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Winning in Weight-loss: The Interaction of Conscientiousness and Perceived Autonomy

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Introduction

According to the Center for Disease Control and Prevention (CDC), 35.7% of U.S. adult population was obese in 2009-2010 (Ogden, Carroll, Kit, & Flegal, 2012). Since the mid-seventies the prevalence of overweight and obesity has increased sharply for both adults and children. Data from two National Health and Nutrition Examination Surveys (NHANES) show that among adults, ages 20–74 years, the prevalence of obesity increased from 15.0% in the 1976–1980 survey to 32.9% in the 2003–2004 survey (Centers for Disease Control and Prevention 2008) and increased again in the 2009-2010 survey to 35.7% (Ogden, Carroll, Kit, & Flegal, 2012). 129 million U.S. adults were overweight or obese in 2003 (U.S. Department of Health and Human Services, 2003). In 2010, 110 million U.S. adults were obese, 19 million less than the 2003 obesity and overweight numbers combined (U.S. Department of Health and Human Services, 2003; Ogden, Carroll, Kit, & Flegal, 2012). The obesity epidemic shows no signs of slowing down with the behaviors of most Americans.

The Center for Disease Control now views obesity as one the greatest threats to the health of the United States (Ogden, Carroll, Kit, & Flegal, 2012). Obesity is an epidemic with serious health consequences (Ogden, Carroll, Kit, & Flegal, 2012). Most of today's obesity and overweight problems are being attributed to poor diets and not enough physical activity.

Obesity is believed to be associated with more chronic disorders and more physical health-related quality of life problems than smoking or drinking (U.S. Department of Health and Human Services, 2003; Ogden, Carroll, Kit, & Flegal, 2012). Overweight and obese adults are at risk for type II diabetes, high blood pressure, high cholesterol levels, coronary heart disease (CHD), congestive heart failure, angina pectoris, stroke, asthma, osteoarthritis, musculoskeletal disorders, gallbladder disease, sleep apnea, respiratory problems, gout, bladder control problems, poor female reproductive health (pregnancy complications, menstrual irregularities, infertility, irregular ovulation), and are at risk for many cancers (uterus, breast, prostate, kidney, liver, pancreas, esophagus, colon, and rectum) (U.S. Department of Health and Human Services, 2003; Cawley & Meyerhoefer, 2012; Ogden, Carroll, Kit, & Flegal, 2012).

Decreasing obesity rates is a national priority (Centers for Disease Control and Prevention, 2010). Consequently, an understanding of weight-loss program determinants is of great importance. There are two key determinants indicated in the weight-loss and healthy behavior literature: conscientiousness (Bogg & Roberts, 2004) and perceived autonomy support (Silva, et al., 2011). To date these key determinants of healthy behavior (one being weight-loss) have not been examined concurrently. Therefore, the purpose of this study was to examine the psychosocial determinants of conscientiousness and perceived autonomy support to adherence to a variant of the "Biggest Loser" reality television program popularized in the United States while controlling for important factors such as personal autonomy for physical activity and initial weight. The "Biggest Loser" is a reality television program that takes morbidly obese participants through rigorous exercise and extreme dieting for three months until one participant loses the most weight. Participants are eliminated each week for losing the least amount of weight, or gaining the most amount of weight that week.

Most weight-loss competitions have focused on individual changes and offer prizes and incentives for success. There has been a surge in team-based competitions as well (Leahey, Crane, Marinilli Pinto, & Weinberg, 2010). Perceived Autonomy Support (PAS) is the social support perceived by an individual in the behavior(s) they are attempting to modify (Brickell,

Chatzisarantis, & Pretty, 2006). PAS is a facet of Self Determination Theory (SDT) (Markland, 2009), and contributes to a participants success or failure in behavior modification (Brickell, Chatzisarantis, & Pretty, 2006). Team based competitions use PAS to give the participants the opportunity to have a positive social support system throughout their experience in a physical activity based weight-loss competition (Brickell, Chatzisarantis, & Pretty, 2006; Leahey, Crane, Marinilli Pinto, & Weinberg, 2010). If the participants have a relatively positive perceived autonomy support through their experience in a weight-loss competition, their percentages of completion, attendance, and weight-loss are much higher than if they have a negative PAS through the same program (Brickell, Chatzisarantis, & Pretty, 2006; Edmunds, Ntoumanis, & Duda, 2006; Edmunds, Ntoumanis, & Duda, 2007).

Conscientiousness is a basic personality factor made up of multiple traits such as thoroughness, organization, competence, reliability, dutifulness, order, achievement striving, self-discipline, and deliberation (Costa & McCrae, 1998; Goldberg , 1993; Roberts, Walton, & Bogg, 2005). Thus, conscientiousness is an important determinant of lifelong health and productivity as research shows higher correlations between conscientiousness and positive health behaviors (Bogg & Roberts, 2004) and improved life functioning (Soldz & Vaillant, 1999).

Conscientiousness is comprised of many different subcategories. Not all of those categories are subsequently correlated with healthy behavior choices (whether positive or negative) (Costa & McCrae, 1998; Bogg & Roberts, 2004). The facets specifically associated with positive health-related behaviors (those that would be associated with success or failure in a weight-loss program) are responsibility, self-control, and traditionalism (Bogg & Roberts, 2004). Nevertheless, a participant in a weight-loss program that scores high across all the categories of conscientiousness would be presumed to make positive health behavior choices (Roberts, Walton, & Bogg, 2005).

Table 1. Summary of Conscientiousness and Physical Activity Studies

Study	Results
Adams & Nettle (2009)	In their days per week of thirty minutes of moderate exercise conscientiousness correlated with a log *k*-value of .28 with a *p*-value of .024. when conscientiousness is correlated with days per week of 20 minutes of vigorous exercise, the log *k*-value was .39 and the *p*-value was < .001
Bogg, Voss, Wood & Roberts (2007)	Significant identity and general level differences were found on correlations between conscientiousness and consuming fiber $r = .08$ general and $r = .24$ dietary identity, $p < .05$. Conscientiousness was also significantly correlated to avoiding fat in diet $r = .17$ general, and $r = .26$ in dietary identity, $p < .05$. Although the findings were not significant, conscientiousness also was correlated to fitness at $r = .06$ general, and $r = .12$ in the physical identity group.
Brujin, Groot, Putte & Rhodes (2009)	Those who participated in moderate PA for at least 150 minutes a week had a correlation $r = .16$ to conscientiousness at $p < .05$. Those who participated in at least 150 minutes of vigorous PA had a correlation $r = .16$ to conscientiousness at a $p < .05$.
Bruijn, Kremers, Mechelen & Brug (2005)	No statistical significant data correlating conscientiousness and routine PA or sport PA. Though not statistically significant, conscientiousness correlated to routine physical activity $r = .003$. Conscientiousness also correlated with sport physical activity $r = -0.073$.
Chatzisarantis & Hagger (2008)	PA correlated with conscientiousness at $r = .11$ with $p < .05$
Conner & Abraham (2001)	Behavior correlates to conscientiousness $r = .32$, $p < .001$ based on the NEO conscientiousness measure and $r = .30$, $p < 001$ based on the Big Five Inventory conscientiousness measure
Conner, Rodgers & Murray (2007)	This study Found statistically significant results for conscientiousness and the intention to exercise $r = .15$, $p > .05$
Courneya, Bobick & Schinke (1999)	This study found a correlation of $r = .23$, $p < .001$ of female undergraduates exercise behavior in correlation to conscientiousness. The study also found a correlation between females participation in aerobics classes and conscientiousness $r = .21$, $p < .005$
Courneya et al. (2002)	Not statistically significant.
Courneya & Hellsten (1998)	Conscientiousness was statistically correlated to health as it related to an exercise motive at $r = .17$, $p < .01$. Conscientiousness correlates to moderate exercise behavior at $r = .11$, $p < .05$; strenuous behavior at $r = .17$, $p < .01$, and total exercise behavior at $r = .18$, $p < .01$
Davies, Mummery & Steele (2008)	Conscientiousness correlated to exercise behavior at $r = .37$, $p < .01$; intention for exercise behavior at $r = .36$, $p < .01$; and attitude towards exercise behavior at $r = .43$, $p < .001$
Hampson, Goldberg, Vogt & Dubanoski (2007)	Conscientiousness was related to health status in Hawaiians $r = .12$, $p < .01$
Hausenblas & Giacobbi (2004)	No significant correlation with conscientiousness
Hoyt, Rhodes, Hausenblas & Giacobbi (2009)	Exercise correlated to conscientiousness on two of the subcategories of the personality trait. Achievement striving $r = .23$, $p < .01$; and self-discipline $r = .23$, $p < .01$
Huang, Lee & Chang (2007)	Conscientiousness correlated to exercise participation $r = .411$, $p < .001$; correlated to physical health improvement $r = .426$, $p < .001$; and psychological health improvement $r = .404$, $p < .001$
Ingledew & Markland (2008)	Not statistically significant
Indeglew, Markland & Sheppard (2004)	Conscientiousness correlated to self-determination of exercise behavior based on external regulation $r = -.33$, $p < .01$; interjected regulation $r = -.15$, $p < .05$; identified regulation $r = .25$, $p < .01$; intrinsic regulation $r = .35$, $p < .01$; and relative autonomy index $r = .42$, $p < .01$

