CHAPTER 5

Physiological reactivity and different forms of aggression in girls: Moderating roles of rejection sensitivity and peer rejection

Abstract

Associations between physiological reactivity to exclusion (i.e., heart rate [HRR], respiratory sinus arrhythmia [RSAR], and skin conductance level [SCLR]) and relational and physical aggression were assessed. It was hypothesized that blunted "fight or flight" responses to stress (i.e., blunted HRR, SCLR, and RSA withdrawal) would be associated with relational aggression, whereas heightened "fight or flight" responses (i.e., heightened HRR, SCLR, and RSA withdrawal) would be associated with physical aggression. In addition, it was hypothesized that heightened "fight or flight" responses would interact with social and cognitive risk factors in the prediction of physical aggression. Data were collected at an all-girls residential summer camp (mean age = 12.47 years; N = 119). Overall, findings indicated that blunted "fight or flight" was associated with relational aggression whereas heightened "fight or flight" was associated with physical aggression, particularly in the context of high social and cognitive risk. These findings contribute to our understanding of the relationship between physiological reactivity and different forms of aggression in girls.

5.1. Introduction

Studies from different fields (e.g., psychology, psychiatry, and biology) have demonstrated that aggressive behavior is associated with physiological reactivity to stress (see Lorber, 2004; Ortiz & Raine, 2004). In line with studies that have examined baseline levels of arousal (e.g., Ortiz & Raine, 2004, Sijtsema et al., 2010), several studies have shown that blunted *reactivity* to stressors is associated with heightened aggression (e.g., Kibler, Prosser, & Ma, 2004; Schneider, Nicolotti, & Delamater, 2002). However, some studies find that heightened reactivity to stressors is associated with elevated aggression (e.g., Waschbusch et al., 2002; Williams, Lochman, Phillips, & Barry, 2003). Thus, additional research is necessary to clarify the association between physiological reactivity to stress and aggressive conduct. In addition, a number of important limitations remain regarding research in this area. First, there is a notable lack of attention to gender in extant research studies. In fact, most studies have either failed to include females as participants (Kibler et al., 2004; Suarez et al., 1993), or, if females are included, findings for males and females are combined (Lorber, 2004). Second, research in this area has tended to focus on forms of aggression that are more typical among males (i.e., physical aggression), to the exclusion of forms that are salient for females (i.e., relational aggression; Rappaport & Thomas, 2004). As a result, knowledge regarding the relation between physiological reactivity and aggression in girls is sorely lacking. Finally, most studies have failed to examine contextual and cognitive moderators of the association between reactivity and aggression. Although a number of studies examine the social, cognitive, and physiological risk factors for involvement in aggressive behavior, several researchers have pointed out that little work has examined how these factors interact with regard to aggressive conduct (Boyce & Ellis, 2005; Dodge & Pettit, 2003; Lorber, 2004; Raine, 2002b).

The current study was designed to address these limitations by examining the association between physiological responses to stress and different forms of aggression in girls. Physiological reactivity was assessed as a difference score; specifically, baseline levels of arousal during rest were subtracted from levels of arousal during a social stress task. We examined the association between heart rate reactivity (HRR), respiratory sinus arrhythmia reactivity (RSAR), and skin conductance level reactivity (SCLR) to a socially stressful situation (i.e., social exclusion) and both relational and physical forms of aggression in a sample of girls. To consider the unique effects on the different forms of aggression, we controlled for the non-focal form of aggression. Moreover, we examined whether the association between physiological reactivity and aggression was moderated by social and cognitive risk factors related to rejection (i.e., peer rejection and rejection-sensitivity).

Physiological reactivity

Typically, when confronted with challenging or stressful situations, the autonomic nervous system (ANS) reacts correspondingly to these stressors. The ANS consists of two branches: the sympathetic nervous system (SNS) and the parasympathetic nervous system

(PNS). The sympathetic component of the ANS becomes active in stressful or challenging contexts by increasing heart rate and oxygen flow and thus preparing the body for a "flight or fight" response (Boucsein, 1992). The PNS, in contrast, acts like a brake to calm the body down (e.g., slowing down heart rate) and focuses on "rest and digest" functions. In the context of threats, there is typically an increase of the "fight or flight" response, reflecting SNS activation and/or PNS withdrawal (i.e., removing the brake), leading to increases in physiological activity (e.g., increased heart rate).

In this study we measure both SNS and PNS reactivity to stress. SNS activity was assessed by skin conductance level reactivity (SCLR), which refers to electrodermal reactivity caused by the activity of the sweat glands (Erath, El-Sheikh, & Cummings, 2009). SCLR is a measure of sympathetic activation in response to stress. Activity of the PNS was assessed by measuring respiratory sinus arrhythmia reactivity (RSAR), a measure of vagal regulation, (e.g., Porges, Doussard-Roosevelt, Portales, & Greenspan, 1996). Decreases in RSA in response to stress are referred to as RSA withdrawal and result in increases in physiological arousal (e.g., increased heart rate), whereas increases in RSA are referred to as RSA augmentation and result in decreases in arousal. Finally, given the substantial body of research examining the association between HRR and aggression (Lorber, 2004), we also assessed heart rate reactivity (HRR) to a stressful situation. HRR reflects both PNS and SNS activity, and stressful situations typically elicit increased levels of heart rate.

Physiological reactivity and aggression

Although individuals typically respond to stressful situations with a "fight or flight response (i.e., sympathetic activation and parasympathetic withdrawal), there are individual differences in physiological responses to stress and distinct patterns of ANS reactivity have been implicated in the development of aggressive behavior (e.g., Beauchaine, Gatzke-Kopp, & Mead, 2007; Lorber, 2004; Ortiz & Raine, 2004). Some individuals exhibit relatively blunted "fight or flight" responses to stress, and researchers have proposed that this blunted reactivity places individuals at risk for aggressive or antisocial behavior (Ortiz & Raine, 2004). Temperamental characteristics, including low fearfulness or a general lack of inhibition, have been proposed as one mechanism underlying this relationship (Ortiz & Raine, 2004; Raine, 1997). Specifically, blunted "fight or flight" responses may reflect a lack of fear and inhibition, reducing concerns about the repercussions of aggression (Kindlon et al., 1995; Raine, 2002a, 2002b). In addition, fearlessness may reduce one's sensitivity to punishment (Fung et al., 2005), which in turn facilitates involvement in aggression (Beauchaine, Katkin, Strassberg, & Snarr, 2001). In fact, consistent with fearlessness theory, low SNS activity is associated with fearlessness and insensitivity to punishment (Raine, 2002a). Additional theories may also explain the relation between low SNS arousal and antisocial behavior, such as sensation seeking theory (see Ortiz & Raine, 2004; Sijtsema et al., 2010), in which underaroused individuals engage in stimulating behaviors, such as aggression, to increase their arousal to more comfortable levels.

