# The Relationship between Anger Rumination and Aggression in Typically Developing Children and High-Risk Adolescents

Stephanie D. Smith[1] · Haley F. Stephens[2] · Karla Repper[3] · Janet A. Kistner[2]

**Abstract** This paper examines anger rumination as a risk factor of aggression in typically developing children and high-risk adolescents. Study 1 developed and evaluated the psychometric properties of a self-report measure of children's anger rumination (Children's Anger Rumination Scale; CARS) and its association with teacher- and peer-rated overt and relational aggression in school-aged children ($n = 254$, $M$ age = 10.62). Findings offered support for the reliability and validity of the CARS as well as support for the hypothesis that children who ruminate to anger exhibit elevated levels of overt and relational aggression. Study 2 examined concurrent and prospective relationships between anger rumination and aggression and the moderating effects of trait anger in a sample of male juvenile offenders ($n = 119$, $M$ age = 16.74). Latent growth curve analyses revealed that the interaction between trait anger and anger rumination predicted initial levels of aggression (i.e., intercept) and changes in aggression over time (i.e., slope). Juvenile offenders who were high in trait anger and ruminated in response to anger exhibited the highest initial levels of aggression. Contrary to our hypothesis, this group did not exhibit greater increases in aggression over time relative to others, but instead they had stably high levels of aggression at each time point. These findings suggest that cognitive-behavioral treatment strategies for aggression may be improved by educating youths about the contributory role of anger rumination in the development of aggression and providing them with adaptive alternatives to coping with feelings of anger.

**Keywords** Anger rumination · Aggression · School-aged children · Juvenile offenders

Children and adolescents who are aggressive have significantly more immediate and long-term interpersonal, psychological, and educational difficulties than their non-aggressive peers (Berkowitz 1993; Dodge and Coie 1987; Parker and Asher 1987; Kupersmidt and Coie 1990). Aggressive youths also place an excessive strain on families, schools, as well as on correctional and mental health systems (Abikoff and Klein 1992). Consequently, it is a high priority to identify factors that contribute to aggression among children and adolescents, especially those factors that may be amenable to interventions. One promising area of research that may enhance our understanding and treatment of aggressive youths is the study of anger rumination.

Rumination refers to a maladaptive cognitive response to negative affect that is characterized by repetitive, intrusive thoughts that focus attention on one's feelings. According to the response styles theory (Nolen-Hoeksema 1991), rumination leads to more intense, sustained negative affect which, in turn, may lead to maladaptive behaviors. Most research focused on the response styles theory examines the role of sadness rumination in the development and maintenance of depressive symptoms (e.g., Abela et al. 2002; Driscoll et al. 2009; Just and Alloy 1997; Nolen-Hoeksema 1991; Ziegert and Kistner 2002). However, in recent years, research has expanded to include rumination to anger and its contributions to aggression (e.g., Bushman 2002, Peled and Moretti 2007).

Evidence of a link between anger rumination and aggression is based primarily on studies conducted with adults (e.g.,

✉ Stephanie D. Smith
SD.Smith@usm.edu

[1] Department of Psychology, The University of Southern Mississippi, 118 College Drive, #5025, Hattiesburg, MS 39406, USA

[2] The Florida State University, Tallahassee, FL, USA

[3] Baptist Health, Jacksonville, FL, USA

Anestis et al. 2009; Bushman et al. 2005; Vasquez et al. 2007). A few recent studies have extended this line of research to adolescents and children (Caprara et al. 2007; Peled and Moretti 2007; Peña and Pacheco 2012; Vasquez et al. 2012). In a sample of adolescents, Vasquez et al. (2012) found that anger rumination was a significant predictor of displaced aggression (i.e., retaliation against an innocent victim) even after taking into account trait anger, trait hostility, and trait irritability. When examining developmental trajectories of adolescents, Caprara et al. (2007) found that high and stable levels of anger rumination were positively linked with aggression and conduct problems (i.e., gang affiliation, use of weapons) whereas low or decreasing levels of anger rumination were negatively linked to these outcomes. In the only study to include a subset of children in a primarily adolescent sample (M age = 13.99, Range = 11 to 18), rumination, as a general coping strategy, was found to be a significant predictor of aggression, but only for male participants (Peña and Pacheco 2012).

With one exception (Peled and Moretti 2007), this body of research has focused on nonclinical samples of children and adolescents. In the only study examining anger rumination in a sample of adolescents exhibiting highly aggressive behaviors where one group comprised of offenders from state correctional facilities and the other of youths referred to an assessment program for severe conduct problems (Peled and Moretti 2007), it was revealed that both anger and anger rumination *independently* and *concurrently* predicted aggression. Interestingly, these results did not vary as a function of gender or location (i.e., assessment program, correctional facility). Based on these findings, it appears that anger rumination may play an important role in the development of aggression prior to adulthood.

Despite theoretical and empirical support for an association between anger rumination and aggression in youths, some important questions remain unanswered and methodological shortcomings limit the conclusions that can be drawn. Specifically, it is still yet to be determined whether the tendency to ruminate in response to anger is prevalent prior to adolescence or if anger rumination is associated with children's aggression, as age differences were not explored in the one study using a combined child and adolescent sample (age range = 11 to 18) and no known studies have used exclusively child participants. Moreover, established measures of anger rumination for younger populations are lacking so most studies have relied on adult measures when assessing this construct in adolescents and older children (i.e., age 11 and above). Therefore, there is a need in the research literature to develop a measure that assesses anger rumination in more developmentally appropriate ways (e.g., reading level matches the ability of participants) so that this response style may be studied across the lifespan. It is also unclear whether anger rumination is indeed a *risk factor* of aggression in

children and adolescents, as prior studies have primarily used cross-sectional designs. In fact, no known studies have examined whether anger rumination is prospectively associated with aggressive outcomes in youths from high-risk or clinical populations. Finally, potential mechanisms underlying or perhaps strengthening the relationship between anger rumination and aggression have yet to be explored.

