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CHANGES IN RESTRAINED EATING IN AN ADOLESCENT POPULATION: A
LONGITUDINAL STUDY

by

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Requirements for the Degree of
Master of Science

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ABSTRACT

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OBJECTIVES: This study examined changes in restrained eating (RE) over time as a function of race, gender, and body mass index (BMI). Participants were 7th grade students ($N = 1,533$; mean age = 13 years) from the first six years of the Memphis Health Project, a 10-year longitudinal study of smoking onset and other health related behaviors.

METHODS: A mixed repeated measures model with an Auto regressive moving average (1, 1) variance covariance matrix was used to examine the changes in RE scores over time as a function of race, gender, and BMI. **RESULTS:** RE scores significantly decreased over time in adolescents. Adolescent females reported more restrained eating than adolescent males at all time points. Among African Americans and Caucasian females, obese teens scored significantly higher on restrained eating than underweight and normal weight adolescents. **CONCLUSION:** RE changes over time as a function of several of the variables examined.

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INTRODUCTION

Social pressures for thinness increase throughout middle to late childhood (Jones & Crawford, 2006) creating an adolescent culture that encourages a drive for thinness (Ricciardelli & McCabe, 2004). Body dissatisfaction and increased dieting behaviors first surface during pre-adolescence and adolescence (McKnight, 2003; Ricciardelli & McCabe, 2001; Shisslak, Crago, & Estes, 1995; Stice, 2001). One dieting behavior in which some adolescents engage is restrained eating (RE; Wardle & Marsland, 1990). RE is defined as the intentional and sustained restriction of caloric intake for the purposes of weight loss or maintenance (Herman & Mack, 1975; Wadden, Brownell, & Foster, 2002; Wilson, 2002).

De Lauzon-Guillain and colleagues (2006) suggest that when food is plentiful, RE serves as an adaptive behavior that limits weight gain. A fundamental assumption of the model of RE is that some people rely on cognitive cues to control eating behaviors, rather than physiological cues that indicate satiety or hunger (Stice, Fisher, & Lowe, 2004). Cognitive cues that lead to RE may develop as a function of external pressures such as from peers, family, and society. Two such examples of cognitive cues include self-attention to food or public attention to food such that a person is aware of another person's attention to their eating behavior (Jones, 2004; Polivy, Herman, Hackett, & Kuleshnyk, 1986; Rhee, 2008; Stice & Bearman, 2001; Stice & Whitenton, 2002).

In a number of studies, RE has been positively associated with serious psychological and health behavior problems such as anxiety, depression, smoking, and obesity (Robinson, Klesges, Zbikowski, & Glaser, 1997; Stice, Cameron, Killen,

Hayward, & Taylor, 1999). Research has also revealed positive associations of RE with variables such as weight gain (Adams et al., 2000), body dissatisfaction, low self-esteem, and negative body image (Shunk & Birch, 2004). Further, associations have been found between RE and eating disorders (EDs), including anorexia nervosa and bulimia nervosa (Stice & Agras, 1998; Stice, Killen, Hayward, & Taylor, 1998). Herman and Polivy (1985) posited that RE is associated with binge eating, and Stice, Presnell, and Spangler (2002) demonstrated this relation in a sample of adolescents. However, many of the above study suffered from methodological limitations. Thus, further research is needed to clarify the relations between RE, BMI, and various types of EDs.

To date, few studies have examined the prevalence of RE, specifically, in adolescent or adult samples. However, rates of associated constructs have been examined. For example, Stice and Whitenton (2002) found that 25% of adolescent girls, aged 11-15, reported body dissatisfaction. Approximately 20% of adult women reported struggling with an ED or abnormal eating behaviors, including RE for the purpose of losing weight (National Institutes of Mental Health [NIMH], 2000). Of the aforementioned females, 90% were between the ages of 12 and 25 (Substance Abuse and Mental Health Services Administration [SAMHSA], 2003).