Consistent with these perspectives, there is some evidence that blunted SCLR and HRR are associated with aggression (Harden et al., 1995; Herpertz et al., 2003; Schneider et al., 2002). For example, in a recent study, harsh parenting was more strongly associated with externalizing behaviors in children with low SCLR (Erath, El-Sheikh, & Cummings, 2009). In another study, HRR during a game in which a confederate cheats was negatively related to teacher-reported aggression (Hubbard et al., 2002). Finally, Kibler and colleagues (2004) found in their meta-analysis that HRR was negatively associated with misconduct (e.g., externalizing or aggressive behavior) in children and adolescents.

Interestingly, most researchers who examine the association between ANS underarousal and aggression have focused on HRR and SCLR (see Lorber, 2004; Van Goozen et al., 2007). However, it is possible that PNS reactivity is also an important correlate of aggressive conduct. In fact, studies suggest that RSA withdrawal during stress is typically associated with fewer behavioral problems in children and adolescents (Calkins, 1997; Calkins, Graziano, & Keane, 2007; El-Sheikh, 2001; Porges et al., 1996). When children face environmental demands that require emotional and behavioral regulation, RSA withdrawal may allow for flexible and appropriate responding (Hessler & Katz, 2007; Porges, 2001). This RSA withdrawal facilitates the mobilization of resources necessary to actively cope with environmental demands (Calkins, 1997; Calkins et al., 2007). Consistent with this perspective, evidence suggests that poor RSA withdrawal during threat or challenge is associated with self-reported dysregulation (Hessler & Katz, 2007), behavior problems (Calkins & Keane, 2004), externalizing problems (Calkins et al., 2007), and aggression (Porges et al., 1996). In a recent study, Hinnant and El-Sheikh (2009) reported that children with impaired RSA withdrawal during stress were the highest on externalizing behavior. Moreover, although most children exhibit RSA withdrawal during challenge (Beauchaine et al., 2007), some children have been found to actually display increases in RSA activity (i.e., RSA augmentation) during challenge or stress (Katz, 2007). Katz (2007) suggests that this RSA augmentation may reflect a hyper-vigilance to threat cues. In other words, children who exhibit RSA augmentation rather than RSA withdrawal in response to stress may be especially attuned to potential cues of threat or hostility. Overall, then, research on RSA reactivity suggests that poor RSA withdrawal (or RSA augmentation) may place children at risk for involvement in aggressive behavior. In this paper, we use the term "blunted RSAR" as an indicator of relatively low levels of parasympathetic withdrawal during stress.

Although we have shown some empirical support for an association between a blunted "fight or flight" response to stress and aggressive behavior, findings in this area are mixed. For example, some studies have reported a positive relationship between aggression and the "fight or flight" response (i.e., heightened SNS reactivity and heightened PNS withdrawal) to stress. Theoretically, this physiological reactivity profile may reflect dysregulation of the "fight or flight" response and may energize aggressive responding to real or perceived provocation (see Scarpa & Raine, 1997). Consistent with this perspective, Hubbard and colleagues (2002) reported that SCLR was positively related to teacher-reported reactive aggression during a game in which a confederate cheats. Moreover, in his meta-analysis, Lorber (2004) reported that

among adults, greater SCLR was associated with increased aggression. Similarly, some studies have found that heightened HRR was positively associated with aggression (e.g., Lorber, 2004; Waschbusch et al., 2002; Williams, Lochman, Phillips, & Barry, 2003), suggesting *heightened* SNS activation and/or PNS withdrawal among aggressive individuals. These mixed findings highlight the importance of considering potential moderators of the association between ANS reactivity and aggression, including distinct forms of aggression and social and cognitive risk.

Gender and forms of aggression

Despite the emerging evidence suggesting an association between ANS arousal and aggression, there is a notable lack of attention to gender in previous research. In fact, much of the extant research has failed to consider the association between ANS arousal and aggression in females. For example, Ortiz and Raine (2004) reported in their review that low HRR is associated with heightened antisocial behavior (e.g., aggression), but the samples they reviewed either only included boys or did not make a distinction between boys and girls. In addition, the vast majority of studies focus on physical forms of aggression and fail to examine whether physiological reactivity is associated with relational forms of aggression. A number of studies have demonstrated that aggression can take on overt (i.e., physical) or relational (e.g., gossiping, ostracizing, and social exclusion) forms (see e.g., Crick & Grotpeter, 1995; Heilbron & Prinstein, 2008). Moreover, when girls engage in aggression, they tend to employ relational rather than physical forms of such behavior (Card, Stucky, Sawalani, & Little, 2008). Thus, an important question is whether physiological reactivity to stress is associated with relational as well as physical forms of aggression.

Relational aggression may be more strategic in nature than physical aggression because it involves actively manipulating social relationships (Rose, Swenson, & Waller, 2004). Importantly, researchers have argued that planned aggression may be associated with blunted ANS reactivity (Van Goozen et al., 2007); in fact, deliberate and controlled aggression seems most likely to result from fearlessness and sensation-seeking. Reduced levels of fear may facilitate children's relationally aggressive conduct because fearless children may be relatively unconcerned about possible retaliation. Additionally, fearless children may be less responsive to socialization efforts designed to prevent involvement in relational aggression. Finally, relational aggression may serve as a relatively stimulating behavior. As such, consistent with sensation seeking theory, it is possible that underaroused individuals engage in relational aggression to increase their arousal to more comfortable levels. To date, only one study has examined whether physiological reactivity to stress is associated with relational aggression. In this study, heightened blood pressure reactivity was associated with relational aggression in girls (Murray-Close & Crick, 2007). However, additional research in this area is sorely needed.

Physical aggression, in contrast, may more often be the result of direct, uncontrolled, and impulsive reactions to the social environment during adolescence because it is highly visible and atypical (Heilbron & Prinstein, 2008), the vast majority of females have learned to inhibit physically aggressive behaviors by adolescence. Similarly, Hawley (1999; 2003) argues that

physical aggression may become less adaptive and regarded as socially awkward in (pre)adolescence, whereas relational forms of aggression (which are more subtle in nature) become more accepted (Heilbron & Prinstein, 2008). This may especially be true for girls, as previous studies indicate that relational aggression is more normative than physical aggression in female populations (Card et al, 2008). Importantly, the decrease in physical aggression across development is thought to, in part, reflect improved emotion-regulation capabilities (Côté et al., 2006). These findings suggest that adolescent girls who use physical aggression may exhibit relatively emotional and impulsive reactions to perceived environmental threats. Consistent with this perspective, research including both males and females suggests that physical aggression in early adolescence is more often enacted in response to threat and provocation than for instrumental gain (Fite et al., 2008). Importantly, emotional aggression is thought to result from heightened "fight or flight" responses to stress (Scarpa & Raine, 1997; Van Goozen et al., 2007), suggesting elevated SNS activation and/or PNS withdrawal to stressors. Thus, we expected that physical aggression would be associated with elevated SNS activation and PNS withdrawal whereas relational aggression would be associated with blunted SNS activation and PNS withdrawal in a sample of (pre)adolescent females.