Kern, Reynolds & Friedman (2010)	Conscientiousness not significant in this study
Lochbaum, Bixby & Wang (2007)	In the male groups, those that had the highest conscientiousness scores also had the highest strenuous and moderate exercise participation. In the female groups, the two high conscientiousness groups also scored high in moderate exercise, and only one group scored high in strenuous exercise participation.
Lochbaum & Lutz (2005)	Those who highly enjoy exercise also scored significantly higher in conscientiousness (35.55, *ES* = 67)
Lochbaum et al. (2010)	Conscientiousness correlated to moderate physical activity in males $r = .09$, $p < .05$, but not in females. Conscientiousness correlated to strenuous exercise in males $r = .14$, $p < .01$; and females $r = .11$, $p < .05$.
Marks & Lutgendorf (1999)	Conscientiousness correlated with exercise at $r = .21$, $p < .05$.
Reed, Pritschet & Cutton (2012)	Conscientiousness was positively correlated with exercise frequency $r = .54$, $p < .05$. Conscientiousness was also positively correlated with moderate intensity exercise $r = .13$, $p < .001$; and high intensity exercise $r = .10$, $p < .01$.
Renfrow & Bolton (1979)	This study showed a significant difference between inactive and active adults and their conscientiousness scores $t = 3.02$, $p < .005$
Rhodes & Courneya (2003)	Conscientiousness by itself was not a significant predictor of exercise behavior in undergraduate students, or cancer survivors, but when combined with the all 5 factors the results were $r = .88$, $p < .05$ undergraduate students; and $r = .89$, $p < .05$ cancer survivors.
Rhodes, Courneya & Bobick (2001)	Conscientiousness showed significant among post-treatment cancer patients and exercise stages $f = 6.74$, $p < .01$.
Rhodes, Courneya & Jones (2002)	Not statistically significant
Rhodes, Courneya & Jones (2003)	Conscientiousness was found to correlate to intention to exercise = .13, $p < .05$; and strenuous exercise $r = .15$, $p < .05$
Saklofske, Austin, Rohr & Andrews (2007)	Conscientiousness was positively correlated with regular exercise $r = .11$, $p < .05$
Tolea et al. (2012)	Conscientiousness was found to be statistically significant when correlated to physical activity $r = .010$, $p < .05$.
Tolea et al. (2012)-Behavioral Med.	Low conscientiousness was highly correlated to low muscle strength.

Table 1 is a summary of conscientiousness studies that support the theory that people who have high conscientiousness are more likely to be physically active than those who have low conscientiousness.

Several studies found that the highest correlation with physical activity was conscientiousness (Adams & Nettle, 2009; Marks & Lutgendorf, 1999; Saklofske, Austin, Rohr, & Andrews, 2007; Tolea, et al., 2012). Across all the time markers where conscientiousness, extraversion, agreeableness, neuroticism, and openness where measured in relationship to physical activity, conscientiousness showed the strongest association (Adams & Nettle, 2009). This study showed that those with lower Body Mass Index's (BMI) were highly correlated with conscientiousness (Adams & Nettle, 2009). Lower rates of smoking were found to be highly related to conscientiousness (Adams & Nettle, 2009). This article shows that conscientiousness is important for physical activity, but for overall health and wellness (Adams & Nettle, 2009).

Several studies showed that those with high conscientiousness were highly active adults (Renfrow & Bolton, 1979; Saklofske, Austin, Rohr, & Andrews, 2007; Tolea, Terracciano, Milaneschi, Metter, & Ferrucci, 2012). The same study found that inactive adults correlate with low conscientiousness (Renfrow & Bolton, 1979). Low conscientiousness was also correlated with low muscle strength. (Tolea, Terracciano, Milaneschi, Metter, & Ferrucci, 2012). This study shows that conscientiousness high or low plays an important role in an adult's physical activity level (Renfrow & Bolton, 1979) (Rhodes & Courneya, 2003; Tolea, Terracciano, Milaneschi, Metter, & Ferrucci, 2012). The importance of determining how to raise an individual's conscientiousness level may be crucial in changing their sedentary behavior to a more active lifestyle (Renfrow & Bolton, 1979).

One particular study investigated the consistency of making exercise part of a lifestyle choice and conscientiousness correlated to that choice (Bruijn, Groot, Putte, & Rhodes, 2009; Saklofske, Austin, Rohr, & Andrews, 2007). This study also examined whether conscientiousness correlated to moderate exercise for 150 minutes a week or if it correlated to vigorous exercise for 150 minutes a week (Bruijn, Groot, Putte, & Rhodes, 2009). The findings of this study showed that the intensity of exercise did not determine whether conscientiousness correlated to having a weekly exercise routine (Bruijn, Groot, Putte, & Rhodes, 2009). In both the moderate and vigorous intensity groups, conscientiousness was significantly correlated to 150 minutes of exercise per week (Bruijn, Groot, Putte, & Rhodes, 2009). This study shows that no matter the intensity of the workout, the higher the level of conscientiousness, the more likely people are going to work out consistently each week (Bruijn, Groot, Putte, & Rhodes, 2009).

Chatzisarantis and Hagger found that conscientiousness correlated not only to physical activtiy, but the intentions to continue physical activity (Chatzisarantis & Hagger, 2008; Rhode, Courneya, & Jones, 2003). High conscientiousness correlates with the willingness to participate in physical activity and the determination to continue a physical activity program (Chatzisarantis & Hagger, 2008). This study determined that low conscientiousness correlated with the intentions of failure to continue a physical activity program (Chatzisarantis & Hagger, 2008). Changing the level of a person's conscentiousness from low to high theoretically changes their ability to successfully start and maintain a physical activity program (Chatzisarantis & Hagger, 2008).

Courneya performed a study that correlated conscientiousness to exercise as it realtes to a person's desire to be healthy (Courneya & Hellsten, 1998). These results are to be expected due to the subcategories that make up the measure of conscientiousness: thoroughness, organization, competence, reliability, dutifulness, order, achievement striving, self-discipline,

and deliberation (Costa & McCrae, 1998). This study found that conscientiousness was statistically correlated to those who perform moderate exercise behaviors (Courneya & Hellsten, 1998). This study determined a strong correlation to vigorous exercise and conscientiousness (Courneya & Hellsten, 1998). Total exercise behavior was correlated to conscientiousness (Courneya & Hellsten, 1998). This study is significant in that it shows a strong indication of people desiring to be healthy and therefore participating in exercise behaviors (Courneya & Hellsten, 1998). Whether they choose to participate in vigorous or moderate exercise, they have the common trait of high conscientiousness (Courneya & Hellsten, 1998).

The 2005 Lochbaum study found that the joy of performing exercise is correlated with conscientiousness (Lochbaum & Lutz, 2005). Most exercise and conscientiousness studies that have been discussed in this project show categories such as self-discipline, and dutifulness (Lochbaum & Lutz, 2005). These categories are usually attributed to being disciplined in action and not necessarily to the joy of the event (Lochbaum & Lutz, 2005). If conscientiousness is correlated with both a sense of duty to exercise and a person's sense of joy, they were more likely to participate in an exercise program and sustain that behavior (Lochbaum & Lutz, 2005).

The Huang study linked conscientiousness to several heath factors (Huang, Lee, & Chang, 2007). Conscientiousness was correlated with exercise participation, physical health improvement, and psychological health improvement (Huang, Lee, & Chang, 2007). This study shows that conscientiousness is not limited to health behaviors only in the physical studies of health (Huang, Lee, & Chang, 2007). The study shows that people who have a high conscientiousness scores are more apt to adopt behaviors that improve their physical health, and adopt behaviors that improve their mental health (Huang, Lee, & Chang, 2007). This is important as more studies are linking people with high conscientiousness to overall wellbeing, and not just the physical health component (Huang, Lee, & Chang, 2007).

Perceived Autonomy Support (PAS) greatly increases or decreases subject participation and weight-loss success depending on whether the PAS is high or low. High PAS is positively correlated with increased exercise behavior (Brickell, Chatzisarantis, & Pretty, 2006). PAS has shown to increase internal motivation through increased support and thus increased competence (Edmunds, Ntoumanis, & Duda, 2007). Exercise and SDT research support the theory that PAS is positively associated with psychological needs satisfaction and self-determined regulation of physical activity behavior (Edmunds, Ntoumanis, & Duda, 2006; Wilson, 2004) PAS and self-determined regulation is mediated by competence need satisfaction (Edmunds, Ntoumanis, & Duda, 2006) Self-determined motivation is positively associated with need satisfaction (Edmunds, Ntoumanis, & Duda, 2006; Wilson, Rodgers, & Fraser, 2002). Various positive behavioral, cognitive, and affective aspects of exercise have been associated with self-determnied regulation and competence need satisfaction (Edmunds, Ntoumanis, & Duda, 2006; Wilson P., Rodgers, & Fraser, 2002; Wilson & Rodgers, 2004).

