important point to be made from the current study is that promoting adaptive rather than maladaptive forms of coping strategies among adolescents may not be enough to reduce the risk of developing emotional distress, rather, there might be other factors that need to be considered when designing intervention programs for this age group.

This study has some methodological limitations. First, the data regarding the use of cognitive emotion regulation strategies and emotion dysregulation had to be gathered via self-report questionnaires, which may limit our understanding of such developmental aspects, and it may also have caused some bias. Second, the sample was recruited only from general population of North Wales. Therefore, generalising our findings to the wider British adolescent population is questionable. Third, the current results were based on cross-sectional data. Although a clear relationship has been found between maladaptive forms of cognitive coping strategies and emotion dysregulation, the current study does not allow us to draw conclusions regarding the causal relationships among these variables. Additionally, the limited time we had for recruiting the participants contributed to the sample being smaller than it could have been. .

Future investigations could focus on exploring other factors that may have an influence on the use of cognitive coping strategies among adolescents, taking into account the pubertal status as an independent variable rather than only the age of adolescents. Additionally, re-studying the same variables, longitudinally, amongst a larger sample of both clinical and non-clinical adolescents would be beneficial. It would enrich our understanding of the pattern of the employment of cognitive coping strategies amongst a broader population of adolescents, and it would provide more information about the nature of the relationships between these strategies and emotion dysregulation, given that the latter variable has been shown to be an important characteristic of many emotional disorders. It may

also be valuable to supplement the self-report assessment of puberty with other objective assessments, such as hormonal tests or a physical examination, wherever that is possible. This would help in categorising the adolescents more accurately based on their actual pubertal status. As the current study was conducted in a non-clinical setting, it was not possible to utilise such assessments.

In conclusion, despite these limitations, this study, to the best of our knowledge, is probably the first study to explore the potential effect of pubertal status on the employment of cognitive coping strategies among adolescents. Although the current study failed to detect any significant differences between either the pubertal groups or between males and females in employing cognitive coping strategies, it provides an important implication for developing more effective interventions for adolescents with emotional problems. Specifically, the positive relationship found between maladaptive cognitive strategies and emotion dysregulation along with the non-significant correlation found between adaptive strategies and emotion dysregulation. The combination of these two results emphasises the importance for future intervention programmes to not only promote adaptive ways for coping with stress, but simultaneously to help adolescents get rid of the maladaptive cognitive strategies they tend to employ when encountering negative life events. This, consequently, would reduce their chance of going through more serious forms of psychopathology.

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