Social and Cognitive Moderators of the Association between Blunted Reactivity and Aggression

Although physiological reactivity to stress may serve as a risk factor for involvement in aggressive behavior, this association may be strongest among individuals who also exhibit additional risk factors for aggression (Raine, 2002b). Adopting an interactive, nonlinear approach has recently been advocated by a number of aggression scholars. For example, researchers have pointed out that although a number of studies examine the social, cognitive, and physiological risk factors for involvement in aggressive behavior, little work has examined how these factors interact in predicting antisocial conduct (Dodge & Pettit, 2003; Lorber, 2004; Raine, 2002b). Raine (2002b), for instance, argues that "research in this area of antisocial behavior is sorely lacking hard empirical data on the nature of interactions, whereas speculation is rampant" (p. 311). Studies that have examined potential interactive effects have supported the notion that many factors predict antisocial conduct most strongly when exhibited in combination with other predictors (e.g., Farrington, 1997).

In the present study, we examine how social experiences (i.e., peer rejection) and cognitive processes related to rejection by peers (i.e., rejection sensitivity) may moderate the association between ANS reactivity to exclusion and aggression. There is strong evidence for a positive relationship between both physical and relational aggression and peer rejection (e.g., Crick, Casas, & Ku, 1999; Newcomb, Bukowski, & Pattee, 1993), and longitudinal work suggests that rejection by peers is associated with the development of relational aggression in girls and physical aggression in both boys and girls (Werner & Crick, 2004). It is possible that physiological responses to experiences of exclusion may only translate into aggressive responding for individuals who frequently encounter such relational stressors.

Cognitive sensitivity to experiences of rejection may also moderate the relationship between ANS reactivity and aggression. Specifically, children's tendency to enact aggressive responses to socially stressful situations may depend to a large extent on their sensitivity to peer rejection or exclusion. Consistent with this hypothesis, in a recent study, social rejection led to aggression only for individuals who were high on rejection sensitivity (Ayduk, Gyurak, & Luerssen, 2008). From this perspective, physiological responses to exclusion may be especially likely to lead to aggressive responses among individuals who are also highly cognitively reactive to exclusion.

We expected, however, that peer rejection and rejection sensitivity would moderate the association between *heightened* (but not blunted) "fight or flight" responses and aggression. In effect, it seems likely that peer rejection and rejection sensitivity would combine with dysregulation of the "fight or flight" response to predict the impulsive and emotional forms of aggression. Children who are highly sensitive to exclusion (both physiologically and cognitively) and who frequently experience peer stressors may be most at risk for these forms of aggression. Fearless children, in contrast, are likely to be relatively unperturbed by peer stressors. As a result, we did not expect that peer rejection and rejection-sensitivity would serve as moderators of the association between physiological reactivity and aggression when "fight or flight" responses were blunted. Finally, because physical aggression is fairly atypical and maladaptive among adolescent females, biological risk factors for this form of aggression may only result in actual aggressive conduct when combined with additional risk factors for aggression (see also Boyce & Ellis, 2005). Thus, we expected that the interaction between reactivity to social stress, peer rejection, and rejection sensitivity would be a particularly strong predictor of physical aggression for (pre)adolescent girls with heightened reactivity to stress (i.e., SNS activation and PNS withdrawal).

In sum, we argue that physiological reactivity may be differently related to different forms of aggression (see Table 5.1). We hypothesized (1) that blunted "fight or flight" (i.e., blunted SNS activation and blunted PNS withdrawal) would be associated with relational aggression in girls. Second, we expected (2) that heightened "fight or flight" responses to stress would be associated with physical aggression, especially in combination with social or cognitive risk factors (i.e., rejection sensitivity and peer rejection). These hypotheses were tested in an all-girls summer camp sample.

Table 5.1. *Overview of the Hypotheses*

	Hypothesis (1) Relational Aggression	Hypothesis (2) Physical aggression
Heart Rate Reactivity	Blunted sympathetic activation and blunted parasympathetic withdrawal	Heightened sympathetic activation and parasympathetic withdrawal
RSA Reactivity	Blunted parasympathetic withdrawal —low RSA withdrawal	Heightened parasympathetic withdrawal – high RSA withdrawal
Skin Conductance Reactivity	Blunted sympathetic activation	Heightened sympathetic activation

5.2. Method

Participants

One hundred and nineteen female children and adolescents from a private residential summer camp participated in this study. Participants ranged in age from 9 to 16 years of age (M = 12.47, SD = 1.96). Informed consent to participate was provided by parents or guardians and assent was provided by participants who were at least 11 years old. Within the camp context, campers are organized into groups based on the school grade they completed before camp. Participants were recruited from seven of the groups at the summer camp. Although campers lived in smaller clusters (i.e., bunks) that were subsets of the larger age group, campers were very familiar with campers within their age group as they participated in activities based on age groupings throughout the day. Ninety-four percent of participants were European-American, 3% were Latino, and 4% did not report ethnicity.

Procedures

All participants were enrolled in a residential summer camp that was 54 days in duration. Campers were invited to participate in a study with two distinct components. First, campers participated in a 30-minute individual interview to assess their physiological reactivity to exclusion. For the second part of this study, participants completed peer nominations assessing perceptions of their peers' social abilities, social motivations, and behaviors. Additionally, camp counselors completed measures about campers who lived in a bunk with them. As a main goal of this study was to better understand the social interactions in child and adolescent social groups, peer nomination and counselor report data were collected in the last two weeks of the summer camp season to make certain that both peers and counselors had enough familiarity with participants to rate them on study measures.

Measures

Relational and physical aggression. The Children's Social Behavior Scale-Teacher Report (Crick, 1996) was used to assess counselor reports of children's aggression. Two subscales of this instrument were used: relational aggression (5 items, α = .92; e.g. 'this camper spreads rumors or gossips about some peers') and physical aggression (4 items, α = .91; e.g. 'this camper hits, pushes, or shoves peers'). Counselors responded to the items on a 5-point scale indicating how true each item was for each of their participating campers. Item scores were averaged across subscales. If more than one counselor reported on a participating child, scores were averaged across counselors to yield an overall relational aggression and physical aggression score for each camper.

ANS reactivity to stress. To assess physiological reactivity to social exclusion, participants completed an individual 30-minute interview. Participants were escorted to an interview room at camp by two female trained research assistants. One research assistant monitored the physiology equipment while the other research assistant administered study tasks to the participant.