Given the negative outcomes associated with aggression and the pressing need to identify risk factors that are associated with aggressive behavior, the present study sought to address these questions in an effort to improve our understanding of the relationship between anger rumination and aggression in children and adolescents. In order to achieve this goal, data are presented from two studies that were designed to circumvent several methodological shortcomings of previous research. The first study evaluated the psychometric properties of the Children's Anger Rumination Scale (CARS), an adaptation of the Anger Rumination Scale (ARS; Sukhodolsky et al. 2001), in a sample of school-aged children for the purpose of determining whether this construct is measurable in younger populations and if scores on the CARS were related to teacher and peer ratings of aggression. The second study used longitudinal data to examine prospective relationships between anger rumination, as measured by the CARS, and aggression among high-risk adolescents. The potential moderating effect of trait anger was also explored because it was speculated that high-risk adolescents who ruminate to feelings of anger and have high levels of trait anger would be most likely to exhibit aggression.

## Study 1

Study 1 examined associations between anger rumination and aggression in a sample of children in grades 2 through 7. This is an important age group to study because aggression is quite stable by middle childhood and is associated with serious negative outcomes (for review, see Card et al. 2008). Also, there is evidence that children in this age range have sufficient cognitive maturity to provide reliable and valid responses to self-report measures of response styles, albeit this evidence is limited to children's sadness rumination (e.g., Abela et al. 2002; Driscoll et al. 2009; Lopez and Kistner 2006; Ziegert and Kistner 2002). The first goal of this study was to use a developmentally appropriate and psychometrically sound measure to assess anger rumination in children. To achieve this goal, the most commonly used measure of anger rumination (i.e., ARS) was adapted for the purpose of this study, as there were concerns about its reading level and complex sentence structure for use with children and even some adolescents. The ARS was changed as minimally as possible while enhancing the developmental appropriateness of the measure for children in the late elementary school years. To assess the

comparability of our adapted version (i.e., CARS) to the ARS, it was evaluated in terms of its reliability and factor structure. The second goal of this study was to extend research on anger rumination and aggression to children by examining associations between self-reported anger rumination and teacher and peer ratings of aggression. Both overt aggression (i.e., physical or verbal assault, threats, or insults) and relational aggression (i.e., behaviors that are intended to harm another's reputation or social relationships) were assessed in this study. There is evidence to suggest that boys may exhibit more overt aggression than girls, while girls may engage in more relational aggression than boys (e.g., Crick 1996). Previous research with adolescents has also found that anger rumination is associated with increased levels of both forms of aggression (Peled and Moretti 2007) and important associations might be missed if aggressive behaviors relevant to both boys *and* girls are not considered. Based on the extant literature, it was anticipated that anger rumination would be associated with elevated levels of overt and relational aggression, after taking into account key demographic variables (i.e., sex, age, family income).

## Method

### Participants

The sample included 254 school-aged children (mean age = 10.62 years, SD = 1.78; 50.4 % female; 66.5 % Caucasian, 19.7 % African American, 7.9 % Hispanic, 0.8 % Asian/Pacific Islander, and 5.1 % Biracial) in grades 2 through 7 of a public, university-affiliated school located in a southeastern state in the United States. The mean family income of the study participants was $56,394.25 (SD = $33,261.13).

### Measures

**Children's Anger Rumination Scale (CARS)** The CARS is a 19-item, Likert scale, self-report questionnaire adapted from the Anger Rumination Scale (ARS; Sukhodolsky et al. 2001). The ARS is comprised of four subscales, which have been labeled as follows: 1) Angry, Afterthoughts (alpha = .86; 6 items; e.g., "Whenever I experience anger, I keep thinking about it for a while"); 2) Thoughts of Revenge (alpha = .72; 4 items; e.g., "When someone makes me angry I can't stop thinking about how to get back at this person"); 3) Angry Memories (alpha = .85; 5 items; e.g., "I keep thinking about events that angered me for a long time"; and 4) Understanding of Causes (alpha = .77; 4 items; e.g., "I think about the reasons people treat me badly") (Sukhodolsky et al. 2001). There is strong support for the reliability and validity of the ARS (Sukhodolsky et al. 2001; Maxwell 2004; Anestis et al. 2009). The CARS consists of 9 items from the ARS that were kept exactly the same and 10 items that were modified by changing vocabulary and/or

sentence structure to be more developmentally appropriate for children. For example, item 1 on the ARS, "I ruminate about my past anger experiences", was revised to read, "I think a lot about other times when I was angry". Items were changed as minimally as possible to maximize the similarity with the ARS. See Appendix A for changes made to the ARS at the item-level for the purpose of creating the CARS. Permission was obtained from the author of the ARS to modify this measure for the purposes of this study. Please note that reliability and validity data for the CARS is reported in the results section.

**Peer Sociometric Nominations** Overt and relational aggression were assessed using a peer nomination procedure that asks participants to nominate from a list of classmates those who best fit 10 descriptors of aggression (Crick 1995; Crick and Grotpeter 1995). Children nominated classmates on five descriptors of *overt aggression* (e.g., hits, kicks, punches others; says mean things to insult others or puts them down) and five descriptors of *relational aggression* (e.g., tries to make other kids not like a certain person by spreading rumors about them; when mad at a person, gets even by keeping the person from being in their group of friends). The peer nomination method was used for the purposes of this study since it is the oldest and most commonly used form of peer-referenced assessment (Asher & Hymel, 1981) and thus has the most documented evidence of reliability and validity, including for use in the assessment of aggression (e.g., Walker et al., 1991; Coie and Dodge, 1983; Jiang & Cillessen, 2005). Nomination scores were standardized within grade. Cronbach's alphas for the peer overt aggression and peer relational aggression nomination scales were .97 and .96, respectively.

**Children's Social Behavior Scale – Teacher Form (CSBS – T; Crick 1996)** The CSBS – T consists of 15-items depicting overt aggression, relational aggression, and prosocial behavior (only the aggression items were examined in this study). The aggression items are virtually identical to the descriptors used for peer nominations. Items were rated by teachers on a 5-point Likert scale (1 = Never True to 5 = Almost Always True) with higher scores representing higher ratings of aggression. Across studies, Crick and colleagues (Crick 1996) have reported internal consistency reliabilities that ranged from .70 to .94. The Cronbach's alpha was .99 for both the overt and relational subscales in this study.