To our knowledge, little research has longitudinally examined how RE might change over the course of adolescence. The onset of RE has been associated with a number of body-related psychological concerns, including negative body image and body dissatisfaction (Bearman, Presnell, Martinez, & Stice, 2006; Dohnt & Tiggerman, 2006; Jones, 2004; Jones & Crawford, 2006). Spangler (2002) found that dysfunctional beliefs

about appearance predicted dietary restraint, both cross sectionally and longitudinally. Dysfunctional beliefs were defined as stable, cross-situational beliefs that give rise to automatic thoughts and processing errors; these beliefs influence the interpretation and behavioral response to stimuli. The onset of RE has also been associated with higher body mass index (BMI; Lluch, Herbeth, Mejean, & Siest, 2000; Snoek, van Strien, Janssen, & Engels, 2008; Stice & Whitenton, 2002).

RE has been examined in conjunction with gender, race, and BMI. The relation of each of these variables with RE will be summarized in turn in the sections that follow.

Gender

To date, very limited research has examined the relation of gender to RE specifically (Jones & Crawford, 2006). However, some authors have proposed that gender is associated with related concepts, such as body dissatisfaction and negative body image (Jones, 2004; Presnell, Bearman, & Stice, 2004). For example, in a longitudinal study, Presnell, Bearman and Stice (2004) found that body dissatisfaction was much more common in adolescent females (43%) than adolescent males (9%).

Research has also demonstrated that male and female adolescents engaged in different behaviors to increase body satisfaction (McCabe & Ricciardelli, 2001); Female adolescents tended to engage in dieting behaviors (Stice, 2001), whereas male adolescents turned to methods to increase muscle mass (Ricciardelli & McCabe, 2004) such as steroid use.

Race

One study of Caucasian American (CA) and African American (AA) college-age women examined racial differences in RE (Abrams, Allen, & Gray, 1993). CA women were more likely than AA women to endorse RE as measured by The Restraint Scale (Herman & Mack, 1975). However, AA women who were more acculturated with the dominant CA culture indicated higher rates of RE than those who were not acculturated (Abrams et al., 1993).

Research has also demonstrated that CA college-age women were more likely than AA college-age women to endorse associated constructs of RE such as dieting (Crago, Shisslak, & Estes, 1996) and body dissatisfaction (Roberts, Cash, Feingold, & Johnson, 2006; Wagner, 2009). Racial differences for these concepts have not been examined in men and younger samples.

Body Mass Index

The relation between RE and BMI remains unclear. Some studies showed a positive correlation between RE and BMI (Lluch et al., 2000; Snoek et al., 2008), whereas other studies demonstrated an inverse relation (Lawson et al., 1995). De Lauson-Guillain et al. (2006) suggested that this inconsistency could partly be due to differences in sample selection. For example, many studies were conducted with samples attempting weight loss, whereas others have used samples randomly drawn from the general population.

Hill (2004) posited that it was possible that the more overweight a person was, the more likely they were to engage in RE. Snoek, van Strein, Janssens, & Engels (2008)

administered surveys to Dutch male and female adolescent siblings at three different times (2003, 2004, and 2005). The adolescents were between 13 to 16 years old during the first survey period. They were divided into two groups, older (average age of 15.2 years) and younger (average age of 13.4 years). RE was measured using the Dutch Eating Behavior Questionnaire (DEBQ; van Strien, Frijters, Bergers, & Defares, 1986). A positive association was found between RE and BMI, such that a higher BMI predicted subsequently greater RE more than RE predicted a subsequently higher BMI.

In summary, there is limited research regarding possible interactions between RE and gender, race and BMI for an adolescents. The purpose of this study was to determine if changes in RE occur over time in an adolescent population and whether changes differ as a function of gender, race, and BMI.

METHOD

Participants

Participants were recruited from an urban mid-south school system (Memphis City Schools) that participated in the Memphis Health Project (MHP), a 10-year longitudinal evaluation of smoking onset and other health behaviors in a diverse adolescent population (Klesges, Elliot, & Robinson, 1997). The sample was reduced by approximately half the original size after six years due to funding constraints.

A subsample selected from the baseline year (1994) provided complete data on the variables of interest: RE, race, gender, SES, and BMI. The original cohort consisted of 6,967 male and female seventh-graders (49.5% male). The majority of the participants (83.1%) were AA. The mean height and weight of the participants was 63.64 inches and 121.85 lbs., respectively. Participants had a baseline BMI of 21.42, with a standard deviation of 4.92. The mean income for those living in the teens' zip codes at baseline was \$26,164.41, with a standard deviation of \$9,803.21.