Following a brief description of study procedures, skin conductance and electrocardiogram (EKG) leads were positioned on participants with the assistance of the research assistants. To assess SCL, Ag/AgCl electrodes were attached to the palmar surface of the middle phalanges of the second and fourth fingers of the nondominant hand. A layer of BioGel (an isotonic NaCl electrolyte gel) was placed on the electrodes to increase conduction, and the gel was limited to a 1 cm diameter circle on the participant's fingers through the use of double-sided adhesive collars. Skin conductance was measured in microsiemens. Participants washed and dried their hands prior to SCL measurement. Skin conductance was missing for 2 participants due to experimenter error.

Heart rate and interbeat interval were assessed using an electrocardiogram (EKG; Biology UFI 3991). Each participant placed electrode stickers in a bipolar configuration on opposite sides of her chest and a ground lead was placed on the sternum. Cardiac inter-beat intervals (IBI) were measured as time in milliseconds between successive R waves of the electrocardiogram. Heart rate, reflecting beats per minute, was calculated using the following standard formula: HR = (1/IBI) X 60,000 ms. To calculate RSA reactivity, IBI artifacts due to movement or digitizing error were manually edited in CardioEdit (Brain-Body Center, 2007), and RSA estimates were calculated using CardioBatch in procedures outlined by Porges (1985). Specifically, CardioBatch uses a time series method to analyze IBI data. This approach uses a moving 21-point detrending polynomial algorithm to isolate the oscillations of spontaneous cardiac rhythms associated with respiration. The frequency band-pass parameters used in the present study were .12 to 1.0 Hz to be consistent with spontaneous respiration in adolescents. The natural log of the variance extracted using this band-pass filter was computed for each sequential 30-s epoch of IBI data, yielding RSA scores for each epoch. The mean of RSA for each epoch was then computed to yield a measure of RSA for each participant. The EKG sampling rate was 1000Hz. RSA is reported in units of $\ln(ms)^2$. EKG data from four participants were excluded because the IBI files required more than 10% editing; the remaining participants' IBI datafiles required minimal editing (generally less than 1%).

Baseline physiological activity (heart rate, respiratory sinus arrhythmia, and skin conductance) was assessed during a 3-minute period of rest. During this baseline, children were instructed to sit quietly, relax, and clear their mind. Participants were provided with an overview regarding the study after the physiological equipment was attached, providing them with an accommodation period to adjust to the equipment (approximately 2 minutes). To assess children's physiological reactivity to exclusion, participants played Cyberball, a 3-minute ball-throwing game. This method usually involves deception where participants are told that they are playing an online game with other players and are then excluded (Williams et al., 2000). However, in the present study, we adapted this game so that participants knew that they were not actually playing with other people. Children were told that they were going to play a computer game that involves ball-throwing. Participants were told that they were playing against the computer, but that they should imagine that they were playing with their three best friends from camp. Although this procedure likely does not elicit as robust reactions as if the

participant actually believed that she was being excluded, preliminary research suggests that participants do react to this game even when they know that there are not actually other players (Zadro, Williams, & Richardson, 2004). Participants were then logged onto a provided laptop computer and asked to read the following instructions on the screen:

"In this part of the study, we want to know how people react to playing a computer ball-tossing game. The game is very simple. When the ball is tossed to you, simply click on the name of the player you want to throw it to. Although you are just playing against the computer, we want you to imagine that you are playing with your three best friends from camp. What is important is not your ball tossing performance, but that you picture the entire experience in your mind. Imagine what the others look like. Where are you playing? Is it warm and sunny or cold and rainy? Create in your mind a complete mental picture of what might be going on if you were playing this game in real life."

In the game, each player is represented by a drawing and a name. In the version of Cyberball used in this study, the names of the other three players were the names of the participant's three best friends at camp (participants were asked to provide this information when they are logged on). Throughout the game, the ball is thrown between players. When the participant receives the ball, she chooses a player to throw the ball to and clicks on that player's name. The computer game is programmed to exclude that participant after she receives the ball twice. For the rest of the game, the other three players only throw the ball to each other. In the present study, Cyberball was programmed to last for 50 total throws (approximately 3 minutes), and mean ANS arousal was calculated to reflect arousal during the length of the game. Following the game, participants engaged in a number of additional tasks not included in the present study. Participants were then debriefed and provided a small prize to thank them for their participation.

Physiological reactivity to Cyberball was calculated by subtracting the mean levels of SCL, RSA, and HR respectively, during baseline from mean scores during the Cyberball game. Thus, negative scores reflect a decrease in the measure in response to stress whereas positive scores reflect an increase in the measures in response to stress. As a result, lower SCLR scores indicate relatively blunted SNS reactivity whereas higher scores reflect relatively high levels of SNS activation in response to stress. Lower RSA scores reflect relatively high levels of RSA withdrawal in response to stress and higher RSA reactivity scores reflect relatively blunted RSA withdrawal.

Peer rejection. Children's peer rejection was assessed with a peer nomination measure (Coie & Dodge, 1983; Crick & Gropeter, 1995). Participants were provided with a roster of age mates and asked to nominate up to three peers who 'you like to hang out with the least'. These peer nominations were then summed and standardized within age group.

Rejection sensitivity. Children's Rejection Sensitivity Questionnaire (Downey, Lebolt, Rincon, & Freitas, 1998) was used to assess children sensitivity to rejection. We used a subscale of this questionnaire to assess children's angry expectations regarding rejection. Participants

were presented with six scenarios (e.g., being picked to meet a famous person) and rated on a six-point scale how mad they would be in each scenario depicting potential rejection. Participants also rated their expectations on a six-point scale that they would actually be rejected in the scenario. To calculate Angry Expectations of Rejection, the score of the expected likelihood of rejection was multiplied by the degree of anger over its possible occurrence. The scores for each item were then averaged to provide a mean level of angry expectation of rejection score (α = .82).

Analysis strategy

First, we calculated means and standard deviations of all unstandardized study variables. Second, correlations were calculated between the independent and dependent variables. To examine the association between "fight or flight" responses to stress, rejection, and rejection sensitivity and physical and relational aggression, we employed hierarchical linear regressions. In the first step, age, the non-focal form of aggression, and the main effects of physiological reactivity, rejection sensitivity, and peer rejection served as predictors of physical and relational aggression, respectively. Step two included two-way interactions between physiological reactivity, rejection sensitivity, and peer rejection (not reported; available upon request). In the last step, the three-way interaction between the independent variables was added to the model. When significant interaction effects emerged, we calculated simple slopes to test whether physiological reactivity affected aggression at different levels of rejection sensitivity and peer rejection (Aiken & West, 1991). Furthermore, we plotted interactions and assessed differences between pairs of slopes using the template designed by Dawson and Richter (2006), available at http://www.jeremydawson.co.uk/slopes.htm. To make sure that the values in Figures 5.1 to 5.3 are accurate representations of the data, we standardized the independent and control variables to a mean of zero and a standard deviation of one.