Table 2. Summary of Perceived Autonomy Support and Physical Activity Studies

Study	Results
Brickel, Chatzisarantis, & Pretty (2006)	Perceived autonomy was correlated $r = .32$ with exercise behavior
Chatzisarantis, Hagger, & Smith (2007)	Three studies were examined and supported perceived autonomy support predicted intentions to participate in physical activity. One of the three studies found that persuasive communication increased PAS and thus increased attitudes and intentions to participate as well. Exercise behavior correlated to PAS $r = .33$, $p < .05$. Intention to perform exercise correlated to PAS $r = .58$, $p < .05$.
Edmunds, Ntoumanis, & Duda (2008)	Perceived autonomy support in the SDT group increased each measurement time, and attendance rates were significantly higher in the SDT lead exercise class. PAS was a positive predictor of identified regulation ($B = 0.48$, $p < .01$). PAS was a positive predictor of intrinsic motivation ($B = 0.62$, $p < .01$). Autonomy support positively predicted behavior intention ($B = 0.30$, $p < .05$)
Halvari, Ulstad, Bagoien, & Skjesol (2009)	Perceived autonomy support, perceived competence, and action orientation all positively correlated with physical activity. Perceived autonomy support and perceived competence also positively correlated with competitive performance. PAS correlated with competitive performance at $r = .24$, $p < 0.01$.
Palmiera, Texiera, Branco, Martins, Menderico, Barata, Serpa, & Sardinha (2007)	The exercise social support component of perceived autonomy support increased during the four-month span. Thus those who increased exercise social support, also increased weight-loss and increased adherence to exercise. ESS in exercise $t = 5.39$, $p < 0.001$. Changes in weight from baseline to 4 months due to ESS was $r = -.19$, $p < 0.05$.
Russell & Bray (2010)	In the cardiac rehabilitation programs, increased autonomy support showed an increase in self-determined motivation. Thus increasing the total number of exercise volume. PAS correlated with exercise duration at $r = 0.27$,
Viera, Mata, Silva, Coutinho, Santos, Minderico, Srdinha, & Teixeira (2011)	Physical activity correlated to PAS $r = .19$, $p < .05$. The obesity specific treatment correlated with PAS $r = .29$, $p < .001$.
Williams, Grow, Freedman, Ryan, & Deci (1996)	Attendance to the program correlated with PAS $r = .53$, $p < 0.01$. PAS also correlated with change in BMI $r = -.09$, $p < .05$.

The first study on perceived Autonomy Support (PAS) found that PAS was highly correlated to exercise behavior (Brickell, Chatzisarantis, & Pretty, 2006). This study determined that high PAS was a predicting factor in autonomy and core autonomous intention (Brickell, Chatzisarantis, & Pretty, 2006). Autonomy and autonomous intention were significant predictors of behavior, specifically exercise behavior (Brickell, Chatzisarantis, & Pretty, 2006).

The second study from Table 2 determined that PAS increased internal motivation and competence (Edmunds, Ntoumanis, & Duda, 2007). PAS was shown to increase intrinsic motivation (Edmunds, Ntoumanis, & Duda, 2007). Internal motivation, competence, and intrinsic motivation are all factors that increase self-efficacy (Edmunds, Ntoumanis, & Duda, 2007). High self-efficacy was determined to be the factor that determined an individual's ability to adhere more to exercise prescription and overcome exercise behaviors (Edmunds, Ntoumanis, & Duda, 2007).

Several studies determined that PAS was a postive predictor of identified regulation (Edmunds, Ntoumanis, & Duda, 2008; Moustaka, Vlachopoulos, Kabitsis, & Thoedorakis, 2012). PAS was a significant postive predictor of intrinsic motivation (Edmunds, Ntoumanis, & Duda, 2008). PAS had postive effects on intrinsic motivation and identified regualtion on all three measurement occurances (Edmunds, Ntoumanis, & Duda, 2008). PAS was found to be a positive predictor for behavioral intention (Edmunds, Ntoumanis, & Duda, 2008). PAS was correlated to competence in physical activity and relatedness in physical activty (Moustaka, Vlachopoulos, Kabitsis, & Thoedorakis, 2012). PAS is a positive predictor for behavioral intention, and more specifically, the intention to perform physical activity behavior patterns (Edmunds, Ntoumanis, & Duda, 2008).

A meta-analysis on three PAS studies supported the theory that PAS is a strong predictor of intentions to participate in physical activty (Chatzisarantis, Hagger, & Smith, 2007). One of the three studies determined that persuasive communication style in physical activty programs also increased PAS, thus increasing positive attitudes towards particiation in exercise programs (Chatzisarantis, Hagger, & Smith, 2007). Intention to participate in physical activity programs was correlated to PAS across the review of studies (Chatzisarantis, Hagger, & Smith, 2007). Exercise behavior was also correlated to PAS in this meta-analysis as well (Chatzisarantis, Hagger, & Smith, 2007). Exercise and exercise duration is correlated to PAS (Russell & Bray, 2010).

The Palmiera study looked at a specific aspect of PAS called exercise social support (ESS) (Palmeira, et al., 2007). This aspect was shown to be influencial, in their study, to weight loss over a four month period (Palmeira, et al., 2007). The study looked at ESS specifically with weight-loss in an exercise program and found significant weight-loss in the subjects over the four month experiment from the baseline statistics (Palmeira, et al., 2007). The ESS findings show the significance of PAS in exercise and weight-loss and how components of ESS more specifically play a role in behavior change (Palmeira, et al., 2007).

PAS was highly correlated to physical activity (Viera, et al., 2011). Physical activity is a behavior change desired when combating obesity (Viera, et al., 2011). In many obesity prevention and reversal programs physical activity is typically a key component to the program (Viera, et al., 2011). In this particular study the obesity prevention program correlated to PAS (Viera, et al., 2011). Attendance to weight-loss programs correlate with the PAS of the participants in the programs (Williams, Grow, Freedman, Ryan, & Deci, 1996). Loss of Body Mass Index (BMI) of participants in weight-loss programs is related to the participants PAS (Williams, Grow, Freedman, Ryan, & Deci, 1996).

Autonomy is a theoretcal construct, but it does yield empirical consequences (Deci & Ryan, 1987). Autonomy is the belief that a person's behaviors emanate from within themselves (Deci & Ryan, 1987). The more autonomous someone feels about a decision the more confident he/she feels that it is his/her own (Deci & Ryan, 1987). The less autonomous a person feels about his/her decision the more he/she feels it is out of his/her control and the less confidence he/she has in making the decision (Deci & Ryan, 1987).

Table 3. Summary of Autonomy and Physical Activity Studies

Study	Results
Barbeau, Sweet, & Fortier (2009)	Physical activity correlate with autonomy at $r = 0.22$, $p < .05$
Edmunds, Ntoumanis, & Duda (2006)	Moderate physical activity correlated with autonomy via exercise at $r = 0.11$, $p < .05$
Fortier, Kowal, Lemyre, & Orpana (2009)	Intention to increase physical activity correlate to autonomy at $r = 0.51$, $p < .001$.
Gay, Saunders, & Dowda (2011)	Moderate-to-vigorous intensity MET minute/week correlated with autonomy at $r = 0.27$, $p < .0001$
Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski (2005)	Relative autonomy index correlated to physical education in the British sample at $r = 0.40$, $p < .01$; the Polish sample at $r = 0.41$, $p < .01$; and the Singaporean sample at $r = 0.22$, $p < .01$.
Hagger, Chatzisarantis, & Harris (2006)	Intention to perform exercise behavior correlated to the relative autonomy index at $r = 0.362$, $p < .01$.
Jacobs, Hagger, Streukens, Bourdeaudhuij, & Claes (2011)	Autonomous motivation in item 1 correlated to intention to exercise at $r = 0.49$, $p < .05$; and physical activity at $r = 0.33$, $p < .05$. Autonomous motivation correlated with item 2's intention to exercise at $r = 0.56$, $p < .05$; and physical activity at $r = 0.30$, $p < .05$.
Russell and Bray (2010)	Autonomous motivation correlated with exercise duration at $r = 0.52$, $p < .01$; and with total exercise volume at $r = 0.34$, $p < .05$.
Russell and Bray (2009)	The relative autonomy index correlated with exercise behavior at $r = 0.33$, $p < .01$.
Segar, Updegraff, Zikmund-Fisher, & Richardson (2012)	Autonomy had an effect on BMI with an $F = 4.5$, $p < .005$
Silva, Viera, Coutinho, Minderico, Matos, Sardinha, Teixeira (2010)	Autonomy was shown to have an effect on exercise with a $t = -9.09$, $p < .001$
Standage, Duda, & Ntoumanis (2003)	Physical activity intention correlated to autonomy ant $r = 0.38$, $p < .01$
Teixeira, Carraca, Markland, Silva, & Ryan	Autonomy was shown to have a significant effect on exercise behavior at 4 months ($f = 4.92$, $p < .01$), 24 months ($f = 6.71$, $p < .01$) ($f = 9.11$, $p < .001$), and 36 months ($f = 5.25$, $p < .01$).