Annual retention rates over the six years of this study are displayed in Table 1. A total of 1,037 participants provided data across all years for all variables in the current study. Of these 1,037 participants used in the current report, 61.5% were female and the majority (80.3%) were AA. The mean height and weight of this subsample was 63.65 inches and 123.03 lbs. Participants had a baseline BMI of 22.99, with a standard deviation of 5.12. The mean income for our subsample was \$27,710.48, with a standard deviation of \$10,765.11.

Table 1

Annual Retention Rates

Year	Data Collected	% Retained from Previous Year
1994	6,967	--
1995	5,636	80.9%
1996	4,470	79.31%
1997	3,553	79.49%
1998	2,713	76.35%
1999	1,944	--

To determine whether the final subsample was representative of the larger sample of participants, we compared the two on BMI, race, and gender. There was no significant difference on baseline BMI between the original sample and the subsample for males ($M = 22.94$, $SD = 4.79$) or females ($M = 23.00$, $SD = 5.29$). There was a significant difference between baseline BMI for CA ($M = 19.95$, $SD = 4.57$ and AA ($M = 21.45$, $SD = 5.15$), $p < .001$. The magnitude of difference in the means (mean difference = -1.5 , 95% CI: $-.214$ to $-.86$) was small (eta squared = $.014$). There was no significant difference between race and gender when comparing the original sample and the subsample used in the current report.

Procedure

The University of Memphis Institutional Review Board approved all survey procedures. Seventh grade students from 39 eligible schools were invited to participate in this survey study. Data were collected in homeroom classes by teachers. Parental consent was obtained prior to the beginning of the study. Parents who did not want their child to participate in this study were instructed to call the researchers' offices to remove the child from the study. The students who participated in the study signed an assent form that outlined the students' rights and the purpose and procedures of the study. Additionally, students were told that their participation was voluntary.

Because the design of this study was longitudinal, complete anonymity could not be guaranteed, as some form of identification was necessary to link specific students' responses across years. However, several procedures were used to assure students that their answers were confidential. Students used an identification number on surveys instead of their names, and teachers were instructed by the researcher not to aid the students once the survey started. After the students completed the survey, they were asked to place the questionnaire in an unmarked envelope and to seal the envelope. The envelopes were then placed in large boxes that were marked "confidential" and stored in a secure location until researchers could retrieve them from the schools, typically later that same day. This procedure was repeated throughout the six annual years of data collection used in this report.

Measures

Race. Participants were asked to self-report their race on each annual survey. Due to the limited number of participants from other racial groups, only data from AA and CA participants were examined in the current study. Race was measured each year to ensure consistent reporting.

Gender. Participants were asked to self report their gender on each annual survey. This variable was examined across years to ensure consistent reporting. For participants who had reported inconsistently on gender, the gender reported most often was coded.

Socioeconomic status. As participants were not able to reliably provide typical SES information, a proxy of socioeconomic status for each participant was developed by estimating economic levels via indirect measures. Information from the 1990 census was used to gather the median income based on the participant's residential zip code. This information provided an indication of the socioeconomic milieu for the original sample. Additionally, a mean education level of residents of each neighborhood was determined by a 6-point rating scale, ranging from "less than ninth grade," "ninth to twelfth grade, no degree," "high school graduate or equivalent," "some college, post high school," "Bachelors degree," and "graduate or professional school" (U.S. Bureau of the Census, 1992). Validation checks of the original census-derived data were conducted; reported income estimates were correlated with the proportion of children who received free school lunches (Robinson & Klesges, 1997).

BMI. BMI is a tool used to determine weight status (Garrow & Webster, 1985) or body fat. BMI has been shown to be a reliable and valid index of BMI for adolescents (Stice et al., 1999). In the current study, participants self-reported height and weight. BMI was computed using the standard BMI formula, $(\text{BMI}) = \text{kg}/\text{m}^2$. BMI was then categorized into three groups: underweight (less than 19.1 % BMI and less than 20.7% BMI for CA or AA, respectively), normal weight (greater than 19.1 % BMI but less than 25.4 and greater than 20.7 % BMI but less than 26.4 percent BMI for CA and AA, respectively), and overweight (greater than 25.8 % BMI and greater than 26.4% BMI for CA and AA respectively; Center for Disease Control [CDC], 2011). Self-reported values of height and weight are generally considered acceptably accurate for large-scale epidemiological studies, such as this one (Tienboon, Wahlquist, & Rutishauser, 1992).

