RELATIONSHIPS AMONG ANGER AND PATTERNS OF ANGER EXPRESSION AND BLOOD PRESSURE, GLUCOSE, AND CORTISOL IN OVERWEIGHT SCHOOL-AGED CHILDREN

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ABSTRACT

Overweight and obesity in school-aged children have become a major health issue. With overweight and obesity, children have increased risk of developing elevated blood pressure readings, glucose levels, and cortisol. Trait anger and patterns of anger expression have been shown to contribute to the elevations of blood pressure, glucose and cortisol in normoweight children and overweight adolescents. However, little research has been done with overweight school-aged children. The purpose of this study was to examine the relationships among trait anger and each of the patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) and blood pressure, glucose, and cortisol in overweight children who were 9-, 10-, and 11-years old.

A convenience sample of 93 (50 females, 43 males; 75.3% Black, 21.5% White, and 3.3% Other) 9-, 10-, and 11-year-old overweight children with a Body Mass Index (BMI) of ≥ the 85th percentile according to the sex specific growth charts of the Centers for Disease Control and Prevention (CDC) were enrolled from a southeastern city. Participants completed Trait Anger and Patterns of Anger Expression instruments and had blood pressure, glucose and cortisol measured.

Twenty nine percent of the participants had systolic blood pressure readings at or above the 90th percentile for age, gender, and height. Thirty three percent of the participants had cortisol levels below the normal range; no participants had elevated
cortisol levels. All participants had glucose levels within the normal range for 2-hour post-prandial.

Trait anger and patterns of anger expression did not influence blood pressure, cortisol, or glucose in this sample of overweight 9-, 10-, and 11-year-old children. Trait anger and cortisol were related in females but not males. Since trait anger and patterns of anger expression have influenced blood pressure, glucose and cortisol in overweight adolescents further investigation is warranted to determine when these influences appear. Further, the research may also need to determine gender-specific influences.
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CHAPTER 1

INTRODUCTION

Overweight in school-aged children has emerged as a major health problem in the United States (Dietz, 2004). In the past 3 decades, the prevalence of overweight has more than tripled in school-aged children ages 6 through 11 years (Centers for Disease Control and Prevention [CDC], 2002; Koplan, Liverman, & Kraak, 2005; Ressel, 2003). Although overweight in children is defined in various ways, children with a body mass index (BMI) in the 85th to 95th percentile on the basis of the gender and age specific growth charts are considered overweight, and those with a BMI at or above the 95th percentile are defined as obese (Barlow, 2007). Data from the National Health and Nutrition Examination Survey (NHANES; 2006) indicate that children ages 6 to 11 years have the highest prevalence of overweight; 18.8% of these children are considered obese (NHANES). Because overweight in children has increased, associated health care costs have also risen from an estimated $35 million per year during the 1970s to current estimates of well over several hundred million dollars per year (Ludwig, 2007).

Another significant issue related to being overweight as a child is that overweight children are also at increased risk of being overweight as adolescents and adults (Dietz, 2004). Two thirds of the adult population in the United States are considered overweight or obese and have associated diseases such as hypertension and Type 2 diabetes (Olshansky et al., 2005). In addition, there is an increasing incidence of these diseases in children, notably in overweight children (Angelopoulos, Milionis, Monschonis, &
Manios, 2006; Falkner et al., 2006; Schiel, Beltschikow, Kramer, & Stein, 2006; Sinha et al., 2002; Wabitsch et al., 2004; Wiegand et al., 2004). Typically, hypertension has been characterized as an adult-onset disease; however, 9 to 25% of overweight children have elevated systolic and/or diastolic blood pressure readings (Angelopoulos et al., 2006; Skinner, Mayer, Flower, & Weinberger, 2008) and have blood pressure significantly higher than that of their normoweight peers (Falkner et al., 2006; Schiel et al., 2006; Skinner et al., 2008).

Along with a rise in blood pressure readings, elevated blood glucose levels are found in an estimated 7% to 36% of overweight children (Sinha et al., 2002; Wabitsch et al., 2004; Wiegand et al., 2004). Furthermore, many overweight children present with metabolic syndrome that includes elevated glucose levels and increased systolic and/or diastolic blood pressure (Del-Rio-Navarro et al., 2008; Lee, S., Bacha, Gungor, & Arslanian, 2008; NHANES, 2006; Sun et al., 2008).

Another outcome which has been noted in addition to the elevations in blood pressure and glucose in overweight children is elevations in cortisol, a hormone secreted by the hypothalamic-pituitary-adrenal (HPA) axis in response to stress (Dimitriou, Maser-Gluth, & Remer, 2003; Sen, Aygun, Yilmaz, & Ayar, 2008; Weigensberg, Toledo-Corral & Goran, 2008). Further, elevations in cortisol have been positively and significantly associated with systolic blood pressure, BMI, and metabolic syndrome (Dimitriou, Maser-Gluth, & Remer, 2003; Sen, Aygun, Yilmaz, & Ayar, 2008; Weigensberg, Toledo-Corral & Goran, 2008).

Furthermore, these elevations in cortisol have been linked to subsequent elevations in glucose, particularly in overweight adults (Besse, Nicod, & Tappy, 2005; Darmon et
al., 2006; Khani & Tayek, 2001; Reynolds, Syddall, Walker, Wood, & Phillips, 2003; Wallerius, Rosmond, Ljung, Holm, & Bjorntorp, 2003; Ward et al., 2003). Although this relationship has rarely been studied in children, an elevation of cortisol with an elevation of glucose was noted in a study with Latino children (Weigensberg et al.). It is unknown whether a rise in cortisol levels and subsequent increases in glucose would be observed in overweight children. Furthermore, it is unclear whether cortisol would mediate the relationship between stress and glucose levels in overweight children.

With the increase of obesity and overweight in school-aged children and the subsequent increases in blood pressure, glucose, and cortisol more children are experiencing normally adult-onset diseases such as hypertension and type 2 diabetes (Olshansky et al., 2005). In comparison with their parents, they may have a shorter life expectancy and a less healthy adolescence and adulthood (Olshansky et al., 2005). Thus, there is a critical need to identify factors that may influence blood pressure, glucose, and cortisol in overweight children and prevent subsequent diseases and sequelae.

Psychological factors such as trait anger and patterns of anger expression have been noted to contribute to the elevation of blood pressure, glucose, and cortisol in normoweight children and overweight adolescents. Trait anger refers to the disposition of an individual to perceive any or all situations as frustrating (Spielberger & Butcher, 1983). The patterns of anger expression refer to the ways in which anger are expressed and include (a) anger-suppression or “holding in” of angry feelings; (b) anger-out or extreme reactions of angry feelings toward others; and (c) anger-reflection/control or the ability to control anger (Spielberger & Butcher; Kassinove, 1995).
Although findings have been equivocal, higher trait anger has been associated with both elevated systolic (Johnson, E., 1989; 1990; Johnson, E., Schork, & Spielberger, 1987) and elevated diastolic (Howell, Rice, Carmon, & Hauber, 2007; Johnson, E., Schork & Spielberger) blood pressure readings in normoweight adolescents and children. Although studies with overweight adolescents are less common, higher trait anger in overweight adolescents has been associated with both higher systolic (Johnson, E., 1990; Johnson, E., Schork, & Spielberger) and higher diastolic (Johnson, E., Schork, & Spielberger) blood pressure readings. Furthermore, these associations may be affected by gender. In some studies, positive relationships have been noted between (systolic or diastolic) blood pressure readings and trait anger only in males (Ewart & Kolodner, 1994; Howell et al., 2007). It is unknown whether these associations between trait anger and blood pressure occur in overweight children younger than adolescence and whether there are differences based on gender.

The influence of trait anger has also been examined in relation to glucose levels, primarily those in adults (Lee, W. H., et al., 2006; Raikkonen, Matthews, & Kuller, 2002). Higher trait anger has been associated with higher glucose levels in one study evaluating metabolic syndrome in adults (Raikkonen et al., 2002); however other studies have not found this relationship (Lee, W. H., et al.). No studies have examined this association in overweight children.

Trait anger has also been examined in relation to levels of cortisol, a glucocorticoid produced in response to stress (Adam, 2006; Al’Absi, Carr, & Bongard, 2007). Trait anger has been found to predict cortisol levels in adults (Al’Absi et al., 2007) and to be positively associated with cortisol levels in adolescents (Adam). It is unknown whether
trait anger and cortisol are associated in children younger than adolescence or in overweight children. Furthermore, although it physiologically appears that cortisol may mediate the relationship between trait anger and glucose, no published studies examining this relationship in overweight children are available.

The patterns of anger expression have also been found to influence blood pressure, glucose levels, and cortisol. The influence of patterns of anger expression has most commonly been examined in regard to blood pressure. A number of studies with both normoweight (Johnson, E., 1989, 1990; Starner & Peters, 2004) and overweight (Mueller, Meininger, Liehr, Chandler, & Chan, 1998; Siegal & Leitch, 1981) adolescents have been conducted with varying results. Higher anger-suppression has been associated with increased systolic blood pressure readings in some studies (Johnson, E., 1989, 1990; Starner & Peters), whereas anger-out has also been positively associated with systolic blood pressure readings in others (Starner & Peters; Vogele & Steptoe, 1993). Anger-reflection/control has been inversely related to systolic blood pressure readings in other reports (Mueller et al., 1998; Starner & Peters).

Patterns of anger expression and blood pressure readings have been examined less frequently in school-aged children. Higher anger-reflection/control has been associated with both lower systolic and lower diastolic blood pressure readings (Hauber, Rice, Howell, & Carmon, 1998; Howell et al., 2007), and higher anger-suppression has been associated with lower diastolic blood pressure readings (Hauber et al.). There have been no published studies that have examined these variables in overweight school-aged children.
Studies that have examined patterns of anger expression and blood pressure in adolescents have yielded differing results by gender (Johnson, E., 1990; Johnson, E., Schork, Spielberger, 1987; Johnson, E., Spielberger, Worden & Jacobs, 1987; Mueller et al., 1998; Starner & Peters, 2004). Positive relationships between anger-suppression and systolic blood pressure were found only in females in some investigations (Mueller et al., 1998; Starner & Peters), whereas others only found such relationships in males (Johnson, E., 1989).

Researchers have also examined the patterns of anger expression and glucose in adults with differing outcomes. Some study results have reported positive relationships between anger-out and glucose levels (Siegman et al., 2002; Vitaliano, Scanlan, Krenz, & Fujimoto, 1996) and others have not found this relationship (Raikkonen, Keltikangas-Jarvinen, Adlercreutz, & Hautanen, 1996). A positive relationship between anger-out bursts and glucose was noted in one study with children (Ravaja & Keltikangas-Jarvinen, 1995). There were no studies found which examined the relationship between patterns of anger expression (anger-suppression, anger-out, or anger-reflection/control) and glucose in overweight school-aged children.

In adults, a positive relationship between anger-out and cortisol has been noted by some researchers (Steptoe, Cropley, Griffith, & Joekes, 1999) but not by others (Koh, Choe, Song, & Lee, 2006). Few studies have been done with other age groups. Adam (2006) noted a relationship between negative emotion (anger-out) and cortisol in adolescents. There have been no published studies of the relationship between anger-out and cortisol in children.
In any research involving school-aged children (9-, 10-, and 11-year-olds) the potentially confounding variables of puberty and gender must be considered. According to Hayward (2003), the onset of puberty is difficult or impossible to pinpoint and may begin occurring in children as young as age 6 but typically commences around age 8. Overweight children may have an earlier onset of puberty (De Ridder et al., 1992; Ribeiro, Santos, Duarte, & Mota, 2006). In several studies, puberty has also been found to influence blood pressure (Shankar, Eckert, Saha, Tu, & Pratt, 2005), glucose levels (Ross, Warren, Kelnar, & Frier, 2005), and cortisol levels (Netherton, Goodyer, Tamplin, & Herbert, 2004),

The second potential factor that can confound results is that of gender. Previous studies have noted differential relationships of trait anger with blood pressure and patterns of anger expression with blood pressure in females and those relationships in males (Adam, 2006; Hauber et al., 1998; Howell et al., 2007; Johnson, E., 1989; 1990; Mueller, Grunbaum & LaBarthe, 2001; Starner & Peters, 2004). Because of the potential effects of puberty and gender on blood pressure, glucose, and cortisol, these variables were measured and controlled for in the analysis.

In summary, trait anger and the patterns of anger expression have been associated with increases in systolic and diastolic blood pressure readings, glucose, and cortisol in overweight adults and, to a lesser extent, in normoweight adolescents and children. Little is known about these relationships in overweight school-aged children. Increased levels of cortisol have also been associated with a subsequent rise in glucose in overweight adults and adolescents; however, this relationship has rarely been studied in overweight
school-aged children. It is unclear whether cortisol mediates the relationship between trait anger and glucose and that between the patterns of anger expression and glucose.

Purpose

Several purposes guided this study. Those are as follows: (a) to describe the levels of trait anger and patterns of anger expression in overweight 9-, 10-, and 11-year-old children (b) to examine the relationships between trait anger and blood pressure, cortisol, and glucose as well as those between patterns of anger expression and blood pressure, cortisol and glucose in 9-, 10-, and 11-year-old children (c) to determine the influence of trait anger and of patterns of anger expression on blood pressure, glucose, and cortisol in overweight 9-, 10-, and 11-year-old children after the confounding variables gender and puberty are controlled; and (d) to determine whether cortisol mediates the relationship between trait anger and glucose, as well as that between patterns of anger expression and glucose in 9-, 10-, and 11-year-old children after the confounding variables, gender and puberty are controlled.

Research Questions and Hypotheses

Research Question 1: What are the levels of trait anger and of patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) in overweight 9-, 10-, and 11-year-old children?

Research Question 2: Are there relationships between trait anger and blood pressure, cortisol, and glucose, as well as between patterns of anger expression (anger-
Hypothesis 1: In 9-, 10-, and 11-year-old overweight children, there will be positive relationships between trait anger and blood pressure, cortisol, and glucose; between anger suppression and blood pressure, cortisol, and glucose; and between anger-out and blood pressure, cortisol, and glucose.

Hypothesis 2: There will be negative relationships between anger-reflection/control and blood pressure, cortisol, and glucose, in 9-, 10-, and 11-year-old overweight children.

Research Question 3: When the effects of puberty and gender are controlled, how much of the variance in blood pressure, cortisol, and glucose is explained by trait anger and patterns of anger expression (anger-suppression, anger-out and anger-reflection/control) in 9-, 10-, and 11-year-old overweight children?

Hypothesis 3: When the effects of puberty and gender are controlled, trait anger and patterns of anger expression will explain the variance in blood pressure, cortisol, and glucose in 9-, 10-, and 11-year-old overweight children.

Research Question 4: When the effects of puberty and gender are controlled, does cortisol mediate the relationship between trait anger and glucose and/or between the patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) and glucose in 9-, 10-, and 11-year-old overweight children?

Hypothesis 4: When the effects of puberty and gender are controlled, cortisol will mediate the effect of trait anger on glucose in 9-, 10-, and 11-year-old overweight children.

Hypothesis 5: When the effects of puberty and gender are controlled, cortisol will
mediate the effects of anger-out, anger-suppression, and/or anger-reflection/control on glucose in 9-, 10-, and 11-year-old overweight children.

Conceptual Framework

The conceptual framework of this study is based on the work of McEwen and Wingfield (2003) who investigated allostatic load and the physiological effects of the sustained activation of the HPA axis and the sympathetic nervous system. McEwen and Wingfield described allostasis as the body’s capacity to adapt to changing environments or stressful events to support the homeostatic systems that are essential for life. This state allows the body to cope physiologically, behaviorally, and emotionally with specific challenges while maintaining regulatory control of body functions (McEwen & Wingfield). The primary systems associated with allostasis are hormones of the HPA axis, catecholamines and cytokines (McEwen & Wingfield).

Allostatic state is the altered or continuous activation of the HPA or SNS, creating an imbalance in the production of glucocorticoids, catecholamines or cytokines (McEwen & Wingfield). These long term effects may result in hypertension, imbalances in cortisol or inflammatory disorders (McEwen & Wingfield). The body can compensate for an allostatic state for a time; however when the imbalance of these systems continues for longer periods of time, the body no longer can accommodate resulting in allostatic overload.

Allostatic load or allostatic overload is defined as the accumulation of wear and tear that affects the physiological systems that result in an adaptation process (McEwen & Wingfield). Overweight has both direct and indirect influences on an increase of
allostatic load in the body. Being overweight is a stressor that, because it may result in
overstimulation of the HPA axis, can directly cause elevated blood pressure, elevated
glucose levels, and increased cortisol levels (Rosmond & Bjorntorp, 2000; Styne, 2001).
If sustained, these elevations can lead to increased risk for cardiovascular disease,
hypertension, and Type 2 diabetes. Indirect influences involve the levels of trait anger
and patterns of anger expression such as anger-out and anger-suppression which may
increase the allostatic load on a system already physiologically stressed system due to
overweight. When overweight and increased levels of trait anger and specific patterns of
anger expression are present, the HPA axis is likely to be activated, and this activation is
likely to lead to a sustained overactivation of physiological responses and increased
allostatic load (See Figure 1). The body can adapt to an increasing allostatic load within
limits. When the allostatic load becomes excessive, maladaptive processes result that are
indicators of physiological dysfunction (McEwen & Wingfield). This dysfunction can
cause cardiovascular responses such as increased blood pressure, truncal adipose tissue
deposit from an increase in glucocorticoids (one of which is cortisol), and increased
glucose levels (McEwen & Wingfield).

The effect of stress on the allostatic load has been described in adults (McEwen &
Wingfield, 2003). In children, stressful situations that elicit elevations in cortisol are ones
that usually are associated with negative reactions (Gunnar, 1992); anger could be
described as a negative reaction. The human body can adapt to stress (such as anger)
within limits; however, when the level of adaptation is exceeded, sustained activation of
the HPA axis will occur. Trait anger, anger-out, and anger-suppression may activate an
intense physiological response in the central nervous system (CNS); in turn, the CNS
stimulates the sympathetic nervous system (SNS) and HPA axis (McCance & Huether, 2006).

Upon activation of the HPA axis and the SNS, the body responds by (a) releasing cortisol (b) increasing the rate and stroke volume of the heart contraction and thereby increasing cardiac output, (c) constricting vessels in blood reservoirs to increase blood pressure and increase the circulating blood volume, (d) increasing epinephrine in the blood, and (e) increasing blood glucose for energy metabolism (McCance & Huether, 2006; Severtsen & Copstead, 2000).

Cortisol is the most potent glucocorticoid and accounts for 95% of glucocorticoid activity (Guyton & Hall, 2000). Cortisol stimulates gluconeogenesis (the formation of glycogen from noncarbohydrate sources such as amino acids and free fatty acids in the liver) but decreases glucose utilization by most cells in the body (Guyton & Hall). These processes lead to a rise in blood glucose; in turn, this rise stimulates the secretion of insulin to return the blood glucose levels to normal range (Guyton & Hall). However, increased blood glucose stimulated by cortisol is more insensitive to insulin. Furthermore, excess cortisol modulates the sensitivity of adipocytes to insulin and catecholamines, and high cortisol has been linked to obesity (Guyton & Hall). These effects seem to be the result of a long-term activation that is caused by stress or by a stressor and that exceeds the allostatic load (Johnson, L., 1998). Therefore, I hypothesize that trait anger or certain patterns of anger expression in children will stimulate a similar stress response and that cortisol secretion will mediate the production of glucose in overweight children.
In contrast, one form of anger expression, anger-reflection/control, may inhibit the activation of the SNS and HPA axis. Individuals displaying anger-reflection/control are able to successfully deal with anger-provoking situations (Kassinove, 1995), and thus do not experience anger-related activation of the HPA axis or the SNS. Anger-reflection/control has shown an inverse relationship with blood pressure in adults (Harburg, Gleiberman, Russell, & Cooper, 1991) and in children (Hauber et al., 1998; Howell et al., 2007). Therefore, as hypothesized in this study, overweight children with greater levels of anger-reflection/control may have normal levels of cortisol and glucose.

In summary, trait anger and/or some forms of patterns of anger expression (anger-suppression and anger-out) may cause overweight children to exceed their body’s ability to adapt to an increased allostatic load. The activation of the SNS and HPA axis could raise the cortisol level, and this rise in cortisol levels could lead to the increased level of glucose in circulation; however, it is not certain. It is likely that trait anger and some forms of patterns of anger expression could increase glucose through the mediation of cortisol in overweight children and further predispose overweight children to stay overweight.

Similarly, trait anger, anger-suppression, and anger-out have been positively associated with blood pressure in adolescents (Johnson, E., 1990; Johnson, Schork & Spielberger, 1987; Johnson, Spielberger, Worden & Jacobs, 1987; Mueller et al., 1998) and in children (Hauber et al., 1998). In contrast, anger-reflection/control has been inversely related to blood pressure in some children (Hauber et al., 1998; Howell et al., 2007). Little research has addressed the potential effects of trait anger or pattern of anger expression on blood pressure, glucose, and cortisol in overweight school-aged children.
Therefore, the main purpose of this study is to determine these relationships and the mediating role of cortisol.

Assumptions

There are several assumptions for the study of overweight 9-, 10-, and 11-year-old overweight children. The assumptions for this study are as follows:

1. Being overweight has negative implications for both short-term and long-term health.
2. School-aged children 9, 10 and 11 years old are cognitively capable to answer questions about their anger and patterns of anger expression.
3. The children have an intact HPA and autonomic nervous systems that can function normally.
CHAPTER 2
LITERATURE REVIEW

In this chapter, research is reviewed that addresses overweight children’s trait anger; patterns of anger expression; and blood pressure, cortisol, and glucose. Each variable is discussed in the context of the available research. Additionally, research related to puberty and gender as possible confounders are included. Among the databases and Web sites accessed were PUBMED and CINAHL and those of the CDC, the National Institutes of Health, the NHANES, the Robert Wood Johnson Foundation, the American Heart Association, American Diabetes Association and the Juvenile Diabetes Association Website.

Introduction

Anger has been studied in adults for many years; however, less research has been done with adolescents and children. Indeed, much of the work with anger in younger age groups has been with adolescents. There is an emerging body of research that indicates that trait anger and patterns of anger expression have been linked to elevations in blood pressure in normoweight school-aged children, commonly 9-, 10-, and 11-year-olds (Hauber et al., 1998; Howell et al., 2007). Research on anger in overweight individuals, particularly overweight school-aged children, is more uncommon. Therefore, this review of related research will include normoweight and overweight adult and adolescent groups, as well as normoweight and overweight children. The purposes of this study
were: (a) to describe the levels of trait anger and patterns of anger expression in overweight 9-, 10-, and 11-year-old children; (b) to examine the relationships between trait anger and blood pressure, cortisol, and glucose, as well as those between patterns of anger expression and blood pressure, cortisol and glucose, in 9-, 10-, and 11-year-old children (c) to determine the influence of trait anger and of patterns of anger expression on blood pressure, glucose, and cortisol in overweight 9-, 10-, and 11-year-old children after the confounding variables, gender and puberty are controlled; and (d) to determine whether cortisol mediates the relationship between trait anger and glucose, as well as patterns of anger expression and glucose, in 9-, 10-, and 11-year-old children after the confounding variables, gender and puberty, are controlled.

This chapter is organized into the following sections: (a) overweight and blood pressure, glucose, and cortisol; (b) trait anger and blood pressure, glucose, and cortisol; (c) patterns of anger expression and blood pressure, glucose, and cortisol; (d) cortisol as a mediator of the relationships between trait anger and glucose and between patterns of anger expression and glucose; and (e) the potential confounding effects of puberty and gender.

Overweight and Blood Pressure, Glucose, and Cortisol

In overweight children, studies have shown an increase in the incidence of usually adult-onset diseases such as hypertension or elevated blood pressure readings (Angelopoulos et al., 2006; Falkner et al., 2006; Schiel et al., 2006) and type 2 diabetes (Sinha et al., 2002; Wabitsch et al., 2004; Wiegand et al., 2004). In particular, increases in blood pressure have been noted with the increases in overweight. In their review of
18,618 records of 2- to 19-year-old children, Falkner and colleagues found that, as BMI increased, there were concurrent increases in both systolic ($p < .001$) and diastolic ($p < .001$) blood pressure readings. Anglepoulos and associates also noted that 24.8% of their sample of 312 overweight children had increased systolic and diastolic blood pressure readings. Last, Maffeis and coworkers (2008), in their study of 1,479 Caucasian children, found that more than one third of overweight males and 50% of obese males had high systolic blood pressure readings and that more than 30% of overweight females and 42.6% of obese females had high systolic blood pressure readings.