**Demographics** Age, sex, family income, and ethnicity data were obtained for the sample from school records.

### Procedure

All study procedures were approved by the Institutional Review Board (IRB) and the school at which data collection took place. Informed consent was obtained from parents or

guardians, and all child participants gave informed assent. Prior to completing each study measure, children were informed about confidentiality and given oral and written directions. Data were collected in a small group format (i.e., 4 to 6 children) and research assistants were available to answer questions and monitor the administration so that the children did not discuss their answers with each other. If needed, measures were read to participants on an individual basis. To assess its stability, the CARS was re-administered to participants approximately 10 months after the initial administration using the same instructions and procedures.

## Results

Prior to conducting analyses, all variables were examined for assumptions of normality and linearity, skewness and kurtosis, and univariate and multivariate outliers. Necessary adjustments to the data were made according to data screening and handling procedures outlined by Tabachnick and Fidell (2001). Specifically, a square root transformation was conducted to correct for non-normality of the overt aggression subscale of the Social Behavior Scale. The maximum likelihood approach was used to handle missing data for all study measures. Ten children were missing teacher ratings of aggression. These missing data stemmed from the fact that two teachers who agreed to complete measures left the school before the project could be completed and there was not enough time for the new teachers to become familiar enough with the children's social behaviors to complete the questionnaires. Also, three children failed to complete the CARS due to repeated absences and another six children skipped several items on the CARS. Means, standard deviations, and intercorrelations for all predictor, outcome, and demographic variables are presented in Table 1. Peer-rated measures of overt and relational aggression were highly correlated, as were the correlations between the teachers' ratings for these two forms of aggression. Correlations across informants for overt and relational aggression were of moderate strength. Anger rumination was significantly and positively correlated with peer-rated and teacher-rated measures of overt and relational aggression.

### Reliability and Factor Structure of the CARS

The first set of analyses focused on the reliability and factor structure of the children's anger rumination scale (i.e., CARS). Reliability analyses revealed that the CARS total score and subscales had adequate internal consistency (alphas ranged from .70 to .92) and 10-month stability ($r = .46$), which is consistent with past research of the ARS (Sukhodolsky et al. 2001; Anestis et al. 2009; Ciesla et al. 2011). All subscales

significantly correlated with the total score ($r$'s ranged from .83 to .93) and with each other ($r$'s ranged from .53 to .76).

Prior research of the ARS has revealed support for both single and four-factor solutions (Maxwell 2004; Sukhodolsky et al. 2001). A confirmatory factor analysis in an independent sample conducted by Sukhodolsky et al. (2001) also supported a 4-factor model. Confirmatory factor analyses (CFA) using MPlus 5.21 (Muthén and Muthén 2006) were performed to assess how well the 19 items comprising the CARS fit both 1- and 4-factor model solutions. Model fit was determined using the Comparative Fit Index (CFI; Bentler 1990), the Tucker-Lewis Index (TLI; Brown 2006), the Standardized Root Mean Square Residual (SRMR; Bentler 1995), and the Root Mean Square Error of Approximation (RMSEA; Steiger 1990). Both the 1- and 4-factor models adequately fit the data (CFA fit statistics appear in Table 2); however, results of a $\chi^2$ difference test indicated that the 4-factor model outperformed the 1-factor model, $\chi^2(6) = 78.79$, $p < .001$. To assess whether these models had equivalent factor structures for boys versus girls and for younger (i.e., grades 2–4) versus older (grades 5–7) children, a series of multi-group CFAs were conducted. Results indicated that the factor structure of the CARS was invariant across sex and age for this sample.

### Relationship between Anger Rumination and Aggression in Children

Multiple regression analyses were used to examine associations between anger rumination and informant ratings of overt and relational aggression, controlling for demographic variables (i.e., age, sex, and family income). To facilitate generalization of our results, moderating effects of sex and age on associations between anger rumination and aggression were also examined. In keeping with prior research on anger rumination (Anestis et al. 2009; Maxwell 2004; Sukhodolsky et al. 2001), including studies that found support for the four factor structure of the ARS (Sukhodolsky et al. 2001), the total score of the CARS, rather than the four subscale scores, was used as the predictor variable in our regression models. Given the high internal consistency and adequate fit of the 1-factor model to our data, the total CARS score was thought to be an appropriate predictor. Moreover, by using the total CARS score rather than the subscale scores to predict aggression, the total number of analyses were subsequently minimized.[1]

Age, sex, and family income were entered on the first step, CARS total scores were entered on the second step, and the CARS x Age and CARS x Sex interactions were entered on

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[1] Given the added specificity of examining the relationships between the four CARS subscales and aggression, we ran regression models using subscale scores as predictors while controlling for age, sex and family income. The results of these analyses revealed that each of the four subscale scores significantly predicted all of the aggression outcome variables (p's < .05); findings that are available upon request.

**Table 1** Descriptive statistics and correlations among measures of anger rumination, aggression, and demographic variables for study 1

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Sex |  | .00 | −.08 | −.24* | −.34* | −.16* | −.15* | .08 |
| 2. Age |  |  | .00 | −.21* | .12 | .15* | .08 | .10 |
| 3. Family income |  |  |  | −.00 | −.07 | −.09 | −.15* | .08 |
| 4. CARS |  |  |  |  | .27* | .27* | .25* | .20* |
| 5. Peer-Overt |  |  |  |  |  | .86* | .67* | .50* |
| 6. Peer-Relational |  |  |  |  |  |  | .63* | .58* |
| 7. Teacher-Overt |  |  |  |  |  |  |  | .72* |
| 8. Teacher-Relational |  |  |  |  |  |  |  |  |
| Mean |  | 127.26 | 56,394.25 | 2.10 | −.04 | −.01 | 1.11 | 2.02 |
| SD |  | 21.39 | 33,261.13 | .69 | .96 | .99 | .58 | .99 |

*CARS* Children's Anger Rumination Scale, *Teacher Overt* Social Behavioral Scale – Overt Aggression subscale, *Teacher Relational* Social Behavioral Scale – Relational Aggression subscale, *Peer Overt* Peer-rated overt aggression, *Peer Relational* Peer-rated relational aggression

Age was measured in years

*p-value < .05

the third step. As these two-way interactions did not significantly add to the prediction of any of the aggression measures, the results of all regression analyses are reported without their inclusion (see Table 3). In accord with our predictions, anger rumination was significantly and positively associated with peer-overt ($\beta = .27$, $t = 4.40$, $p < .001$), peer-relational ($\beta = .26$, $t = 4.22$, $p < .001$), teacher-overt ($\beta = .27$, $t = 4.10$, $p < .001$), and teacher-relational ($\beta = .19$, $t = 3.00$, $p < .01$) aggression after controlling for sex, age, and family income.