Dietary restraint. Participants responded to the six Concern with Dieting (CD) items of the Restraint Scale, which provided an assessment of food intake inhibition (Herman & Polivy, 1980). The Restraint Scale has been shown to have adequate internal consistency ($\alpha = .79-.86$; French, Jeffery, & Wing, 1994; Heatherton, Herman, Polivy, King, & McGree, 1998; Klesges, Isbell, & Klesges, 1992; Overduin & Jansen 1996) and test-retest reliability (.74; Stice et al., 2004).

Participants were asked the following six questions from the RE scale that measure Concern with Dieting: "How often are you dieting?," "Do you eat sensibly in front of others and splurge alone?," "Do you give too much time and thought to food?," "Do you have feelings of guilt after overeating?," "Would a weight change of 5 pounds affect the way you live your life?," Verbal anchors included "never" (0), "rarely" (1),

“sometimes” (2), “often” (3), and “always” (4). In addition, students were asked "How conscious are you of what you are eating?" Verbal anchors for this item included "not at all" (0), "slightly" (1), “moderately" (2), and "very much" (3). The participants’ responses to each of the six items were then summed to yield a RE score for each year (French et al., 1994). A higher score on the RE scale indicates a greater level of dietary restraint.

RESULTS

Descriptive information on the 1,037 participants' RE scores is presented in Table 2. As can be seen, mean scores in this study fell below a score of eight. Notably, scores on the RE scale can range between 0 and 23, indicating that this sample expressed little interest in dieting for each race and gender category, across the entire duration of the study.

Table 3 summarizes all significant and non-significant within and between-subjects effects. Turning first to the between-groups analyses, we found a significant Race x Gender x BMI interaction, $F(2, 5416.47) = 7.06, p < .05$ (Figure 1).