Physical activity behavior is highly correlated with autonomy (Barbeau, Sweet, & Fortier, 2009; Russell & Bray, 2009; Silva, et al., 2011). The more autonomy one feels about his/her physical activity behavior the more ownership he/she has in that decision, and the more likely he/she is to continue that behavior (Barbeau, Sweet, & Fortier, 2009; Russell & Bray, 2009; Deci & Ryan, 1987; Silva, et al., 2011). Those who live a more active lifestyle are more autonomous about that behavior choice (Barbeau, Sweet, & Fortier, 2009; Russell & Bray, 2009; Silva, et al., 2011).

The intensity of the exercise routine, whether moderate or vigorous, depends on how autonomous a person feels about that behavior (Edmunds, Ntoumanis, & Duda, 2006; Gay, Saunders, & Dowda, 2011). Those who perform moderate physical activity are more autonomous in their decision to be physically active (Edmunds, Ntoumanis, & Duda, 2006; Gay, Saunders, & Dowda, 2011). Those who participate in vigorous physical activity are more autonomous in that behavior choice (Gay, Saunders, & Dowda, 2011). Autonomy is an essential factor in a person's exercise behavior, whether the person engages in moderate or vigorous activities (Edmunds, Ntoumanis, & Duda, 2006; Gay, Saunders, & Dowda, 2011). The duration of exercise is highly correlated to autonomy (Russell & Bray, 2010). Autonomy is shown to correlate with the longevity of people and their exercise routines (Teixeira, Carraca, Markland, Silva, & Ryan, 2012). People who exercise from 4 month to 36 months have higher levels of autonomy (Teixeira, Carraca, Markland, Silva, & Ryan, 2012).

In the fight against obesity, autonomy is shown to have an effect on BMI (Body Mass index) (Segar, Updegraff, Zikmund-Fisher, & Richardson, 2012). Those with higher levels of autonomy tend to have lower BMI scores (Segar, Updegraff, Zikmund-Fisher, & Richardson, 2012). People with higher autonomy are more likely to be physically active and more nutrition conscience (Segar, Updegraff, Zikmund-Fisher, & Richardson, 2012). This is important as we battle to decrease obesity and overweight, and learn how to increase autonomy to increase the physical activity of populations (Segar, Updegraff, Zikmund-Fisher, & Richardson, 2012).

Purpose of Study

The purpose of the study is to determine whether conscientiousness and perceived autonomy support (while controlling for personal autonomy and initial weight prior to beginning the program) determines participants' success in a twelve week weight-loss intervention in the contexts of weight-loss, body fat percentage lost, and adherence to the program. It is hypothesized that an interaction exists between conscientiousness and perceived autonomy support, and that participants that score high in conscientiousness, or high in

conscientiousness and perceived autonomy support, will have more success in a twelve-week variant of "The Biggest Loser" contest. Success is determined in weight-loss, adherence, and body fat percentage lost, compared to those who score low in conscientiousness and perceived autonomy support.

Methodology

Participants

Participants were enrolled in multiple fitness facilities in Albuquerque, New Mexico, and participated in "The Challenge" (a twelve-week weight-loss contest) through communication with the program directors. Given the program goals, eligible participants were male and female adults 18 years and older. Due to the exercise requirements of the program, participants were free from major illness, not taking medications known to interfere with exercise and body weight loss. A total of 64 obese women (62.5%) and men (37.5%) completed the initial assessments and the follow-up assessments required to be part of the program. Participants were selected first by convenience, as they were people who chose to participate in "The Challenge" fitness competition. Since we were only interested in weight-loss for the study, we then only studied participants that were considered obese by determining their body fat percentages with the bioelectrical impedance analysis. Thus, the analyzed sample of participants was comprised of 64 participant's ages 18 to 66. Cost for the program is insignificant to the research, and was not recorded. The race of each participant was not recorded. BMI that was recorded from the program administrators was not shared with us, since we were not using BMI for our data.

Instruments

Tanita BF350 Bioelectrical Impedance Analysis

This bioelectrical impedance analysis unit measures weight, Body Mass Index (BMI), and body fat percentage (Buchholz, Bartok, & Shoeller, 2004). It is a standing unit that sends electric impulses through the legs and back to determine the speed if the current (Buchholz, Bartok, & Shoeller, 2004). The impedance of fat is greater than lean mass and water (Buchholz, Bartok, & Shoeller, 2004). The impedance of fat slows the impulse giving a body fat percentage measurement based on weight and electrical current speed (Buchholz, Bartok, & Shoeller, 2004).

The Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2)

The BREQ-2 (Markland & Tobin, 2004) is used to assess behavioral regulations for exercise. Based on Deci and Ryan's (1991) continuum conception of extrinsic and intrinsic motivation, the BREQ-2 measures amotivation, external, introjected, identified, and intrinsic regulation of exercise behavior. The BREQ-2 is widely used to measure exercise motivation and has been shown to have sound factorial validity (Markland & Tobin, 2004) (Wilson, Rodgers, & Fraser, 2002). The BREQ-2 does not have an integrated regulation subscale as do other regulation instruments. The BREQ-2 instrument is comprised of 19 items scored on a five-point scale ranging from 0 (not true for me) to 4 (very true for me). The BREQ-2 was used in this study to assess the RAI (Relative Autonomy index) or personal autonomy of the participants entering the study.

The International Personality Item Pool (IPIP)

Conscientiousness was measured by using the IPIP measurement tool. The IPIP is derived from the Big-Five factor Markers (Goldberg L. , 1992) and has 5 factors and 10 items for each factor. Agreeableness, surgency (or extraversion), conscientiousness, emotional stability, and intellect (or imagination) are the Big Five factors. In the present study only the conscientiousness subscale was used. Item examples for conscientiousness include: "I pay attention to details", "I carry out my plans", and "I waste my time" (reverse scored). The Likert scale is used for the IPIP ranging from 1 (very inaccurate) to 5 (very accurate) (Goldberg L., 1999; Goldberg, et al., 2006).

Perceived Needs Support: Health Care Climate Questionnaire (HCCQ)

The Perceived needs support variable that determines the quality of the social/treatment environment was assessed by the Health Care Climate Questionnaire (HCCQ) (Wilson, Rodgers, Blanchard, & Gesell, 2003). There are three aspects of a motivationally facilitative social environment in the SDT (autonomy support, structure, and involvement) that correspond to supporting the psychological needs satisfaction for autonomy, competence, and relatedness (Deci & Ryan, 2000). The HCCQ items reflect all three dimensions of the facilitative environment even though it was designed to assess autonomy support (Markland & Tobin, 2004). All three support dimensions are highly interrelated and their items are typically collapsed into a single score. Participants can respond to 15 items and are rated on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). The alpha coefficient for this study was $\alpha = .97$.

Procedures

After gaining Institutional ethics approval from the author's institution, the Program Coordinator for "The Challenge" was contacted. After gaining the Program Coordinator's approval, informed consents with the IPIP and the BREQ-2 were distributed to all fitness facilities to eligible "The Challenge" participants. Upon entry, participants pay for the program, fill out the BREQ-2, fill out the IPIP. Immediately following the questionnaires "before" pictures were taken. Participants get circumference, weight, and body fat percentages measured. During the twelve-week weight-loss intervention, participants are placed into platoons of 10-15 people who met up to three times a week with platoon leaders (personal trainers, health coaches, a hormone therapist, and a chiropractor). During the twelve weeks, the platoon leaders lead the participants through group personal training and gave them information on healthy eating and fitness activities to perform when they did not meet with the platoons. At the end of the twelve weeks, the participants took a post intervention picture, measure circumference, weight, and body fat percentage, and filled out a BREQ-2 and a HCCQ. Participants were then eligible to win prizes based on weight-loss, percentage of body fat lost, and other physique results.

Data Analysis

Pearson Correlations and descriptive statistics are presented in table 4. Moderated hierarchical regression analysis (Cohen & Cohen, 1983) (Jaccard & Turrisi, 2003) of conscientiousness, autonomy support, and change in autonomy was performed on weight-loss, body fat percentage, and attendance. Before product terms were created and data was subjected to analysis, all independent variables were centered using *z*-score transformations (Jaccard & Turrisi, 2003). The Homoscedasticity and normality of residuals assumptions were satisfied by all regression models.