## Discussion

The results of Study 1 suggest that the CARS is a reliable and valid measure of anger rumination in middle childhood through early adolescence. More specifically, an evaluation of its psychometric properties found support for its factor structure, as it was comparable to what has been found with the ARS when administered to adults (Sukhodolsky et al. 2001; Maxwell 2004). Moreover, the CARS factor structure for this sample was equivalent across boys and girls and younger and older children. Both the subscale scores and total score

**Table 2** Fit statistics for the Confirmatory Factor Analysis of the Children's Anger Rumination Scale

| Fit Statistic | 4-factor Model | 1-factor Model |
|---|---|---|
| $X^2$ (df) | 341.26 (147)* | 374.15 (152)* |
| CFI | .92 | .90 |
| TLI | .90 | .89 |
| RMSEA | .06 | .07 |
| SRMR | .06 | .05 |

*p-value < .05

of the CARS evidenced good internal consistency, 10-month stability, and its association with aggression offered some support of construct validity. Overall, these results suggest that the CARS is a promising measure of anger rumination for use with children and that further examination of its psychometric properties is warranted (e.g., convergent/divergent validity).

In addition to Study 1 providing evidence that anger rumination is a relevant and measurable response style in children, anger rumination was also found to be significantly related to overt and relational aggression at this stage in development. These results suggest that children who ruminate about feelings of anger are not only more likely to demonstrate direct forms of aggression that are intended to verbally or physically hurt others, but also indirect forms of aggression that are damaging to the social relationships of the perpetrator's victims. This replication and extension of findings from previous research with adults and adolescents (e.g., Bushman et al. 2005; Peled and Moretti 2007) is an important contribution to the literature, as childhood aggression is especially pernicious in terms of the developmental outcomes of children who commit aggressive acts and the negative consequences experienced by their victims.

The results of this study also revealed that anger rumination predicted teacher-rated *and* peer-nominated aggression; measures that have strong evidence of external validity (Henry, D.B. and The Metropolitan Area Child Study Research Group 2006; Kamphaus and Frick 2002). Indeed, the measures used to assess aggression in this study are the gold standards for identifying children with clinically elevated aggression such as children meeting criteria for disruptive behavior disorders (i.e., clinical disorders for which aggression is often present) and are often used to evaluate the success of interventions by determining if children's levels of aggression are in fact abating following treatment in their naturalistic settings (e.g., home, classroom,

**Table 3** Predicting peer and teacher reports of overt and relational aggression from children's responses to the Children's Anger Rumination Scale

| Dependent Variable | Predictors | B | SE B | Beta | t | R² Change | F Change |
|---|---|---|---|---|---|---|---|
| Peer –Overt | Step 1 | | | | | .13 | 11.81* |
| | Sex | −.64 | .12 | −.33 | −5.45* | | |
| | Family income | .01 | .01 | −.09 | −1.49 | | |
| | Age | .36 | .16 | .14 | 2.21* | | |
| | Step 2 | | | | | .06 | 16.92* |
| | CARS | .25 | .06 | .26 | 4.13* | | |
| Peer-Relational | Step 1 | | | | | .05 | 4.39* |
| | Sex | −.32 | .13 | −.16 | −2.52* | | |
| | Family income | .01 | .01 | −.10 | −1.53 | | |
| | Age | .15 | .06 | .15 | 2.28* | | |
| | Step 2 | | | | | .08 | 20.61* |
| | CARS | .29 | .07 | .29 | 4.54* | | |
| Teacher-Overt | Step 1 | | | | | .06 | 4.51* |
| | Sex | −.17 | .07 | −.16 | −2.54* | | |
| | Family income | .00 | .01 | −.16 | −2.61* | | |
| | Age | .04 | .03 | .08 | 1.30 | | |
| | Step 2 | | | | | .06 | 15.66* |
| | CARS | .13 | .03 | .26 | 3.96* | | |
| Teacher-Relational | Step 1 | | | | | .03 | 2.31 |
| | Sex | .64 | .63 | .07 | 1.02 | | |
| | Family income | −.01 | .01 | −.11 | −1.76 | | |
| | Age | .51 | .32 | .10 | 1.58 | | |
| | Step 2 | | | | | .06 | 15.74* |
| | CARS | 1.27 | .32 | .26 | 3.97* | | |

*CARS* Children's Anger Rumination Scale, *Peer Overt* Peer-rated overt aggression, *Peer Relational* Peer-rated relational aggression, *Teacher Overt* Social Behavioral Scale – Overt Aggression subscale, *Teacher Relational* Social Behavioral Scale – Relational Aggression subscale

*$p$-value < .05

playground). Thus, our findings build upon the results of prior research, which have primarily relied on self-reports or laboratory paradigms of aggression, and offer strong support for the hypothesis that anger rumination is associated with externally valid measures of aggression.

## Study 2

Given our limited understanding of what predisposes high-risk adolescents to engage in chronically aggressive behaviors, study 2 aimed to evaluate whether anger rumination is indeed a risk factor of aggression in male juvenile offenders while adding to the extant literature in two important ways. First, it examined the *prospective* relationship between anger rumination and aggression in juvenile offenders, which attempted to replicate and build upon the findings of Peled and Moretti (2007) who found significant and concurrent associations between these two variables in adolescents with a history of chronically aggressive behaviors. Second, this study was the first to explore the potential moderating effect of trait anger in order to understand if

anger accounted for or strengthened this relationship. It is important to note that the CARS was also used to assess anger rumination in this study, as it better matched the reading level of our participants. In keeping with the aims of study 2, the following hypotheses were tested: 1) trait anger and anger rumination would predict initial levels of aggression and increases in aggression over time among juvenile offenders during their incarceration and, 2) the relationship between anger rumination and aggression was expected to strengthen for juvenile offenders exhibiting high levels of trait anger.