A number of researchers (Falkner et al., 2006; Maffeis et al., 2008; Schiel et al., 2006; Skinner et al., 2008) have also noted that in comparison with their normoweight peers, overweight children have significantly higher blood pressure values. In their review of two cross-sectional databases, the NHANES and the Medical Expenditure Panel Survey (MEPS), Skinner and colleagues (2008) noted that the incidence of increased systolic blood pressure readings for overweight children was 9.0%, and for normal weight children was 1.6%. Schiel and associates, in their study of 172 children and adolescents (86 overweight or obese and 86 controls), also reported that overweight and obese subjects had significantly higher systolic and diastolic blood pressure readings than normal weight subjects did.

Along with a rise in blood pressure, an increase in the incidence of type 2 diabetes, a disease usually seen in adults, has been found in overweight children. Elevated glucose levels are a precursor to the development of type 2 diabetes (McCance & Huether, 2006). Several studies have shown a positive relationship between being overweight as a child and having elevated glucose levels (Maffeis et al., 2008; Sinha et al., 2002; Wabitsch et
al., 2004; Wiegand et al., 2004). Sinha and associates evaluated 167 overweight youths (112 adolescents and 55 children) and reported that 21% of the adolescents and 25% of the children had elevated glucose levels. In later studies with 520 overweight children and adolescents, Wabitsch and colleagues noted elevated glucose levels in 6.7% of their participants. Wiegand and coworkers found increased glucose levels in 102 (36%) of the 491 overweight adolescents and children in their sample. Last, Maffeis and coworkers noted that 17.7% of overweight and obese males and 10.8% of overweight and obese females in their study of 1,479 Caucasian children and adolescents had increased glucose levels.

In addition to increased blood pressure readings and increased glucose levels, overweight individuals have also been found to have elevated cortisol levels. In their study of 300 adolescents and children, Dimitriou and coworkers (2003) found that increased cortisol levels were positively associated with BMI ($p < .001$); furthermore, cortisol explained 10 to 33% of body fat in the overweight children. Similarly, Sen and colleagues (2008) noted that cortisol levels were higher in 241 obese adolescents and children with metabolic syndrome than in children without metabolic syndrome; cortisol was also positively associated with systolic blood pressure readings. Weigensberg and coinvestigators (2008) supported these findings with results from their study of 205 overweight Latino youths aged 8 to 13 years; participants who had metabolic syndrome had increased cortisol levels ($r = .16, p < .05$) and systolic blood pressure readings ($r = .34, p < .001$).

Elevations in cortisol have been associated not only with overweight but also with a subsequent increase in glucose levels in overweight adults (Besse et al., 2005; Darmon et
al., 2006; Khani & Tayek, 2001; Reynolds et al., 2003; Wallerius et al., 2003, Ward et al., 2003). In a study with 370 middle-aged men, Reynolds and colleagues, noted that BMI led to increases in cortisol and to subsequent elevations in glucose. In a similar study with 28 middle-aged men, Wallerius and others found that BMI and cortisol were significantly related to increases in glucose. This relationship was noted in studies in which cortisol was artificially administered to participants. Khani and Tayek, in a study with 10 participants, found a subsequent increase in blood glucose levels after administration of a cortisol infusion. In a later study with 11 obese women, Besse and coauthors administered small doses of cortisol and found a subsequent increase of 15.4% in circulating glucose. Last, in a study of 16 women, (8 normal weight and 8 overweight), Darmon and colleagues noted a moderate hypercortisolism along with elevations in circulating glucose, in the overweight women but not in the normal weight women.

Few studies investigating the relationship between cortisol and glucose have been conducted with overweight adolescents and children. In one of the few investigations with obese adolescents and children, Sudi and associates (2000) found that cortisol in the pre-pubertal group was positively correlated to glucose ($p = .01$) and that the relationship between cortisol and glucose was mediated by weight. In a later study with 205 Latino adolescents and children, Weigensberg and colleagues (2008) also noted that higher cortisol levels were associated with higher fasting glucose levels ($r = .23, p < .01$). Sen et al. (2008) examined 241 obese children and adolescents aged 2.0 to 17.6 years and observed higher cortisol levels in children diagnosed metabolic syndrome than in participants not having metabolic syndrome. In addition, Sen et al. found that the adrenocorticotropic hormone (ACTH) associated with the stimulation of the HPA axis
was significantly associated with increased BMI ($r = .13, p = .02$), systolic blood pressure readings ($r = .17, p = .002$), diastolic blood pressure readings ($r = .21, p = .01$), and fasting glucose levels ($r = .17, p = .01$).

In summary, overweight has been associated with increases in systolic and diastolic blood pressure readings, increases in glucose, and increases in cortisol. In addition, elevations in cortisol have been associated with elevations in glucose. These relationships have been seen primarily in studies conducted with adults but have also been apparent in the few studies conducted with overweight adolescents and children.

Trait Anger and Blood Pressure in Adolescents and Children

Trait anger, described as angry feelings that are persistent (Spielberger, Jacobs, Russell, & Crane, 1983), has been studied in relation to blood pressure in studies with normoweight and overweight adolescents (Ewart & Kolodner, 1994; Groer, Thomas, Droppleman, & Younger, 1994; Johnson, E., 1990; Johnson, E., Schork, & Spielberger, 1987; Johnson, E., Spielberger, Worden, & Jacobs, 1987; Mueller et al., 2001; Starner & Peters, 2004) and with normoweight school-aged children (Hauber et al., 1998; Howell, et al., 2007). The results have been equivocal. In one of the earliest studies, E. Johnson, Spielberger and coworkers evaluated the relationship between trait anger and blood pressure in 219 Black and 270 White adolescent males who had no previously reported or diagnosed history of elevated blood pressure; they noted that trait anger was positively associated with systolic blood pressure in Black adolescent males ($r = .13, p < .05$), but not in White males. In a similar study with Black and White female adolescents, E. Johnson, Schork, and Spielberger found that Black females with higher levels of trait
anger had higher diastolic blood pressure readings than White females. A positive relationship between trait anger and systolic blood pressure readings were also found by E. Johnson (1990) in 489 adolescent males. Although not examining relationships per se, Groer and coinvestigators studied 167 high school students in their freshman year and again in their senior year and noted that an increase in anger scores from the students’ freshman to senior years contributed to increases in their diastolic blood pressure readings. Last, Ewart and Kolodner (1995) studied trait anger and blood pressure in 228 Black and White adolescents and found that trait anger predicted systolic blood pressure readings in males and in Blacks.

In contrast, E. Johnson (1989) did not find a relationship between trait anger and systolic or diastolic blood pressure readings in 447 Black and 613 White adolescents. In a similar study, Mueller and colleagues (2001) explored the relationship between trait anger and systolic blood pressure readings and between trait anger and diastolic blood pressure readings in 167 fourteen-year-old adolescents and did not find a relationship between trait anger and either value of blood pressure readings.

Few researchers have examined the relationship between trait anger and blood pressure in school-aged children. In one of the few studies that examined this relationship in school-age children, Hauber and colleagues (1998) did not find a relationship between trait anger and blood pressure in 230 normoweight third-grade children. However, in a later study with 264 third- through sixth-grade normoweight school-aged children, Howell and coinvestigators (2007) noted a positive relationship between diastolic blood pressure and trait anger in male but not in female children.
Most studies that have examined the relationship between trait anger and blood pressure in adolescents and children have not considered weight. However, a few have included weight when examining this relationship. In a study of 489 Black and White male adolescents, E. Johnson, Spielberger, and coworkers (1987) found that trait anger was associated with systolic blood pressure readings in Black males; weight was not significant in this relationship; however, weight was a strong predictor of both systolic and diastolic blood pressure in that study. In contrast, E. Johnson (1990), in his study of 1,021 Black males and females, found that both trait anger and weight were predictors of systolic blood pressure for Black males.

Although there have been studies noting a relationship between trait anger and systolic blood pressure readings and trait anger and diastolic blood pressure readings in normoweight and overweight adolescents, few have examined this relationship in children. In the two studies (Hauber et al., 1998; Howell et al., 2007) with normoweight children, the results were equivocal, with one yielding findings indicating a relationship between trait anger and diastolic blood pressure readings in males. However, there have been no published studies examining the relationship between trait anger and systolic and/or diastolic blood pressure readings in overweight school-aged children.

Trait Anger and Glucose

The relationship between trait anger and glucose has been examined on a limited basis in adults. Raikkonen and coworkers (2002) conducted a longitudinal study (7.4 years) of a cohort of 425 middle-aged women to measure the effect of trait anger (among several other psychological risk factors) in the development of the metabolic syndrome;
their findings revealed that trait anger was the only significant psychological predictor of the metabolic syndrome. In a later study of 448 nurses, physicians, and technicians from a large medical center, W. H. Lee and colleagues (2006) examined trait anger and blood glucose but did not find a relationship. No studies have examined this association in adolescents or children, either overweight or normal weight.

**Trait Anger and Cortisol**

The relationship between trait anger and cortisol has been studied in adults and to some extent in adolescents. However, there has been much less research with school-aged children and this relationship.

In one of the few studies with adults, the relationship between trait anger and cortisol was examined in 87 adults that were participating in a study to determine the effects of perceived stress, trait anger, and mood states on salivary cortisol (Van Eck, Berkhof, Nicholson, and Sulon, 1996). The study enrolled 41 “high stress” and 46 “low stress” individuals; findings suggested trait anger had no significant effect on cortisol. However, the authors’ note this study was comprised of mainly male white collar workers and certainly generalizability might be questioned. Al Absi, Carr, and Bongard (2007) looked at a group of 72 adults that had identified themselves as smokers and found trait anger did predict cortisol levels when the smokers were abstaining from smoking.

Adam (2006) in a recent study of 52 adolescents noted a positive relationship between trait anger and increased cortisol levels. In Adam’s (2006) study, a one-point increase in self-reported trait anger was associated with a 33% increase in cortisol response. Further, in this study higher BMI’s were associated with higher cortisol levels.
(Adam, 2006). The study was comprised of 52 subjects. Given this small sample size, the study might have had low power. However, the author used repeated measures of 14 diary entries and 14 saliva samples per each participant that with 52 participants the study had enough power (Adam, 2005). Examination of the relationship between trait anger and cortisol has been shown to be equivocal for adults; in addition, too little research has been done on adolescents and children to support any conclusions.

Patterns of Anger Expression and Blood Pressure

In addition to the relationship between trait anger and blood pressure readings, the relationships between patterns of anger expression (anger-out, anger-in, or anger-reflection/control) and blood pressure readings have also been explored, primarily in adolescents. Both anger expressed outwardly and suppressed anger have been associated with increased systolic or diastolic blood pressure readings in adolescents (E. Johnson, 1989; E. Johnson, Spielberger, et al., 1987; Mueller et al., 2001; Starner & Peters, 2004). In a 1987 cross-sectional study, E. Johnson, Spielberger and coworkers (1987) noted a positive relationship between suppressed anger and blood pressure readings (diastolic and systolic) in 489 Black and White adolescent males. This finding was supported in a later study in which E. Johnson (1989) noted that, among 1,060 Black and White adolescents aged 15 to 17 years suppressed anger was a significant predictor of systolic blood pressure readings. For the adolescent males, anger-suppression accounted for 75% of the variance in systolic blood pressure readings for Blacks and for 57% of the variance in systolic blood pressure readings for Whites; in adolescent females, anger-suppression accounted for 57% of the variance in systolic blood pressure readings in Blacks. Anger-
suppression and anger-out were not significant predictors of diastolic blood pressure readings in this study (Johnson, 1989). This positive association between anger-in and systolic blood pressure was again noted by Vogele and Steptoe (1993) in a study with 60 males aged 12 through 16 years.

In contrast to findings of positive associations between anger-suppression and blood pressure, the results of a study by Starner and Peters (2004), who evaluated 63 adolescents aged 16-18 years, found no significant relationships between anger-in, anger-out or anger-reflection/control and blood pressure readings. When data were examined by gender, females were noted to have positive significant correlations between anger-in and systolic blood pressure readings and between anger-out and systolic blood pressure readings (Starner & Peters). Also, females were noted to have an inverse relationship between anger-reflection/control and systolic blood pressure (Starner & Peters).

Although most investigations have included normoweight adolescents, researchers have also examined this relationship between patterns of anger expression and blood pressure in overweight adolescents (Mueller et al.,1998; Siegel & Leitch, 1981). In an early study, Seigal and Leitch (1981) found a positive relationship between anger-expression (mainly anger-out as described by the Edwards Personality Inventory; 1966 (as cited by Siegal & Leitch, 1966) and blood pressure readings in 213 adolescents in the 7th through the 10th grades and found this relationship was mediated by weight. In a later cross-sectional study, Mueller et al. (1998) evaluated 60 adolescents 15 to 16 years old and noted that anger-in was significantly related to increased diastolic blood pressure readings in females and that this relationship was mediated by weight. Last, Mueller and associates (2001), in a later study, did not find an association between blood pressure and
anger-suppression or anger-out in 167 adolescents; however, they did note an inverse relationship between decreased levels of anger-control, a healthy form of anger expression, and increased body mass in 85 females.

Although the majority of studies of anger expression and blood pressure have been with adults, two studies have been conducted with normoweight school-aged children. In a study of 230 third-grade children, Hauber and coworkers (1998) found inverse relationships between anger-suppression and diastolic blood pressure readings for males and between anger-reflection/control and systolic blood pressure readings, for females. Howell and colleagues (2007), in a later study of 264 third- through sixth-grade children, found that females had a negative correlation between anger-reflection/control and both systolic and diastolic blood pressure readings.

The studies that have examined the patterns of anger expression and blood pressure (systolic and diastolic) have included predominately adolescent participants. However, there are two studies that examined school-aged children. Studies have also examined the effects of BMI and the relationships between patterns of anger-expression and blood pressure. At present, there are no published studies that have examined the effects of patterns of anger expression (anger-suppression, anger-out or anger-reflection/control) on 9-, 10-, and 11-year-old overweight children.

Patterns of Anger Expression and Glucose

The relationships between patterns of anger-expression and glucose have been studied to some degree in adults but only minimally in children. Investigations of the relationship between patterns of anger expression and glucose in adults have yielded
inconsistent findings. Vitaliano and coworkers (1996) found a positive relationship between anger-out and glucose in 78 adult caregivers; however, these researchers did not evaluate anger-suppression or anger-reflection/control. Siegman and colleagues (2002) also reported a positive correlation between anger-out and glucose in 103 middle-aged women; however, there were no significant relationships between anger-suppression and glucose and anger-reflection/control and glucose in this group. Raikkonen and associates (1996) were unable to find a relationship between anger-out or anger-suppression and glucose in 90 nondiabetic middle-aged men; anger-reflection/control was not examined in their study.

In one of the only studies of children, Ravaja and Keltikangas-Jarvinen (1995) enrolled 573 healthy children and noted a positive relationship between anger outbursts and glucose in females who were 6 to 12 years old; this relationship did not hold true for males. No other patterns of anger expression were examined in this study (Ravaja & Keltikangas-Jarvinen). There have been no published studies that have examined the relationships between patterns of anger expression and glucose in overweight school-aged children.

The existence of the relationship between patterns of anger expression and glucose has been shown in a few studies with adults; however, there is a paucity of studies that have examined these relationships in children and adolescents. Presently, the findings are equivocal. Only one study (Ravaja & Keltikangas-Jarvinen, 1995) has evaluated the relationship between one form of anger expression (anger-out) and children; however, there are no published studies that have examined the relationship of patterns of anger expression and glucose in overweight 9-, 10-, and 11-year-old school-aged children.
Patterns of Anger Expression and Cortisol

Significant correlations between patterns of anger expression, especially anger-out, and cortisol in adults have been documented in the literature. Steptoe and coworkers (1999) noted a positive relationship between anger-out and levels of cortisol in 105 junior and high school teachers; however, these findings did not hold true for the relationship between anger-in and cortisol. Anger-reflection/control was not examined in this study (Steptoe et al.). In a later study, Al’Absi, Bongard, and Lovallo (2000) reported that increased levels of cortisol were associated with increased levels of anger-out in 46 male volunteers; these researchers did not examine anger-in or anger-reflection/control. However, Koh and colleagues (2006) did not find relationships between patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) and cortisol in 38 medical students.

Although relatively little work has addressed the relationship of anger expression and cortisol in children, Adam (2006), in her work with 52 adolescents, noted that increased levels of anger-out or anger-suppression resulted in a subsequent increase in cortisol. In contrast, Lewis, Ramsay and Sullivan (2006) examined the relationship of provoked expressed anger in 4-month-old infants and found that results did not support a relationship between anger expressed outwardly and cortisol.

The relationship between patterns of anger expression and cortisol has been studied minimally in adults, adolescents, and children; results have been inconclusive. Most studies have had a relatively small number of participants, and such numbers may affect power and outcomes. None of the studies have examined overweight school-aged children.
Mediating Effect of Cortisol on Relationships Between Trait Anger and Glucose and Between Patterns of Anger Expression and Glucose

Studies have examined the direct relationships between trait anger and glucose (Lee et al. 2006) and between trait anger and cortisol (Adam, 2006; Al’Absi et al., 2007; Van Eck, Berkhof, Nicholson, & Sulon, 1996) as well as those between the patterns of anger expression and glucose (Raikkonen et al., 1996; Ravaja & Keltikangas-Jarvinen, 1995; Siegman et al., 2002; Vitaliano et al., 1996) and between the patterns of anger expression and cortisol (Adam; Al’Absi et al., 2000; Koh et al., 2006; Lewis et al., 2006; Steptoe et al., 1999), and have noted positive associations. Furthermore, associations have been found between cortisol and glucose (Besse et al., 2005; Darmon et al., 2006; Khani & Tayek, 2001; Reynolds et al., 2003; Sudi et al., 2000; Wallerius et al., 2003; Ward et al., 2003; Weigensberg et al., 2008). However, it is unclear, whether cortisol mediates the relationships between trait anger and glucose and between patterns of anger expression and glucose.

Stimulation of the HPA axis by stressors such as trait anger and some patterns of anger expression suggests that cortisol may mediate the effect of these stressors on glucose levels (Besse et al., 2005; Khani & Tayek, 2001). In studies conducted by Besse and coauthors and by Khani and Tayek the circulating cortisol levels were artificially increased and a resultant increase in glucose was noted. Furthermore, in studies with adolescents (Sudi et al., 2000) and children (Weigensberg et al., 2008), findings revealed a positive association between cortisol and glucose. However, there are no published studies that have examined trait anger or the patterns of anger expression and the relationship between each of these variables and cortisol levels and between each of the
variables and subsequent levels of glucose. It is unclear whether cortisol may mediate the relationship between trait anger or patterns of anger expression and glucose.

**Potential Confounders**

Two variables that may exert an independent influence on blood pressure, cortisol and glucose are puberty and gender. Although not the focus of this study, puberty and gender must be considered as possible confounding variables. This section contains a review of the research related to these variables and the outcomes.

*Puberty*

One potential confounding variable that may independently influence the outcomes of this study of 9- to 11-year-old overweight children is puberty. Puberty is a multifactorial process that involves a cascade of changes affecting biological, physiological and emotional development in children (Hayward, 2003). This is usually seen in children as development of secondary sex characteristics (Hayward, 2003). In previous studies puberty has been measured by use of Tanner staging (De Ridder et al., 2006; Ribeiro, J., et al., 2006, Wang, 2002), physical examination (Kaplowitz et al., 2001) or self assessment (Casrskadon & Acebo, 1993). Although difficult to pinpoint, the onset of puberty may begin occurring in children as young as age 6; however, it typically begins around age 8 (Hayward, 2003). Pubertal changes have been associated with obesity, elevations in blood pressure (systolic and diastolic), glucose and cortisol (Adam, 2006; Kaplowitz et al., 2001; Knutsson et al., 1997; Ross et al., 2005).
Overweight children may have an earlier onset of puberty (De Ridder et al., 1992; Ribeiro et al., 2006). In their study of 17,077 girls aged 3 to 12 years, Kaplowitz and associates (2001) noted an earlier onset of puberty in young obese girls measured by physical examination. In a similar study, Wang (2002) also noted earlier sexual maturity by Tanner staging in overweight females; however, males who had early sexual maturity were less likely to be overweight. In contrast, Ribeiro and coinvestigators in their study of 819 children, found that early sexual maturity was associated with overweight in both males and females. Early sexual maturity or puberty was measured by physical examination and Tanner staging.

Puberty may independently stimulate the HPA axis and therefore cause a rise in blood pressure, cortisol and glucose (Knutsson et al., 1997). In several studies, puberty has been found to influence blood pressure (Leccia et al., 1999; Shankar et al., 2005), cortisol levels (Adam, 2006; Netherton et al., 2004), and glucose levels (Ross et al., 2005). Leccia and colleagues investigated the influence of puberty on blood pressure in 98 males and 87 females with a mean age of 12.0 ± 0.8 years; puberty was significantly correlated to systolic and diastolic blood pressure readings in females but not in males. In contrast, Shankar and associates studied 151 children for 3 years to document the effect of puberty on blood pressure readings. Over the 3-year period, they determined that, in the prepubertal phase of development, systolic blood pressure readings increased significantly in both males and females ($p = .029$). Furthermore, systolic blood pressure readings increased significantly between the onset of puberty and the end of pubertal growth in both females and males ($p < .001$), although males had more of an increase than females ($p < .001$). Interestingly, diastolic blood pressure readings did not increase
in the prepubertal phase of development for either gender. However, diastolic blood pressure readings did increase significantly from the onset of puberty to the conclusion of pubertal development \((p < .001)\) for both genders, with females having a greater increase \((p = .034; \text{ Shanker et al.})\).

Cortisol levels have also been noted to be affected by puberty. Netherton and coworkers (2004) examined the basal levels of cortisol in relation to pubertal development in 129 children and adolescents aged 8 to 16 years, salivary cortisol levels were highest in the postpubertal stage of development and were particularly in so girls. Similarly, Adam (2006), in her study of 52 adolescents, found that those subjects at a higher pubertal stage of development had higher levels of cortisol; cortisol values increased by 23% with every point of increase on a 5-point pubertal-development scale. In contrast, Rosmalen and associates (2005) did not find a relationship between puberty and cortisol levels for either males or females in 1,768 subjects aged 10 to 12 years.

Along with cortisol and blood pressure, glucose levels have also been examined in relation to stage of puberty. Ross and colleagues (2005) examined the glucose levels of 8 prepubertal subjects, 7 midpubertal subjects, and 12 postpubertal Type 1 diabetic children to determine the effect of puberty; the midpubertal group had higher glucose levels than the prepubertal group \((p = .005)\) although varied for each stage.

In summary, evidence suggests that puberty may independently influence blood pressure, cortisol, and glucose. Thus, puberty will be controlled in order to examine the effects of trait anger and of patterns of anger expression on blood pressure, cortisol and glucose without the influence of this variable.
Gender

Evidence suggests that gender may influence the relationships between trait anger and blood pressure and between patterns of anger expression and blood pressure (Ewart & Kolodner, 1994; Hauber et al., 1998; Howell et al., 2007; Johnson, E., 1990; Mueller et al., 2001; Starner & Peters, 2004), the relationship between trait anger and glucose and between patterns of anger expression and glucose (Raikkonen et al., 1996, Siegman et al., 2002) and cortisol and between patterns of anger expression and cortisol (Adam, 2006). Ewart and Kolodner noted, in a study of 228 adolescents (114 females and 114 males) with an average age of 14 years, that trait anger predicted systolic blood pressure readings in males but not in females. In contrast, Starner and Peters found that trait anger and systolic blood pressure readings were positively associated in 39 adolescent females but not in the 26 adolescent males. E. Johnson (1989) evaluated 1,060 Black and White adolescents (459 females and 601 males) and did not find a significant relationship between trait anger and systolic blood pressure.

Gender-related differences in relationships between trait anger and diastolic blood pressure readings have also been noted by gender in several studies (Howell et al., 2007; E. Johnson, 1989; E. Johnson, Schork & Spielberger, 1987). E. Johnson, Schork, and Spielberger (1987) reported that adolescent females with higher levels of trait anger also had higher diastolic blood pressure readings; this association was not found in the adolescent males. In contrast, Howell and coinvestigators noted a positive relationship between trait anger and diastolic blood pressure readings in male but not female school-aged children. However, E. Johnson (1989), who examined 459 female and 601 male
adolescents, did not find a significant relationship between trait anger and diastolic blood pressure readings, in either gender.