Table 4. Pearson Correlation

Measure	Conscientiousness	RAI	Initial Weight	Autonomy Support	Attendance	Change in Weight
1. Conscientiousness	1	.26*	.02	.08	.14	-.09
2. RAI		1	-.27*	.06	-.0	-.00
3. Initial Weight			1	.02	.15	-.50*
4. Autonomy Support				1	.12	-.10
5. Attendance					1	-.08
6. Change in Weight						1
M	3.73	11.36	184.58	5.32	3.84	-15.26
SD	.66	6.43	42.45	1.58	1.31	29.06
A	.76		n/a	.97	n/a	

$N = 64$

Table 5. Weight loss by Attendance with Conscientiousness and Autonomy Support as Covariates

Attendance	Mean	*SD*	95% *Confidence Interval*		*n*
			Lower Bound	Upper Bound	
1.00	-19.63	25.32	-42.30	3.05	5
2.00	-5.94	25.13	-26.48	14.60	6
3.00	-8.78	25.04	-23.25	5.70	12
4.00	-19.72	25.01	-34.18	-5.26	12
5.00	-15.84	16.08	-25.14	-6.55	29

Note: Covariates appearing in the model are evaluated at the following values: Initial Weight= 184.57

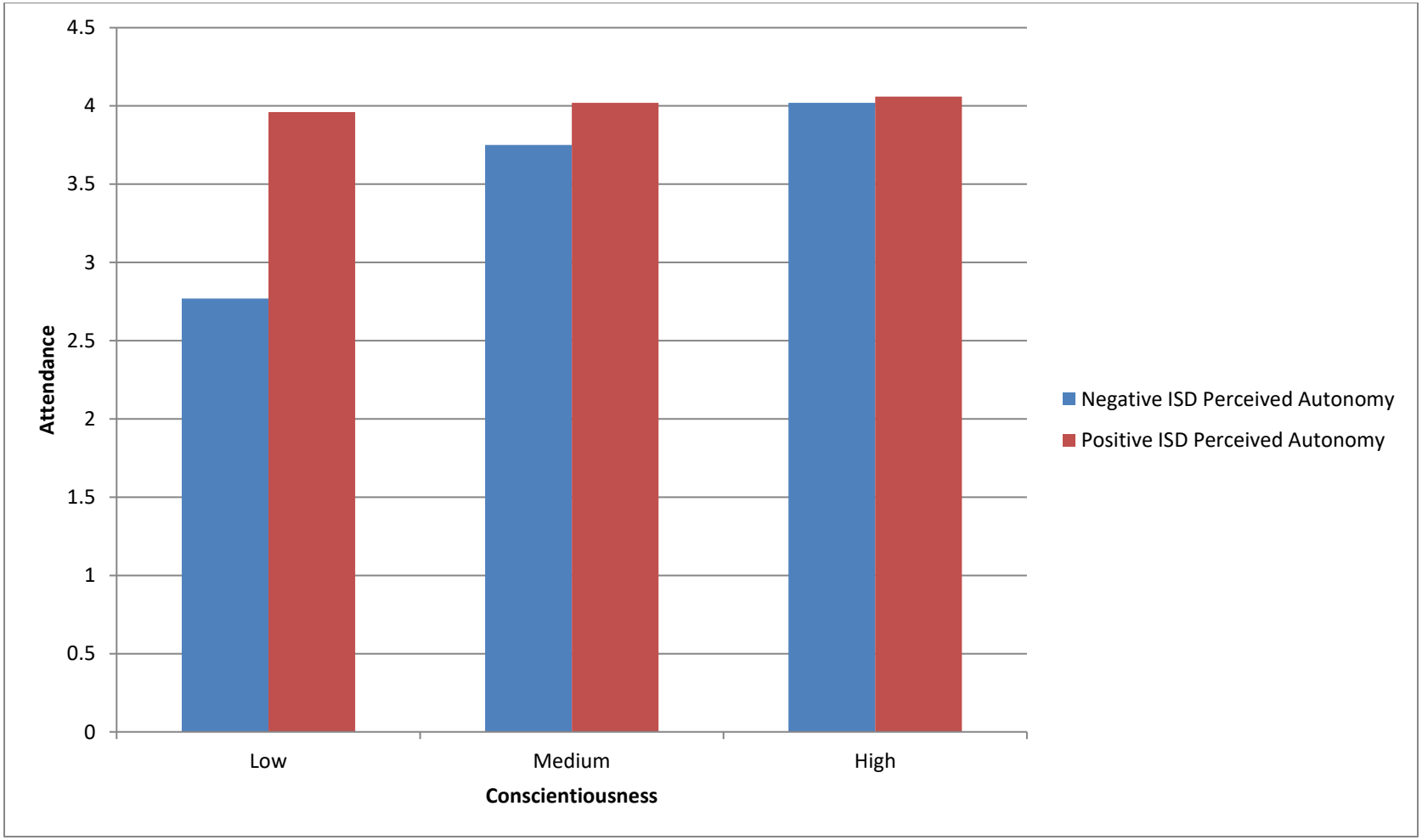

Figure 1. Effects of Conscientiousness and Perceived Autonomy on Attendance

Table 6. Effects of Conscientiousness and Autonomy Support on Weight Loss

	beta	*se*	*t*	*p*
RAI	**.22**	**.59**	**.37**	**.71**
Conscientiousness	-4.17	5.69	-.73	.47
Autonomy	-1.42	2.33	-.61	.55
Interaction	-1.50	3.44	-.44	.67

Interaction = conscientiousness and autonomy r^2 = .0213 r^2 *interaction* = .0032

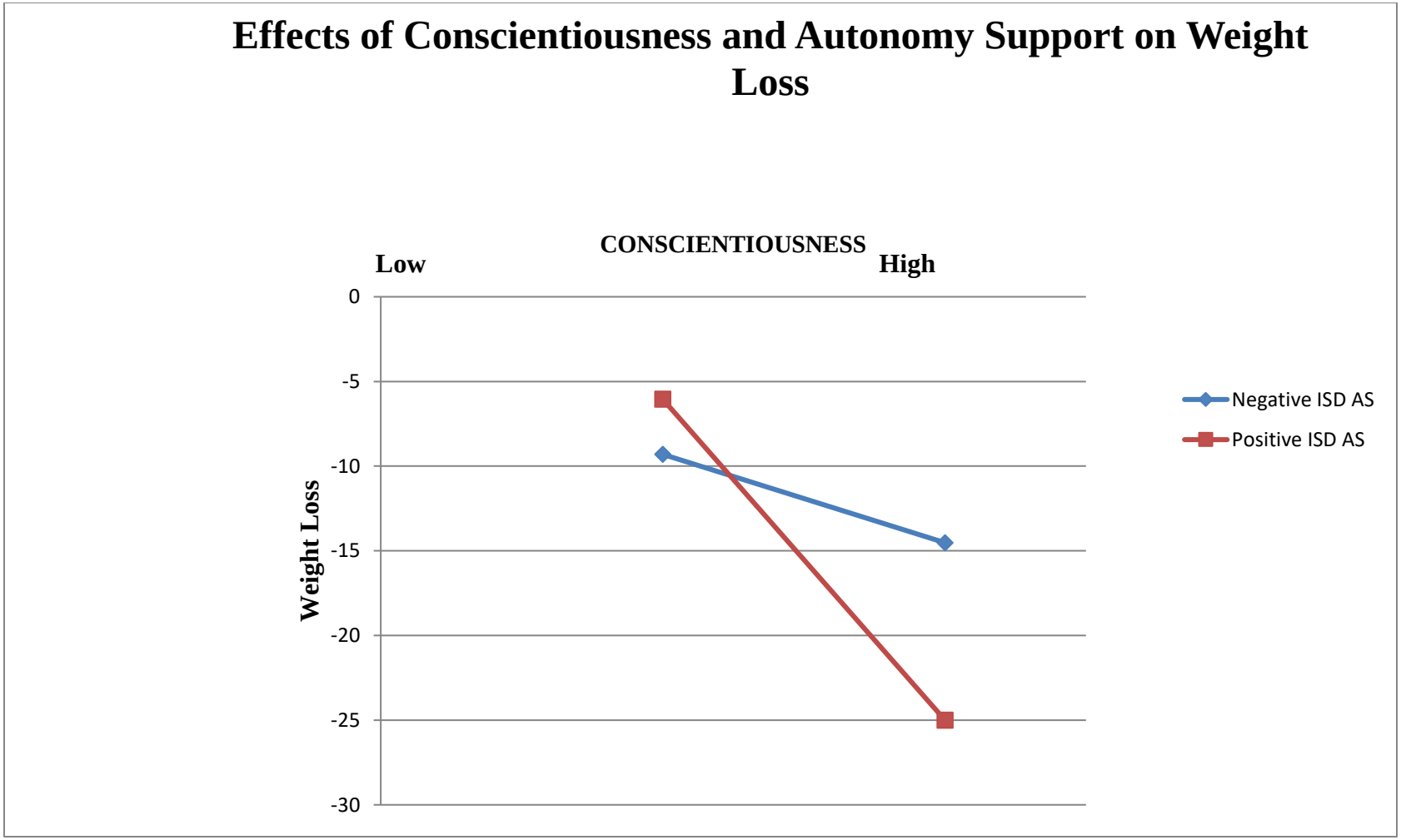

Figure 2. Effects of Conscientiousness and Autonomy Support on Weight Loss

Table 7. Effects of Conscientiousness and Autonomy Support on Attendance

	beta	*se*	*t*	*p*
Conscientiousness	.26	.25	1.05	.30
Autonomy Support	.10	.11	.97	.34
Interaction	-.17	.16	-1.07	.29