Table 5.2 *Means, Standard Deviations, and Range of Age, Physiological Reactivity, Rejection Sensitivity, Peer Rejection, and Counselor-reported Aggression*

	N	Mean	Standard deviation	Range
Age *(in years)*	119	12.47	1.96	8.87 – 16.00
Heart rate baseline	115	88	11.6	61.4 – 129.5
Heart rate Cyberball	115	87	11.2	63.4 – 123.6
Heart rate reactivity	115	-0.56	3.17	-10.74 – 6.27
RSA baseline	115	6.95	1.19	2.50 – 10.08
RSA Cyberball	115	6.91	1.20	3.10 – 9.58
RSA reactivity	115	-0.04	0.54	-1.34 – 1.64
Skin conductance baseline	117	4.53	2.50	0.67 – 14.04
Skin conductance Cyberball	117	5.53	2.83	0.71 – 17.46
Skin conductance reactivity	117	1.00	1.00	-1.11 – 5.23
Rejection sensitivity	117	6.75	4.06	1.33 – 25.50
Peer rejection	119	0.06	1.10	-0.83 – 4.54
Relational aggression	119	2.09	0.91	1.00 – 4.80
Physical aggression	118	1.09	0.26	1.00 – 2.25

5.3. Results

Descriptive analyses

Table 5.2 shows the means and standard deviations of all unstandardized study variables. A paired sample *t*-test showed that girls were significantly higher on relational than physical aggression (t = 11.92, df = 118, p < .001). Correlations between the variables are presented in Table 5.3. Correlations with age showed that older girls scored marginally higher on RSAR (r = .17, p = .07), whereas younger girls were more sensitive to rejection. With regard to physiological reactivity, girls with higher HRR showed lower levels of RSAR and relational aggression. Moreover, lower SCLR was also associated with more relational aggression. Rejection sensitivity was marginally associated with relational aggression (r = .17, p = .07), whereas peer rejection was positively associated with both relational and physical aggression. Correlations between physical and relational forms were marginally significant (r = .16, p = .08) which suggests that, in the present sample, the two forms were largely distinct manifestations of aggressive behavior.

Table 5.3 *Correlations Between Age, Physiological Reactivity, Rejection Sensitivity, Peer Rejection, and Aggression*

	1	2	3	4	5	6	7
1. Age *(in years)*	-						
2. Heart rate reactivity	0.03	-					
3. RSA reactivity	0.17†	-0.52**	-				
4. Skin conductance reactivity	-0.15	0.07	-0.03	-			
5. Rejection sensitivity	-0.21*	0.04	-0.10	0.01	-		
6. Peer rejection	-0.04	-0.11	-0.05	-0.09	0.12	-	
7. Relational aggression	-0.10	-0.22*	0.12	-0.19*	0.17†	0.22*	-
8. Physical aggression	-0.07	0.06	-0.04	-0.03	0.03	0.20**	0.16†

† p < .10, * p < .05, ** p < .01

Relational aggression

Heart Rate Reactivity. The results of the regression analyses are depicted in Table 5.5. In the first part of the table, the main effects of HRR, rejection sensitivity, peer rejection, and the three-way interactions among these variables in predicting relational and physical aggression, respectively, are presented. We hypothesized that blunted HRR (i.e., lower reactivity) would be associated with heightened relational aggression. Main effects showed that HRR was negatively related to relational aggression (b = -.20, p < .05). In other words, blunted levels of HRR were associated with more relational aggression. As expected, the interaction between blunted reactivity, rejection, and rejection sensitivity was not significant.

Respiratory Sinus Arrhythmia Reactivity. In the second part of Table 5.5, findings regarding RSAR are presented. We expected that higher RSAR values, as an indication of blunted RSA withdrawal, would be associated with relational aggression. Although the main effect of RSAR was not significant, the three-way interaction between RSAR, rejection sensitivity, and peer rejection significantly improved the model fit (ΔR^2 = 4.6%, ΔF = 5.51, p < .05; see Figure 5.1). Simple slope analyses indicated that high RSAR was associated with more relational aggression in girls who were either low on both rejection sensitivity and peer rejection (b = 0.39, t = 2.32, p

< .05) or high on both (b = 0.61, t = 2.03, p < .05). Slope difference tests (see Table 5.4) indicated that these two slopes differed significantly from girls who were only high on either rejection sensitivity or peer rejection. As illustrated in Figure 1, the most relationally aggressive girls were those who exhibited blunted RSA withdrawal in combination with peer rejection and rejection-sensitivity.

Skin Conductance Level Reactivity. The third part of Table 5.5 shows the results of SCLR and relational aggression. As hypothesized, blunted SCLR (i.e., lower reactivity) was associated with higher levels of relational aggression (b = -.17, p < .05). As expected, the association between SCLR and relational aggression was not stronger for girls high on peer rejection or rejection sensitivity.

Table 5.4 *Slope Difference Tests for Three-Way Interactions in Figure 1-3*

	Figure 1: RSAR and RA		Figure 2: HRR and PA		Figure 3: RSAR and PA	
Pair of slopes	*t*-value	*p*-value	*t*-value	*p*-value	*t*-value	*p*-value
(1) and (2)	2.35	< 0.05	3.48	< 0.01	-1.98	< 0.05
(1) and (3)	1.85	0.07	2.99	< 0.01	-2.40	< 0.05
(1) and (4)	0.84	0.40	2.85	< 0.01	-2.91	< 0.01
(2) and (3)	-0.26	0.79	0.95	0.35	-0.67	0.50
(2) and (4)	-2.29	< 0.05	-0.47	0.64	0.32	0.75
(3) and (4)	-1.79	0.08	-1.58	0.12	1.27	0.21

Note. RA = Relational aggression, PA = Physical aggression, RSAR = Respiratory sinus arrhythmia reactivity, HRR = Heart rate reactivity.

Physical aggression[1]

Heart Rate Reactivity. Consistent with hypotheses, HRR interacted with social and cognitive risk in the prediction of physical aggression among girls (see Figure 5.2). Simple slope analyses showed that high HRR was associated with more physical aggression in girls high on both rejection sensitivity and peer rejection (b = .07, t = 3.16, p < .01). Comparing pairs of slopes showed that the slope for girls high on both rejection sensitivity and peer rejection differed significantly from the other three slopes (see Table 5.4). Including this three-way interaction in the model resulted in additional explained variance of 5.4% (ΔF = 6.44, p < .05).