Gender-related relationships between the patterns of anger expression and blood pressure readings have also had differing results (Johnson, 1989; Johnson, 1987; Mueller et al., 1998; Starner & Peters, 2004). Positive relationships between anger-suppression and systolic blood pressure readings were found only in females in one investigation (63 adolescents; 37 females and 26 males; Starner & Peters). Muller and associates (1998), in a study of 60 adolescents (30 females and 30 males), found a positive relationship between diastolic blood pressure readings and anger-suppression in females only. In a study of 230 normoweight children (123 females and 107 males), Hauber and coworkers (1998) found an inverse relationship between anger-suppression and diastolic blood pressure readings in males not evident in females. Howell and colleagues who examined 262 school-aged children (155 females and 107 males); did not find significant gender-related relationships between for anger-out or anger suppression and diastolic blood pressure readings. Moreover, Mueller and co-investigators (2001) confirmed this finding in their study of 167 adolescents (85 females and 82 males).

Anger-reflection/control has been inversely correlated with systolic blood pressure readings in 39 adolescent females (Starner & Peters, 2004); this association was not seen in adolescent males. In children, higher scores have been noted for anger-reflection/control correlated with lower systolic and lower diastolic blood pressure readings in females (Hauber et al., 1998). Additionally, Howell and coworkers (2001), in their study of 264 school-aged children, noted that the 155 girls in the study had an inverse correlation between anger-reflection/control and systolic blood pressure readings
and between anger-reflection/control and diastolic blood pressure readings. Furthermore, the entire group of 262 children was noted to have an inverse relationship between anger-reflection/control and diastolic blood pressure readings (Howell et al.).

Lee and colleagues (2006) examined the relationship between trait anger and glucose in 448 medical personnel; however, these researchers failed to find any significant correlations in males or females. No published studies have examined the gender-related relationship between trait anger and glucose in school-aged children.

The relationship between patterns of anger expression and glucose have been examined but not usually by gender. Although Raikkenon and coworkers (1996) noted a relationship between anger-out and glucose in middle-aged men, this study consisted of only men. Siegman and associates (2002) evaluated 103 middle-aged women and found that anger-out and glucose had a significant correlation. However, Vitaliano and others (1996) found that in their sample of 78 adult caregivers, increased levels of anger-out were positively correlated with increased glucose levels for both genders.

There are studies that have examined the relationship between glucose levels and overweight by gender in adolescents and children but have not evaluated the effect of trait anger or patterns of anger expression. To evaluate the prevalence of metabolic syndrome, Maffeis and coinvestigators (2008) examined glucose levels in 1,479 Caucasian children aged 5 to 15 years. A difference between the glucose levels of overweight and obese males and those levels of overweight and obese females was observed (17.5% and 10.8%, respectively) (Maffeis et al., 2008). However, other studies have not found this relationship (Ravaja & Keltikangas-Jarvinen, 1995; Ross, Warren, Kelner & Frier, 2005).
Although differences in the relationships between trait anger and cortisol have been tested by gender in some studies (Adam, 2006) whereas, other studies have not addressed gender (Al’Absi et al., 2000; Van Eck et al., 1996). In her study of 52 adolescents (24 females and 28 males), Adam found no gender associated differences in the relationship between trait anger and cortisol. Van Eck and colleagues only recruited men \((n = 87)\) to participate in their study. Al’Absi and others (2007) recruited 34 females and 38 males for their study of smoking abstinence but did not address whether gender influenced the relationship between trait anger and cortisol.

Gender associated differences between patterns of anger expression and cortisol have also been tested (Adam, 2006; Koh et al., 2006; Steptoe et al., 1999). Adam tested 52 adolescents by gender to examine the relationship between patterns of anger expression and cortisol but did not find differences. Steptoe and colleagues evaluated 105 adults (64 females and 41 males) and noted no significant gender-related differences between patterns of anger expression (anger-suppression or anger-out) and cortisol. Koh and others studied 38 medical students and the effect of patterns of anger expression (anger-suppression and anger-out) and cortisol and noted no significant gender related differences. However, although not significant, minor differences were found in anger-suppression \((M = 16.2 \pm 4.7 \text{ and } M = 13.9 \pm 5.1)\) for females and males respectively and anger-out \((M = 5.9 \pm 4.9 \text{ and } M = 4.8 \pm 2.7)\) for females and males respectively (Koh et al., 2006). The relationship between anger-reflection/control and cortisol was not addressed in these studies.

Differences in cortisol levels have been noted to be associated with gender. Netherton and others (2004) found in their study of 129 children aged 8 to 16 years, that
salivary cortisol levels were higher in females than in males. Rosmalen and associates (2005) measured cortisol levels 5 times a day in 1,768 children 10 to 12 years old; females had greater cortisol levels at all five times than males did, and significant differences were noted in three of the five measurements (Rosmalen et al. 2005).

In summary, differential effects based on gender have been noted in studies that have examined relationships between trait anger and both systolic and diastolic blood pressure readings and between patterns of anger expression and both systolic and diastolic blood pressure readings. In addition, gender-related differences between trait anger and glucose and between trait anger and cortisol have been examined and findings suggest that differences do exist. Gender was examined in studies that have evaluated patterns of anger expression (anger-suppression and anger-out) and cortisol; although no significant differences were found differences were noted between the mean values of each gender for anger-out and between those values of each gender for anger-in. Anger-reflection/control was not addressed in these studies. Gender differences have been noted in studies that have examined cortisol and glucose, including one study with children.

No published studies have examined the relationships between trait anger and blood pressure, cortisol, and glucose and between the patterns of anger expression and blood pressure, cortisol, and glucose in adults or in children. Neither has such a study been published in which overweight 9-, 10-, and 11-year-old school children have been enrolled as participants.
Summary

Although results have been equivocal, trait anger has been associated with both systolic and diastolic blood pressure readings. These relationships have been noted primarily in normoweight adolescents; however, they have also been found in overweight adolescents. Most studies with normoweight adolescents included larger samples, but age groups were varied. Instruments used to measure anger were also varied. Differential effects have been noted with gender. Fewer studies have been conducted with school-aged children and none have been done with overweight children.

Relationships between patterns of anger expression and blood pressure readings have also been reported that, again, have been noted primarily in normoweight adolescents. Results have been equivocal. Some investigators have noted relationships with anger-out, whereas others have noted relationships with anger-suppression or anger-reflection/control. Sample size has varied, and some problems with power have resulted. Because instruments used to measure the patterns of anger expression were varied, comparing findings proved difficult. Studies with normoweight school-aged children are limited and studies with overweight school-aged children are not available.

Studies are limited that have examined the relationships between trait anger and cortisol, between trait anger and glucose, between patterns of anger expression and cortisol, and between patterns of anger expression and glucose. Most have been done with adults. Of the small number that have been done with adolescents, most have involved normoweight adolescents. Sample sizes have been small power limitation have occurred as a result. Differential effects have been noted by gender. Studies with school-aged children, either normoweight or overweight, are rare.
Last, no published studies have evaluated cortisol as a mediator between trait anger and glucose and between patterns of anger expression and glucose. Investigators have noted direct relationships between trait anger and both cortisol and glucose and between patterns of anger expression and both cortisol and glucose. Furthermore, cortisol has been directly linked to glucose. However, studies elucidating the effect of cortisol as a mediator of the relationships between trait anger and glucose and between patterns of anger expression and glucose have not been done.

Therefore, in this study, the effects of trait anger and of patterns of anger expression, and effects on blood pressure, cortisol, and glucose will be examined in overweight school-aged children. Furthermore, the mediating effects of cortisol on the relationships between trait anger and glucose and between patterns of anger expression and glucose will be examined. Because puberty and gender are known to independently influence these relationships in other groups, they will be controlled.
CHAPTER 3
METHODOLOGY

The purpose of this study was to examine the influence of trait anger and patterns of anger expression on blood pressure, cortisol, and glucose in overweight children who are 9, 10, and 11 years old. In this chapter the research design, sample, setting, methods of data collection, instrumentation, protection of vulnerable subjects, data management, and data analysis will be addressed. Additionally, the rationale for utilizing this type of methodology and design will be discussed.

A predictive, cross-sectional design was used to address the research questions and hypotheses. The following determinations were undertaken: (a) the levels of trait anger and of patterns of anger expression; (b) the direct relationships between trait anger and blood pressure, cortisol, and glucose and between patterns of anger expression and blood pressure, cortisol, and glucose; (c) the amount of variance in blood pressure, glucose, and/or cortisol explained by trait anger and by patterns of anger expression; (d) the possible mediation by cortisol of the relationships between trait anger and glucose and between patterns of anger expression and glucose in overweight children.

Descriptive studies describe the characteristics of a population by directly examining samples of the population (Polit & Beck, 2003). In this study, data were collected by administration of three self-report questionnaires, measuring the child’s blood pressure, obtaining a saliva specimen, and assessing blood glucose via finger stick.
Determination of Sample Size

According to Stevens (1996) to have adequate power of .80 with an alpha of .05, the sample size for the five predictor variables of trait anger, anger-suppression, anger-out, anger-reflection/control, and cortisol (using 15 subjects per predictor) would require 75 participants. However, Cohen (1988) recommends using a power analysis that utilizes effect size as the determinate of sample size. Effect size is defined as the measure of the magnitude of the relationship between the independent and dependent variables (Polit & Beck, 2003). In psychological studies, a small effect size is a measured effect that accounts for a minimum 2% of the Y variance (Cohen).

In a secondary analysis of data from 73 overweight children that evaluated the relationship between trait anger and systolic blood pressure, Nichols, Rice, and Howell (2006) noted a small effect size of 0.09, with trait anger accounting for 9% of the variance in systolic blood pressure. Because a small effect size (0.09) had been derived from a previous study (Nichols et al.), Cohen’s (1988) formula and lambda (λ) table were used in this study for an additional calculation of sample size. Lambda is a derivation of the simple function of the effect size index (f²), the numerator (u) and denominator (v), and degrees of freedom (df). For each u value in this table, there are four values of v (20, 60, 120 and ∞); the v values assigned by Cohen’s table for five independent variables are 16.7, 14.0, 13.3, and 12.8, respectively. For the determination of v, Cohen notes, a trial value of λ for v =120 will yield a sufficient sample size.

According to Cohen’s (1998) effect size λ table, the sample size is determined (a) the level of significance (p < .05), (b) the number of independent variables (degrees of freedom for the numerator of the F ratio, u); (c) a value for the degrees of freedom of the
denominator of the $F$ ratio, (v), and (4) the desired power (.80). The formula for calculating sample size derived by Cohen (1988) is as follows:

$$N = \frac{\lambda (1 - f^2)}{f^2}.$$ 

Therefore, if the predetermined significance level of .05, $\lambda$ value of 13.3, the $f^2$ of 0.09 are used and desired power is .80, the calculation results are as follows:

$$N = 13.3(1-.09)/.09 = 134;$$

$$N = 134.$$ 

In summary, these two analyses indicate that the sample size should range from 75 to 134 participants for a small effect size.

Sample and Setting

A convenience sample of 94 children was recruited from 3 public elementary schools and one middle school in one city in the Southeastern United States. The inclusion criteria for the study were as follows: (a) 9, 10, or 11 years old; (b) at or above the 85th percentile of the recommended BMI of the CDC’s (2007) sex-specific growth charts; (c) able to understand and speak English; (d) has parental consent; (e) willing to participate and give assent; and (f) cognitively capable of responding to instruments. The exclusion criteria included substantiated medical conditions that might affect blood pressure, glucose or cortisol, such as asthma requiring long-term steroid therapy, or diseases of the endocrine system (e.g. diabetes). Children of all ethnic groups who met the inclusion criteria were recruited.

An information packet containing a letter explaining both the purpose of the study and data to be collected, as well as two consent forms, was sent to the parents of each
student in the fourth, fifth or sixth grades in which children age 9, 10, or 11 are enrolled (See Appendix A; Appendix B). In addition, a Health Insurance Portability and Accountability Act (HIPAA; See Appendix C) form allowing University of Alabama at Birmingham (UAB) to use their child’s health information for research was included. A description of the height and weight that were required for the child to be eligible for the study was included to help parents to grossly determine BMI and their child’s eligibility for participation.

These forms were given to the teachers of children in the fourth, fifth and sixth grades of four city schools for distribution to all children in the respective grades. Returned forms were collected on the 6th day after distribution. Before data were collected, potential participants whose parents gave consent for their child to participate were screened for eligibility based on BMI. Each child’s weight and height were entered in metric values, and the BMI percentile was determined for the gender and exact age.

After eligibility was determined, a note sent to the parents of eligible children informed them when the study would take place. Prior arrangements were made with the principals and teachers to collect data about trait anger, patterns of anger expression, blood pressure, glucose, and cortisol during the children’s physical education class period in a special classroom designated for the data collection. On the day of data collection, the children reported to the designated classroom during their physical education period. The study was explained to the children. Children who did not want to be in the study were told that they could leave without consequences.
Protection of Vulnerable Subjects

Protocol for the protection of vulnerable subjects’ protocol was first approved by the Internal Review Board for Human Use at UAB (See Appendix D). In addition, the school system’s board of education also reviewed and approved the study.

The school counselor and school nurse were informed about the data collection process and asked to assist if children became upset as a result of answering survey items about anger feelings, became nauseated during the saliva collection, became faint as a result of the finger stick to obtain blood glucose or other possible problems as a result of the data collection. The risks associated with the physiological procedures were outlined in the letter to the parents and in the consent form. The risks were also discussed with the children prior to their signing of the assent form (See Appendix E). Children were informed that there would be no repercussions if they chose not to answer a question that might cause them to be uncomfortable. Children were given the opportunity to ask questions and to resign from the study at any time without prejudice. The assent form was signed in the presence of the assistants and researcher.

Data were collected in a designated area that ensured privacy. Height and weight were measured by metric values which are not commonly used in the schools; therefore the children were unable to make accurate comparisons. During data collection, a cover sheet was placed over the physiological data collection form to deter the children from looking at each other’s measurements.

Confidentiality was maintained through a coding system in which the identity of the participant was known only to the primary researcher. Neither the child’s name nor any
specific identifier appeared on any data collection sheet or in any database. The data were analyzed and reported as a group, without identification of the school system, or teachers.

Procedure

Approval of the study and procedures was obtained from the Institutional Review Board for Human Use at UAB (See Appendix D). Approval of the study was also granted by the school system’s school board, chairman, and superintendent. If the parents chose to allow their child to participate, and if all appropriate forms were signed, the children were admitted to the first phase of the study. The children with parental permission were screened for eligible BMIs. The measurements were entered into the CDC’s (2006) calculation system to obtain BMIs. If these criteria were met, the child was admitted to the study.

On the day of data collection, children signed assent forms. Physiological measures were taken first, followed by the psychological measures. Physiological measures were taken before the psychological measures because answering questions about anger could potentially influence the child’s blood pressure. Each physiological measurement (blood pressure, cortisol, and glucose) was explained to the children before the measurement or specimen was obtained. The data were collected mid-morning to ensure that the children had not eaten anything for 2 hr and had not consumed caffeine for 30 min. This collection time was chosen because carbohydrate or sugar ingestion can cause an uncontrolled spike in glucose and because caffeine can artificially increase blood pressure.

Saliva samples for cortisol were obtained first, followed by blood pressure and glucose. After completing the physiological measures, the participants completed the
psychological instruments. All but one of the psychological instruments were read to the children as a group, the exception was A Self-Administered Rating Scale for Pubertal Development (Carskadon & Acebo, 1993), which was completed privately with each child. Reading the instruments assisted children who may have been slow readers or may have had some difficulty reading; this method enabled the answering of children’s questions and also set time limits for everyone. After completing the data collection, each child was given $5.00 for participating in the study.

**Instrumentation**

*Screening BMI*

The BMI of each child was calculated after obtaining the child’s height and weight. The children’s height was measured by use of a freestanding stadiometer, and the weight was measured by use of a freestanding metric scale. The children were weighed and measured without shoes, coats, or hats. After these measurements were obtained, the BMI was calculated by using the following formula: weight (kilograms) ÷ stature (centimeters) ÷ stature (centimeters) x 10,000. This formula was obtained from the CDC’s (2007) Website which provides the BMI and the corresponding BMI-for-age percentile on a CDC BMI-for-age growth chart. Boys at age 9, 10, and 11 reach the 85th percentile at BMIs of 18.6, 19.4 and 20.1, respectively. Girls ages 9, 10 and 11 reach the 85th percentile at BMIs of 19.0, 20.0 and 20.8, respectively (CDC, 2004). To provide privacy, these measurements were taken behind a screen.
**Blood Pressure**

Participants’ blood pressures readings were taken with a Dinamap (an automatic oscillometric blood pressure machine [Davis Medical Electronic, Vista CA]), according to the guidelines established by the National High Blood Pressure Education Program Working Group for High Blood Pressure Education in Children and Adolescents (NHBPEP) (2004) (See Appendix G). To obtain an accurate blood pressure reading, the operator must determine the appropriate cuff size by ensuring that the cuff bladder length encircles at least 80% of the circumference of the arm. In children, the mean difference and standard deviations between oscillometric and auscultatory methods were 3.18 +/- 5.96 mm Hg for systolic and -0.82 +/- 5.24 mm Hg for diastolic, respectively (Ling, Ohara, Orime, Noon, & Takatani, 1995). The Dinamap has a cuff pressure range of 0 to 290 mmHg for adults and children. The accuracy of the Dinamap meets or exceeds SP 10-1992 AAMI standards (The Association of Medical Instrumentation, Arlington, VA) because it (a) enables agreement between two observers, (b) provides a wide spectrum of blood pressure from hypertensive (above 240 mm Hg) to hypotensive (40 mm Hg), and (c) offers an accurate and noninvasive measure of systolic and diastolic blood pressure readings for both adults and children (Ling et al., 1995). In a study of 189 prepubertal diabetic children over 4 years old, Jin, Donaghue, Fairchild, Chan, and Silink (2001) correlated readings from the Dinamap with a sphygmomanometer, and concluded that the Dinamap is an acceptable measurement tool for research in children aged 8-13 years.

In accordance with the protocol established by the NHBPEP (2004), the participants rested 5 minutes before their blood pressure was taken. To increase accuracy, the operator obtained blood pressure readings twice with a 5-minute interval between
readings. The two readings were averaged. Parents were notified of any blood pressure readings that were elevated (above the 95th percentile for 9, 10, and 11 year olds); this notification was done to comply with the guidelines established by the NHBPEP (2004) on the basis of gender, age, and height.

The normal values for males and females were determined by converting, the height into a percentile factor by using the value on the CDC’s Stature-for-Age and Weight-for-Age Percentile Chart (CDC, 2006). After the percentile of height was determined from these numbers, the percentiles for systolic and diastolic blood pressure were obtained.

Glucose

Glucose levels were obtained by use of the ACCU-CHEK Advantage gluometer (Roche Diagnostics; Model No. A19508) and the ACCU-CHEK glucose strips (Roche Diagnostics; Model No. A19510) (See Appendix G). This device has been approved by the U. S. Food Drug Administration (FDA) for use in children 8 years of age through adults (Roche Diagnostics, 2005). This gluometer has a quality-control check built into the device and test strips are provided to check accuracy of readings. All control tests were performed at each data collection site immediately before the children’s blood glucose levels were obtained and all control values were within the range noted on each strip container. A capillary-blood comparison study of the ACCU-CHEK meter and a glucose hexokinase reference method yields a correlation coefficient of 0.996, in studies by Roche Diagnostics (2005). The ACCU-CHEK Advantage has a correlation with venous blood of less than 5% standard deviation, which is in compliance with the FDA guidelines of 5% acceptable deviation (Roche Diagnostics). The test strip, the ACCU-
CHEK comfort strip used in conjunction with the ACCU-CHEK Advantage glucose monitor, has a precision of 5 mg/5% standard deviation and therefore meets guidelines set by the National Committee for Clinical Laboratory Standards (Roche Diagnostics).

Before the measurement was obtained, a clean test strip was inserted into the device, and quality control recommendations by Roche Diagnostics were followed. A period of less than 2 minutes was allowed for obtaining the specimen and placing it on the test strip. The glucometer analyzed the specimen within 5 s (Roche Diagnostics). Expected postprandial blood glucose values for children who are 9, 10 and 11 years old range from 80 to 140 mg/dl (McCance & Huether, 2006). The results were recorded on the participant’s demographic sheet. If readings were outside the normal range, the child’s parents were advised to have the value rechecked by the child’s health care provider.

Before the blood specimen was obtained, each child was informed of the procedure. The collector donned latex-free gloves and inserted the test strip into the meter. The child’s middle finger on the left hand was wiped with alcohol and dried with a sterile cotton ball. The lancet was inserted into the automatic lancet device, placed on the child’s finger, and deployed. The first drop of blood was wiped, and the second specimen was placed on the glucose strip for reading. Pressure was applied to the puncture site, and a Band-Aid was placed on the wound. The lancets were discarded according to the U.S. Occupational Safety and Health Administration standards (U.S. Dept. of Labor, OSHA).
Salivary Cortisol

The influence of circadian rhythmic fluctuations was controlled by taking participants’ salivary samples within a one-hour window. In accordance with guidelines established by Salimetrics (2002) the children rinsed their mouth with water before the saliva specimen was obtained; this procedure was followed to minimize possible food or bacterial contamination. The saliva was obtained from the children by asking them to spit saliva accumulations in their mouth into a straw that drained into a 3-cc tube (See Appendix G). The children were given 3 min to provide the specimen. After 3 min, the tubes were collected and placed in a Styrofoam cooler for transfer; after being transported to the laboratory, they were placed in a -80° freezer. According to Salimetrics, salivary cortisol will remain stable for up to 6 hr before freezing (Salimetrics, 2006 State College, PA).

Cortisol levels from saliva were determined by high-sensitivity enzyme immunoassay with the use of commercially prepared salivary cortisol kits (HS-CORTISOL; Catalog No. 1-3002/1-3012) from Salimetrics, LLC (State College, PA). The sensitivity of the assay is reported to be .007 µg/dl, with a mean intra-assay coefficient variation of 7.1%, and has been strongly correlated with serum cortisol $r = .91, p < .0001$; Salimetrics. The assay measures the bound cortisol peroxidase on the substrate tetramethylbenzidine (TMB).

The Salimetrics microtiter plate has 96 available wells. Each plate is coated with monoclonal antibodies to cortisol. Cortisol in the standards and unknowns (wells) competes with the cortisol linked to horseradish peroxidase for the antibody-binding sites. After incubation is completed, unbound components are washed away, leaving the
bound cortisol to react to the peroxidase enzyme and subsequently to TMB. Adding sulfuric acid to the wells stopped the reaction of the peroxidase and TMB, and the plates were read within 10 min by measurement of the optical density on the standard plate reader which was set at 450 nm.

The first 12 wells were reserved for the standards sent from Salimetrics. The standards were six vials of cortisol at concentrations of 3.0, 1.0, 0.333, 0.111, 0.037, and 0.012. The next 2 wells were reserved for the zero values, after which nonspecific binding wells were inserted in the plate. Nonspecific binding wells do not contain the anti-cortisol antibody coating and should have an erroneous value. The controls, high and low, were placed in the last 2 wells of the plate. All values were run in duplicate. After the number of specimens to be assayed was determined, 25 µl each of the standard solutions, controls, and unknowns were placed in the appropriate wells. A 1:1,600 dilution of conjugate (50 µl of a solution labeled with horseradish peroxidase and mixed with 24 ml of assay diluent) was made, and 200 µl of the solution were placed into each well with a multichannel pipette. The assay diluent, a phosphate-buffered solution containing detergents and a nonmercury preservative, was diluted 10 fold before use (Salimetrics). After each well was filled, the plate was placed on a rotator for 5 min and incubated at room temperature for 55 min. After the incubation was finished, the plate was washed four times with the use of a 1X wash buffer and was blotted dry after each wash. Next, 200 µl of TMB solution were added to each well with a multichannel pipette, the plate inoculated with the TMB solution was mixed on a rotator for 3 min at 500 rpm. The bottom of the plate was wiped dry with a water-moistened lint-free cloth. The stop solution (a solution of sulfuric acid in distilled water) was then added to the
wells, and the plate was immediately read at 450 nm in a plate reader. When the salimetrics cortisol enzyme immunoassay kit is used, morning cortisol levels for healthy children (ages 8 to 11 years) have been determined to range from 0.084 µg/dl to 0.839 µg/dl (Salimetrics, 2002).