Interaction = conscientiousness and autonomy support r^2 = .048 r^2 *interaction* = .018

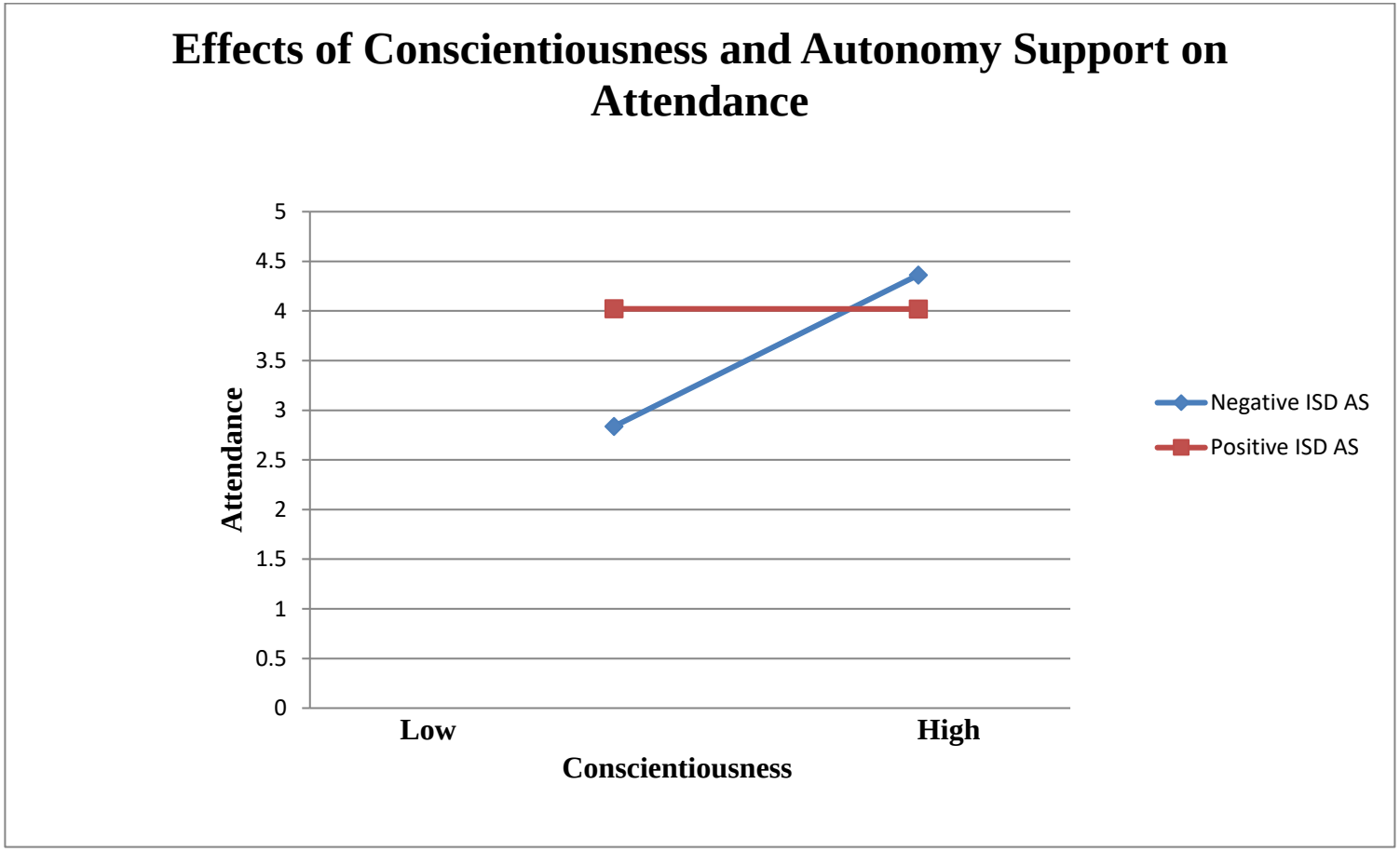

Figure 3. Effects of Conscientiousness and Autonomy Support on Attendance

Table 8. Effects of Conscientiousness and Autonomy Support on Attendance While Controlling for Initial Autonomy

	Beta	*se*	*t*	*p*
RAI	-.01	.03	-.53	.60
Conscientiousness	.30	.26	1.14	.26
Autonomy Support	.11	.11	.99	.33
Interaction	-.17	.16	-1.06	.29

Interaction = conscientiousness and autonomy support r^2 = .0529 r^2 *interaction* = .0181

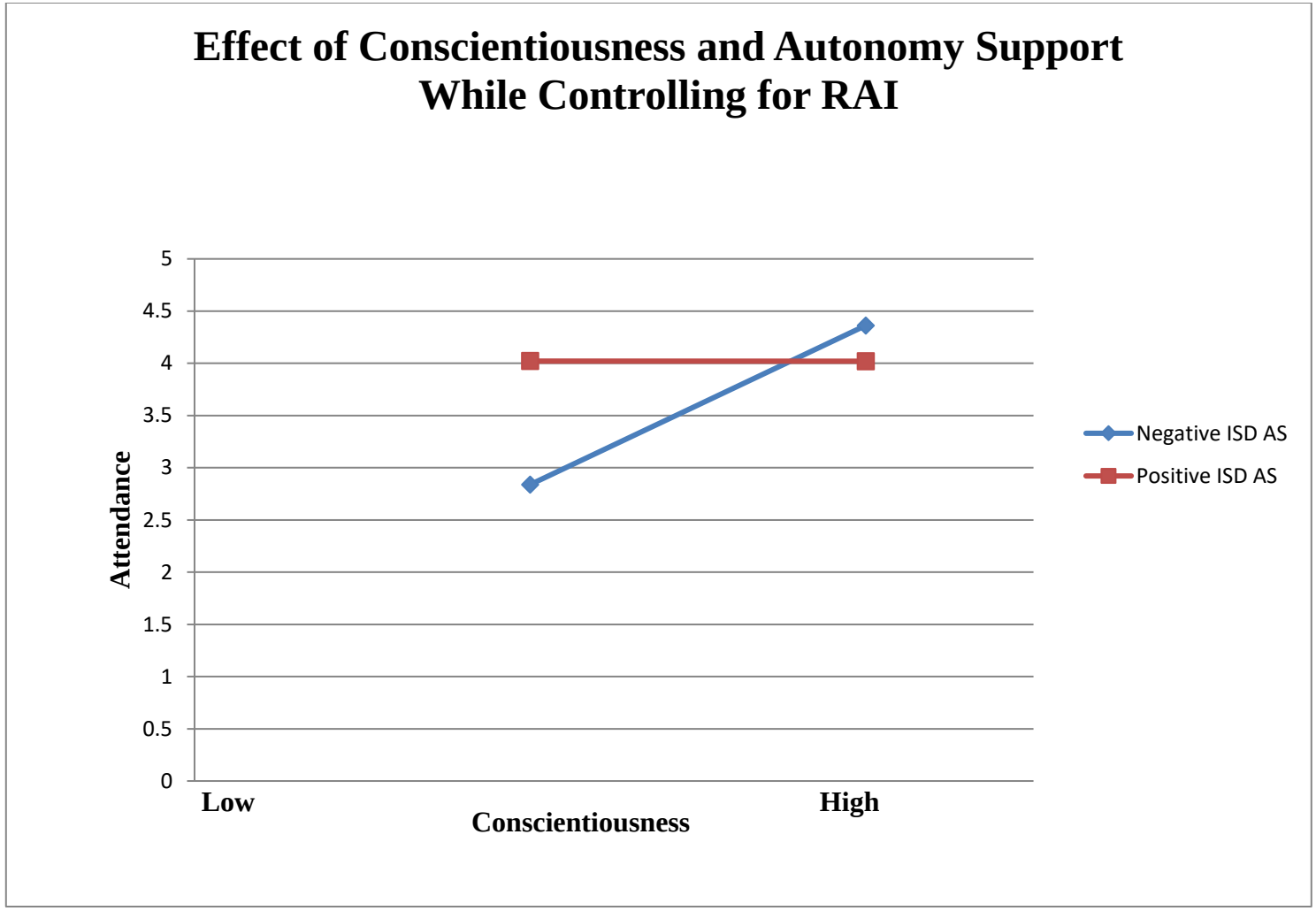

Figure 4. Effects of Conscientiousness and Autonomy Support While Controlling for RAI

Hypothesis

Direct Effects

Conscientiousness will predict weight-loss, decrease in body fat percentage, and attendance. Perceived autonomy support will predict weight-loss, decrease in body fat percentage, and attendance. An increase in personal autonomy will predict weight-loss, decrease in body fat percentage, and attendance.