Respiratory Sinus Arrhythmia Reactivity. As hypothesized, the three-way interaction between RSAR, rejection sensitivity, and peer rejection in predicting physical aggression was significant (see Figure 5.3). Including the three-way interaction in our regression analysis substantially improved the model (ΔR^2 = 3.5%, ΔF = 4.16, p < .05). Simple slope analyses showed that higher RSAR (i.e., blunted RSA withdrawal) was marginally associated with elevated physical aggression in girls high on peer rejection (b = .10, t = 1.67, p < .10).

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[1] Physical aggression among the girls in our sample was relatively uncommon (see Table 2) and the distribution was highly skewed. A closer look at the distribution of physical aggression showed that most girls had the lowest possible score on this form of aggression (i.e., 80.8% scored 1). Of the other 19.8% most scored within the 1.08 to 2.25 range. However, there was also one girl who scored 4.33. In the current analyses we removed this outlier. Additionally, we also took the natural logarithm of physical aggression to adjust for the skewness of the distribution. However, analyses with the log-transformed dependent variable resulted in similar findings and therefore we reported the analyses on the untransformed variables.

Furthermore, lower RSAR (i.e., heightened RSA withdrawal) was associated with physical aggression in girls who were *both* high on rejection sensitivity and peer rejection (b = -.26, t = -2.65, p < .01); these girls were the highest on physical aggression. Slope difference tests showed that the slope for girls high on both rejection sensitivity and peer rejection differed significantly from the other three slopes (ts > 1.98, ps < .05; see Table 5.4).

Skin Conductance Level Reactivity. With regard to SCLR and physical aggression, adding the two-way interactions improved our model significantly (ΔR^2 = 7.9%, ΔF = 3.24, p < .05; not shown in the table). Simple slope analyses revealed that at high levels of rejection sensitivity, high SCLR was marginally associated with elevated physical aggression (b = .07, t = 1.90, p = .06). Furthermore, in girls high on peer rejection, higher SCLR scores were marginally associated with more aggression (b = .07, t = 1.84, p = .07).

Figure 5.1 *Three-way Interactions between RSA Reactivity, Rejection Sensitivity, and Peer Rejection on Relational Aggression*
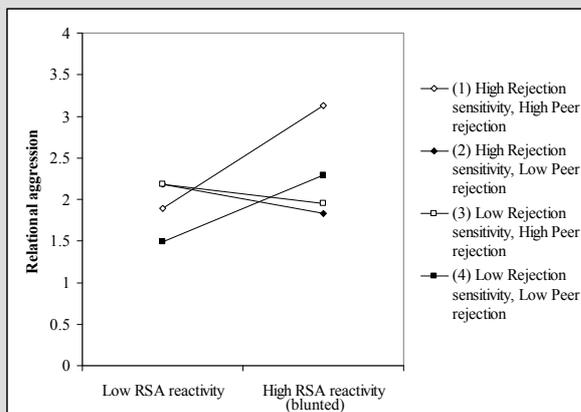
Figure 5.2A-B *Three-way Interaction between Heart Rate Reactivity (5.2A), RSA Reactivity (5.2B), Rejection Sensitivity, and Peer Rejection on Physical Aggression*
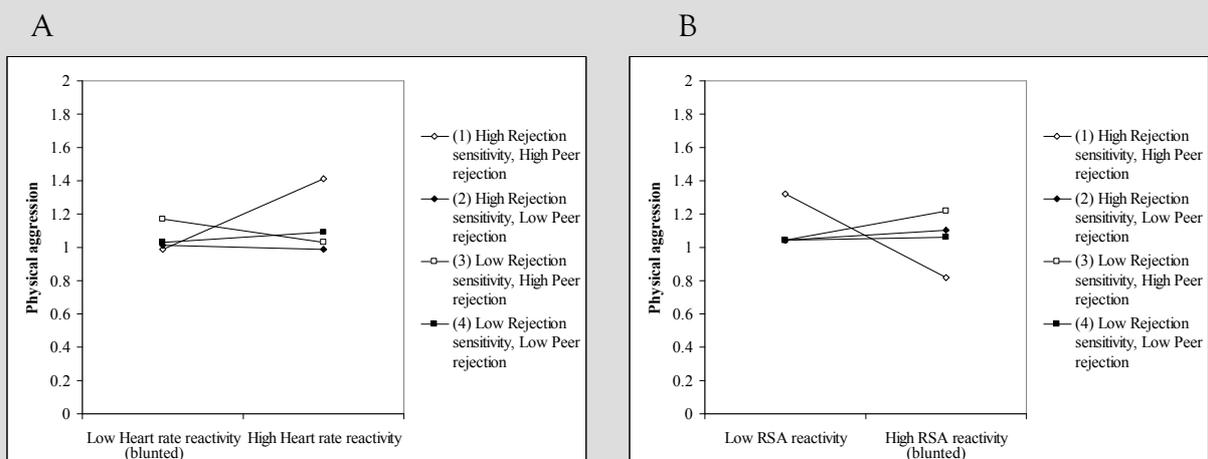
Table 5.4 *Regression Analyses of Physical Reactivity, Rejection Sensitivity, and Peer Rejection on Physical and Relational Aggression*

	Relational aggression				Physical aggression			
	b	t-value	b	t-value	b	t-value	b	t-value
Age (in years)	-0.05	-0.59	-0.06	-0.69	-0.02	0.62	0.01	0.50
Aggression	0.05	0.60	0.10	0.96	0.05†	1.72	0.05†	1.70
Heart rate reactivity	-0.20*	-2.44	-0.23*	-2.62	0.03	1.17	0.04	1.46
Rejection sensitivity	0.16†	1.90	0.13	1.46	-0.00	-0.09	0.01	0.51
Peer rejection	0.10	1.20	0.08	0.94	0.04†	1.73	0.06*	2.38
Rejection sens. x HRR	-	-	-0.05	-0.52	-	-	0.06†	1.78
Peer rejection x HRR	-	-	0.02	0.32	-	-	0.03	1.52
Rejection sens. x Peer rejection	-	-	-0.02	-0.25	-	-	0.04	1.41
Rejection sens. x Peer rejection x HRR	-	-	-0.10	-1.01	-	-	0.08*	2.54
R²	11.9%		13.5%		6.9%		14.8%	

	Relational aggression				Physical aggression			
	b	t-value	b	t-value	b	t-value	b	t-value
Age (in years)	-0.08	-0.95	-0.10	-1.19	0.02	0.76	0.03	1.11
Aggression	0.03	0.37	0.13	1.27	0.04	1.56	0.05	1.65
RSA reactivity	0.13	1.51	0.18*	2.06	-0.02	-0.58	-0.03	-1.08
Rejection sensitivity	0.15†	1.81	0.14	1.59	0.00	-0.02	-0.01	-0.50
Peer rejection	0.13	1.60	0.17*	1.98	0.04	1.58	0.02	0.56
Rejection sens. x RSAR	-	-	0.04	0.35	-	-	-0.08**	-2.65
Peer rejection x RSAR	-	-	0.07	0.77	-	-	-0.05†	-1.69
Rejection sens. x Peer rejection	-	-	0.08	1.05	-	-	-0.02	-0.75
Rejection sens. x Peer rejection x RSAR	-	-	0.33*	2.35	-	-	-0.09*	-2.04
R²	8.9%		14.7%		6.0%		13.1%	