## Method

### Participants

The sample in study 2 comprised of 119 adolescent males (M age = 16.74, SD = .98, Range = 14–18) who were incarcerated in a maximum security residential facility for juvenile offenders. At the time of their admission, the average number of adjudicated offenses was 9 where 18 % were violent offenses,

39 % were property offenses, 2 % were drug offenses, and 41 % were miscellaneous offenses (e.g., probation violation, disorderly conduct). The mean age of these adolescents at the time of their first adjudicated offense was 14.37 years (SD = 1.78). Thirty percent of the sample was European American and 70 % was African American. Most of these juvenile offenders (i.e., 76 %) had been enrolled in the tenth grade or higher when entering the facility and about half of the sample (i.e., 48 %) received special education services while in school. The average reading level of the sample in terms of grade equivalency was 6.65 (SD = 3.10). The data used in this study were collected as part of the facility's treatment evaluation protocol and permission to use these data was received from the Department of Juvenile Justice (DJJ) and from the Internal Review Board (IRB) of the institution conducting this research prior to the initiation of any study procedures. As these data were archival, formal consent for this study was not required.

## Measures

**Children's Anger Rumination Scale (CARS)** As mentioned previously, the CARS was used as a measure of anger rumination for this sample considering the Anger Rumination Scale (ARS; Sukhodolsky et al. 2001) included some words at the twelfth grade reading level and we wanted to ensure comprehension on behalf of all juvenile offenders. The internal consistency ($\alpha$ = .91) and 5-month stability (r = .56) of the CARS total score for this sample was in line with prior research (Sukhodolsky et al. 2001; Maxwell 2004). The four subscales of the CARS also had acceptable internal consistencies ($\alpha$'s ranged from .65 to .79) and significantly correlated with the total score (r's ranged from .74 to .88) and with each other (r's ranged from .49 to .88). Results of a confirmatory factor analysis demonstrated that the 4-factor model was an adequate fit to the data, $\chi^2(146) = 232.78$, $p < .001$; TLI = .87, CFI = .89, RMSEA = .07, SRMR = .06, which was also found to significantly outperform the 1-factor model, $\chi^2(6) = 47.42$, $p < .001$.

**State-Trait Anger Expression Inventory–2 Child and Adolescent (STAXI-2 C/A)** The 35-item STAXI-2 C/A was adapted from the 57-item STAXI-2 to measure anger in children and adolescents aged 9 to 18 years. The conceptual structure of the STAXI-2 C/A is highly similar to both the STAXI and the STAXI-2, which was based on extensive research conducted for more than two decades by Spielberger (1988, 1999). The STAXI-2 C/A is comprised of five scales that assess state anger, trait anger, anger expression-in, anger expression-out, and anger control. For the purposes of this study, the trait anger scale was used as a measure of anger because we were interested in assessing chronic feelings of anger and not feelings of anger "in the moment" (i.e., state anger) and trait anger has been consistently used in previous studies of anger rumination (e.g., Anestis et al. 2009; Peled and Moretti 2007; 2010). The internal

consistency coefficient alpha of the trait anger subscale was .86 for this sample; results that are consistent with the findings found for the STAXI-2 C/A and STAXI-2 (Brunner and Spielberger 2009; Kollar et al. 1991). The two subscales that form the trait anger scale also had acceptable internal consistencies (anger temperament $\alpha$ = .82 and anger reaction $\alpha$ = .77) and were significantly and positively correlated (r = .60).

**Aggressive Behaviors** Staff members at the DJJ facility recorded the number of behavioral write-ups for rule violations that each juvenile offender incurred while incarcerated. These rule violations ranged in severity from minor violations (e.g., stealing/trading food) to major violations (e.g., inciting a riot). Four highly trained research assistants coded the descriptions of these rule violations across a five month time frame by assigning them to one of twelve different behavior categories (e.g., disruptive, destructive, physical aggression). The interrater reliability estimates for each behavior category over the five months of coded data were excellent ($\kappa \geq .92$). The number of rule violations per month disaggregated by behavior category were summed and recorded. Following the protocol of Kosson et al. (1990), which has been employed by other studies using criminal offense data for juvenile offenders (e.g., Dodge et al. 1990), the physical aggression, verbal aggression, threatening behavior, and sexual behavior categories were conceptualized as aggressive behaviors (see Table 4 for how behaviors were classified into the four aggressive behavior categories). The totals from each of the four aggressive behavior categories were summed at each month to form five composite measures of aggression where each of these data points referred to one month's worth of aggression. The aggressive behavior categories were moderately correlated with each other (r's ranged from .30 to .52) with the exception of the association between the sexual and threatening behavior categories (r = .10).

**Demographic Information and Covariates** Demographic information (e.g., age, ethnicity, types of criminal offenses, grade level) was obtained for the sample from their clinical files maintained at the facility. Moreover, the age of first arrest and total number of past offenses were used as covariates and gathered from the adolescents' official DJJ records.

## Procedures

Study participants completed the self-report measures described above as part of an assessment battery designed to evaluate their progress in treatment. The measures were administered between two and four weeks following their arrival in order to allow for their adjustment to the facility. A team of graduate and undergraduate psychology students administered the measures to the incoming adolescents on an individual basis and read the measures aloud when necessary. They were encouraged to ask questions if they did not understand

**Table 4** Classification of aggressive behaviors

| Verbal Aggression | Physical Aggression |
| --- | --- |
| Profanity w/o qualifier | Fighting other youth |
| Gross profanity directed to staff/peers | Harm to others |
| Attempting to verbally get staff/peers into altercation | Hitting/kicking/biting staff or peers |
| Arguing/yelling at staff/peers | Trying to provoke others into physical altercation |
| | Throwing objects intentionally at others |
| | Inciting a riot |
| Threatening Behavior | Sexual Behavior |
| Threatening staff/peers | Sex play/sexual coercion |
| Getting in staff's face/yelling in staff's face | Indecent exposure (e.g., exposing sex organs) |
| Making threatening gestures | Sexual misbehavior (e.g., fondling self publicly) |
| Possession of a weapon | Saying something sexual in nature to staff/peers |
| Gang evidence (gang contraband/items implying gang affiliation) | Sexual gestures directed at staff/peers |

the directions or needed help understanding the items. Demographic information, age of first arrest, and total number of past offenses were recorded directly from the juvenile offenders' de-identified clinical files by trained psychology graduate students. De-identified behavior data were obtained from the DJJ facility staff and were coded across a five month time period beginning on the date that the self-report measures were completed. It should be noted that the minimum length of stay at this juvenile justice facility was 9 months. However, the facility was undergoing changes and downsizing the juvenile population at the time these data were collected. Therefore, twenty participants (16 % of the sample) were transferred to another juvenile justice facility prior to the end of this 5-month tracking period and their expected time of discharge so these data were treated as missing.