Interactive Effects

Low Conscientiousness multiplied by Low perceived autonomy support will predict weight gain, increase in body fat percentage and low attendance rates. Low Conscientiousness multiplied by decrease personal autonomy will predict weight gain, increase in body fat percentage and low attendance rates.

Results of Study

Descriptive statistics and Pearson Correlations given in Table 4 show that conscientiousness correlates with RAI (r = .26, M = 11.36, SD = 6.43), Autonomy Support (r = .08, M = 5.32, SD = 1.58, α = .97), Attendance (r = .14, M = 3.84, SD = 1.31), and Change in Weight (r = -.09, M = -15.26, SD = 29.06).

Table 5 shows average weight loss by those who attended the initial weigh-in, the four weigh-in sessions, the final weigh-in, and answered the initial and final questionnaires. To qualify what the statistics are describing, the n=5 on attendance 1.00 does not mean the participants came to the initial weigh-in and the first weigh-in. That attendance=1.00 means that the participants came to the initial weigh-in and the final weigh-in. n=64 for all the participants represented in table 5, were all at the initial and final weigh-ins, the number of attendance for 2.00, 3.00, 4.00, and 5.00 represent the participants attending weigh-ins in between the initial and final weigh-ins. The mean weight loss for the 1.00 attendance group (n = 5) was (M = -19.65, SD = 25.32, CI 95% = -42.30 to 3.5), the 2.00 attendance group (n = 6) was (M = -5.94, SD = 25.13, CI 95% = -26.48 to 14.60), the 3.00 attendance group (n = 12) was (M = -8.78, SD = 25.04, CI 95% = -23.25 to 5.70), the 4.00 attendance group (n = 12) was (M = -19.72, SD = 25.01, CI 95% = -34.18 to -5.26) and the 5.00 attendance group (n = 29) was (M = -15.84, SD = 16.08, CI 95% = -25.14 to 6.55)

Correlational Analysis

The correlation between conscientiousness and weight loss demonstrated a change in weight of t = -.73 with an r^2 = .0213. The correlation between autonomy support and weight loss demonstrated a change in weight of t = -.61 with an r^2 = .0213. The interaction of conscientiousness and autonomy support on weight loss yielded a change in weight of t = -.44 with an r^2 = .0032.

The effects of conscientiousness on attendance show a change in attendance at t = 1.05 with an r^2 = .048. Autonomy support had an effect on attendance with a t = .97 while the r^2 =

.048. The interaction of autonomy support and conscientiousness demonstrated a change in attendance at t = -.17 with an r^2 = .018.

While controlling for personal autonomy (RAI), conscientiousness had an effect on the change in attendance with a t = 1.14 and an r^2 = .0529. Autonomy support effected attendance while controlling for RAI with a t = .99 and an r^2 = .0529. The interaction of conscientiousness and autonomy support on attendance while controlling for RAI was t = -1.06 with an r^2 = .0181.

Conscientiousness and Autonomy Support as Predictors of Attendance and Change in Weight

Hierarchical multiple regression analysis was used to test the hypothesis that the relationships of conscientiousness to attendance and change in weight was moderated by the perceptions of autonomy support. Participants who scored low in conscientiousness and low in autonomy support showed an average weight loss of -9.31 lbs. The group with low conscientiousness and high autonomy support had an average weight loss of -6.05 lbs. The participants who score high in conscientiousness and low in autonomy support showed an average weight loss of -14.52 lbs. The group with the greatest weight loss was the interaction group that scored high in both conscientiousness and autonomy support. This group's average weight loss was -25.00 lbs.

Conscientiousness and autonomy support were then statistically analyzed to test their ability to predict attendance of the participants. Those participants with low autonomy support and low conscientiousness had an average weigh-in attendance of 2.84 times. Those with low conscientiousness and high autonomy support attended the weigh-ins on average of 4.0 times. Those with low autonomy and high conscientiousness attended the weigh-in sessions at an average of 4.36 times. The participants who scored high in both autonomy and conscientiousness attended an average of 4.02 times. The statistical analysis showed that conscientiousness was not a factor for attendance. Those with high autonomy support attended, on average, about four out of five possible times.

To determine whether or not personal autonomy was a factor in attendance, statistical analysis was run while controlling for RAI. The statistics in this analysis were identical to the statistics of the previous attendance analysis that did not control for RAI. The low conscientious and low autonomy support group attended an average of 2.84 times. The low conscientious and high autonomy support group attended an average of 4.02 times. The high conscientious and low autonomy support group attended an average of 4.36 times. The high conscientiousness and high autonomy support group attended an average of 4.02 times. RAI was not a contributing factor to participants attending the scheduled weigh-in sessions.

Discussion of Study

The purpose of the present investigation was to examine the effects of conscientiousness, autonomy, and perceived autonomy support on success in a twelve-week weight loss study. Success was measured using attendance, weight loss, and body fat percentage lost. Each personality variable was studied on its own merit as well as the interaction between variables and success.

The combination of conscientiousness and perceived autonomy support measured success in attendance and weight loss. The combination of autonomy and conscientiousness was measured in respect to attendance. Body fat percentage was used as a measure of success in

respect to these combinations, but limitations in the conduction of the bioelectrical impedance measurements existed due to the lack of professional knowledge in preparation for that type of measurement. This error in measurement will be addressed later in the discussion.

Effects of Conscientiousness and Autonomy Support on Weight Loss

The hypothesis for this part of the study was that those with higher conscientiousness will have greater weight loss in comparison to those who have lower levels of conscientiousness. The second part of the hypothesis dealt with the analysis of those with higher autonomy support having greater weight loss than those participants with lower autonomy support. The third component of this section of the hypothesis is that those with high autonomy support coupled with high conscientiousness, will show the greatest weight loss in comparison to all groups.

The statistics determined that participants with low conscientiousness, and either positive or negative autonomy support, showed minimal weight loss during the twelve-week program. These statistics suggested that autonomy support, alone, was not a predicting factor for weight loss success during a twelve-week weight loss program. Those with low autonomy support and high conscientiousness showed an average weight loss of five pounds more than those with low autonomy support and low conscientiousness. This statistic suggests that conscientiousness may play a greater part in the success of participants wanting to lose weight in a program structure like the one studied in this project.

The greatest success was in the group that scored high in autonomy and conscientiousness. The group lost nearly nineteen pounds more than the group that was low in conscientiousness and high in autonomy support. The group lost close to fifteen pounds more on average than the group that was low in conscientiousness and low in autonomy support. The group lost approximately ten pounds more than the group that scored high in conscientiousness and low in autonomy support.

The statistics for this study show that health and wellness professionals need to focus on programs that increase both the conscientiousness of the individuals as well as have increased autonomy support during the program. A total of 245 participants participated in "The Challenge" competition. Since this was a weight-loss in obese population study, there were only 64 participants that started and finished the study that met those criteria. We were unable to run data on other obese participants who did not report the final day as we were unable to obtain post-test data from them. All other participants were at healthy weights and thus would not lose weight, or possibly gain weight in muscle mass, and would not show whether or not conscientiousness and perceived autonomy support played any roles in obese individuals losing weight in a 12 week weight-loss program.

Effects of Conscientiousness and Autonomy Support on Attendance

The hypothesis for the statistical analysis of this part of the study was that those with high conscientiousness would have a higher attendance rate than those with low conscientiousness. It was also hypothesized that those with higher autonomy support would attend more than those who scored low in autonomy support. The final hypothesis for this section of the study theorized that those who scored high in conscientiousness in combination with a high score in autonomy support would have the greatest attendance rates in comparison to all the other groups.

The final analysis found that those participants that scored low in conscientiousness and high in autonomy support scored nearly identical to those who scored high in conscientiousness and high in autonomy support. This analysis would suggest that high autonomy support was more significant than high or low score in conscientiousness. The highest attendance score was five (the total number of weigh-in days that attendance was recorded during the program). The high autonomy support group's average attendance was four in both the low and high conscientiousness groups.

The next analysis results were in contrast to the results of those who were high in autonomy support. It showed that those participants that scored low in autonomy support and low in conscientiousness were the least likely to attend all five weigh-in sessions. Their average score was just under three (2.8) visits. The group that was low in autonomy support, but high in conscientiousness scored the highest average attendance at 4.4 visits. That evidence is contrary to the previous evidence that supports the conclusion that conscientiousness plays a higher role in attendance than autonomy support.

Due to lack of final statistics based on attrition, there needs to be further study on the effects of both autonomy support and conscientiousness. Those with high autonomy support had a high attendance rate whether they had high or low conscientiousness. Those with low autonomy support, that scored high in conscientiousness, had the highest overall attendance. Due to these findings, I hypothesize that another study may find a stronger attendance rate for those participants that score high in both autonomy and conscientiousness. Both higher scores of autonomy and conscientiousness as separate factors show higher attendance. In this study both seem to have effects on attendance mutually exclusive from each other. This may also show that high autonomy support in a program may buffer out low levels of conscientiousness.