	Relational aggression				Physical aggression			
	b	t-value	b	t-value	b	t-value	b	t-value
Age (in years)	-0.07	-0.87	-0.06	-0.64	0.02	0.72	-0.00	-0.11
Aggression	0.03	0.42	0.05	0.51	0.04	1.60	0.04†	1.72
Skin conductance reactivity	-0.17*	-2.09	-0.17*	-2.01	0.01	0.31	0.00	0.10
Rejection sensitivity	0.12	1.41	0.13	1.41	0.00	-0.03	-0.01	-0.44
Peer rejection	0.14†	1.76	0.12	1.38	0.04†	1.78	0.06*	2.53
Rejection sens. x SCLR	-	-	-0.08	-0.72	-	-	0.05†	1.71
Peer rejection x SCLR	-	-	-0.02	-0.21	-	-	0.05	1.56
Rejection sens. x Peer rejection	-	-	0.04	0.48	-	-	0.00	0.06
Rejection sens. x Peer rejection x SCLR	-	-	-0.01	-0.03	-	-	0.05	1.40
R²	10.5%		11.3%		6.8%		16.3%	

†p < .10, *p < .05, **p < .01; *Note.* HRR = Heart rate reactivity; RSAR = Respiratory sinus arrhythmia reactivity; SCLR = Skin conductance level reactivity

5.4. Discussion

The goal of the present study was to examine the association between ANS reactivity and physical and relational forms of aggression in a sample of females. Findings indicated that, as expected, blunted "fight or flight" responses to social exclusion, indexed by blunted SNS activation and blunted PNS withdrawal, were associated with elevated levels of relational aggression in girls. These effects held after controlling for physical forms of aggression. Interestingly, with respect to PNS reactivity, the most relationally aggressive girls were those who exhibited blunted PNS withdrawal in combination with high levels of rejection sensitivity and peer rejection. In contrast, a heightened "fight or flight" response was associated with physical forms of aggression, particularly among girls who exhibited both high rejection sensitivity *and* high peer rejection. Importantly, girls who exhibited this heightened "fight or flight" response to exclusion and also displayed high levels of rejection sensitivity and peer rejection were consistently the most physically aggressive girls in the sample. In contrast to our hypotheses, there was also some evidence that blunted parasympathetic withdrawal was associated with physical aggression when girls were also rejected. However, this effect was only marginal.

Taken together, these findings may provide insight regarding the mixed findings in the literature examining the association between physiological reactivity to stress and aggression. On the one hand, our findings indicated that blunted "fight or flight" responses to stress were associated with relational aggression. These findings are consistent with fearlessness theory, stimulation seeking theory, and temperamental theories (e.g., Raine, 2002b) and research regarding the development of aggression (e.g., Kibler et al., 2004; Ortiz & Raine, 2004; Schneider et al., 2002). Moreover, our findings are some of the first to provide evidence that reactivity to stress is associated with relational aggression. Moreover, when focusing only on the sympathetic nervous system (SNS) or the combination of the SNS and PNS, it turns out that blunted SCLR and HRR each were associated with relational aggression among girls, regardless of social or cognitive risk. These findings suggest that blunted reactivity of the SNS may serve as an independent biological risk factor for relational aggression regardless of social and cognitive risk factors. Blunted physiological reactivity may be enough to increase girls' involvement in relationally aggressive behaviors even in low risk environments, which may be due to the fact that relational aggression is relatively normative among girls (Card et al., 2008).

However, our findings also demonstrated that, with respect to PNS functioning, the most relationally aggressive girls exhibited blunted parasympathetic withdrawal in combination with both social and cognitive risk. This finding is consistent with previous findings demonstrating that RSAR was positively associated with conduct problems, especially in children who were at risk (i.e., exposed to domestic violence; Katz, 2007). Katz (2007) suggested that augmented RSA activity during stress may reflect hyper-vigilance to threat, leading to behavior problems among at-risk youth. In a similar vein, girls who exhibit augmented RSA reactivity to social exclusion in combination with high levels of peer rejection and rejection

sensitivity may be highly attuned to rejection experiences and thus frequently engage in relational aggression in response to real or perceived experiences of rejection. However, future research examining this hypothesis is necessary.

In line with our second hypothesis, we also found that heightened "fight or flight" responses were associated with physical aggression; moreover, these effects only emerged among girls who exhibited additional social and cognitive risk factors. Specifically, girls who exhibited a heightened "fight or flight" response to exclusion (high HRR and low RSAR) and were also high on both rejection sensitivity and peer rejection were the most physically aggressive girls in the sample. These results are consistent with the idea that physical aggression results from direct, uncontrolled, and impulsive reactions to the social environment among adolescent girls. Moreover, the findings suggest that distinct processes, such as exaggerated emotional responses to stress, may contribute to physical aggression among high-risk females.

Overall, our findings are consistent with the mixed literature; both blunted (e.g., Herpertz et al., 2003; Ortiz & Raine, 2004; Porges et al., 1996) and heightened (e.g., Katz, 2007; Lorber, 2004) "fight or flight" responses were associated with aggression. However, heightened reactivity only appeared to be associated with physical forms of aggression among girls who suffered from additional risk (i.e., social risk, cognitive risk, or both). This is consistent with the view that heightened stress responses can serve as a risk factor in highly adverse environments (Boyce & Ellis, 2005). Our findings suggest that the mixed findings in the literature may be the result of a failure to consider different forms (and functions) of aggression. However, mixed findings may also be due to different methodological approaches (e.g., different stress-experiments, physiological responses measured during or after the task). Future studies should examine the impact of different assessments and experiments on the association between blunted and heightened "fight or flight" responses to stress and aggression.

Strengths

There are a number of strengths regarding this study. First, to our knowledge, this is one of the first studies to examine the association between physiological reactivity to stress and both physical and relational forms of aggression in girls. Importantly, our findings indicated that physiological reactivity to stress was uniquely associated with both forms of aggression, as we controlled for the non-focal form of aggression in our analyses. Our findings indicated that such a distinction is important, as different physiological processes were associated with relational versus physical aggression. Correlations as well as regression analyses indicated that relationally aggressive girls are distinct from physically aggressive girls.