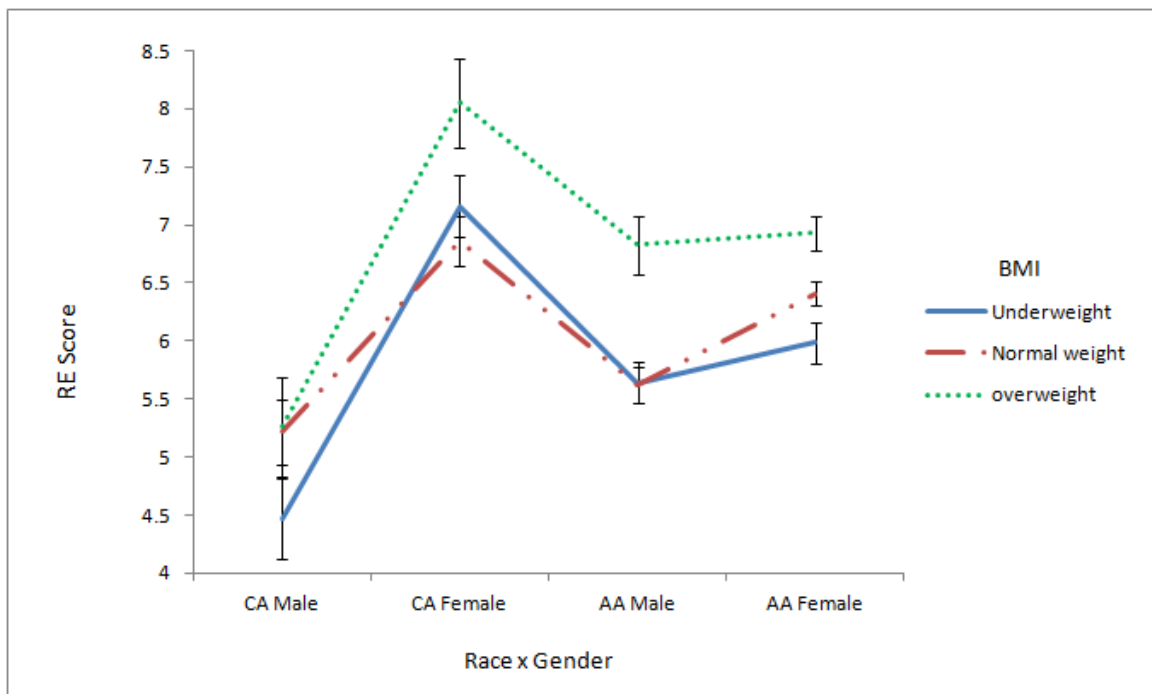


Figure 1. Race x Gender x BMI

There were no significant differences in RE between underweight, normal weight, and overweight CA adolescent males. However, there were significant differences (all $s < .05$) between weight groups for the other gender/ethnicity groups. For example, among CA females, those who were overweight showed more concern with dieting than normal weight and under weight girls, $p < .05$. AA males and females both showed exactly the same pattern. Thus, for CA females and AAs of both genders, overweight was associated with more restraint than was underweight or normal body weight.

Table 3 reveals that there were also main effects of gender and BMI, along with an interaction of Race x Gender. These results should be interpreted in light of the three-way interaction described above. Briefly, females as a group reported more restraint than males, and higher BMI was associated with more concern with dieting, $ps < .05$. Among females, CAs demonstrated more restraint than AAs, unless BMI was normal. The *opposite* pattern was evident for males: AA boys showed more restraint than CA boys, except with BMI was normal. In that case, there was no difference in restraint across groups.

Table 3 also provides results for the within subjects effects. Overall, there was a significant effect of time, with concern about dieting lessening over the course of the study, $p < .001$. In addition, there was a significant Time x Race x Gender interaction, $F(5,3496.69) = 3.18, p < .05$ (see Figure 2).

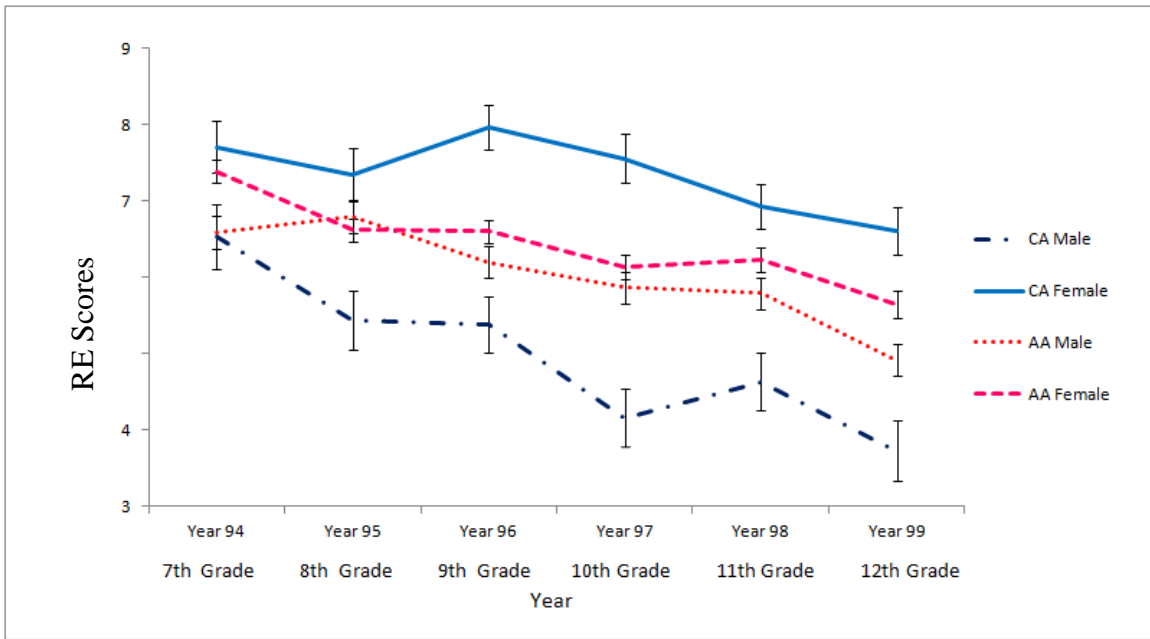


Figure 2. Time x Race x Gender

As can be seen, CA females show significantly more restraint than CA males at all time points, all p 's $<.05$. The restraint scores of AAs fell between the high scores of CA girls and the low scores of CA boys. During the first year and the sixth year, AA females showed more concern with dieting than AA males, $ps <.05$. However, during the middle years, AA males and AA females showed similar levels of restraint.