## Results

### Data Preparation & Analytic Strategy

The same data screening and handling procedures described in Study 1 were followed when preparing Study 2 data for analyses. Univariate outliers were identified for the total score of the CARS, the total number of past offenses, and the composite aggression measure at each time point. These measures were also found to be positively skewed and leptokurtic. Considering no differences were found in the outcome of the main analyses when the outliers were replaced with less extreme values (i.e., the median plus or minus 2 interquartile ranges), thus addressing the non-normality of these variables, the results were presented using only the raw data. The maximum likelihood approach was used to handle missing data for the self-report measures (<1 % missing data). Multiple

imputation was used to approximate values for the composite aggression measure, as 10 % of the data were missing at each monthly time point and these data were not missing completely at random according to the results of Little's MCAR test. Means, standard deviations, and intercorrelations for all study variables and covariates are presented in Table 5. Most notably, anger rumination was found to be significantly and positively correlated with trait anger and initial levels of aggression. However, trait anger was not related to any measures of aggression (i.e., aggression at month 0 and months 1–4).

To test the main hypotheses of this study, a series of latent growth curve models using Mplus software (Muthén & Muthén, 2006) were run to examine the relationship between the predictor variables (i.e., trait anger and anger rumination) and initial levels of aggression (i.e., intercept/month 0) and subsequent changes in aggression across a four month period (i.e., slope/months 1 through 4). Unconditional growth curve models were estimated to identify the optimal functional form (e.g., linear, quadratic) of the growth trajectory (Duncan et al. 1999). The predictor variables were then added to the correctly identified unconditional model to explain random variability in initial levels of aggression and changes in aggression over time. Model fit was determined using the Comparative Fit Index (CFI; Bentler 1990), the Tucker-Lewis Index (TLI; Brown 2006), the Standardized Root Mean Square Residual (SRMR; Bentler 1995), and the Root Mean Square Error of Approximation (RMSEA; Steiger 1990; Steiger and Lind 1980).

### Latent Growth Curve Models

The unconditional growth curve models were tested with and without a quadratic latent slope and were compared using the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), with smaller scores indicating a better model

**Table 5** Means, standard deviations, and intercorrelations between anger rumination, trait anger, covariates and aggression for study 2

|                          | 1 | 2     | 3     | 4      | 5     | 6     |
|--------------------------|---|-------|-------|--------|-------|-------|
| 1. CARS total score      |   | .70*  | .01   | .03    | .25*  | .12   |
| 2. STAXI-2 C/A trait anger |   |       | .07   | −.02   | .14   | .10   |
| 3. Age of 1st offense    |   |       |       | −.36*  | .02   | .07   |
| 4. Total # of offenses   |   |       |       |        | .08   | −.07  |
| 5. Aggression Month 0    |   |       |       |        |       | .32*  |
| 6. Aggression Months 1–4 |   |       |       |        |       |       |
| Mean                     |   | 33.58 | 18.17 | 12.90  | 19.83 | 10.22 | 8.65 |
| SD                       |   | 9.48  | 4.62  | 2.31   | 13.18 | 10.38 | 9.13 |

*CARS* Children's Anger Rumination Scale, *STAXI-2 C/A* State-Trait Anger Expression Inventory-2 Child and Adolescent

*\*p-value < .05*

fit (Bollen and Curran 2006). Although inspection of the means suggested a nonlinear growth trajectory, the model with a linear term (AIC = 3132.33, BIC = 3175.68) outperformed the model with the quadratic term (AIC = 3142.61, BIC = 3187.08). Moreover, the quadratic term when entered into the model did not significantly differ from zero. By allowing residuals to correlate, the unconditional model with the linear term was a good fit to the data, $\chi^2(8) = 13.09$, $p = .11$; TLI = .93, CFI = .95, RMSEA = .06, SRMR = .07.

A conditional model was then estimated which included the centered total CARS score, the centered trait anger score, the interaction term comprising these two variables, and the two covariates as predictors of initial levels of aggression (i.e., intercept) and changes in aggression over time (i.e., slope). This model (see Table 6) was an excellent fit to the data, as qualified by the following fit indices: $\chi^2(23) = 18.69$, $p = .72$; TLI = 1.08, CFI = 1.00, RMSEA < .01, SRMR = .04. The anger rumination x trait anger interaction was found to be a significant predictor of the intercept ($P = .23$, $p < .04$) and slope ($P = −.22$, $p = .05$), but no other significant paths emerged.

As expected, the simple effects of the intercept revealed a significant and positive relationship between anger rumination and initial levels of aggression for those adolescents high in trait anger ($P = .34$, $p < .02$). In order to interpret the significant interaction term for slope, which should be conceptualized as a three-way interaction between anger rumination, trait anger, and time, simple slopes were calculated using the methods outlined by Preacher et al. (2006). (See Fig. 1 for a graphical depiction of this interaction.) An examination of the simple slopes revealed only one marginally significant finding ($P = .26$, $p = .07$) where the change in aggression over time was steepest for those adolescents who were high in trait anger and low in anger rumination. Therefore, the hypothesis that high anger rumination coupled with high trait anger would be associated with the greatest increases in aggression over time was not supported. Instead, Fig. 1 clearly shows that adolescents

high in trait anger and high in anger rumination exhibited stably elevated levels of aggression across a 5-month time frame.