Controls were within the accepted range for the assay kit as recommended by Salimetrics (control high range 1.339 to 0.803, control low range 0.139 to 0.03); however, Salimetrics does note that there could be some slight variation in values within the laboratory, and these ranges should only be used as guides. The assay was run by using three plates, with individual templates for each plate. The control high values for Plates 1, 2, and 3 were 1.16, 1.13, and 1.25, respectively; the control low values for Plates 1, 2, and 3 were 0.14, 0.09, and 0.12, respectively. All values are within the normal expected range. The intra-assay precision for this assay, as determined by Salimetrics for the high control sample has a 3.35% coefficient of variation and the low control sample has a 3.65% coefficient of variation. The inter-assay precision was determined from the mean average duplicates for 12 separate runs and has a 3.75% coefficient of variation, indicating high sensitivity and precision of the salivary cortisol assays (Salimetrics, 2002). Interassay variations were controlled for by simultaneously batch processing the specimens.

**Trait Anger**

After permission of the authors was obtained, the Jacobs Pediatric Anger Scale (PPS-2; Jacobs & Blumer, 1984; See Appendix H; Appendix I) was used to measure trait anger. The PPS-2 is a 10-item Trait Anger subscale of the Jacobs Pediatric Anger Scale
and was developed for use with 9-, 10-, and 11-year-old children (Jacobs & Blumer). Likert-type responses to the questions consists of “hardly ever,” “sometimes,” and “often.” Scores range from 10 to 30; the higher the score is found to be, the higher the level of trait anger. As established by the authors, alpha coefficients for internal consistency range from 0.77 to 0.84. In a study with 166 fourth-grade students, Howell et al. (2007) found alpha coefficients of 0.89. Nichols and colleagues (2008) who conducted a secondary analysis of data of overweight children reported alpha coefficients of 0.85. Using focus groups, Jacobs and Blumer established validity by assessing children from the fourth through seventh grades for their understanding and interpretation of the items; additionally, this instrument was reviewed by fourth grade teachers to determine suitability for fourth grade students (Jacobs & Blumer).

**Patterns of Anger Expression**

After permission of the authors was obtained patterns of anger expression were measured by the Pediatric Anger Expression Scale (PAES-3; Jacobs, Phelps & Rhors, 1989; See Appendix H;Appendix I). The PAES-3 is a 15-item scale composed of three subscales: Anger-Out, Anger-Suppression, and Anger-Reflection/Control. Each subscale is composed of five items. The responses are in Likert like and include “hardly ever,” “sometimes,” and “often.” Each subscale is scored from 5 to 15; the higher the score is found to be, the more predominant the behavior. Alpha coefficients for the subscales of the PAES-3 are Anger-Out, 0.66 to 0.78; Anger-Suppression, 0.57 to 0.76; and Anger-Reflection/Control, 0.32 to 0.62 (Jacobs et al.). Rice and Howell (2006) in their study with 166 fourth-grade children noted alpha coefficients of 0.85, 0.76, and 0.70 for Anger-
Out, Anger-Suppression, and Anger-Reflection/Control, respectively. Jacobs and coworkers confirmed validity in studies of fourth-grade students and teachers using the PAES-3 and self, peer, and teacher ratings of anger expression. Hagglund and others (1994) further noted concurrent validity of the PAES with the “Anger and Hostility Scales with Differential Emotion Scale-IV” (as cited in Hagglund et al.) and the “Aggressive subscale from the Child Behavior Checklist parent form (CBCL)” (as cited in Hagglund et al.).

Rating Scale for Pubertal Development

Because obesity may affect puberty and because puberty may affect blood pressure, glucose and cortisol, participants were measured for the level of pubertal development with the use of a self-administered rating scale (Carskadon & Acebo, 1993) (See Appendix H; Appendix I). The rating scale has been developed individually for females and males and consists of five items. Each item is followed by five possible selections, of which the child circles the letter of the selection that most closely represents his or her level of physical growth. Specifically, the five questions for both genders are related to height, growth of body hair, and skin changes. The five possible responses for each item are (1) “I have not yet begun,” (2) “I have barely started,” (3) “The change is definitely underway,” (4) “The change is complete,” and (5) “I don’t know” (Carskadron & Acebo). Each response has a corresponding numerical value assigned; the higher the total score is found to be the greater the level of pubertal maturation. Range of scores for this instrument is 0 to 20 (Carskadon & Acebo). For females, the pre-pubertal and early puberty score that ranges from 1-3 without menses; mid- pubertal scores are 4 without
menses; late pubertal development scores are from 4 to 7 with onset of menses; and post-pubertal is 8 or greater with onset of menses (Carskadon & Acebo, 1993). For males, pre-pubertal scores range from 0 to 3; early pubertal scores are 4-5; mid-pubertal scores are 6-8; late pubertal scores range from 9-11 and post-pubertal scores equal 12 or greater (Carskadon & Acebo, 1993). Children were considered pubertal if their scores were within the mid-pubertal scores or greater. The internal consistency assessed by Cronbach’s coefficient alpha ranged from 0.67 to 0.70 for student versions (Carskadon & Acebo). Validity of this scale was determined by comparing child scores with puberty levels determined by physical examination by a pediatrician (Carskadon & Acebo, 1993). Students’ rating and pediatricians’ ratings determined by physical examination were within one stage of developmental difference (Carskadon & Acebo). In addition, these scales demonstrated significant correlations between child and parental ratings (Carskadon & Acebo).

Demographics

Demographic data obtained included age, race, birth date, gender, and grade status. Screening information about asthma or diabetes was also obtained from the parents and personal conversation with the participants.

Data Management and Analysis

Data were collected from four schools on separate dates. To prevent inadvertently missing values, the assistants or I reviewed each child’s record before the children left the data collection area. Data from all measures were entered into a database by using a double-entry system. The two databases were then compared for discrepancies. Any
errors were resolved by checking the paper forms and making appropriate corrections before the data were merged into the study’s working data set. Microsoft Excel software was the data program used as the initial database for entering the physiological and the psychological data. The Statistical Package for Social Sciences (SPSS; 2004) GradPak, version 13.0 for Windows, was used for analyzing all data. A code book was created based on the authors’ specific instructions and guidelines for scoring the instruments. Statistical significance was set for each analysis at $p < .05$, using 2-tailed tests.

Descriptive statistics were utilized to identify missing and invalid values within the initial data sets. As part of data quality assurance, each study variable was examined for normal distribution and outliers. Each statistical model was examined for adherence to assumptions (linearity, normality, and homoscedasticity). In addition, Cronbach’s alpha coefficients were computed for each instrument used in this study.

Several analyses were conducted to address the research questions and hypotheses of the study. A brief description of these analyses is provided next.

**Research Question 1:** What are the levels of trait anger and patterns of anger expression (anger-suppression, anger-out and anger-reflection/control) in overweight 9-, 10-, and 11-year-old children? This question was addressed by using descriptive statistics (frequencies, percentages, means, standard deviations, and range) as appropriate to describe distributions of trait anger, anger-suppression, anger-out, and anger-reflection/control. In addition, descriptive statistics were used to describe levels of blood pressure, glucose, and cortisol; age; gender; ethnicity; and BMI.

**Research Question 2:** Are there relationships between trait anger and blood pressure, cortisol, and glucose, as well as between patterns of anger expression (anger-
suppression, anger-out, and anger-reflection/control) and blood pressure, cortisol, and glucose, in 9-, 10-, and 11- year-old overweight children?

_Hypothesis 1:_ Bivariate correlation techniques were used to determine whether in these overweight children, there were positive relationships between trait anger and blood pressure, cortisol, and glucose; and between anger-suppression and blood pressure, cortisol, and glucose; and between anger-out and blood pressure, cortisol, and glucose.

_Hypothesis 2:_ Bivariate correlation techniques were used to determine whether there were negative relationships between anger-reflection/control and blood pressure, cortisol, and glucose in these overweight children.

**Research Question 3:** When the effects of puberty and gender are controlled, how much of the variance in blood pressure, cortisol, and glucose is explained by trait anger and patterns of anger expression in 9-, 10-, and 11-year-old overweight children?

_Hypothesis 3:_ Univariate multiple regression techniques, which included controlling for gender and puberty, were used to determine whether there were relationships between trait anger and blood pressure, cortisol, and glucose and between the patterns of anger expression (anger-suppression, anger-out, anger-reflection/control) and blood pressure, cortisol, and glucose.

**Research Question 4:** When the effects of puberty and gender are controlled, does cortisol mediate the relationship between trait anger and glucose in 9-, 10-, and 11-year-old overweight children and between each of the patterns of anger expression and glucose in 9-, 10-, and 11-year-old overweight children?

_Hypothesis 4:_ Univariate multiple regression techniques, which included controlling for
gender and puberty, were used to determine whether cortisol mediated the relationship between trait anger and glucose in these overweight children.

*Hypothesis 5:* Univariate multiple regression techniques, which included controlling for gender and puberty, were used to determine whether cortisol mediated the relationship between each of the patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) and glucose in these overweight children.

Mediation modeling is a statistical process often used to explain the relationship between three or more variables (Dudley, Benuzillo & Carrico, 2004). The mediation process defines the association that occurs between the independent variables (trait anger and patterns of anger expression), the mediation variable (cortisol), and the outcome variable (glucose; Bennett, 2000). The model depicted in Figure 2 represents the function of cortisol as a mediator. This simple mediation model was described by Baron and Kenny (1986) and has been used extensively for testing the direct effects of a mediator.

According to Baron and Kenny (1986), cortisol can be considered to function as a mediator (a) if there is a significant relationship between the hypothesized mediator and the dependent variable

\[
\text{Cortisol} \rightarrow \text{Glucose};
\]

(b) if there is a significant relationship between the independent variables and the hypothesized mediating variable

\[
\text{Trait anger} \rightarrow \text{Cortisol}
\]

\[
\text{Patterns of Anger Expression} \rightarrow \text{Cortisol};
\]

(c) if the independent variable (trait anger or patterns of anger expression) and the mediating variable are significantly related to the dependent variable (glucose)
Trait Anger $\rightarrow$ Glucose

Patterns of Anger Expression $\rightarrow$ Glucose

and (d) if the coefficient relating the independent variables (trait anger and patterns of anger expression) to the dependent variable (glucose) is reduced or becomes non-significant when the mediator (cortisol) is entered into the model.

Cortisol $\rightarrow$ Glucose, after Trait Anger is statistically controlled

Cortisol $\rightarrow$ Glucose, after each of the Patterns of Anger Expression is statistically controlled

The strongest representation of mediation will be present if the relationship of trait anger (independent variable) to glucose (dependent variable) is zero and if the relationship of patterns of anger expression (independent variables) to glucose (dependent variable) is zero when the mediating variable (cortisol) is included in the model (Baron & Kenny, 1986). However, in psychological analysis, most phenomena are explained as multifactorial; therefore, a mediating relationship of zero is unrealistic, and any reduction in significance will demonstrate mediation (Baron & Kenny, 1986).
Summary

This chapter described the methodology for assessing the influence of trait anger and of the patterns of anger expression on blood pressure, cortisol, and glucose. The rationale for the research design, sample, setting, data collection methods, and instrumentation were addressed. The plan for the protection of vulnerable subjects was outlined, and the plan for the data management and analysis was discussed.
CHAPTER 4

FINDINGS

The findings from this study are addressed in the chapter. First, the characteristics and demographic information of the participants, including age, gender, race, BMI, and puberty score are described by using frequencies and descriptive statistics (mean, standard deviation, range, and median). Then, descriptive information about the study variables and relationships among the variables are included using descriptive statistics and bivariate correlations. Reliability information for the instruments for this study follow. Last, a summary of the findings by each specific aim and hypothesis is presented. A lack of statistically significant relationships between trait anger and glucose and between each of the patterns of anger expression and glucose precluded the need for additional testing of cortisol for mediation.

Sample Characteristics

A convenience sample of 94 children was recruited from a southeastern city school system in the United States. Letters and consent forms were sent to all of the parents of 584 children enrolled in the fourth, fifth, and sixth grades of three elementary schools and one middle school regardless of BMI. The parents of 185 of the children consented to their child’s to participation in the study. Of those 185 children, 103 met the criteria for BMI and age and were enrolled in the study. At the time of data collection, 94 children were present and participated. One child was eliminated from the study because of
missing data on the surveys. The final sample was composed of 93 (50 females and 43 males) children. This sample represented an eligibility rate of 56% of the original 185 whose parents consented to their child’s participation (See Figure 3).

Demographic data, including age, grade level, race, puberty status, gender, and BMI, are presented in Table 1. There were 24 nine-year-olds, 29 ten-year-olds and 40 eleven-year-olds; 51 were in the fourth grade, 34 were in the fifth grade, and 11 were in the sixth grade. Approximately three fourths (75.3%) of the participants were Black, 21.5% of the sample were White, 1.1% were Hispanic, and 2.2% were of more than one race. Seventy-seven percent (n = 72) of the children reported that they were prepubescent.
and 17% \((n = 16)\) of the children indicated that they were in puberty; 5% were unsure or unwilling to complete the survey. Of the prepubescent children, 54% \((n = 39)\) were female and 46% \((n = 33)\) were male. BMI was almost equally divided with 48% \((n = 45)\) being overweight and 51% \((n = 48)\) considered as obese.

Table 1.

<table>
<thead>
<tr>
<th>Demographic Characteristics of Sample ((N = 93))</th>
<th>(M (SD))</th>
<th>(N (%))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (range 9-11 years)</td>
<td>10.17 (0.82)</td>
<td></td>
</tr>
<tr>
<td>9 years</td>
<td></td>
<td>24 (25.8)</td>
</tr>
<tr>
<td>10 years</td>
<td></td>
<td>29 (31.2)</td>
</tr>
<tr>
<td>11 years</td>
<td></td>
<td>40 (43.0)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td>50 (53.8)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td>43 (46.2)</td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4(^{th})</td>
<td></td>
<td>50 (54)</td>
</tr>
<tr>
<td>5(^{th})</td>
<td></td>
<td>32 (34)</td>
</tr>
<tr>
<td>6(^{th})</td>
<td></td>
<td>11 (12)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td>70 (75.3)</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>20 (21.5)</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
<td>1 (1.1)</td>
</tr>
<tr>
<td>More than one race</td>
<td></td>
<td>2 (2.2)</td>
</tr>
<tr>
<td>Puberty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prepubescent</td>
<td></td>
<td>72 (77.4)</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td>39 (54.2)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td>33 (45.8)</td>
</tr>
<tr>
<td>Pubertal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td>16 (17.2)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td>11 (12)</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td>5 (5.4)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85(^{th}) to 94(^{th}) percentile (overweight)</td>
<td>45 (48.4)</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td>25 (55.6)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td>20 (44.4)</td>
</tr>
<tr>
<td>95(^{th}) percentile and greater (obese)</td>
<td></td>
<td>48 (51.6)</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td>25 (52.0)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td>23 (48.0)</td>
</tr>
</tbody>
</table>

*Note.* Because of rounding, not all percentages total 100. BMI = Body Mass Index
Descriptive Statistics of Outcome Variables

The descriptive statistics for the physiological data of the sample are as follows. The systolic blood pressure mean for the group of overweight children was 113.129 mm Hg (range 85 to 144 mm Hg). There were 27 (29%) children, 16 females and 11 males, with systolic blood pressure values at the 90th percentile or greater for height. Of those 27 children, 6 (0.06%; 4 females and 2 males) had values greater than the 99th percentile.

The diastolic blood pressure for the group had a mean of 65.29 mm Hg (range 45 to 81 mm Hg). Diastolic blood pressure values were all within normal limits with the exception of one child, who had a level in the 90th percentile. In addition, this child also had an elevated systolic blood pressure reading.

The mean value of cortisol for the group was 0.1068 µg/dl (range .00 to .29 µg/dl). Cortisol values were within the normal limits of 0.08 to 0.839 µg/dl for 67% of the children; however, 33% of the children had values less than 0.08 µg/dl (See Table 2).

The glucose mean value was 93.17 mg/dl (range 69 to 132 mg/dl). Glucose levels for all children were within the normal range or lower of 80 to 140 mg/dl for a 2-hr post-prandial reading.

Table 2

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Normal range</th>
<th>N</th>
<th>Actual range</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP</td>
<td>95-120 mm Hg</td>
<td>93</td>
<td>85 – 144 mm Hg</td>
<td>113.13 mm Hg</td>
<td>2.04</td>
</tr>
<tr>
<td>DBP</td>
<td>57-81 mm Hg</td>
<td>93</td>
<td>45 – 81 mm Hg</td>
<td>65.3 mm Hg</td>
<td>6.18</td>
</tr>
<tr>
<td>Cortisol</td>
<td>0.084-0.839 µg/dl</td>
<td>93</td>
<td>0.0 – 0.29 µg/dl</td>
<td>0.107 µg/dl</td>
<td>0.06</td>
</tr>
<tr>
<td>Glucose</td>
<td>80-140 mg/dl</td>
<td>93</td>
<td>69 – 132 mg/dl</td>
<td>93.17 mg/dl</td>
<td>10.77</td>
</tr>
</tbody>
</table>

*Note.* SBP = systolic blood pressure; DBP = diastolic blood pressure.
Instrument Reliability

The instruments used in the data collection for this study have been found to have adequate reliability in prior studies for children who are 9, 10, and 11 years old. The Jacobs Pediatric Trait Anger Survey and the Jacobs Patterns of Anger Expression Survey were utilized in this study. The Jacobs Patterns of Anger Expression Survey is comprised of subscales for Anger-Out, Anger-Suppression and Anger-Reflection/Control.

Jacobs Pediatric Trait Anger Survey had a Cronbach’s alpha of 0.76; the Jacobs Patterns of Anger Expression subscales Anger-Out and Anger-Suppression had Cronbach’s alphas of 0.76 and 0.62, respectively; and the Anger-Reflection/Control subscale had a Cronbach’s alpha of 0.39 for this study (See Table 4). The poor reliability of the subscale of Anger-Reflection/Control must be considered in the interpretation of the results. The Self-Administered Rating Scale for Puberty Developmental used in this study was noted to have a Cronbach’s alpha coefficient of 0.49 for the group as a whole; however Cronbach’s alpha was 0.51 for females and 0.47 for males.

Table 3

<table>
<thead>
<tr>
<th>Psychological Instrument Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>Trait Anger</td>
</tr>
<tr>
<td>Anger-Out</td>
</tr>
<tr>
<td>Anger-Suppression</td>
</tr>
<tr>
<td>Anger-R/C</td>
</tr>
</tbody>
</table>

*Note.* Anger-R/C = Anger-Reflection/Control
Analyses for Research Question 1

Research Question 1: What are the levels of trait anger and of patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) in overweight 9-, 10-, and 11-year-old children? The results are as follows.

Table 3 includes descriptive data derived from the psychological variables of trait anger and patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control). Trait anger had a possible range of 10 to 30, with a score of 10 being the lowest level of trait anger and a score of 30 being the highest level. The mean for the group of 93 participants was 19.34, with the median being 19.00. Patterns of anger expression were measured from three subscales: (a) anger-suppression, (b) anger-out, and (c) anger-reflection/control; scores for each of the subscales ranged from 5 to 15, with 5 being the lowest and 15 being the highest level. The anger-suppression subscale for the 93 subjects had a mean of 9.06, the anger-out subscale had a mean of 8.91, and the anger-reflection/control subscale had a mean of 10.35. Females had higher mean values of trait anger, anger-out and anger-reflection/control; males had higher levels of anger-suppression.

Table 4

Descriptive Statistics for Psychological Variables

<table>
<thead>
<tr>
<th>Instrument</th>
<th>N</th>
<th>Actual range</th>
<th>M (SD)</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Anger</td>
<td>93</td>
<td>11.0-29.0</td>
<td>19.34 (4.27)</td>
<td>19.0</td>
</tr>
<tr>
<td>Females</td>
<td>50</td>
<td>12.0-29.0</td>
<td>19.48 (4.38)</td>
<td>19.0</td>
</tr>
<tr>
<td>Males</td>
<td>43</td>
<td>11.0-29.0</td>
<td>19.18 (4.17)</td>
<td>19.0</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>93</td>
<td>5.0-15.0</td>
<td>8.91 (2.64)</td>
<td>8.0</td>
</tr>
<tr>
<td>Females</td>
<td>50</td>
<td>5.0-15.0</td>
<td>9.14 (2.62)</td>
<td>9.0</td>
</tr>
<tr>
<td>Males</td>
<td>43</td>
<td>5.0-15.0</td>
<td>8.65 (2.66)</td>
<td>8.0</td>
</tr>
</tbody>
</table>
Table 4 (Continued)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>N</th>
<th>Actual range</th>
<th>M (SD)</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger-Suppression</td>
<td>93</td>
<td>5.0-15.0</td>
<td>9.06 (2.33)</td>
<td>9.0</td>
</tr>
<tr>
<td>Females</td>
<td>50</td>
<td>5.0-15.0</td>
<td>8.90 (2.46)</td>
<td>9.0</td>
</tr>
<tr>
<td>Males</td>
<td>43</td>
<td>5.0-14.0</td>
<td>9.25 (2.18)</td>
<td>9.0</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>93</td>
<td>5.0-15.0</td>
<td>10.35 (2.0)</td>
<td>10.0</td>
</tr>
<tr>
<td>Females</td>
<td>50</td>
<td>6.0-15.0</td>
<td>10.46 (1.87)</td>
<td>10.0</td>
</tr>
<tr>
<td>Males</td>
<td>43</td>
<td>5.0-15.0</td>
<td>10.23 (2.16)</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Analyses for Research Question 2

Research Question 2: Are there relationships between trait anger and blood pressure, cortisol, and glucose, as well as between patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) and blood pressure, cortisol, and glucose, in 9-, 10-, and 11-year-old overweight children?

Research Question 2a: Are there relationships between trait anger and blood pressure, cortisol, and glucose, as well as between patterns of anger expression (anger-suppression, anger-out and anger-reflection/control) and blood pressure, cortisol, and glucose, in 9-, 10-, and 11-year-old overweight females?

Research Question 2b: Are there relationships between trait anger and blood pressure, cortisol, and glucose, as well as between patterns of anger expression (anger-suppression, anger-out and anger-reflection/control) and blood pressure, cortisol and glucose in 9-, 10-and 11-year-old overweight males?

Bivariate correlations were computed for all of the independent, mediator, and dependent variables, as well as for the puberty covariate. Within the entire group (N = 93), a significant correlation was noted between systolic blood pressure and anger-
reflection/control ($r = .208; p = .045$; See Table 5). However, females ($n = 50$) were shown to have significant bivariate correlations between trait anger and cortisol ($r = .347, p = .014$) and between anger-reflection/control and systolic blood pressure ($r = .330, p = .019$; See Table 6). There were no significant correlations between any of the independent and dependent variables in the sample of males ($n = 44$; See Table 7).

Because puberty was thought to be a significant confounder, it was included as a covariate. The only significant bivariate correlation for puberty occurred with anger-out in females (See Table 6).

Table 5

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Cortisol</th>
<th>Glucose</th>
<th>Puberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Anger</td>
<td>-.063</td>
<td>.009</td>
<td>.181</td>
<td>-.063</td>
<td>.005</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>-.004</td>
<td>.007</td>
<td>.074</td>
<td>-.112</td>
<td>.132</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>.120</td>
<td>.101</td>
<td>-.141</td>
<td>.083</td>
<td>-.017</td>
</tr>
<tr>
<td>Anger-R/C</td>
<td>.208*</td>
<td>.056</td>
<td>.012</td>
<td>.041</td>
<td>.094</td>
</tr>
</tbody>
</table>

*Note. Anger-R/C = Anger-Reflection/Control. *$p < .05$.