Second, we were able to show fairly consistent findings across several assessments of physiological reactivity, including RSAR, SCLR, and HRR. It is important to note that HRR reflects both SNS and PNS activity; as a result, the inclusion of additional measures (i.e., RSAR and SCLR) allowed us to consider the distinct role of the SNS and PNS in the development of aggression. Overall there was strong support for an association between blunted "fight or flight" responses, indexed by both blunted SNS activation and blunted PNS withdrawal, and relational

aggression. In contrast, girls who exhibited heightened "fight or flight" responses and who experienced high social (i.e., peer rejection) and cognitive (i.e., rejection sensitivity) risk showed elevated levels of physical aggression. Importantly, although findings were generally consistent across indices of SNS and PNS functioning, some distinct patterns of results emerged. For example, PNS but not SNS reactivity interacted with social and cognitive risk in the prediction of relational aggression. Moreover, the interaction between social, cognitive, and physiological risk in the development of physical aggression appeared to be greatest with respect to PNS functioning (i.e., 3-way interaction effects emerged for RSAR and HRR but not SCLR), highlighting the importance of including pure measures of PNS functioning in future research.

Third, our study provides strong evidence in favor of including contextual factors in the study of associations between physiology and problem behavior (Dodge & Pettit, 2003; Lorber, 2004; Raine, 2002b). Although physiological responses to stress may predispose individuals to behave aggressively, there is increasing support for the notion that contextual stressors serve as important moderators of risk. Therefore, inclusion of contextual risk factors such as peer rejection and cognitive interpretations of environmental stressors such as rejection sensitivity may be particularly important in future research. In the context of Cyberball, social and cognitive risk factors related to rejection and exclusion experiences may be especially relevant factors to consider because Cyberball assesses reactivity to experiences of exclusion.

Fourth, this study used Cyberball as a standardized paradigm. The only previous study to look at the associations between physiological reactivity to stressors and different forms of aggression (Murray-Close & Crick, 2007) used semi-structured interviews where participants recounted previous experiences of social stress. The ability to standardize this social stress experience addresses concerns with the previous approach that individual differences in the severity of the previous social stress may account for associations between physiological reactivity and aggressive conduct.

Limitations

Notwithstanding the strengths of our study there were also some limitations. Most importantly, our data were collected in an all-girls summer camp. This context is fundamentally different from other research settings, such as school classes, which raises the question of the generalizability of our findings to other populations. During the summer camp, girls lived in bunks with their peers and were not able to get breaks from social stressors if they occurred (e.g., they could not go home at the end of the day). This may have intensified peer relational processes. In addition, the girls at the camp were predominantly Caucasian and from middle to high SES backgrounds. As a result, it is not clear if the findings would be similar in low SES or minority samples. Furthermore, our measure of social exclusion during the Cyberball game is somewhat artificial and likely less intense than actual experiences of exclusion. Girls were informed that they were playing against a computer and were asked to imagine they were playing the game with three of their friends; as a result, the stressor was relatively minor. Nonetheless, our findings indicate that individual differences in physiological reactivity to social

exclusion were associated with participants' aggressive behavior in the camp setting. Moreover, in previous studies with adults, the Cyberball game elicited feelings of exclusion, even after participants were told they were playing against a computer and that both the computer and humans were following a script during the game (Zadro et al., 2004). Lastly, our study is cross-sectional in nature and can thus only assess associations between physiological reactivity and aggression.

Future research

Future research may benefit from distinguishing between different forms and functions (i.e., proactive and reactive) of aggression and including additional informants regarding aggression (e.g., peer reports; see Crick et al., 1999). Some studies have shown that blunted physiological reactivity may be associated with proactive (or instrumental) functions of aggression, whereas heightened physiological responses to stress may predict reactive functions (Hubbard et al., 2002; Scarpa & Raine, 1997). Furthermore, longitudinal studies should assess the direction of effects regarding the relationship between physiological reactivity and aggressive behavior. More specifically, it may be worthwhile to study whether physiological reactivity puts youth at risk for later problem behavior and/ or whether involvement in aggression can change children's responses to stress. It is also important to consider whether social and cognitive experiences may shape physiological reactive responses to stress. For example, youth may develop increased physiological reactivity to exclusion as a result of perceived or actual peer rejection. Given some research suggesting the importance of interacting physiological stress systems (e.g., El-Sheikh et al., 2009), future research would benefit from examining whether SNS and PNS reactivity interact in predicting physical and relational forms of aggression. Additionally, it is worthwhile to extend the current analyses to male samples as well. Although there is substantially more research examining the association between physiological reactivity and aggression among boys than among girls, there is currently little research examining the association between physiological reactivity and relational aggression in boys. Getting insight in these processes in boys may be important because boys also frequently engage in relational aggression and are more likely than girls to display physically aggressive behaviors (e.g., Card et al., 2008). As a result, social rejection and rejection sensitivity may differently affect the relationship between physiological reactivity and physical and relational aggression in boys compared with girls.

An important venture for future research would also be to compare whether physiological reactivity across different tasks yields similar results. For example, it may be interesting to see whether it is "blunted" reactivity in general (i.e., across tasks) that puts girls at risk for relational aggression or only during social tasks. In addition, because Cyberball asks participants to engage in visual imagery, it is possible that individual differences in this ability may relate to differences in physiological reactivity. As such, it is important for future research to adopt additional standardized paradigms to examine the association between ANS reactivity to social exclusion and aggression. Finally, future studies may benefit from including measures

of fearlessness and sensation-seeking to directly test whether these theories mediate the association between a blunted "fight or flight" response to stress and relational aggression.

Practical implications

The findings from the present study suggest that interventions should tailor their programs to the types of aggression exhibited by girls. For example, girls with heightened "fight or flight" responses who are also high on social rejection and rejection sensitivity appeared to be at relatively high risk. These girls showed substantially more physical aggression than any of their peers. Given their high levels of non-normative aggressive behavior, these girls may benefit from a social skills training. Moreover, their heightened physiological stress response may indicate that these girls are quick to respond with physical aggression in the case of (perceived or actual) social rejection. In turn, this could lead to increased (or actual) levels of social rejection, causing these girls to end up in a vicious cycle of aggression and rejection. Anger management interventions have shown moderate effect sizes in terms of effectiveness (e.g., McGuire, 2008; Wilson & Lipsey, 2007) and may be beneficial for this group of girls as well. In contrast, girls with blunted stress responses may most benefit from alternative techniques, such as providing alternative stimulating experiences.

To conclude, this study sheds some light on the mixed evidence regarding physiological reactivity and aggression. In general, our findings showed that blunted "fight or flight" responses were associated with relational aggression. However, girls who exhibited heightened stress responses and were also high on both peer rejection and rejection sensitivity were the most physically aggressive girls in the sample.

PART III

Do dispositions shape context or does the context shape dispositions?