## Discussion

A primary aim of Study 2 was to add to the existing literature by examining concurrent and prospective links between trait anger, anger rumination, and aggression in a sample of male juvenile offenders. Moreover, trait anger was tested as a moderator whereby the relationship between anger rumination and aggression was expected to strengthen for those adolescents exhibiting high levels of trait anger. As expected, trait anger emerged as a moderator in the relationship between anger rumination and initial levels of aggression and changes in aggression over time; however, the pattern of results differed slightly depending on whether concurrent or prospective associations with aggression were under consideration. In terms of concurrent associations, the results were consistent with the proposed hypothesis, as a significant and positive relationship between anger rumination and initial levels of aggression was found for juvenile offenders high in trait anger. This finding fits well with Nolen-Hoeksema's response styles theory (1987, 1991, 1996), which posits that anger will more likely result in an aggressive outcome if one ruminates to anger as opposed to using a more adaptive strategy. Therefore, it would follow that juvenile offenders who feel heightened levels of anger and ruminate in response to that anger would exhibit elevated levels of aggression.

Regarding prospective associations, marginally significant increases in aggression over time were only found for those adolescents high in trait anger and low in anger rumination. These results were unexpected, as we hypothesized that juvenile offenders with the highest levels of both predictors (i.e., trait anger, anger rumination) would exhibit the steepest increase in aggressive behaviors over time. Instead, as seen in Fig. 1, high and stable levels of aggression appear to characterize this group. Perhaps a significant increase in aggression over time was not possible for these juvenile offenders because they already displayed the highest levels of initial aggression, which is

**Table 6** Standardized parameter estimates, standard errors, and statistical significance of the conditional LGC model

|                      | Intercept | | | Slope | | |
|----------------------|-----------|-----|-------|----------|-----|-------|
|                      | Estimate  | SE  | *p*   | Estimate | SE  | *p*   |
| CARS total score     | .15       | .14 | .30   | −.08     | .15 | .61   |
| STAXI-2 C/A trait anger | .02    | .14 | .92   | −.01     | .15 | .98   |
| CARS x trait anger   | **.23**   | **.11** | **< .04** | **−.22** | **.11** | **< .05** |
| Age of 1st offense   | −.14      | .10 | .18   | .15      | .10 | .14   |
| Total # of offenses  | .11       | .10 | .26   | −.19     | .10 | .07   |

*CARS* Children's Anger Rumination Scale, *STAXI-2 C/A* State-Trait Anger Expression Inventory-2 Child and Adolescent
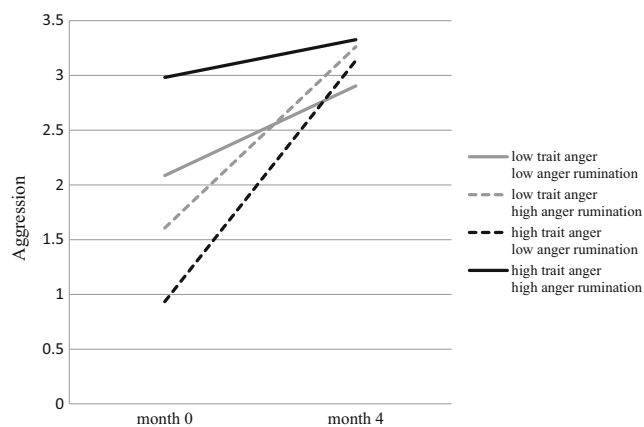
**Fig. 1** Significant 3-way interaction (anger rumination x trait anger x time) for slope and its prediction of aggression

suggestive of a ceiling effect. However, our results do fit the hypothesis that adolescents who are most likely to aggress are those who have high levels of trait anger and have a tendency to ruminate in response to anger, especially upon their initial entry into a juvenile facility and perhaps over the course of their incarceration (in the absence of ceiling effects). Given that youths high in trait anger and low in anger rumination exhibited marginally significant increases in aggression over time suggests that strong feelings of chronic anger in juvenile offenders should be targeted in treatment and CBT techniques such as anger management is a recommended evidence-based approach (Del Vecchio and O'Leary 2004; Henwood et al. 2015; Lipsey et al. 2007). Nevertheless, these findings must be interpreted with caution until replicated with a larger sample size, as our study may not have had enough power to detect small effects.

The fact that the effect sizes of both significant interaction terms were modest in terms of their magnitude is also worthy of some attention. Although prior studies have never looked at anger as a moderator in the relationship between anger rumination and aggression, research with adults and adolescents examining the unique associations of anger and anger rumination with aggression have yielded effect sizes in the small to medium range (Peled and Moretti 2007; Anestis et al., 2009). For those studies reporting medium effect sizes (e.g., Peled and Moretti 2007), most have relied on self-report measures of aggression, which raises concerns over validity. Moreover, the shared method variance between the predictor and outcome variables in past studies may have artificially inflated the magnitude of these effects. As such, the independent and unique strengths of the associations between anger, anger rumination, and aggression warrant further investigation.

Contrary to the findings of Peled and Moretti (2007), anger rumination and trait anger did not uniquely predict aggression. However, it is important to note that we did find that anger rumination significantly correlated with initial aggression, but not later aggression (i.e., mean aggression for months 1–4) and that trait anger was unrelated to both aggression measures.

These discrepancies in results may be explained by how anger was operationalized in the Peled and Moretti (2007) study. Specifically, the four items comprising the anger measure were four symptoms of oppositional defiant disorder (e.g., "I am easily annoyed by others", "I blame others for my mistakes"), thus potentially and artificially strengthening the relationship between anger and aggression. Additionally, shared method variance was a limitation of the Peled and Moretti (2007) study since self-report measures assessed both predictor and outcome variables, which was circumvented in the present study by using behavioral observations of aggression. In fact, the extant literature recommends avoiding the use of youth self-report measures to formulate diagnostic impressions of disruptive behavior disorders due to validity concerns (Crowley et al. 2001; McMahon and Frick 2005). Explanations as to why anger rumination did not significantly correlate with later aggression might include the possibility that youths prone to this cognitive response style learned how to address ruminative thoughts by means of cognitive-behavioral techniques taught in individual/group therapy at the facility or that these later aggressive acts were attributable to a need to assert dominance in a setting with a high percentage of youths with conduct problems or a product of other risk factors of aggression such as impulsivity, history of trauma, or certain personality traits (e.g., narcissism, limited prosocial emotions).