Table 6

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Cortisol</th>
<th>Glucose</th>
<th>Puberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Anger</td>
<td>-.060</td>
<td>-.084</td>
<td>.347*</td>
<td>.006</td>
<td>.101</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>.031</td>
<td>.010</td>
<td>.246</td>
<td>-.108</td>
<td>.293*</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>.229</td>
<td>.150</td>
<td>-.166</td>
<td>.002</td>
<td>-.068</td>
</tr>
<tr>
<td>Anger-R/C</td>
<td>.330*</td>
<td>.048</td>
<td>-.200</td>
<td>.010</td>
<td>.103</td>
</tr>
</tbody>
</table>

*Note. Anger-R/C = Anger-Reflection/Control *$p < .05$.
Table 7

**Bivariate Correlations for Males**

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Systolic</th>
<th>Diastolic</th>
<th>Cortisol</th>
<th>Glucose</th>
<th>Puberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trait Anger</td>
<td>-.066</td>
<td>.135</td>
<td>-.036</td>
<td>-.160</td>
<td>-.149</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>-.045</td>
<td>.047</td>
<td>-.169</td>
<td>-.086</td>
<td>-.115</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>-.061</td>
<td>.008</td>
<td>-.076</td>
<td>.191</td>
<td>.088</td>
</tr>
<tr>
<td>Anger-R/C</td>
<td>.070</td>
<td>.091</td>
<td>.151</td>
<td>.108</td>
<td>.073</td>
</tr>
</tbody>
</table>

*Note.* Anger-R/C = Anger-Reflection/Control

Analyses of Research Question 3

**Research Question 3:** When the effects of puberty and gender are controlled, how much of the variance in blood pressure, cortisol, and glucose is explained by trait anger and patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) in overweight 9-, 10-, and 11-year-old overweight children? The findings will be discussed separately for each gender.

**Females**

*Systolic blood pressure.* Gender was controlled within this analysis by evaluating males and females separately. Because puberty and anger-out had a significant bivariate relationship in females, puberty was added as a covariate into the initial model for predicting systolic blood pressure for females. The full model adjusted $R^2$ was .107, which was not significantly different from 0 ($F(5, 44) = 2.176, p = .074$). This finding indicated that, the independent variables together were not significant predictors of systolic blood pressure in overweight female children (See Table 8). Although, anger-reflection/control with a $\beta$ of .356 produced a $p$ value of .040.
**Diastolic blood pressure.** There were no significant bivariate correlations between diastolic blood pressure and puberty for females noted; therefore puberty was not used as a covariate. Adjusted $R^2$ for the full model was less than 0, indicating the variance accounted for by the set of predictors was not significantly different from 0 ($F(4, 45) = 0.457, p = 0.767$) (See Table 9).

Table 8

*Multiple Regression Results for Model Predicting Systolic Blood Pressure for Females, Including Puberty as a Covariate*

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>71.31</td>
<td>(16.70)</td>
<td>-</td>
<td>4.27</td>
<td>.000</td>
</tr>
<tr>
<td>Puberty</td>
<td>1.36</td>
<td>(1.61)</td>
<td>.126</td>
<td>.842</td>
<td>.404</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>-0.49</td>
<td>(.58)</td>
<td>-0.164</td>
<td>-0.844</td>
<td>.404</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>1.55</td>
<td>(1.19)</td>
<td>.309</td>
<td>1.385</td>
<td>.173</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>0.76</td>
<td>(.81)</td>
<td>.143</td>
<td>0.945</td>
<td>.350</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>2.50</td>
<td>(1.18)</td>
<td>.356</td>
<td>2.12</td>
<td>.040</td>
</tr>
</tbody>
</table>

Table 9

*Multiple Regression Results for Model Predicting Diastolic Blood Pressure in Females*

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>60.38</td>
<td>(8.20)</td>
<td>-</td>
<td>7.37</td>
<td>.000</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>-0.22</td>
<td>(.281)</td>
<td>-0.155</td>
<td>-0.778</td>
<td>.441</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>0.411</td>
<td>(.504)</td>
<td>0.180</td>
<td>0.814</td>
<td>.420</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>0.364</td>
<td>(.398)</td>
<td>0.150</td>
<td>0.916</td>
<td>.364</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>0.092</td>
<td>(.553)</td>
<td>0.029</td>
<td>0.167</td>
<td>.868</td>
</tr>
</tbody>
</table>

**Glucose.** Puberty was not related to glucose and so was not included as a covariate. The adjusted $R^2$ for the model was less than 0, ($F(5, 47) = 0.176, p = .970$); therefore, the set of independent variables may not be a predictor of glucose in the females (See Table 10).
Cortisol. In the full model, the adjusted $R^2$ was .050, ($F(4, 45) = 1.642, p = .180$).

As a result, the set of anger variables may not be related to cortisol in females (See Table 11).

Table 10.

*Multiple Regression Model Predicting Glucose in Females*

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>97.451</td>
<td>(16.34)</td>
<td>-</td>
<td>5.963</td>
<td>.000</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.433</td>
<td>(.561)</td>
<td>.164</td>
<td>.789</td>
<td>.434</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>-1.128</td>
<td>(1.005)</td>
<td>-.250</td>
<td>-1.122</td>
<td>.268</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>-.028</td>
<td>(.792)</td>
<td>-.006</td>
<td>-.035</td>
<td>.972</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>-.377</td>
<td>(1.102)</td>
<td>-.060</td>
<td>-.342</td>
<td>.734</td>
</tr>
</tbody>
</table>

Table 11.

*Multiple Regression Model Predicting Cortisol in Females*

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.065</td>
<td>(.078)</td>
<td>-</td>
<td>.836</td>
<td>.408</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.005</td>
<td>(.003)</td>
<td>.339</td>
<td>1.725</td>
<td>.091</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>-.001</td>
<td>(.005)</td>
<td>-.030</td>
<td>-.143</td>
<td>.887</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>-.001</td>
<td>(.004)</td>
<td>-.060</td>
<td>-.386</td>
<td>.702</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>-.002</td>
<td>(.005)</td>
<td>-.052</td>
<td>-.313</td>
<td>.756</td>
</tr>
</tbody>
</table>

Males

The males had no significant bivariate correlations. However, the beta weights and explained variance are presented in the following sections for each dependent variable.

Systolic blood pressure. For the model predicting systolic blood pressure in males, the set of trait anger, anger-out, anger-suppression, and anger reflection/control produced an adjusted $R^2 = 0, F(4, 38) = 0.209, p = .932$ and therefore was not a significant
predictor of systolic blood pressure in males (See Table 12). The total amount of variance explained by the set of all independent variables for systolic blood pressure in males was about 2%.

Diastolic blood pressure. For males, the set of independent variables did not predict diastolic blood pressure. The multiple $R^2$ for the full model was less than .05, and the adjusted $R^2$ for the model was 0, $F(4, 38) = 0.456, p = .768$. Results for the model are provided in Table 13.

Table 12

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>120.80</td>
<td>(19.46)</td>
<td>-</td>
<td>6.207</td>
<td>.000</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>-.248</td>
<td>(.563)</td>
<td>-.096</td>
<td>-.441</td>
<td>.662</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>-.028</td>
<td>(.932)</td>
<td>-.007</td>
<td>-.031</td>
<td>.976</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>-.722</td>
<td>(.955)</td>
<td>-.145</td>
<td>-.756</td>
<td>.454</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>.437</td>
<td>(.969)</td>
<td>.087</td>
<td>-.451</td>
<td>.655</td>
</tr>
</tbody>
</table>

Table 13

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>53.82</td>
<td>(10.96)</td>
<td>-</td>
<td>4.908</td>
<td>.000</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.317</td>
<td>(.317)</td>
<td>.214</td>
<td>1.00</td>
<td>.324</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>.053</td>
<td>(.525)</td>
<td>.023</td>
<td>.102</td>
<td>.919</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>.150</td>
<td>(.538)</td>
<td>.053</td>
<td>.279</td>
<td>.782</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>.438</td>
<td>(.546)</td>
<td>.169</td>
<td>.885</td>
<td>.382</td>
</tr>
</tbody>
</table>

Glucose. The independent variables, trait anger, anger-out, anger-suppression, and anger- reflection/control were not significant predictors of glucose in males. The total
model had an adjusted $R^2$ of 0, $F(4, 38) = 0.465, p = .761$). Trait anger and the patterns of anger expression accounted for less than 5% of the variance in glucose for males (See Table 14).

Table 14

*Multiple Regression Model Predicting Glucose in Males*

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>89.82</td>
<td>(16.29)</td>
<td>-</td>
<td>5.513</td>
<td>.000</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>-.279</td>
<td>(.471)</td>
<td>-.127</td>
<td>-.592</td>
<td>.557</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>.313</td>
<td>(.780)</td>
<td>.091</td>
<td>.401</td>
<td>.691</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>.660</td>
<td>(.799)</td>
<td>.157</td>
<td>.825</td>
<td>.415</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>.171</td>
<td>(.811)</td>
<td>.040</td>
<td>.210</td>
<td>.835</td>
</tr>
</tbody>
</table>

*Cortisol*. As with the other dependent variables examined for males, there was no significant relationship between trait anger, anger-out, anger-suppression and anger-reflection/control and cortisol. The adjusted $R^2$ for the full model to predict cortisol was 0, $F(4, 38) = 0.786, p = .542$). The amount of variance in cortisol explained by the dependent variables was less than 8% (See Table 15).

Table 15

*Multiple Regression Model Predicting Cortisol in Males*

<table>
<thead>
<tr>
<th>Effect</th>
<th>B</th>
<th>(SE)</th>
<th>$\beta$</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>.134</td>
<td>(.100)</td>
<td>-</td>
<td>1.337</td>
<td>.189</td>
</tr>
<tr>
<td>Trait Anger</td>
<td>.001</td>
<td>(.003)</td>
<td>.077</td>
<td>.364</td>
<td>.718</td>
</tr>
<tr>
<td>Anger-Out</td>
<td>-.005</td>
<td>(.005)</td>
<td>-.247</td>
<td>-1.111</td>
<td>.274</td>
</tr>
<tr>
<td>Anger-Suppression</td>
<td>-.006</td>
<td>(.005)</td>
<td>-.214</td>
<td>-1.143</td>
<td>.260</td>
</tr>
<tr>
<td>Anger-Reflection/Control</td>
<td>.004</td>
<td>(.005)</td>
<td>.139</td>
<td>.742</td>
<td>.462</td>
</tr>
</tbody>
</table>
Analyses for Research Question 4

Research Question 4: When the effects of puberty and gender are controlled, does cortisol mediate the relationship between trait anger and glucose and/or between patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) and glucose in 9-, 10-, and 11-year-old overweight children? The analyses is as follows.

Univariate multiple regression techniques were planned to be used to determine whether, after gender and puberty were controlled, cortisol mediated the relationships between trait anger and glucose and/or between patterns of anger expression and glucose. For mediation to exist, there must be (a) a bivariate relationship between trait anger, anger-out, anger-suppression, and/or anger-reflection/control and cortisol; (b) a bivariate relationship between trait anger, anger-out, anger-suppression, and/or anger-reflection/control and glucose; and (c) a bivariate relationship between cortisol and glucose. Because none of these relationships were identified, the null form for Hypotheses 4 and 5 (i.e. that cortisol does not act as a mediator) could not be rejected, and no additional tests of those hypotheses were required.

Summary

Of the 94 children who were enrolled in the study, 93 participants in the final data analysis; for the entire group, the only significant relationship found was a bivariate correlation between anger-reflection/control and systolic blood pressure. Females were shown to have several significant bivariate relationships: trait anger and cortisol, anger-reflection/control and systolic blood pressure, and anger-out and puberty. The female sample was used in a regression analysis and anger-reflection control was significant in
the model predicting systolic blood pressure; however, with only an $R^2\Delta$ of 0.082, anger-reflection/control not significant for explaining variance in systolic blood pressure. Trait anger and anger-out explained 12% of the variance in cortisol in females. The males ($n = 43$) did not have any significant bivariate correlations. Because puberty and gender have been noted to be confounders in studies with children, these two variables were controlled. Puberty was not a significant confounder. However, gender was an important factor in the data analysis.
CHAPTER 5
DISCUSSION

The purpose of this study was to examine the relationships between trait anger and blood pressure, glucose, and cortisol; and between patterns of anger expression and blood pressure, glucose and cortisol in 9-, 10-, and 11-year-old overweight children. This chapter includes a discussion of the characteristics of the sample, the summary statistics for the outcomes, the findings for each research question, limitations of the study, implications for nursing practice, and future research.

Sample Characteristics

Ninety-three 9-, 10-, and 11-year-old overweight children were recruited from the fourth, fifth, and sixth grades of selected schools in a southeastern city school district. Fourth and fifth graders were recruited from three elementary schools, and sixth graders were recruited from one middle school. To access eligible children and to prevent possible stigmatization caused by weight, the research protocol involved giving each of the 584 children in these grades a packet to take to his or her parents. Included in the packet were information about inclusion and exclusion criteria and a table of gross estimates of weight to be used by the parents to determine whether their child might be eligible for the study. Because participation was voluntary, only those children in the fourth, fifth, and sixth grades who had consent from their parents were evaluated for BMI greater than or equal to the 85th percentile. The number of children who were overweight
or obese in the accessible population was not available; therefore, it was not possible to accurately calculate response rate among those who were overweight. A total of 185 parents consented for their child to participate. Of the 185 children recruited, 103 (56% of recruited sample) were eligible and assented to be in the study. Nine of the 103 children were absent on the day of data collection. Data from one participant were excluded because of unanswered items on the surveys. Therefore, the total number of children who comprised the final sample was 93.

Of the 93 participants, 50 were females and 43 were males. Of the 50 females, there were 14 nine-year-olds, 15 ten-year-olds, and 21 eleven-year-olds. Among the males, 10 were 9-year-olds, 14 were 10-year-olds, and 19 were 11-year-olds. The majority of the participants were from the fourth grade \((n = 51)\), with less from the fifth \((n = 34)\) and sixth \((n = 11)\) grades; there were more 11-year-olds \((n = 40)\) than either 9- or 10-year-olds. The imbalance in the number of children from the 6th grade could have been due to the fact that the researcher was unable to have access to the 6th grade teachers. Contact with teachers to access and recruit students has been noted to increase recruitment of children in the schools (Rice, Bunker, Kang, Howell & Weaver, 2007).

The sample included 70 Black (39 females/31 males), 20 White (9 females/11 males), 1 Hispanic (male), and 2 biracial (females) children. In the accessed schools, 76% of students are Black, 23% are White and 1.2% are other races (Alabama Department of Education, 2008). Thus, the ethnicity of the participants was representative of the schools from which they were drawn. Ogden and associates (2006) reported that, of overweight or obese children ages 6-11 in the NHANES sample, there were 62% Black and 44.6% White participants.
Although, 9-, 10-, and 11-year-olds would be considered to be approaching puberty, the number of pubertal subjects was 16 (17%): 9 females (1 nine-year-old, 1 ten-year-old, 7 eleven-year-olds), 7 males (2 nine-year-olds, 1 ten-year-old, 4 eleven-year-olds). Of 72 participants determined to be pre-pubescent; 39 (12 nine-year-olds, 13 ten-year-olds, 14 eleven-year-olds) were females and 33 (7 nine-year-olds, 12 ten-year-olds, 14 eleven-year-olds) were males. Based on age, the percentage of pubescent children should have been greater. However, either more pre-pubescent children were enrolled in the study or children did not accurately report pubescence.

In this sample, overweight and obesity did not seem to accelerate the onset of puberty. Similarly, De Ridder and colleagues (1992) found that the age at the onset of puberty was not related to body fat mass or distribution. However, others have noted an association between overweight and pubescence. Kaplowitz and associates (2001) concluded in their study of 17,077 pre-pubertal females aged 3 to 12 years that earlier onset of puberty in females is attributable to obesity. Likewise, Ribeiro and coworkers (2006), in their study of 819 children, noted an association between early sexual maturation and overweight in males and females. Wang (2002) found that early sexual maturity was positively associated with overweight in females, but that early maturing has a negative association with overweight in males.

All of the children in this sample were overweight or obese and may have been unable to distinguish between fat mass and secondary sex changes. Although there is some research that reported that fifth grade males were able to recognize pubertal development through self-assessment (Carskadon & Acebo, 1993), others have noted that self-assessment to determine pubertal development in overweight children may not be
reliable, due lack of awareness of the body and physical development (Bonat, Pathomvanich, Keil, Field, & Yanovski, 2002).

This sample was evenly distributed between overweight and obese. The participants in the 85th to 95th percentile comprised 48.4% of the sample, whereas the other 51.6% were in the 95th or greater percentile of BMI. In the 85th to 95th percentile, there were 25 females and 20 males; in the 95th and greater percentile, there were 25 females and 23 males. These findings are in contrast of Ogden and associates (2006), who reported percentages for BMI’s at the 85th to 95th percentile in children 6 to 11 to be 36.5% and those for BMI’s at the 95th and greater percentile was 19.9%.

Systolic Blood Pressure

The range of systolic blood pressure (SBP) readings for the entire group of overweight 9-, 10-, and 11-year-old children who participated in this study was 85 to 144 mm Hg; mean systolic pressure was 113.13 mm Hg. According to the NHLBI (2004), the norm for 9-year-old children based on height and age at the 90th percentile or less is 95 to 118 mm Hg. In this study there were three 9-year-old children with SBP readings greater than 118 mm Hg (3 females: 2 Black, 1 White); all were included in the 95th percentile or greater category.

The normal range of SBP readings for 10-year-old children is 97 to 119 mm Hg (NHLBI, 2004). In this study, there were 11 ten-year-old children with SBP readings greater than 119 (5 females/6 males). Of the 5 females, all had SBP readings greater than the 95th percentile. Four were Black, and 1 was of more than one race. The ethnicities of the 6 males were 3 Black and 3 White.
For normal SBP readings, 11-year-olds have a range of 99 to 120 mm Hg based on height, gender, and age (NHLBI, 2004). In this study, there were 13 eleven-year-old children with SBP readings greater than the 95th percentile (6 females/7 males). The ethnicities of this group were 6 Black males and 1 Hispanic male, as well as 4 Black females and 2 females of more than one race. There were 27 (29%) children with SBP readings at the 90th percentile or greater for height, age, and gender; 14 (15%) were females and 13 (14%) were males. Of those 27 children, 20 were Black, 4 were White, 1 was Hispanic and 2 were of more than one race. Of the Black participants, 21% had SBP readings at the 90th percentile or greater (11 females/9 males). Four percent of the White sample (1 female/3 males) had SBP readings greater than or equal to the 90th percentile. One Hispanic male and 2 females of more than one race were also at the 90th percentile or greater for SBP readings.

The numbers of participants who had SBP elevations are comparable to those noted in other studies of overweight children. Sorof and others (2004) noted elevated systolic readings in 19.4% of 5,102 normoweight children, and Falkner and colleagues (2006) reported elevations in 7.2% of a sample of more than 18,000 children aged 2 through 19. In studies of overweight children, Angelopoulos and colleagues (2006) noted that in a sample of 312 fifth graders, 27.5% of overweight and 54.4% of obese children had elevated SBP readings. Likewise, in a study of 1,479 Caucasian children, more than 33% of the overweight children had elevated SBP readings, and more than 46% of the obese children had elevated SBP readings (Maffeis et al., 2008).

When gender was considered, males and females had almost an equal incidence of elevated SBP readings. More Black females had elevated SBP readings than any other
group. Maffeis and coworkers (2008) in their study of Caucasian children noted elevated blood pressure in both males and females. White males had a higher prevalence of elevated SBP readings than White females (Maffeis et al., 2008), similar to findings from this study. Further, in a study of 5,102 normoweight children, researchers found that males had higher SBP levels than females and that White children had higher SBP pressure readings than Black children (Sorof et al., 2004). Angelopoulos and associates (2006) found in their study of 312 Greek children (43 overweight and 85 obese participants) that overweight females had a 13.8% incidence of elevated SBP readings and that overweight males had a 13.7% incidence of elevated SBP readings. In addition, obese females had 26.4% incidence of elevated SBP readings, and obese males had a 28.1% incidence of such readings (Sorof et al., 2004).

According to Hayman and colleagues (2007), who evaluated racial differences in the 85th to 95th percentile of SBP readings, Black youths have higher SBP readings than White youths. In this study, there were 9 Black participants with elevated SBP readings and 1 White participant with an elevated SBP reading in the 85th to 95th percentile. In addition, Hayman and associates (2007) reported that, in children in the 95th percentile and greater category, White participants have a higher incidence of elevated SBP readings than Black participants, but that of all races, Hispanics have the greatest percentages of elevated SBP readings. In the 95th percentile and greater category in this study, participants with elevated SBP readings were as follows: 11 Black, 3 White, and 1 Hispanic. While Black participants with elevated readings exceeded those of White participants, the sample was comprised of a greater percentage of Black participants which would account for the seeming contradiction with other studies. Further, there
were few Hispanic children in the sample so these percentages might not be replicated in other more ethnically balanced samples.

**Diastolic Blood Pressure**

Only one male had a diastolic blood pressure (DBP) reading greater than the 90th percentile for height, and he also had a SBP reading greater than the 90th percentile. Similarly, Paradis and researchers (2004) noted that less than 1% of 3,589 participants 9, 13, and 16 years old had significantly elevated DBP readings. In addition, Schiel and colleagues (2006) found no association between DBP readings and body mass. In contrast, E. Johnson (1990) evaluated Black and White males and noted a significant relationship between BMI and elevated DBP readings. With only one elevation, it is difficult to determine whether this finding would be noted in other samples of school-aged children.

**Glucose**

Glucose levels for the group of overweight children aged 9, 10, and 11 years were all within the normal range (80 to 140 mg/dl) for a 2-hr postprandial sample. The range of glucose levels in this study was from 69 to 132 mg/dl, with a mean of 93.1. These values are much lower than those that have been previously reported in the literature (Weigensberg et al., 2008; Wiegand et al., 2004). Researchers who have evaluated overweight and obese children have noted a mean of 124.7 mg/dl in children with impaired glucose tolerance and a mean of 97.6 mg/dl in children without glucose intolerance (Wiegand et al., 2004). Weigensberg and associates (2008) evaluated 205
Latino youth and noted mean 2-hr postprandial glucose levels of 123.3 mg/dl for overweight 8- to 13-year-olds without metabolic syndrome and 133.9 mg/dl for overweight children in the same age group with metabolic syndrome. However, fasting glucose levels were obtained, and then an oral glucose tolerance tests were administered in a clinical setting in the aforementioned studies. Children in this study were not fasting, and glucose levels were within the normal values for postprandial tests.

**Cortisol**

Cortisol levels were obtained from salivary specimens collected between 10:00 and 11:15 a.m. The actual range of salivary cortisol levels was 0.0 to 0.29 µg/dl, with a mean of 0.107 µg/dl. The expected morning range of cortisol in children aged 8-11 is 0.084 to 0.839 µg/dl (Salimetrics, 2002). Cortisol values of 34 children in the sample fell below the expected level of .08; however, all values were in the low normal range. This finding is in contrast to that of Dimitriou and colleagues (2003) who found that an increase in cortisol levels was related to body fat in children. Further, Csabi and others (2000) noted an increased excretion of cortisol in hypertensive, overweight children. Sen and associates (2008) noted increased cortisol in overweight children diagnosed with the metabolic syndrome. Finally, Weigensberg and others (2008) evaluated 205 overweight Latino youth and found a relationship between increased cortisol levels and BMI.

Although some have reported increased cortisol levels in overweight children, Chalew, Nagel, Burt and Edwards (1997) noted that childhood obesity is associated with a decrease in cortisol levels that results from a blunting effect of chronic HPA stimulation. In some children with chronic illnesses or states (such as obesity), cortisol...
activity has been shown to be blunted or to habituate quickly (Buske-Kirschbaum et al., 1997, 2003; Wamboldt et al., 2003). Overweight children may have chronic HPA stimulation caused by obesity. Buske-Kirschbaum and associates (1997, 2003) compared children with atopic dermatitis (AT) to a group of control children and found a blunted cortisol response to stressors in the AT group. In addition, Wamboldt and colleagues (2003) noted an attenuated cortisol response in children with allergic disorders. Schommer, Hellhammer and Kirschbaum (2003) concluded that HPA responses quickly habituate to psychosocial challenge such as obesity, AT or allergy disorders and that this habituation results in a decreased cortisol value (i.e. a blunted cortisol response).

Although it was expected that cortisol levels would rise in overweight children, cortisol levels in the participants in this study were actually lower than the norms for children. Whether cortisol levels in these overweight participants would remain consistently low throughout the day or over time is not known and is worthy of further study.

Instrument Reliability

The Jacobs Pediatric Trait Anger is a subscale of the Jacobs Pediatric Anger Scale. This instrument has been normed for children in the fourth through the seventh grades with Cronbach’s alpha coefficients of .77 to .84 (Jacobs & Blumer, 1984). In later studies, Cronbach’s alpha was noted at .85 in a study of 916 normoweight children (Rice & Howell, 2006). The Cronbach’s alpha for Trait Anger was .76 for this study.

The Pediatric Anger Expression Scale is composed of three subscales: Anger-Out, Anger-Suppression and Anger-Reflection/Control; reliability coefficients from the
norming studies for these three subscales ranged from .66 to .78; .57 to .76; and .32 to .62, respectively (Jacobs & Mehlhaff, 1994). The norming studies were carried out with 387 Appalachian children and 92 Native American children in the fourth through the seventh grade (Jacobs & Mehlhaff, 1994) which are comparable to the children in this study.