Table 2

Restrained Eating for Gender and Race by Year

Race and Gender	Restraint Scale*					
	1994 <i>M(SD)</i>	1995 <i>M(SD)</i>	1996 <i>M(SD)</i>	1997 <i>M(SD)</i>	1998 <i>M(SD)</i>	1999 <i>M(SD)</i>
<u>Caucasian American (n=223)</u>						
Male (<i>n</i> =81)	6.70 (2.79)	5.40 (2.95)	5.32 (3.17)	4.38 (2.45)	4.68 (2.85)	4.17 (2.41)
Female (<i>n</i> =142)	7.13 (3.50)	7.10 (3.36)	7.65 (3.52)	7.29 (3.67)	6.80 (3.36)	6.26 (3.23)
<u>African American (n=814)</u>						
Male (<i>n</i> =268)	6.46 (2.67)	6.49 (2.97)	5.90 (3.15)	5.71 (3.33)	5.64 (3.15)	4.88 (2.30)
Female (<i>n</i> =546)	7.21(3.12)	6.65 (3.11)	6.60 (3.17)	6.23 (3.11)	6.33 (3.35)	5.84 (3.26)

*Scores may range from 0 to 23, with higher scores indicating more concern about dieting.

Table 3

Full Sample Mixed Repeated Measures Model Effects

	df	F	α
<u>Between Subject Effects</u>			
Race	1	.120	.729
Gender	1	56.983	***
BMI	2	13.166	***
Race x Gender	1	28.285	***
Race x BMI	2	.283	.253
Gender x BMI	2	.835	.434
Race x Gender x BMI	2	7.056	.001**
<u>Within Subjects Effects</u>			
Time	5	20.816	***
Time x Race	5	1.087	.365
Time x Gender	5	2.508	.05*
Time x BMI	10	1.155	.317
Time x Race x Gender	5	3.180	.007*
Time x Race x BMI	10	.833	.597
Time x Gender x BMI	10	1.107	.352
Time x Race x Gender x BMI	10	.643	.778

* $p < .05$. ** $p < .01$. *** $p < .001$

DISCUSSION

The results of this study revealed that in this large population-based sample, rates of restrained eating were low over the entire life of the study. Thus, concern with dieting appears to be relatively rare in AA and CA adolescents. Further, RE declines significantly over the years from middle school through the end of high school. Notably, prior research has found that as adolescents become more comfortable with themselves and develop both the cognitive abilities and social constructions to accept different aspects and a better understanding [of themselves] as they mature (Harter, 2008). The period under study in this investigation is one marked by considerable maturation (Harter, 2008). Thus, young people appear less likely to restrict their intake as they approach young adulthood.

Despite the generally low rates of RE, it should be noted that adolescent girls in this sample displayed higher levels of RE compared to males. This finding could reflect the different techniques that males versus females used to address body dissatisfaction; males tended to use muscle gain strategies whereas females endorsed weight loss strategies, including RE (McCabe & Ricciardelli, 2004; McCabe & Ricciardelli, 2005; McCabe, Ricciardelli, & Banfield, 2001). In addition, previous studies have found that body dissatisfaction was significantly less in adolescent males than in females (Stice & Bearman, 2004). These findings, in combination with our own, suggest that greater socio-cultural pressure on girls for thinness may promote their concern with dieting (Hutchinson, Rapee, & Taylor, 2010; Stice, Agras, & Spangler, 2001). Notably, our study began in middle school, an age when girls are beginning to develop their interest in the opposite sex as well as their own identity. RE could be higher in adolescent girls at

this age due to the desire for an ideal and desirable body type as much as for themselves, as for peer comparisons and for romantic interests (Compian, Gowen, & Hayward, 2004; Halpern, King, Oslak, Udry, 2005). We should point out, however, that even for this group RE declined over the course of adolescence, suggesting that girls become more comfortable with their bodies as they mature.

The differences between AA girls and boys showed a somewhat surprising pattern. AA females displayed greater RE than AA adolescent males, but only for the first and last years of the present study. In other years, we found no significant differences between the restraint scores of AA boys vs. girls. In general, AA girls were less concerned with dieting than CA girls. These findings are interesting in light of previous research indicating that body dissatisfaction is less common among AA girls than CA girls. DiGiacchino, Sargent, and Topping (2001) found that AA females not only desired larger body sizes but also perceived larger body sizes of themselves. Other research has indicated that AA college women who experienced greater acculturation with the dominant CA culture exemplified greater rates of RE (Abrams et al., 1993). Taken together, these findings suggest that AA girls may be more accepting of higher body weights and thus less inclined to restrict their intake.