## General Discussion

The goal of the present research was to add to our understanding concerning the development of aggression in youths by examining the relationship between anger rumination and aggression in samples of typically developing children and juvenile offenders. Empirical evidence suggests that anger rumination may indeed be a risk factor of aggression in adults (e.g., Anestis et al., 2009; Bushman et al. 2005; Vasquez et al. 2007), but little is known about the role anger rumination might play in the development and maintenance of aggression in children and adolescents. One of the main obstacles in studying anger rumination in younger populations has been the lack of available assessment measures. Study 1 addressed this obstacle by adapting a measure most commonly used in studies of anger rumination with adults for use with children (i.e., Children's Anger Rumination Scale; CARS). It was also the first study to evaluate whether anger rumination predicted different forms of aggression (i.e., overt and relational) as assessed by multiple raters (i.e., teachers and parents) in a child only sample. Study 2 attended to questions of directionality and magnitude by examining concurrent and prospective associations between anger rumination and aggression among juvenile offenders in addition to evaluating the potential moderating effects of trait anger.

The results of Study 1 supported the hypothesis that anger rumination can be measured in children and this construct is

related to the enactment of aggressive behavior in childhood. Study 2 supported the notion that a tendency to ruminate to anger coupled with high trait anger might lead to initially heightened levels of aggression and stably high levels of aggression over time in juvenile offenders. Taken together, these findings have some implications for how clinicians may approach treating aggressive children and adolescents. Specifically, evidence-based interventions (e.g., cognitive-behavioral therapy) may be enhanced if youths are educated of the maladaptive nature of anger rumination, are shown how to recognize when they are using rumination as an emotion regulation strategy, and are taught how to identify and reframe the unhelpful thoughts elicited when ruminating. Although this study has added to the extant literature by extending this line of research to younger populations, further research is needed to determine the robustness of this relationship between anger rumination and aggression, identify other variables that might impact this association (e.g., gender, age, impulsivity, narcissism, limited prosocial emotions, history of trauma), and explore the specificity of rumination in response to certain affective states (e.g., sadness, anger) and their relation with corresponding internalizing and externalizing disorders.

## Limitations and Future Directions

These two studies are the first to: 1) examine the construct of anger rumination in childhood, 2) investigate associations between anger rumination and children's aggression, 3) determine whether trait anger and anger rumination are prospectively predictive of aggression in high-risk adolescents, and 4) evaluate other factors (i.e., trait anger) that might affect the magnitude of the relationship between anger rumination and aggression. Despite its contributions, there are a few caveats that are worthwhile mentioning as well as potential areas of further examination, which would enhance the understanding of these constructs in children and adolescents. Our results suggest that anger rumination may contribute to youths' tendencies to be aggressive, but conclusions about causal associations cannot be drawn, as our findings are based on correlational data. Prior research with adults suggests that anger rumination is causally associated with aggression as assessed on lab analogue tasks, but awaits replication with child and adolescent samples. A potential experimental manipulation that could provide evidence of causality if results were shown to be significant and in the expected direction might include asking child participants to play an unwinnable game in which they receive negative feedback from a confederate concerning their performance. Child participants would then be primed to either think about this anger-provoking event or distracted by engaging in a neutral activity followed by an opportunity to retaliate (e.g., loud air blasts of noise) against the confederate who originally insulted their performance. As with any study using a correlational design, there is concern that one or more third variables

account for associations between the constructs of interest. Several potential third variables were controlled for in Study 1 (i.e., sex, age, family income) and Study 2 (i.e., age of first arrest, total number of offenses), which also examined trait anger as a potential moderator, but it was not feasible to rule out all possible third variables. One potentially relevant variable that was not considered is impulsivity. Given its relatively strong association with aggression (Joireman et al. 2003; Luengo et al. 1994), it will be important for future research to control for impulsivity to establish the unique contribution of anger rumination to aggression in children and adolescents. One of the strengths of Study 2 was the use of an aggression measure that reflects DJJ staff observations of verbal, physical, threatening and sexual behaviors. Still, as with all methods of assessment, some error is inherent in this outcome measure, as it is unclear to what extent this type of observation reflected aggressive behaviors that were not reported by facility staff or enacted in front of them. In order to gain further insight into the relations between anger rumination and aggressive behavior in juvenile offenders, multiple measures of aggression should be employed. Finally, it is unclear if the results of this study would hold for other juvenile justice facilities with different age, sex, and racial compositions, thus replication studies with larger samples of juvenile offenders are encouraged.

## Conclusion

Overall, the results of these studies suggest that anger rumination is associated with overt and relational aggression in childhood and that anger and anger rumination are predictive of aggressive behaviors in juvenile offenders, especially upon their initial entry into a juvenile facility and perhaps over the course of their incarceration Thus, cognitive-behavioral treatment strategies for aggression may be improved by educating children and adolescents about the contributory role of anger rumination in the development of aggression and providing them with adaptive alternatives to coping with feelings of anger.

## Appendix

**Table 7**  Item-level changes made to the Anger Rumination Scale (ARS) to create the Children's Anger Rumination Scale (CARS)

| Item | Anger Rumination Scale | Children's Anger Rumination Scale |
| --- | --- | --- |
| 1. | I ruminate about my past anger experiences. | I think a lot about other times when I was angry. |
| 2. | I ponder about the injustices that have been done to me. | I think about the bad things that I did not deserve that have been done to me. |
| 7. | After an argument is over, I keep fighting with this person in my imagination. | After an argument is over, I keep fighting with this person in my mind. |
| 8. | Memories of being aggravated pop up into my mind before I fall asleep. | Memories of being angry pop up into my head before I fall asleep. |
| 10. | I have times when I cannot stop being preoccupied with a particular conflict. | I have had times when I could not stop thinking about a particular conflict. |
| 11. | I analyze events that make me angry. | I try to figure out what makes me angry. |
| 13. | I have daydreams and fantasies of a violent nature. | I have day dreams and fantasies that are violent. |
| 16. | When someone provokes me, I keep wondering why this should have happened to me. | When someone makes me angry, I keep wondering why this happened to me. |
| 17. | Memories of even minor annoyances bother me for a while. | Memories of even minor problems bother me for a while. |
| 19. | I re-enact the anger episode in my mind after it has happened. | I replay what made me angry over and over after it happened. |

Items on the Anger Rumination Scale that do not appear in this table were retained verbatim for use on the Children's Anger Rumination Scale

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