The Anger-Out subscale, for a sample of 46 children (mean age 11.3) with juvenile rheumatoid arthritis, 32 children (mean age 11.4) with juvenile onset diabetes mellitus, and 58 healthy children (mean age 10.9), was noted by Hagglund and colleagues (1994) to have an alpha coefficient of .72. Similarly, an internal consistency of .77 was found for the Anger-Out subscale in a sample of 1060 third through the sixth grade normoweight children (Rice & Howell, 2006). The Anger-Out subscale had a Cronbach’s alpha of .76 for this study of overweight 9-, 10-, and 11-year-old children, which is an adequate reliability coefficient.

The Cronbach’s alpha for the Anger-Suppression subscale in this study was .62 and can be considered somewhat marginal for measuring anger-suppression. Some studies have reported higher alpha coefficients. Hagglund and associates (1994) reported .71 in a group of 136 children diagnosed with childhood rheumatoid arthritis, childhood onset diabetes, and healthy children. Rice and Howell (2006) reported alpha coefficients of .77 in 916 normoweight children with ethnicities (70% Black, 29% White) and grade distributions similar to the current study. Perhaps overweight children respond to the anger-suppression instrument in a different manner than other children who have completed the instrument. Without multiple studies of overweight children using this scale, this remains conjecture.
The alpha coefficient for the Anger-Reflection/Control subscale in this study was .39 and should be considered a poor measure of reliability for this pattern of anger expression. Jacobs and Mehlhaff (1994) noted an alpha coefficient of .36 in their sample of 94 Native American children and an alpha coefficient of .62 in a sample of 387 Appalachian children. Hagglund and others (1994) noted one of .59 in the group of children \( n = 136 \) in their study; (46 diagnosed with juvenile rheumatoid arthritis, 32 diagnosed with juvenile diabetes, and 58 healthy children). Additionally, Rice and Howell (2006) noted an alpha coefficient of .67 in 916 third through the sixth grade normoweight children. This instrument does appear to have better reliability in samples. Given the low reliability in this sample, any findings using the scores from this subscale would be suspect. It might be helpful, before using this instrument in other studies with overweight children, to conduct focus groups to determine what the children are thinking when they respond to the items. In addition, it might be appropriate to conduct a factor analysis with responses to this instrument from a larger sample. Perhaps the results from a factor analysis may present a different configuration of items or factor loadings.

The Self-Administered Rating Scale for Pubertal Development was found to have a Cronbach’s alpha of .49 for the group as a whole. For females, the alpha coefficient was .51; for males, this coefficient was .47. Peterson and others (1988) in a study with 698 children in the sixth and seventh grades noted an alpha coefficient of .83. In a subsequent study of 17 females aged 10 to 16 years and of 21 boys aged 9 to 16 years, Carskadon and Acebo (1993) compared the self-report of the children with the results of a physical examination of puberty by a pediatrician and noted a Spearman correlation of \( r = .868, p < .001 \). In a larger study of 698 children, Carskadon and Acebo (1993) determined the
alpha coefficient to be .70. In this study, the internal consistency of the Self-Administered Rating Scale for Pubertal Development is marginal. It may be difficult for overweight children to differentiate developing breast tissue or other signs of puberty from adiposity. Although the children answered the survey in private, with only a researcher present, there might also have been some embarrassment and unwillingness to report their actual stage of maturation. Alternatively, the children may just be unaware of their bodies and stage of development.

Analyses of Research Question 1

The following is the discussion of statistical analysis addressed in Research Question 1. What are the levels of trait anger and of patterns of anger expression (anger-suppression, anger-out, and anger-reflection/control) in overweight 9-, 10-, and 11-year-old children?

Summary Statistics for Outcome Measures

Trait Anger

Trait anger in this group of overweight 9-, 10-, and 11-year-olds, as measured by the Jacobs’ Pediatric Anger scale, had an actual range of 11.0 to 29.0 of a possible range of 10.0 to 30.0. The mean of 19.34 was higher than the value reported from Jacobs and Blumer (1984), who had a mean of 18.30 for a group of fourth through seventh graders. Howell and colleagues (2007) reported a mean value of 17.87 in 264 third through sixth graders. Because there have been no studies done with exclusively overweight or obese children who have used this scale, it is difficult to compare findings; however, the mean
level of anger appears to be higher for such children than for other similarly aged and
normoweight groups. It may be that overweight children experience more anger or
children in this study experienced more trait anger. There is some evidence to suggest
that overweight children and adolescents are stigmatized and react with anger. Neumark-
Sztainer, Story & Faibisch (1998), in a study of 50 adolescent females (24 African-
American and 26 Caucasian), noted that 60% of the participants reported stigmatization
to which they reacted with anger. Perhaps the children in this sample felt stigmatized and
reacted with anger. Since stigma was not addressed in this study it is difficult to
substantiate this conjecture or to determine whether these findings would be consistent.

The mean score for trait anger for females in this study was 19.48. Jacobs and
noted a mean of 17.34 in 155 females in the third through the sixth grades. Females in
this sample had mean trait anger scores higher than norms and higher than reported in
other studies, which may be attributed to their weight status. However, there is some
evidence to indicate that females are experiencing more anger and are more aggressive
than formerly seen in females (Smith & Thomas, 2000).

The actual range of trait anger scores for males in this study was 11.0 to 29.0 ($M =
19.18$). Similarly, Jacobs and Blumer (1984) found that males in the fourth through the
seventh grades had a mean of 18.38. Howell and others (2007) noted a mean of 18.72 for
107 males in the third through the sixth grades. Although the mean trait anger scores for
males in this study were slightly higher than the norms or in other studies, it does not
appear that these overweight males were particularly angry. It has been noted that
overweight in males may not be as problematic as for females, which may stem from
their physical dominance over normoweight peers (Griffiths, Wolke, Page, Horwood, ALSPAC study team, 2005), and reflected in less anger.

Patterns of Anger Expression

Anger-Suppression

For anger-suppression in this sample, scores ranged from 5 to 15, with a mean of 9.06. Jacobs and Mehlhaff (1994) reported a mean of 9.33 for anger-suppression in fourth- through seventh-grade students. Much like this study, Hagglund and colleagues (1994) reported a mean of 9.19 in 136 children aged 7 through 17 years. Howell and colleagues (2007) noted a mean of 9.28 in their group of 264 school-aged children.

Females, as a subgroup, had an actual range of 5.0 to 15.0, with a mean of 8.90. Although results were comparable, Jacobs and Mehlhaff (1994) noted that females in their study had a mean of 9.28. Similarly, Hagglund et al., (1994) noted a mean of 9.16 for females in their study; Howell and associates (2007) noted a mean of 9.29 for females. Therefore, in comparison with the female children and adolescents in other studies, this group of overweight and obese females had a lower anger-suppression mean. Additionally, they had higher anger-out scores. With lower anger-suppression and higher anger-out scores, the overweight females in this study may express their anger using either anger-out or anger-reflection/control. However, the use of anger-reflection/control cannot be substantiated due to the low reliability of the anger-reflection/control subscale.

Males had a higher level of anger-suppression than the females in this study with an actual range of 5.0 to 15.0 and a mean of 9.25. Jacobs and Mehlhaff (1994) found a higher level \( M = 9.57 \) of anger-suppression in a sample of school-aged males.
Hagglund and co-researchers (1994) noted similar findings of 9.22; Howell and colleagues (2007) noted an anger-suppression mean of 9.30 in school-aged males. Although the males in this study were noted to have higher anger-suppression scores than the females, the scores for these males were similar to those in previous studies. Anger-suppression scores for these overweight males were comparable with other studies of normoweight males, but lower than the females in this study. It may be that males have learned to suppress anger in response to situations that get them in trouble, at school and/or home.

*Anger-Out*

For this study, anger-out had an actual range of 5.0 to 15.0, which is equivalent to the possible range. The mean value for anger-out in this study was 8.91. These findings were similar to the norm of 9.1 noted by Jacobs and Mehlaff (1994) in a sample of adolescents. In a group of 136 children aged 7 to 17, Hagglund and associates (1994) reported a mean anger-out score of 8.73. Howell and others (2007) noted similar findings of 9.00 in school-aged children. Overweight and obese children in this study were found to have had lower scores for anger-out than participants in other studies, which may be reflective of overweight children’s ability to control anger-out; or their size may be protective in that normoweight children do not want a confrontation with an overweight child due to size disparity; and the fear of being hurt (physically) (Griffiths et al., 2006).

Females were noted to have a mean score of 9.14 for anger-out in this sample of overweight children. Other studies with school-aged females (Hagglund et al., 1994; Howell et al., 2007; Jacobs & Mehlhaff, 1994) noted similar means. Jacobs and
Mehlhaff (1994) in their study of 102 adolescent females in the fourth through the seventh grades, noted a mean anger-out value of 8.93, while Hagglund and others (1994) found females aged 7 through 17 to have a mean anger-out score of 8.69. Howell et al., (2007) in their study of third through sixth-grade females, found a mean of 8.96. Mean anger-out scores for females were slightly higher than those found in other studies.

Males had a mean anger-out score of 8.65 in this study of overweight children. Jacobs and Mehlhaff (1994) found a higher mean value (9.69) in males in the fourth through the seventh grades. However, Hagglund and others (1994) noted similar findings of 8.86 in males aged 7 through 17. Other studies have yielded a higher mean of 9.50 in school-aged normoweight males (Howell et al., 2007). Males have, for the most part, had higher levels of anger-out than females in other studies. This may be due to the fact that society is more accepting of anger-out in males. That these overweight males had lower levels of anger-out than their female counterparts is somewhat surprising. However, Smith and Thomas (2000) examined 213 adolescent girls and noted an increase in violent (anger-out) behaviors, which subsequently are beginning to outnumber these types of behaviors in boys. Without multiple studies with overweight children, it is difficult to determine if this is a consistent pattern.

**Anger-Reflection/Control**

The anger-reflection/control scores in this sample had a range of 5 to 15. The mean value for anger-reflection/control was 10.35 for the entire group of 93 overweight participants in this study. Jacobs and Mehlhaff (1994) found a similar mean value of anger-reflection/control of 9.98 in a group of fourth through seventh graders. Hagglund
and others (1994) who studied a group of 7- to 17-year-old children, some with chronic
disease, reported a mean value of 10.70; while Howell and others (2007) noted an anger-
reflection/control mean of 9.98 in school-aged children. While it would seem that
overweight children in this study used more anger-reflection/control as a pattern of anger
expression, it is difficult to draw conclusions since the subscale reliability was low and
thus, results are unreliable.

Females had an actual range of anger-reflection/control scores of 6 to 15, with a
mean of 10.46. In an earlier study, Jacobs and Mehlhaff (1994) reported a mean anger-
reflection/control score of 9.98 in females in the fourth through seventh grades. Hagglund
et al. (1994) reported a mean of anger-reflection/control scores for females of 10.67. In
third-through sixth-grade females, Howell and others (2007) reported a mean value of
10.32. Thus, the mean anger-reflection/control score in this sample was comparable to
those in other studies. With the unreliability of the measure, it is difficult to determine if
the level of anger-reflection/control noted is consistent.

The males in this sample had an actual range of anger-reflection/control scores of 5
to 15 and a mean of 10.23. Other studies with school-aged males have reported similar
results. Jacobs and Mehlhaff (1994) reported a mean of 10.03 for the males in his study.
Hagglund and co-researchers (1994) reported an anger-reflection/control mean of 10.72
for males. However, Howell and others (2007) noted school-aged males in their study to
have a mean anger-reflection/control score of 9.55. It would seem that the anger-
reflection/control scores are consistent with those of other studies but the unreliability of
the measure makes any interpretation suspect.
Analyses of Research Question 2

Research Question 2: Are there relationships between trait anger and blood pressure, cortisol, and glucose, as well as between patterns of anger expression (anger-suppression, anger-out and anger-reflection/control) and blood pressure, cortisol, and glucose in 9, 10, and 11-year-old overweight children? These relationships were examined through bivariate correlation analysis.

Trait Anger

Systolic blood pressure. A relationship between trait anger and SBP readings was not found for the entire group or for females or males separately in this sample of 9-, 10-, and 11-year-old overweight children. This finding coincides with those of earlier studies of both children and adolescents that did not find such a relationship for entire groups or for specific genders (Hauber et al., 1998; Johnson, E., 1990; Mueller et al., 1998; Mueller et al., 2001). In contrast, E. Johnson, Spielberger, and colleagues (1987) found a positive correlation between trait anger and SBP readings in 219 Black adolescent males. In addition, relationships between trait anger and SBP readings have been also been reported in the literature on adults (Chang et al., 2002; Durel et al., 1989; Friedman et al., 2001; Ratnasingam & Bishop, 2007; Suls, Wan, & Costa, 1995). A significant positive relationship between trait anger and SBP readings has been reported in adults in some studies (Ratnasingam & Bishop; Suls et al.) but not in others (Chang et al; Friedman et al., 2001). In children, perhaps this association does not appear until later in adolescence, when trait anger may have more of an influence on systolic blood pressure. Since studies with adults (Ratnasingam & Bishop; Suls et al.) and adolescents (Ewart & Kolodner,
1994; Groer et al., 1994; Johnson, E., 1990; Johnson, Schork, & Speilberger, 1987) have noted relationships, these relationships may be dependent on age. The inability to detect a relationship based on gender in this study may also result from the relatively small sample of males and females.

**Diastolic blood pressure.** A relationship between trait anger and DBP readings was not found for the entire sample or for females or males separately. Findings from earlier studies (Hauber et al., 1998; Howell et al., 2007; Mueller et al., 1998, 2001) also did not show this relationship. In contrast, E. Johnson (1990) examined 1,021 normoweight adolescents and found a significant positive relationship between trait anger and DBP readings. Durel and others (1989) found positive significant relationships between trait anger and DBP readings in Black and White women but not in men. Ratnasingam and Bishop (2007) also found a significant positive relationship between trait anger and diastolic blood pressure readings in Chinese female undergraduate students. However, Howell and colleagues (2007) found a significant negative correlation between trait anger and diastolic blood pressure in 107 third- through sixth-grade males. Although the mean trait anger score for the males in this study was greater than those reported in earlier studies for children, trait anger was not significantly related to DBP readings. The lack of significance between trait anger and diastolic blood pressure readings in this study could be caused by the small sample (43 male participants) and resulting low power.

**Glucose.** The relationship between trait anger and glucose for the entire group or for females or males was not significant. Because there are no published studies with
children with which to compare this study’s findings, adult studies were used for comparison. Like the findings of this study, those noted by W. H. Lee and colleagues (2006) also indicated no relationship between trait anger and glucose in 448 adult medical personnel. In contrast, Raikkonen and associates (2002), in their longitudinal study of a cohort of 425 middle-aged women, found that trait anger was a significant predictor for increased blood glucose levels. Because the number of females and males was limited in this study and therefore resulting in low power, it was difficult to determine whether such a relationship between trait anger and glucose exists in children. Perhaps this relationship only becomes apparent in adulthood and may be gender specific.

Cortisol. Relationships between trait anger and cortisol were not evident in this sample of overweight children. Van Eck and others (1996) also did not find a relationship between trait anger and cortisol in 87 adult females and males. In contrast, in a group of 72 adults in a smoking abstinence program, Al’Absi and associates (2007), found that trait anger predicted cortisol levels. In addition, Adam (2006), in a recent study of 52 adolescents noted a positive relationship between trait anger and increased cortisol levels.

Females were shown to have a significant positive relationship between trait anger and cortisol. This finding is in contrast to that of Adam (2006), who did not find that gender influenced the significance of the relationship between trait anger and cortisol. The trait anger scores for females in this study were higher than those that have been previously reported in other studies (Howell et al., 2007; Jacobs & Blumer, 1984). This relationship between trait anger and cortisol in females may be indicative of the
stimulation of the HPA axis in response to trait anger, and therefore supports part of the conceptual model.

Although, the mean trait anger score for males in this study was higher than in previous reports (Howell et al., 2007; Jacobs & Blumer, 1984), there was not a relationship between trait anger and cortisol. This finding may have been caused by the small sample of males and by the resulting low power that led to an inability to detect the relationship or males may respond to trait anger with elevations in cortisol.

In this study, most of the cortisol levels were within normal limits but were in the low normal range and appeared to be blunted. Blunting of cortisol levels has been seen in previous studies of children who have chronic stressors from disease; overweight may be viewed as a chronic stressor. Therefore, the assumption that overweight children have a normally functioning HPA axis may be in question; alternatively, overweight children may habituate to the stress of obesity so that normal responses are not seen.

Patterns of Anger Expression

**Anger-Suppression**

*Systolic blood pressure.* There was no significant relationship between anger-suppression and SBP readings in the entire sample or when gender was considered. These findings coincide with those of earlier studies (Hauber et al., 1998; Howell et al., 2007; Mueller et al., 1998, 2001). In contrast, other researchers have found significant positive relationships between anger-suppression and SBP readings in both females and males (Johnson, E., Shork, & Spielberger, 1987; Starner & Peters, 2004); however, the participants in those studies were adolescents. Perhaps the relationship between anger-
suppression and SBP does not become apparent until adolescence. Because the anger-suppression scores for the entire group and for females and males were lower than those in previously reported studies (Hagglund, et al., 1994; Howell et al., 2007; Jacobs & Blumer, 1984), this pattern of anger expression does not appear to be employed by the sample to as great an extent as other patterns. This lower rate of use could result in anger-suppression not having an effect on SBP readings.

Diastolic blood pressure. Anger-suppression and DBP readings were not significantly related for the group as a whole or for females or males. Other researchers have reported similar findings (Howell et al., 2007; Mueller et al., 2001; Starner & Peters, 2004). However, Hauber and colleagues (1998) found a significant negative correlation between anger-suppression and DBP readings in 231 third-grade normoweight children. In adolescents, Johnson, E., Schork and Spielberger (1987) noted a significant positive relationship between anger-suppression and DBP readings in 171 Black females and 219 Black males. Likewise, Mueller and colleagues (1998) noted a significant positive relationship between anger-suppression and DBP readings in 30 adolescent females. In this study, the anger-suppression scores were lower than those found in other studies of adolescents and children. The children in this sample may have not used anger-suppression as much as children in other studies, and the resulting relationship with DBP would not have been apparent. It could also be that the effect size in children is small, requiring larger samples to detect the relationship.
Glucose. No relationship between anger-suppression and glucose was noted in this group of overweight 9-, 10-, and 11-year-old children or in females or males separately. Because there are no published studies of this relationship in children, findings were compared with those from studies of adults (Raikkonen et al., 1996; Siegman et al., 2002; Suarez, 2006), in which these relationships were also not found. According to the conceptual framework for this study, anger-suppression as a stressor may stimulate the SNS and HPA axis with a subsequent release of cortisol. Because cortisol is a stress-related hormone, the body would respond by increasing the circulating glucose to prepare for “fight or flight.” The blunted cortisol levels in this study this could affect the production of glucose, and the relationship of anger-suppression and cortisol would not be seen. Therefore, because this relationship was not noted in the sample, anger-suppression may not elicit this activation of the SNS or HPA axis. However, there are very few studies of this relationship in adults, and there are none in children. Given the sample size is small, this relationship may not be apparent; furthermore, anger-suppression may not elicit negative responses in school-aged children. Hauber and colleagues (1998) noted a negative relationship between anger-suppression and SBP seeming to indicate that anger-suppression may actually decrease SBP readings.

Cortisol. No relationship between anger-suppression and cortisol was found in the entire group or in females or males separately. This finding coincides with the findings in the adult literature (Koh et al., 2006; Siegman et al., 2002; Steptoe et al., 2000) in which anger-suppression was not related to cortisol. In the only published study with adolescents, Adam (2006) found a positive relationship between anger-suppression and
cortisol in 52 male and female adolescents. The relationship between anger-suppression and cortisol may not be apparent in school-aged children; alternatively the effect size may be small and a large sample may be required.

**Anger-Out**

*Systolic blood pressure.* Anger-out and SBP readings were not associated in the total sample of overweight children. Findings from other studies have been inconsistent. Some researchers (Hauber et al., 1998; Howell et al., 2007; Mueller et al., 1998) have reported similar findings, whereas Siegal (1984) noted a positive relationship between anger expressed outwardly and SBP readings in 213 adolescents aged 13 to 18.

Furthermore, gender-based relationships between anger-out and SBP readings were not found. Other researchers (Johnson, E., Schork, & Spielberger, 1987; Johnson, E., Spielberger, et al., 1987; Mueller et al., 1998; Starner & Peters, 2004) have noted relationships. E. Johnson, Schork, and Spielberger (1987) found a significant positive relationship between anger-out and SBP readings in 171 Black adolescent females. Mueller and colleagues (1998) and Starner and Peters noted a significant positive relationship between anger-out and SBP readings in adolescent females. In 270 White adolescent males, E. Johnson, Spielberger, and coworkers (1987) noted a negative association between anger-out and SBP readings. These relationships were noted in adolescents; perhaps this relationship is not evident in younger children.

*Diastolic blood pressure.* For this sample, no relationship was noted between anger-out and DBP readings, nor was the relationship apparent when gender was considered.
This finding coincides with those of earlier studies (Hauber et al., 1998; Howell et al., 2007; Mueller et al., 2001; Starner & Peters, 2004). In contrast, Siegel (1984) noted a positive significant relationship between anger-out and DBP readings in 213 adolescents. When gender was considered, Johnson, Schork, and Spielberger (1987) found a significant relationship between anger-out and DBP readings in 171 Black females. Furthermore, Mueller et al. (1998), in a small sample of ethnically diverse females ($N = 30$), found a significant relationship between these two variables. Additionally, Johnson, Spielberger, Worten, and Jacobs (1987) found an inverse relationship between anger-out and DBP readings in 219 Black males. Participants in the studies in which the relationship between anger-out and BP was noted were adolescents. Perhaps this relationship is not apparent in younger children, or perhaps the effect size is so small that a much larger sample would be required to reveal the relationship.

*Glucose.* No relationship between anger-out and glucose in either the total group or females or males separately was noted in this study. In an earlier study of 573 healthy 6-, 9-, 12-, and 15-year-old children, Ravaja and Keltikangas-Jarvinen (1995) also failed to find a relationship; they did, however, find a positive relationship between negative emotionality (which may be some form of anger) and glucose levels. In the adult literature, Vitaliano and colleagues (1996) noted significant positive relationships between anger-out and glucose in 78 adult caregivers. Siegman and colleagues (2002) also noted a positive relationship in middle-aged women. In contrast, Raikkonen and associates (1996) did not find a relationship between these two variables in 90 nondiabetic middle-aged men. Because so few studies of this relationship have been
conducted, the relationship between anger-out and glucose may not be consistently apparent in children or adolescents.

*Cortisol.* Anger-out and cortisol were not found to be related in this group of overweight children; neither was this relationship apparent in females or males considered separately. Studies of this relationship in adults have yielded equivocal findings. Steptoe et al. (1999) noted a significant positive relationship between anger-out and cortisol in 105 schoolteachers. In contrast, Koh and colleagues (2006) did not find a relationship between anger-out and cortisol in 38 medical students. In addition, Al’Absi and colleagues (2000) also did not find anger-out and cortisol to be related in 46 male volunteers. Few studies have examined the relationship between anger-out and cortisol in children or adolescents. However, Adam (2006) evaluated 52 adolescents and found a positive relationship between anger-out and cortisol. With so few studies, it is difficult to determine whether anger-out and cortisol are consistently related.

*Anger-Reflection/Control*

*Systolic blood pressure.* There was a significant positive relationship between anger-reflection/control and SBP readings for the entire group of overweight children and for females specifically. When gender was considered, a positive significant relationship between anger-reflection/control and SBP readings was noted in females. Although relationships between anger-reflection/control and SBP readings have previously been reported, all were negative relationships (Hauber et al., 1998; Howell et al., 2007; Starner & Peters, 2004). Hauber and colleagues, as well as and Howell and others, noted a
negative relationship between anger-reflection/control and SBP readings in school-aged children; in addition, Starnes and Peters (2004) found a negative relationship in adolescent females. The findings for the present study are suspect given the low reliability of the anger-reflection/control subscale. According to Polit and Beck (2004), the reliability of instrument may be lower when the sample is homogeneous. In this study, 76% of the sample was Black, and all were overweight. Additionally, although an instrument may have been reliable in previous studies, the reliability of any instrument is directly related to the circumstances and sample involved (Polit & Beck, 1994).