Previous research has suggested that RE may be a precursor of unhealthy dietary restraint and contribute to eating disorders. For example, RE has been found to be more common among those with eating disorders (EDs), including anorexia nervosa and bulimia nervosa (Stice & Agras, 1998; Stice et al., 1998; Stice et al., 2001). However, in our population-based study, concern with dieting was clearly associated with *overweight* rather than underweight or normal weight, for CA girls and AAs of both genders.

Among CA boys, body weight was not related to RE. These findings suggest that RE may be a reaction to being overweight and aware of the health consequences associated with obesity. Further research is needed to clarify the role, if any, that RE may play in the development of eating disorders.

Of course, concern with dieting may not necessarily lead to effective weight loss. Neumark-Sztainer et al. (2006) conducted a study among an ethnically diverse adolescent population that engaged in various dieting behaviors, including RE. This study examined whether adolescents who reported various weight-control behaviors, including RE, were at differential risk for gains in body mass index, overweight status, binge eating, extreme weight-control behaviors, and eating disorders 5 years later. The results suggested that dieting and unhealthy weight-control behaviors predicted obesity and eating disorders 5 years later. The findings of the above study, combined with those of the current study, seem to suggest that overweight adolescents who engage in RE early in adolescence could remain overweight in the future, despite their weight control efforts. Therefore, these overweight adolescents may benefit from instruction in more effective methods of losing weight than RE.

Several intervention and prevention programs have been developed to help overweight adolescents lose weight. Celio (2005) conducted a study evaluating the efficacy of an Internet delivered, early intervention program aimed at targeting weight loss, body dissatisfaction, and eating disordered behaviors in an overweight adolescent sample. The program was successful, with BMI significantly reduced in the cognitive-behavioral treatment group compared to the typical care group. Similarly, Jelalian, Sato, & Hart (2011) conducted a study examining the effectiveness of a weight-control

intervention on adolescent psychosocial outcomes. The results revealed positive benefits of a group-based weight-control treatment for improving adolescents' social anxiety and self-concept. These findings suggest that intervention programs can be effective at reducing weight and improving psychological difficulties among overweight adolescents. Further research is needed to determine whether these interventions actually reduce dietary restraint while teaching teens more effective ways to lose weight.

Several weaknesses in this study need to be acknowledged. First, researchers relied upon self-reported data. For BMI specifically, one study found discrepancies between self-reported and actual weight among adolescents (Vriendt, Huybrechts, Ottevaere, Trimpont, & Henauw, 2009). Fortunately, these differences were trivial. Second, the sample was largely comprised of AAs and included few members of other racial groups. Thus, the findings could be less generalizable to other samples that are ethnically different. Notably, the analyses used in the present study were chosen for their ability to reduce statistical errors due to the unequally balanced sample.

At the same time, the study presents a number of strengths. Our sample size was quite large, and the long time frame in which participants were repeatedly measured is unusual. Although there are other measures of dietary restraint available, we focused on the RE Scale because its subscale of dietary restraint questions allowed us to remove items that measure weight fluctuations, which are normal in adolescence (Malina & Bouchard, 1999). In addition, our inclusion of both boys and girls and two races strengthened our study.

Overall, the findings of this study provide support for the assertion that RE decreases over time during the course of adolescence as a function of gender, race, BMI,

and the related interaction of these variables with time. Future studies of changes in concern with dieting should consider using younger individuals. To our knowledge only one prospective study has examined weight-related concerns in children younger than adolescence (Shunk & Birch, 2004). Further, studies of changes in concern with dieting during the transition from adolescence to adulthood should be considered.

It should also be noted that our study focused on group averages in restraint at each time point. It would be interesting to explore the range of trajectories in RE over the course of childhood and adolescence, and whether certain trajectories are more likely to be associated with severe overweight or underweight. By examining initial BMI and measures of eating disorders in combination with trajectory analysis, it might be possible to determine whether RE is simply a reasonable strategy for weight loss used by those who are overweight, or whether it sometimes functions as a precursor to eating disorders.

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