*Diastolic blood pressure.* For this group of 9-, 10-, and 11-year-old children, anger-reflection/control and DBP readings were not associated in the entire group or in the females or males. Mueller and colleagues (1998; 2001) and Starner and Peters (2004) did not find a relationship between these two variables in their studies with adolescents. In contrast, in two studies with school-aged children, Hauber and others (1998) and Howell and colleagues (2007) noted significant negative findings between anger-reflection/control and DBP readings. In these studies, gender was also examined independently. Only one study, that of Hauber and colleagues, found males to have an inverse statistically significant relationship between anger-reflection/control and DBP readings. The insignificant findings in this study may be reflective of the small sample size, the homogeneity of the sample, the low power, and the lack of reliability of the instrument.
Glucose. Anger-reflection/control and glucose were not significantly related in the entire group or in females or males. Only one study, that of Siegman and colleagues (2002), reported that anger-reflection/control was a significant negative predictor of glucose levels in women. No other studies have examined this relationship. This finding is difficult to discuss given the low reliability of the subscale. Children in this sample had high mean anger-reflection/control scores. High anger-reflection/control levels may not elicit a response from the HPA axis; and thus, glucose would not be affected. In addition, because range of scores in both anger-reflection/control and glucose levels is limited, a relationship may not be apparent.

Cortisol. The relationship between anger-reflection/control and cortisol was not significant in this study of overweight children. In addition, there were no significant findings in females or males. There have been no studies in adults or children that have examined the relationship between anger-reflection/control and cortisol. In part, these findings may be attributed to the poor reliability of the instrument or to the small sample size by gender. Anger-reflection/control is considered a healthy form of anger expression in which anger is inwardly controlled (Jacobs & Mehlhaff, 1994). Therefore, it is reasonable to expect that the relationship between anger-reflection/control and cortisol would be negative (the higher the levels of anger-reflection/control, the lower the level of cortisol). Because anger-reflection/control scores were elevated, and because the blunted cortisol levels in this study appear a normal response; a relationship between anger-reflection/control and cortisol would be expected.
**Puberty**

There were no findings for the effect of puberty and trait anger on the relationships between the dependent variables (blood pressure, cortisol, or glucose) and between patterns of anger expression and the dependent variables (blood pressure, cortisol, or glucose) in the entire group in this study. Without more research examining these relationships, it is difficult to determine whether puberty influences the relationships or if they are more influenced by gender and/or age.

A significant relationship was noted in females between anger-out and puberty. Of the 50 females enrolled in this study, 39 were pre-pubescent, and 9 were pubescent, 2 females did not complete the instrument. When the females were separated into the two groups of pre-pubescent or pubertal participants, there were no significant relationships. Therefore, the significant relationship found in the females between anger-out and puberty may have been spurious. Further, the reliability of the instrument to measure puberty was low; therefore results may not be consistent.

**Analyses of Research Question 3**

The following discussion addresses the findings of Research Question three. It is as follows: Controlling for the effects of puberty and gender, how much of the variance in blood pressure, cortisol and glucose is explained by trait anger and each of the patterns of anger expression (anger-suppression, anger-out and anger-reflection control) in overweight 9, 10 and 11 year old children?
Females

In this study of 9-, 10-, and 11-year-old overweight children, gender was controlled by separately analyzing females and males. Relationships based on gender have been noted between trait anger and SBP and DBP readings and between patterns of anger expression and SBP and DBP readings (Hauber et al., 1998; Howell et al., 2007; Johnson, E., Schork, & Spielberger, 1987; Johnson, E., Spielberger, 1987; Mueller et al., 1998, 2001; Starner & Peters, 2004).

The regression model to predict systolic blood pressure for females included puberty as a covariate. However, when the regression analysis was performed, the anger variables were not significant predictors of SBP readings ($p = .07$). Neither Mueller and others (2001) nor Howell and colleagues (2007) found that the anger variables predicted systolic blood pressure in females. In contrast, E. Johnson, Schork, and Spielberger (1987) found that, in Black females, anger expression, anger-suppression, and anger-out, were significant predictors of systolic blood pressure and accounted for 64% of the variance.

None of the anger variables were significant predictors of diastolic blood pressure. Mueller and co-investigators (2001) also did not find anger variables to be significant predictors of diastolic blood pressure in adolescents. Howell and others (2007) also reported similar findings. However, E. Johnson, Schork, and Spielberger (1987) found that trait anger was a significant positive predictor of diastolic blood pressure in Black adolescent females.

In addition to blood pressure, none of the anger variables were significant predictors of glucose levels in females in this study. Few published studies have evaluated this
relationship in adults, children, or adolescents. Raikkonen and associates (2002) in their
study of women, reported that trait anger was a predictor of the metabolic syndrome and
that glucose was a significant predictor. Siegman and colleagues (2002) reported that
anger-reflection/control was a significant negative predictor of glucose levels in women.
Ravaja and Keltikangas-Jarvinen (1995) found that in children, negative emotionality
(such as anger-out) was a significant predictor of glucose of 6- and 9-year-old females,
however, they did not utilize the same anger instrument for measuring patterns of anger
expression.

Males

For males in this sample, trait anger and patterns of anger expression were not
significant predictors of SBP or DBP readings, glucose, or cortisol. Because puberty was
not significantly related to any anger variable for males, it was not used as a covariate.
The findings for SBP and DBP readings coincide with those of Howell and others (2007),
who found that anger variables were not significant predictors of systolic or diastolic
blood pressure readings in school-aged children. E. Johnson, Spielberger, and coworkers
(1987) reported that, for Black adolescent males, four variables, anger-in, weight, salt,
and evaluation of threatening anger, accounted for 34% of variance in systolic blood
pressure. Additionally, E. Johnson, Spielberger, and coworkers, noted that six variables,
anger-in, weight, salt, trait anxiety, Harburg in/out anger scales, and mothers family
history of heart disease would account for 48% of the variance in systolic blood pressure
in White adolescent males. Muller et al. (2001) noted in a study of 167 children and
adolescents (82 males) that 24% of the variance in DBP readings for males could be
predicted by ethnicity, pubertal maturation, BMI, state anger, and anger-control. Ewart and Kolodner (1994) noted that in adolescent males, trait anger was a significant predictor of diastolic blood pressure and accounted for 31% of the variance in adolescent males.

For males in this study, trait anger and patterns of anger expression did not account for any of the variance in glucose. Lee and colleagues (2006) also did not find trait anger or patterns of anger expression to be predictors of glucose levels. The data do not support the conceptual model indicating that trait anger and patterns of anger expression predict glucose levels in males. The findings in this study may result from a small sample of males or from psychological instrument measurement issues.

Trait anger and patterns of anger expression were not predictors of cortisol for males in this study. Van Eck and colleagues (1996) also reported that trait anger did not predict cortisol in adult males. In contrast, Adam (2006) found that trait anger was a significant predictor of cortisol in a mixed male and female group of adolescents, and Al’Absi and coworkers (2007) found that trait anger was a significant predictor of cortisol ($p = .02$) in adults. In a mixed group of adolescents, Adam noted that increasing levels of negative emotionality (anger) were associated with increases in cortisol.

In this study, the cortisol levels appear to be blunted. McBurnett and coworkers (2000) evaluated 38 school-aged males (aged 7 to 10) in a clinical setting and found that aggression (of which anger may be an antecedent) was associated with low cortisol levels. Because the levels of cortisol were low, the effects of trait anger and of patterns of anger expression could have been masked. Trait anger and patterns of anger expression were considered stressors that would initiate a response from the SNS and from the HPA.
axis; however, if the cortisol levels were low or habituated to stress, the effects of trait anger and patterns of anger expression may not be perceptible. Because blunting of cortisol in children has been reported previously (Buske-Kirschbaum et al., 2003; Chalew et al., 1997; Schommer et al., 2003; Wamboldt et al., 2003) the responses predicted in the conceptual model might not be apparent. A resulting increase in glucose would most likely not be seen.

Analyses of Research Question 4

The findings associated with research question four are as follows. The question was, when the effects of puberty and gender are controlled, does cortisol mediate the relationship between trait anger and glucose and/or between each of the patterns of anger expression and glucose in 9-, 10-, and 11-year-old overweight children?

There were no significant relationships between cortisol and glucose in the sample as a whole or in females or males. Although previous researchers have noted significant relationships between glucose and cortisol in adults (Besse, et al., 2005; Darmon et al., 2006; Reynolds et al., 2003; Sudi et al., 2000; Wallerius et al., 2003; Ward et al., 2003) and in adolescent Latino youths (Weigensberg et al., 2008), those findings were not replicated in this study. Therefore, without there being a significant relationship between cortisol and glucose, mediation cannot be tested.

In the conceptual model as depicted, trait anger and patterns of anger expression would elicit a response resulting in the stimulation of the HPA axis; this stimulation would result in an increase in cortisol, with a subsequent rise in glucose levels. For this group of overweight children, this series of events was not seen. However, this lack of
rise in cortisol levels may have resulted from habituation of the HPA axis (Buske-Kirschbaum et al., 2003; Chalew, et al., 1997; Schommer et al., 2003; Wamboldt et al., 2003); and thus expected responses would not be seen.

Limitations

There are several limitations which must be considered. The 93 participants recruited for this study fell within the range of 75 to 134 subjects calculated to obtain adequate power. However, when the sample was analyzed by gender the numbers of females and males were inadequate to test the hypotheses on the basis of gender. Further, the sample was fairly homogenous (76% of the sample were Black, all were overweight or obese) resulting in narrow standard deviations among scores. This could affect the analyses of data. Further, there were no normoweight participants with whom to compare results. It would be interesting to determine if differences between normoweight and overweight children exist.

Studies that have been conducted with children who are have a BMI at the 85th percentile or greater are few. Therefore, there are few studies to compare with these findings. It would be advantageous to evaluate the baseline cortisol and glucose levels in other studies of overweight children to determine the normal levels. This study was cross-sectional. It would be helpful to examine data collected over a longer period of time to determine if results are consistent. Further, collection of cortisol at regular periods throughout the day may give a better picture of cortisol levels and response to stress.

The majority of studies have noted elevations in cortisol in response to a stressor (Adam, 2006; Dimitriou et al., 2003; Sen et al., 2008), however some studies have noted
blunting (Buske-Kirschbaum et al., 2003; Schommer et al., 2003). Although, cortisol levels appear to be blunted for the sample group, there could be explanations other than the chronic stimulation of obesity or anger. Cortisol levels may have habituated from a chronic stressor such as obesity or trait anger (higher levels of trait anger were noted in this study), or it could be contributed to individual variability or the time the sample was obtained.

The measure of overweight or obesity was determined by BMI. The use of Dual-energy X-ray absorptiometry (DEXA) may be a more accurate measure of obesity, since it is impossible to differentiate fat mass from muscle mass in some children (Erselcan, Candan, Sarhan, & Ayca, 2000). The cost and feasibility of performing DEXAs in the school setting, however, precludes its use.

The study took place within the public school system during the students’ regular physical education class. Although the students were aware that data collection would occur during this time, some of the participants completed the instruments in a hurried manner so that they could get to physical education class. Therefore, the responses to the questionnaires may not be reflective of the participants’ feelings or level of anger.

The blood glucose sample was not obtained under fasting conditions because of the constraints of the academic schedules of the selected schools. In other studies that have examined blood glucose in adolescents and adults, the samples were collected when the participants were fasting (Raikkonen et al., 2002; Ravaja & Keltilangas-Jarvinen, 1995; Siegman et al., 2002; Vitaliano et al., 1996; Weigensberg et al., 2008). Thus, making an accurate comparison of data with previous studies is difficult because all others evaluated fasting glucose levels. It would have been advantageous to have fasting blood glucose
levels, however in the sample school system this was not feasible due to the burden on the children to refrain from eating until 10:00 am. Additionally, in this school system all children in the 4th, 5th, and 6th grades have a protected period during the morning for math and English studies that prohibited any outside interruptions or visitors until after 10:00 am.

The reliability of the Self-Administered Rating Scale for Pubertal Development and the Anger-Reflection/Control subscale were low. Pre-testing the instruments with other overweight samples may reveal response explanations and would be helpful in making decisions about the use of these instruments.

This study was cross-sectional and a longitudinal study would provide further insight into blood pressure readings or measures of the anger variables over time. Findings of this study are in concert with some of the findings of similarly conducted studies (Hauber et al., 1998; Howell et al., 2007; Johnson, Schork, & Spielberger, 1987; Johnson, Spielberger, et al., 1987; Mueller et al., 1998, 2001; Starner & Peters, 2004). However, it is impossible to adequately determine the mediation properties of cortisol between the anger variables and glucose with one sample. This relationship should be studied longitudinally or at least by obtaining several cortisol and glucose samples during the course of a day.

Although it is reasonable to expect relationships between trait anger and blood pressure, cortisol, and glucose and between each of the patterns of anger expression and blood pressure, cortisol, and glucose, the model was not supported by the findings of this study. Previous data have supported the relationships between trait anger and blood pressure and between the patterns of anger expression and blood pressure in children and
adolescents (Hauber et al., 1998; Howell et al., 2007; Johnson, Schork, & Spielberger, 1987; Johnson, Spielberger, et al., 1987; Mueller et al., 1998, 2001; Starner & Peters, 2004), as well as between trait anger and cortisol and between some forms of patterns of anger expression and cortisol in adolescents (Adam, 2006). Furthermore, a relationship between negative emotionality (anger) and glucose was noted in children (Ravaja & Keltikangas-Jarvinen, 1995). A relationship between cortisol and glucose has been noted in overweight Latino children (Weigensberg et al., 2008). Therefore, it is reasonable to expect that the relationships depicted in this model will be present in overweight children. Inability to note relationships may be caused by the small sample sizes and by the low reliabilities of some of the subscales or instruments. Or the model may need to be revised based on findings from this study. In particular, the elevation in cortisol may need to be reconsidered.

Finally, participants were recruited from one school system in one geographical location. Most of the participants were Black. Other studies would need to enroll participants from other geographical locations with more ethnically diverse samples.

Implications for Nursing Practice

The health of overweight children has become a major health care concern over the last few years. The number of overweight children with elevated SBP readings in this sample should be of concern to nurses and other health care providers (Olshansky et al., 2005; Sinha et al., 2002; Sorof & Daniels, 2002; Sorof et al., 2004; Styne, 2001). Adult-onset diseases like hypertension can decrease life expectancy and quality of life in overweight children. At the least, blood pressure readings should be part of the required
health record for school-aged children and for overweight children in particular. Children with elevated blood pressure readings should be followed over time to initiate treatment if hypertension becomes apparent.

Further, the BMIs of all children should be monitored and assessed. In addition, children in this study had higher mean levels of trait anger. It may be necessary to assess levels of trait anger and determine whether these levels become detrimental to the health and well-being of children. Since patterns of anger expression have been noted to relate to blood pressure readings in adults, it would be helpful to monitor how children express anger and encourage positive strategies.

Future Research

A study with a larger sample of males and females would allow gender-related testing of hypotheses. Furthermore, greater diversity of ethnicities would permit greater generalizability. In a future study of overweight children, using the Tanner Scale for pubertal measurement might prove helpful. It would also be beneficial to compare the Self-Administered Pubertal Rating Scale with the Tanner Scale in this group of children to assess their ability to recognize pubertal changes within themselves. Since the utilization of a Tanner rating scale or physical examination may not be feasible in the school environment, alternative methods may provide greater reliability.

Although overweight seems to have become more accepted, there may be a stigma in the school-aged children that may have lead to a reduction in the number of children willing to participate. In future research, it would be helpful to study this topic to determine whether stigma presents an obstacle in recruitment.
Further studies could examine the reliability of the Anger-Reflection/Control subscale for measurement in overweight children. Because the reliability has been greater in other studies of school-aged children (Hauber et al., 1998; Howell et al., 2007), it might be beneficial to use focus groups of overweight children to further explore the meaning of the items to the children, as well as to investigate and the rationale for their answers.

In addition, cortisol and adipose tissue have a relationship in which adipose tissue directly influences the secretion of cortisol through the conversion of cortisone to cortisol (Lee et al., 2008). Therefore, an accurate determination of the amount of cortisol secreted through activation of the HPA or from adipose tissue was not addressed in this study of overweight children, but might prove beneficial in subsequent studies.

While there were few relationships in this study, there may be plausible explanations for this lack, one of which is the homogeneous nature of the sample (age, race and weight status). It may be helpful to compare findings from normoweight children with those of overweight children. Further, it may be helpful to collect physiologic data throughout the day or over time.

Summary

In summary, this study evaluated the relationship between trait anger and blood pressure, cortisol, and glucose and between patterns of anger expression and blood pressure, cortisol, and glucose in 93 (50 females, 43 males) overweight 9-, 10-, and 11-year-old children in the school setting. The mean trait anger scores for the group for the females, and for the males were higher than those that have been previously reported. The
mean scores for each of the patterns of anger expression were comparable with scores from previous studies. Systolic blood pressure readings ranged from 85 to 144 mm Hg ($M = 113.13$), and 29% of the sample had readings greater than the 90th percentile. Only one male had an elevated diastolic blood pressure reading. Cortisol levels appeared to be blunted; 34 children fell below the expected level of 0.08, with most being in the low to low normal range. Glucose levels for the entire group fell into the expected normal values of 80 to 140 mg/dl.

For the group, a significant bivariate correlation was noted between anger-reflection/control and systolic blood pressure. For females, significant bivariate correlations were noted between trait anger and cortisol, between anger-out and puberty, and between anger-reflection/control and systolic blood pressure readings. There were no significant bivariate correlations for males.

In the multiple regression analysis, neither trait anger nor any of the patterns of anger expression were significant predictors for blood pressure, cortisol, or glucose for the entire group, or for females or males. None of the patterns of anger expression were significant predictors for blood pressure, cortisol, or glucose for the group or for females and males. Because there were no significant relationships between trait anger and glucose, between patterns of anger expression and glucose, and between cortisol and glucose, mediation could not be tested. In this study, puberty was related to anger-out in females and thus controlled for in the female-specific analysis. In addition, there were gender-based relationships so that the analyses were conducted with females and males separately. Last, although relationships have been previously reported between trait anger and blood pressure, cortisol, and glucose, and between patterns of anger expression and
blood pressure, cortisol, and glucose, these relationships were not found in this study.

The conceptual model as identified was not supported.
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APPENDIX A

LETTER TO PARENTS
Kimberly Nichols, RN, MSN, CRNP
Doctoral Candidate
University of Alabama at Birmingham

Dear Parents of 4th, 5th and 6th Grade Children,

I am inviting your child to participate in a study of children's health conducted by Kimberly Nichols, RN, a nurse and doctoral student at the University of Alabama at Birmingham.

This study involves looking at how your child's feelings affect their health. Your child will have their blood pressure taken, a finger stick for blood sugar and a spit sample. In addition, he/she will be asked to respond to a survey about their feelings and questions about their physical growth. In order to be able to participate your child should weigh in this range or more.

9 year old boys - 130 or more pounds
10 year old boys - 140 or more pounds
11 year old boys - 147 or more pounds

9 year old girls - 130 or more pounds
10 year old girls - 140 or more pounds
11 year old girls - 145 or more pounds

Children in these weight ranges may be eligible to participate in the study. If your child is a diabetic, takes steroid medicine for asthma, or does not have a Body Mass Index level that is necessary to meet the criteria or if your child cannot read and understand English he/she may not be in the study.

If you allow your child to be in the study, he/she will be screened (height and weight) in private to determine if he/she is eligible to participate. Please sign one copy of the consent form attached to this letter and return it to the school by your child. The second copy of the consent form is for you to keep. As soon as I get your decision I will contact you about the details, time, and date of the study.

Your child will receive $5.00 at the completion of the study.
Please return consent form by ____________________.

Thank you,

Kimberly Nichols, RN, MSN CRNP

101 Glendevon Lane • Dothan, Alabama 36305
Home: 334.671.0171 • Cell: 334.791.4180 • Fax: 334.671.0171
APPENDIX B

PARENTAL CONSENT
TITLE OF RESEARCH: Relationships Among Anger, Patterns of Anger Expression, and Blood Pressure, Cortisol and Glucose in Overweight School-aged Children

INVESTIGATOR: Kimberly Hall Nichols, RN, MSN, CRNP

SPONSOR: None

For Minors (persons under 19 years of age) participating in this study, the use of the term "You" refers to "You or Your Child" and addresses both the participant and the parent or legally authorized representative.

Explanation of Procedures

Your child is one of approximately 111 children who are being asked to participate in a health study that is interested in evaluating how children's feelings affect their health. This research study is designed to examine the effects of anger on the child's blood pressure, cortisol levels (a hormone related to stress), and glucose levels. Children who are at or above the 85th percentile of weight are being asked to participate.

If your child has a mental condition that prevents him/her from reading and concentrating he/she will not be eligible for the study. If your child does not have a Body Mass Index equal to or greater than the 85th percentile on a growth chart or if your child is presently taking steroid medications daily, he/she will not be eligible for the study. If your child is a diabetic, he/she will not be eligible for participation in the study.

Your child will be asked to provide samples of saliva (spit), have his/her blood pressure checked, height and weight measured, and have a glucose test through a finger stick. Your child will also be asked to complete questionnaires about his/her feelings and how he/she normally acts. Height and weight will be done in a private room or behind a privacy screen.

Your child will be asked to complete a set of questionnaires about anger that should take about 30 minutes. The saliva (spit) samples will be used to measure your child's stress hormones. In addition, your child will be asked to provide data about his/her physical development. All data collection with your child will occur during the school day and your child will not miss class Information or school work. This time will be coordinated with your child's teacher to allow minimal disruption of your child's normal school day, during study time or physical education.

Risks and Discomforts

The risks are minimal. Your child may become aware of feelings of anger. While these

Participant's Initials__________________

April 2, 2007

UAB-IRB

Consent Form Approval 04/16/07

Expiration Date 04/16/08
feelings may arise, the questionnaires and session are not designed to make your child angry. Your child does not have to answer all of the questions. If your child was to become upset, he/she would be referred to the school counselor. If your child’s blood pressure is not what it should be, you will be notified and instructed to have your child’s blood pressure taken again by his/her health care provider. The finger stick glucose measurement may be associated with slight discomfort or bruising. However, a band aide will be applied immediately to the site. If your child’s glucose levels are not what they should be, you will be notified and instructed to have your child’s blood glucose level taken again by his/her health care provider.

**Benefits**

Your child may receive no direct benefit from participation in this research. However, findings from this study can guide us and other health professionals in developing better programs for helping children. Also this study will provide information about your child’s health. You will be notified if your child’s blood pressure and glucose levels are not within normal.

**Alternatives**

The alternative is for your child not to participate in the study.

**Confidentiality**

The information gathered during this study will be kept confidential to the extent permitted by law. Only the investigators and University of Alabama at Birmingham’s Institutional Review Board will have access to confidential information that identifies you or your child by name. The results of the study may be presented and/or published for scientific purposes and used in educational programs; however neither you or your child will be identified in any way by name.

**Withdrawal Without Prejudice**

You are free to withdraw your consent and for your child to stop participating in this project at any time. If you would like to withdraw your child or if your child would like to withdraw, tell Ms. Kim Nichols or the child’s teacher. Nothing will happen. If your child is not feeling well the day of the study, Ms. Nichols will withdraw your child from the study.

**Significant New Findings**

Any significant new findings that develop during the course of the study that may affect your willingness to continue in the research will be provided to you by Ms. Kim Nichols.

Participant’s Initials ____________

April 2, 2007
**Cost of Participation**

There will be no cost to you from participation in this study. All study related materials and examinations will be provided at no cost.

**Payment for Participation in Research**

Your child will be paid $5.00 for participation in this research.

**Payment for Research Related Injuries**

UAB has made no provision for monetary compensation in the event of injury resulting from the research and in the event of such injury, treatment is provided, but is not provided free of charge.

**Questions**

If you have any questions about the research or a research related injury, Ms. Kim Nichols will be glad to answer them. Ms. Nichols number is 334-791-4180. If you have questions about your rights as a research participant, you may contact Ms. Sheila Moore, Director of the Office of the Institutional Review Board for Human Use (IRB). Ms. Moore may be reached at (205) 934-3789 or 1-800-822-8816, press the option for an operator/attendant and ask for extension 4-3789 between the hours of 8:00 a.m. and 5:00 p.m. CT, Monday through Friday.

**Legal Rights**

You are not waiving any of your legal rights by signing this consent form.

**Signatures**

You are making a decision whether or not to have your child participate in this study. Your signature below indicates that you have decided to allow your child to participate, that you have read (or been read) the information provided above and that you have received a copy of this consent form.

Signature of Participant or Legally Authorized Representative

______________________________  ______________________________

Child’s Name

Signature of Investigator  Date

______________________________  

April 2, 2007  Page 3 of 4
APPENDIX C

HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT (HIPAA)
University of Alabama at Birmingham
Authorization for Use/Disclosure of Health Information for Research

What is the purpose of this form? You are being asked to sign this form so that UAB may use your child's health information for research. Participation in research is voluntary. If you choose for your child to participate in the research, you must sign this form so that health information may be used for the research.

Participant name: ___________________________ UAB IRB Protocol Number: X070312021
Research Protocol: ___________________________ Principal Investigator: Kimberly Nichols
Anger, Patterns of Anger Expression, Cortisol and Glucose Sponsor: None
in Overweight School-Aged Children

What health information do the researchers want to use? The blood pressure reading, cortisol levels, and glucose levels collected as a part of this research protocol.

Why do the researchers want my health information? The researchers want to use your child's health information as part of the research protocol listed above and described to you in the Informed Consent document.

Who will disclose, use and/or receive my health information? The researcher involved in this study, Kimberly Nichols, RN.

How will my health information be protected once it is given to others? Your child's health information will not be shared with anyone other than the researcher involved. Data collected will be identified by code number only.

How long will this Authorization last? Your authorization for the uses and disclosures described in this Authorization does not have an expiration date.

Can I cancel the Authorization? You may cancel this Authorization at any time by notifying the Director of the IRB, in writing, referencing the Research Protocol and IRB Protocol Number. However, researchers may continue to use the health information that was provided before you cancelled your authorization.

Can I see my health information? You have a right to request to see your child's health information. However, to ensure the scientific integrity of the research, you will not be able to review the research information until after the research protocol has been completed.

Signature of participant:

or participants' legally authorized representative:

Printed Name of participant's representative:

Relationship to the participant:

April 2, 2007
APPENDIX D

INSTITUTIONAL REVIEW BOARD FOR HUMAN USE APPROVAL
Form 4: IRB Approval Form
Identification and Certification of Research
Projects Involving Human Subjects

UAB's Institutional Review Boards for Human Use (IRBs) have an approved Federalwide Assurance with the Office for Human Research Protections (OHRP). The UAB IRBs are also in compliance with 21 CFR Parts 50 and 56 and ICH GCP Guidelines. The Assurance became effective on November 24, 2003 and expires on February 14, 2009. The Assurance number is FWA00005960.

Principal Investigator: NICHOLS, KIMBERLY HALL
Co-Investigator(s):
Protocol Number: X070312021
Protocol Title: Relationships Among Anger, Patterns of Anger Expression and Blood Pressure, Cortisol and Glucose in Overweight School-Aged Children

The IRB reviewed and approved the above named project on 04/26/07. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services. This Project will be subject to Annual continuing review as provided in that Assurance.

This project received EXPEDITED review.

IRB Approval Date: 4-23-07
Date IRB Approval Issued: 04/23/07

Marilyn Doss, M.A.
Vice Chair of the Institutional Review Board for Human Use (IRB)

Investigators please note:

The IRB approved consent form used in the study must contain the IRB approval date and expiration date.

IRB approval is given for one year unless otherwise noted. For projects subject to annual review research activities may not continue past the one year anniversary of the IRB approval date.

Any modifications in the study methodology, protocol and/or consent form must be submitted for review and approval to the IRB prior to implementation.

Adverse Events and/or unanticipated risks to subjects or others at UAB or other participating institutions must be reported promptly to the IRB.
APPENDIX E

CHILD ASSENT FORM
Child Assent Form

Title: Relationships Among Anger, Patterns of Anger Expression and Blood Pressure, Cortisol and Glucose in Overweight School-Aged Children

IRB Protocol No.: X070312021

Investigator: Kimberly Nichols

Sponsor: None

Sub-Investigators: None

The investigator named above is doing a research study.

These are some things we want you to know about research studies:
We are asking you to be in a research study. Research is a way to test new ideas. Research helps us learn new things.

Whether or not to be in this research is your choice. You can say Yes or No. Whatever you decide is OK.

Why am I being asked to be in this research study?
You are being asked to be in the study because researchers want to know how your feelings may affect your health.

What is the study about?
The study will be checking your blood pressure, your blood sugar and your saliva to see how they may change according to how you feel.

What will happen during this study?
If I agree to be in this study, I will

- Have my blood pressure checked.
- Have a finger stick to measure my blood sugar.
- Take a saliva (spit) specimen.
- Answer questions about my feelings and my physical growth.
- Get $5.00 for participating.

Will the study hurt?
Sometimes having your blood pressure taken squeezes your arm and the finger stick may hurt a little.

Participant’s initials __________

UAB – IRB

04/11/2007 Consent Form Approval 04/13/07
Expiration Date 04/13/07
What else should I know about the study?
You do not have to answer any questions that are asked of you.

What are the good things that might happen?
People may have good things happen to them because they are in research study. These are called “benefits.” Researchers may learn important facts about children that are not already known.

What if I don’t want to be in this study?
You do not have to be in the study if you do not want to.

Who should I ask if I have any questions?
If you have any questions about this study, you or your parents can call Ms. Kim Nichols, RN at (334) 791-4180.

Do I have to be in the study?
No, you do not have to be in the study. Even if you say yes now, you can change your mind later. It is up to you. No one will be mad at you if you don’t want to do this.

Now that I have asked my questions and think I know about the study and what it means, here is what I decided:

________ OK, I’ll be in the study. ________ No, I do not want to be in the study.

The researchers have told me about the research. I had a chance to ask questions. I know I can ask questions at any time. I want to be in the research.

If you sign your name below, it means that you agree to take part in this research study.

Your Name (Printed)  Age  Date

Your Signature  Date

Signature of Witness  Date

Signature of Person Obtaining Consent  Date
APPENDIX F

PHYSIOLOGICAL DATA COLLECTION FORM
Physiological Data Sheet

| Gender: | Male | Female | Grade: | | Age: |
|---------|------|--------|--------|--------|

<table>
<thead>
<tr>
<th>Ethnicity:</th>
<th>Race:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic or Latino</td>
<td>American Indian/Alaska Native</td>
<td>Black or African American</td>
<td></td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>Asian</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Native Hawaiian or Other Pacific Islander</td>
<td>More than one race</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Height:</th>
<th>inches</th>
<th>Weight:</th>
<th>lbs.</th>
</tr>
</thead>
</table>

**Dinamap Blood Pressure (right arm)**

<table>
<thead>
<tr>
<th>#1</th>
<th>systolic/</th>
<th>diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>#2</td>
<td>systolic/</td>
<td>diastolic</td>
</tr>
</tbody>
</table>

Asthma _______ Diabetes _______

Glucose [ ] [ ]

How long since having something to eat or drink. _______

Subject ID [ ] [ ] [ ] [ ]
APPENDIX G

PROTOCOL FOR PHYSIOLOGICAL DATA COLLECTION
PROTOCOL FOR WEIGHT MEASUREMENT

Equipment:

Digital scales
Data collection forms
Privacy Screen or Private area

1. Be sure that the scales are calibrated to 0 before the child stands on the scale.
2. Ask one child at a time to come behind the privacy screen or the private area.
3. Ask the child to remove his shoes.
4. Ask the child to step up on the platform.
5. Ask the child to stand so that the body weight is evenly distributed between the feet.
6. Record weight to the nearest 10\textsuperscript{th} of a kilogram on the data collection sheet.

Heyward, V., & Stolarczyk, L. (1996). \textit{Applied Body Composition Assessment.}
Champaign, IL: Human Kinetics

Adapted from the PASS program, Dr. Marti Rice, PI, University of Alabama at Birmingham
PROTOCOL FOR HEIGHT MEASUREMENT

Equipment:
Stadiometer

1. Tell the child that you are going to measure his/her height.
2. Request that the child take off his shoes.
3. The child should stand at a right angle to the vertical rod of the stadiometer.
4. The child should stand with his/her weight evenly distributed between both feet, and the arms hanging by the sides with the palms facing the thighs. The heels are together, touching the vertical board of the stadiometer. The feet are spread at a 60 degree angle to each other.
5. When possible, tell the child to have his/her head, scapula, and buttocks touching the vertical board.
6. Request that the head be erect with eyes focused straight ahead.
7. Tell the child to take a deep breath and then lower the horizontal board of the stadiometer to the most superior point on the head, compressing the hair.
8. Measure the height to the nearest 1/4 inch.
9. Record the height in the space on the data collection form.


Adapted from the PASS program, Dr. Marti Rice, PI, University of Alabama at Birmingham
**PROTOCOL FOR BLOOD PRESSURE MEASUREMENT**

1. The participant should not have ingested caffeine (or nicotine) for 30 minutes prior to measurement.

2. Explain to the child that the blood pressure measurement does not hurt but the cuff will squeeze the arm (it may be tight) but it will not last long.

3. The participant should rest for 5 minutes in a chair, with feet on the floor, back supported, and right arm supported at heart level before measurement.

4. The Dinamap should be calibrated before use and numbers on the screen should all be zero.

5. The data collector should use the appropriate cuff size for the patient; the cuff bladder length should encircle at least 80% of the circumference of the arm between the acromion (lateral, triangular projection of scapula, forming the point of the shoulder) and olecranon (bony prominence of the elbow) on the upper **right** arm.

6. The data collector should use a cuff bladder width that is approximately 40% of the circumference of the arm measured at a point midway between the olecranon and acromion.

7. With the arm supported at heart level, place the blood pressure cuff so that the cuff is located over the artery on the right arm just above the bend of the elbow.

8. Press the start button on the dinamap machine.

9. Wait until the numbers remain on the screen and the indicator sounds. Record the blood pressure measurement on the data collection form.
10. Wait 2 minutes. Do not remove the cuff.

11. The numbers will zero out. Press the start button and wait until the numbers remain on the screen.

12. Record the blood pressure reading on the data collection sheet.

13. Record the higher of the two blood pressure readings on the sheet for the parent and/or guardian or the staff blood pressure form.


Adapted from the PASS program, Dr. Marti Rice, PI, University of Alabama at Birmingham
PROTOCOL FOR COLLECTION OF SALIVA

1. Pass out the straws for each participant. Give each child several Kleenex to use (saliva can be ropey and it can be hard to finish without a string of saliva coming from the mouth).

2. Explain that the participant needs to take the cap off the tube and put it down in front of them. Take the straw provided and place inside the tube. Explain that saliva is what is produced in the mouth and does not come from clearing the throat or coughing up sputum.

3. Each child will have 3 minutes to provide as much saliva as they can into the tube. Tell the children you will set the timer and when it goes off they must stop spitting into the tube.

4. If they cannot spit give them some rubber bands to chew or ask them to suck in the sides of their mouth (this will make the saliva flow). Do not give them gum or koolaid or sugar (it can change the values of the measures). If they are unable to provide a specimen, you may give them 5 minutes

5. Once the timer goes off, have the child take the straw out of the tube and put the cap back on tube. The data collector will collect each tube and put in the specimen box. The data collector will need to push down firmly on the cap so the cap does not come off and there is leakage.

6. The specimen box will be double bagged for transport to freezer.

7. Store specimens in -80° freezer, until thawed for assay.
Adapted from the PASS program, Dr. Marti Rice, PI, University of Alabama at Birmingham

1. Wash and dry your hands, or use alcohol based antibacterial hand gel, and apply latex free gloves

2. Let the child wash their hands or use alcohol based antibacterial hand gel.

3. Prepare the glucose meter.

4. Choose spot. Prick the side of the fingertip, not right on top. The side hurts less and is less likely to bruise.

5. Wipe the child’s finger with an alcohol sponge and dry with cotton.

6. Prepare the lancet and finger-pricking device.

7. Place the finger-pricking device against child's finger and push the button.

8. Squeeze out a drop of blood.

9. Place the blood on the test strip and put the test strip in the meter according to manufacturer directions.

10. Wait for the results.

11. Record the results on demographic sheet.

12. Assess the site for bleeding

13. Place a bandaid over puncture wound.

The risks associated with having blood drawn are:

1. Bleeding at the site

2. Fainting or feeling lightheaded

3. Hematoma (blood accumulating under the skin)

4. Infection (a slight risk any time the skin is broken)
APPENDIX H

PSYCHOLOGICAL INSTRUMENT PROTOCOL
PROTOCOL FOR ADMINISTRATION OF “FEELING QUESTIONNAIRE” PPS-2

Prior To Data Collection make sure you have:

- Pencils
- questionnaires with IDs coded
- clipboards, as necessary, dependant upon room assignment and presence of desks
- red/green colored squares
- a second data collector to assist with administration

1. The data collector determines that all students are ready to begin the PPS-2 and asks them to turn to the page that has at the top “Feelings Questionnaire” PPS-2. Students should be reminded not to put their names anywhere on the questionnaire, and that extra sharpened pencils are available if needed.

2. The data collector informs the group that she/he will read the questionnaire aloud to them, giving them time to mark their answers before moving on to the next question.

3. The data collector directs the students’ attention to the red/green colored squares in front of them and asks students to turn their squares red side up now, and green side up when they’ve finished answering a question.

4. Students are asked to raise their hands if they have a question so that the second data collector can assist them.

5. Ask students to look at the questionnaire as the directions are read: ”A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide if it is ‘hardly-ever’, ‘sometimes’, or ‘often true’ for you.”

6. The data collector should emphasize that unlike the last questionnaire, this questionnaire deals with how you usually feel.

7. Ask students to put a mark in the box next to the word or phrase on their questionnaire that seems to describe them best.

8. Inform students that there are no right or wrong answers. Do not spend too much time on any one statement.

9. Instruct students to raise their hand if they have a question so that the second data collector could assist them.

10. Reinforce directions by reminding students to “choose the word which best describes how you usually feel.” The data collector should emphasize that unlike
the last questionnaire, this questionnaire deals with how you usually feel, then suggest that the class begin by reading the first question as an example and talking about it together as in # 11 below.

11. The data collector reads “I worry too much.” He/she then explains “if this is hardly ever true for you, then you would place a mark in the box in front of “hardly ever” on your test, using the pencil we provided for you. If you feel that this statement sometimes describes you, you would fill in the area next to ‘sometimes.’ If this statement often describes you , then you would mark in the box next to ‘often’ on your test.”

12. The data collector should allow time for students to mark their answer to question one and then begin reading questions 2 through 20, giving the same instructions as above in #11, and allowing time for each child to answer before moving on.

13. Remind students when to turn to the next page before reading the next question.

14. Ask students to take a few minutes to look over their questionnaire to be sure they have answered all questions, and have not accidentally left questions unanswered.

15. A second data collector should review each participant’s questionnaire as it is turned in, to be certain that every question is marked, and no portions of the questionnaire have been accidentally left blank. Students may refuse to answer certain questions.

Adapted from PASS program, with permission from Dr. Marti Rice., PI, University of Alabama at Birmingham
PROTOCOL FOR ADMINISTRATION OF THE “FEELINGS QUESTIONNAIRE”

(PAES-3)

Prior To Data Collection make sure you have:

- A second data collector
- red/green colored squares for each student
- coded instruments
- pencils, & clipboards if necessary

1. Distribute instruments, pencils, and colored squares to students. The data collector determines that all students are ready to begin the PPS-3 and asks them to turn to the page that has at the top “Feelings Questionnaire” PAES-3. Students should be reminded not to put their names anywhere on the instrument and that extra sharp pencils are available if needed.

2. The data collector informs the group that she/he will read the inventory aloud to them, giving them time to mark their answers before moving on to the next question. The data collector asks students to turn their squares to green when they’ve finished answering the first question, and to leave the square turned to green unless they are not ready to move to the next question with the group.

3. Inform students that they should raise their hand if they have a question, and the second data collector, who is circulating around the room, will help them.

4. Ask students to look at the instrument as you read the directions: ”A number of statements which boys and girls use to describe themselves when they feel angry or very angry are given below. Read each statement carefully and decide if it is hardly-ever, or sometimes, or often true for you.  Then for each statement, put a mark in the space next to the word on your answer sheet that seems to describe you best. There are no right or wrong answers.  Do not spend too much time on any one statement. Remember, choose the word which best describes how you usually feel . Suggest that the class begin by reading the first question as an example and talking about it together as in # 5 below.

5. The data collector reads “I control my temper.” He/she then explains “if this is hardly ever true for you, then you would place a mark in front of ‘hardly ever’ on your test, using the pencil we provided you. If you feel that this statement sometimes describes you, you would fill in the area next to ‘sometimes.’ If this statement often describes you, then you would mark in the space next to ‘often’ on your answer sheet.”
6. The data collector should allow time for students to mark their answer to question one and then begin reading question two through 15, allowing time for each child to answer before moving on. Remind students when to turn to the next page before reading the next question.

7. Ask students to take a few minutes to look over their questionnaire to be sure they have answered all questions, and have not accidentally left questions unanswered.

8. A second data collector should review each participant’s questionnaire as it is turned in, to be certain that every question is marked, and no portions of the questionnaire have been accidentally left blank. Students may refuse to answer certain questions.

Adapted from PASS program, with permission from Dr. Marti Rice, PI, University of Alabama at Birmingham.
PROTOCOL FOR ADMINISTRATION OF THE “SELF-ADMINISTERED SCALE FOR PUBERTAL DEVELOPMENT”

Prior To Data Collection make sure you have:

- A second data collector
- pencils, & clipboards if necessary

1. Distribute instruments and pencils to each student to complete with researcher. The data collector determines that the student is ready to begin the Self-Administered Scale for Pubertal Development and asks them to turn to the page that has at the top “Self-Administered Scale for Pubertal Development”. Students should be reminded not to put their names anywhere on the instrument and that extra sharp pencils are available if needed.

2. Ask students to look at the instrument as you read the directions: “These questions are about changes that may be happening to your body. These changes normally happen to young people at different ages. Since these changes have something to do with your blood pressure and your stress hormones, do your best to answer carefully. If you do not understand a question or do not know the answer, just mark “I don’t know”. Please circle the letter of the response to each item that is most like you.

3. The data collector should allow time for students to mark their answer to question allowing time for each child to answer before moving on. Remind students when to turn to the next page before reading the next question.

4. Ask students to take a few minutes to look over their questionnaire to be sure they have answered all questions, and have not accidentally left questions unanswered.

5. A data collector should review each participant’s questionnaire as it is turned in, to be certain that every question is marked, and no portions of the questionnaire have been accidentally left blank. Students may refuse to answer certain questions.

Adapted from PASS program, with permission from Dr. Marti Rice, PI, University of Alabama at Birmingham.
APPENDIX I

PSYCHOLOGICAL INSTRUMENTS
Feelings Questionnaire PPS-2

**Directions:** A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide if it is hardly ever, or sometimes, or often true for you. Then for each statement, put an "X" in the box in front of the word which seems to describe you best. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, choose the word which seems to describe how you **usually** feel.

1. I worry too much
   - [ ] hardly-ever
   - [ ] sometimes
   - [ ] often

2. I get angry quickly
   - [ ] hardly-ever
   - [ ] sometimes
   - [ ] often

3. It is difficult for me to face my problems
   - [ ] hardly-ever
   - [ ] sometimes
   - [ ] often

4. I have a bad temper
   - [ ] hardly-ever
   - [ ] sometimes
   - [ ] often

5. I get upset at home
   - [ ] hardly-ever
   - [ ] sometimes
   - [ ] often
6. I get angry when I have to wait for someone because they have made a mistake
☐ hardly-ever ☐ sometimes ☐ often

7. Unimportant things run through my mind and bother me
☐ hardly-ever ☐ sometimes ☐ often

8. When I get mad I say nasty things
☐ hardly-ever ☐ sometimes ☐ often

9. I worry about school
☐ hardly-ever ☐ sometimes ☐ often

10. I get angry very quickly
☐ hardly-ever ☐ sometimes ☐ often

11. I have trouble deciding what to do
☐ hardly-ever ☐ sometimes ☐ often

12. I feel bothered when no one notices that I did something well
☐ hardly-ever ☐ sometimes ☐ often
13. I worry about my parents
   □ hardly-ever   □ sometimes   □ often

14. I get mad too quickly
   □ hardly-ever   □ sometimes   □ often

15. I worry about things that may happen
   □ hardly-ever   □ sometimes   □ often

16. I get angry when I'm told I'm wrong in front of others
   □ hardly-ever   □ sometimes   □ often

17. It is hard for me to fall asleep at night
   □ hardly-ever   □ sometimes   □ often

18. When I get so angry I don't know what to do, I feel like hitting someone
   □ hardly-ever   □ sometimes   □ often

19. I worry about what others think of me
   □ hardly-ever   □ sometimes   □ often

20. I feel mad when I do something well and my parents or teacher say I didn't do a good job
   □ hardly-ever   □ sometimes   □ often

---

**TIME 1**

Subject ID: [ ] [ ] [ ] [ ] [ ] [ ]
Feelings Questionnaire PAES-3

Directions: A number of statements which boys and girls use to describe themselves when they feel angry or very angry are given below. Read each statement carefully and decide if it is "hardly ever", or "sometimes", or "often" true for you. Then for each statement, put an "X" in the box in front of the word which seems to describe how you feel or act when you are angry or very angry. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, choose the word which seems to describe how you usually feel or act when you are angry or very angry.

1. I control my temper
   [ ] hardly-ever  [ ] sometimes  [ ] often

2. I show my anger
   [ ] hardly-ever  [ ] sometimes  [ ] often

3. I hold my anger in
   [ ] hardly-ever  [ ] sometimes  [ ] often

4. I talk to someone until I feel better
   [ ] hardly-ever  [ ] sometimes  [ ] often

5. I do things like slam doors
   [ ] hardly-ever  [ ] sometimes  [ ] often
6. I hide my anger
   □ hardly-ever   □ sometimes   □ often

7. I keep my cool
   □ hardly-ever   □ sometimes   □ often

8. I attack whatever it is that makes me very angry
   □ hardly-ever   □ sometimes   □ often

9. I get mad inside but I don't show it
   □ hardly-ever   □ sometimes   □ often

10. I do something totally different until I calm down
    □ hardly-ever   □ sometimes   □ often

11. I say mean things
    □ hardly-ever   □ sometimes   □ often

12. I can stop myself from losing my temper
    □ hardly-ever   □ sometimes   □ often
13. I try to calmly settle the problem
   □ hardly-ever   □ sometimes   □ often

14. I lose my temper
   □ hardly-ever   □ sometimes   □ often

15. I'm afraid to show my anger
   □ hardly-ever   □ sometimes   □ often
A Self-Administered Rating Scale for Pubertal Development

Introduction: These questions are about changes that may be happening to your body. These changes normally happen to young people at different ages. Since these changes have something to do with your blood pressure and your stress hormones, do your best to answer carefully. If you do not understand a question or do not know the answer, just mark "I don't know". Please circle the letter of the response to each item that is most like you.

1. What would you say about your growth in height?
   a. I have not yet begun to spurt (grow).
   b. I have barely started.
   c. My growth in height is definitely underway.
   d. My growth seems completed.
   e. I don’t know.

2. What would you say about the growth of your body hair (“Body hair” means hair any place other than your head, such as under your arm)?
   a. My body hair has not yet begun to grow.
   b. My body hair has barely started to grow.
   c. The growth of my body hair is definitely underway.
   d. The growth of my body hair seems completed.
   e. I don’t know.

3. Have you noticed any skin changes, especially pimples?
   a. Skin has not yet started changing.
   b. Skin has barely started changing.
   c. Skin changes are definitely underway.
   d. Skin changes seem complete.
   e. I don’t know.

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ID ____________________
4. Have you noticed that your breasts have begun to grow?
   a. My breasts have not yet started growing.
   b. My breasts have barely started growing.
   c. My breast growth is definitely underway.
   d. My breast growth seems complete.
   e. I don't know.

5a. Have you begun to menstruate (started to have your period)?
   a. Yes (If yes, please answer 5b).
   b. No.

5b. If yes, how old were you when you started to menstruate?
   ____________________ years old
4 Have you noticed a deepening of your voice?
   a. Voice has not yet started changing.
   b. Voice has barely started changing
   c. Voice changes are definitely underway.
   d. Voice changes seem complete.
   e. I don’t know.

5. Have you begun to grow hair on your face?
   a. Facial hair has not yet started growing.
   b. Facial hair has barely started growing.
   c. Facial hair growth has definitely started.
   d. Facial hair growth seems complete.
   e. I don’t know.