Effects of Conscientiousness and Autonomy Support on Attendance While Controlling for RAI

To further study whether conscientiousness and autonomy support had an effect on attendance, I controlled for personal autonomy. This was to see if personal autonomy played any role in the results that were discovered in the first statistical analysis of autonomy support and conscientiousness on attendance. The results were almost identical in both statistical analyses.

In both attendance, statistical analyses with and without controlling for RAI, the numbers and the charts were identical. The low conscientiousness with negative autonomy support in both groups scored a 2.8 out of 5 attendance points. The high conscientiousness and negative autonomy support group scored a 4.4 out of 5 attendance points. The low conscientiousness and positive autonomy support group scored 4 out of 5 attendance points. The high conscientiousness and high autonomy support also scored 4 out of 5 attendance points in both statistical analyses.

These results show that autonomy did not play a role in the statistics of these two groupings. This also shows that with or without RAI, participants with low conscientiousness and low autonomy support will have the lowest attendance rates. These results show that autonomy support buffers low conscientiousness in predicting attendance, while controlling for personal autonomy in exercise.

Final Conclusion, Limitations, and Future Directions

The statistics lead to the conclusion that weight loss programs, particularly twelve-week programs that are run in community or workplace wellness settings should focus their behavior change efforts on building high conscientiousness and autonomy support in the individuals

participating in their programs. While autonomy support may override levels of conscientiousness in the attendance statistics, the group that scored higher in both still had a high attendance score and that group had the greatest amount of weight loss. These findings support efforts to increase success in these programs by recognizing participants that initially have low conscientiousness and low autonomy support, and creating programs that foster increases in both categories to develop more successful weight loss campaigns. These two factors should help participants to attend more of the wellness classes, the group fitness classes, as well as the weigh-ins to increase success in their ability to lose excess weight.

There were several limitations to this study. The first resulted in the inability to use the body fat percentage data. The people who conducted the bioelectrical impedance testing where not informed on how important it is to have the participants well hydrated to get accurate results (Buchholz, Bartok, & Shoeller, 2004). The more dehydrated a participant is, the slower the current of electricity passing through the body. Water and lean mass have a faster conductivity rate than fat mass (Buchholz, Bartok, & Shoeller, 2004). If both lean mass and fat mass are dehydrated, the current is much slower than if that participant is properly hydrated and the readings will determine the participant to have a higher fat mass than what their body fat should read (Buchholz, Bartok, & Shoeller, 2004). This would create a greater degree of error in this measurement.

Although participants were not well hydrated, the bioelectrical impedance measurement system also tells the technician and the participant the percentage of water in the body. If the participant is not properly hydrated, he/she could measure again at the end of the study at or near the same hydration level, and get a fairly accurate decrease or increase in body fat percentage. The technicians where not educated on any of these needs and thus the participants results were not accurate. In this program before and after pictures were taken. During the last weigh-in, participants were told to be on a strict diet for the last two weeks and to be dehydrated for the final weigh-in so that they would look more defined in the final pictures. This meant most of the participants were more dehydrated in the last weigh-in compared to the first, making the bio-electrical impendence even less accurate. A further study using more qualified technicians, who give instructions to participants to come in well hydrated for each bioelectrical impedance measurement, would give accurate results that could be studied.

One other phenomenon that was observed was that participants that scored high in conscientiousness, personal autonomy, and autonomy support, had very healthy weights and body fat percentages. They may have entered the program more as a competition to see if their physique would improve from the beginning to end. Whether they had high or low participation, they would not see great weight-loss results or body fat percentage decrease. Their data was excluded from the final analysis. Those who came in the program overweight or obese, completed all the paperwork, the pre and post questionnaires, and the initial and post weigh-ins and bioelectrical impedance, were the only participants that could be used in the statistical analysis.

Selection bias based on convenience sampling could be a limiting factor. No subjects were recruited based on the needs of the study to have obese participants who are willing to partake in a twelve-week weight-loss study. The sample was limited to the individuals who voluntarily participated, and was again limited to those who were also determined to be obese through bioelectrical impedance.

Further studies may want to implement questionnaire protocols at each weigh-in to capture the other overweight and obese participants that do not complete the program. New

studies would help to understand what their personal autonomy levels, autonomy support levels, and conscientiousness levels of those participants. This would give further insight as to why they failed to complete the program.

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Appendix A Baseline Questionnaire

- Please think about your goals for participating in the Challenge. Please list up to five goals and write them below.

Goal 1	
Goal 2	
Goal 3	
Goal 4	
Goal 5	

Of the 5 goals you listed; please circle your most important goal. Goal 1 Goal 2 Goal 3 Goal 4 Goal 5

- Use the scale (below) to answer each of the following questions concerning you MOST IMPORTANT GOAL. Remember that you can use any of the numbers 0 to 4 in your response—whichever you see as closest to how you feel about your goal. Simply X out your choice.

	Not at all	Slightly	Moderately	Very	Extremely
I possess the necessary skills to attain this goal.	0	1	2	3	4
This goal is valuable to me.	0	1	2	3	4
I have the necessary knowledge to reach this goal.	0	1	2	3	4
This goal is worthwhile.	0	1	2	3	4
This goal is important to me.	0	1	2	3	4
I have what it takes to reach this goal.	0	1	2	3	4
This goal is meaningful to me.	0	1	2	3	4

I have the ability to reach this goal.	0	1	2	3	4

- Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. Remember that you can use any of the numbers 1 to 5 in your response—whichever you see as closest to how you feel about yourself. Simply X out your choice.

I…	**Very Inaccurate**	**Moderately Inaccurate**	**Neither Accurate nor Inaccurate**	**Moderately Accurate**	**Very Accurate**
Am always prepared.	1	2	3	4	5
Leave my belongings around.	1	2	3	4	5
Pay attention to details.	1	2	3	4	5
Make a mess of things.	1	2	3	4	5
Get chores done right away.	1	2	3	4	5
Often forget to put things back in their proper place.	1	2	3	4	5
Like order.	1	2	3	4	5

Shirk my duties.	1	2	3	4	5
Follow a schedule.	1	2	3	4	5
Am exacting in my work.	1	2	3	4	5

- Please read each question and respond as to how "like" the statement is about you when thinking about exercising within a group setting. Remember that you can use any of the numbers 1 to 7 in your response—whichever you see as closest to how you feel. Simply X out your choice.

When thinking about exercising within a group setting…	**Not at all like me**			**Neither Like Me or Unlike Me**			**Completely Like Me**
It is important to me to exercise as well as I possibly can.	1	2	3	4	5	6	7
I worry that I may not exercise as well as I possibly can.	1	2	3	4	5	6	7
It is important for me to do well as compared to others in my group.	1	2	3	4	5	6	7
I just want to avoid exercising worse than others in my group.	1	2	3	4	5	6	7
I want to exercise as well as it is possible for me to exercise.	1	2	3	4	5	6	7

Sometimes I'm afraid that I may not exercise as well as I'd like.	1	2	3	4	5	6	7
It is important for me to exercise better than others in my group.	1	2	3	4	5	6	7
My goal is to avoid exercising worse than everyone else in my group.	1	2	3	4	5	6	7
It is important for me to master all aspects the exercise sessions.	1	2	3	4	5	6	7
I'm often concerned that I may not exercise as well as I can exercise.	1	2	3	4	5	6	7
My goal is to do better than most other exercisers in my group.	1	2	3	4	5	6	7
It is important for me to avoid being one of the worst exercisers in my group.	1	2	3	4	5	6	7

- We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

	Not True for Me		**Sometimes True for Me**		**Very True for Me**
I exercise because other people say should.	0	1	2	3	4
I feel guilty when I don't exercise.	0	1	2	3	4
	0	1	2	3	4

I value the benefits of exercise.					
I exercise because it's fun.	0	1	2	3	4
I don't see why I should have to exercise.	0	1	2	3	4
I take part in exercise because my friends/family/partner say I should.	0	1	2	3	4
I feel ashamed when I miss an exercise session.	0	1	2	3	4
It's important to me to exercise regularly.	0	1	2	3	4
I can't see why I should bother exercising.	0	1	2	3	4
I enjoy my exercise sessions.	0	1	2	3	4
I exercise because others will not be pleased with me if I don't.	0	1	2	3	4
I don't see the point in exercising.	0	1	2	3	4
	Not True for Me		Sometimes True for Me		Very True for Me
I feel like a failure when I haven't exercised in a while.	0	1	2	3	4

I think it is important to make the effort to exercise regularly.	0	1	2	3	4
I find exercise a pleasurable activity.	0	1	2	3	4
I feel under pressure from my friends/family to exercise.	0	1	2	3	4
I get restless if I don't exercise regularly.	0	1	2	3	4
I get pleasure and satisfaction from participating in exercise.	0	1	2	3	4
I think exercising is a waste of time.	0	1	2	3	4

My name is _____ .

Appendix B Follow-Up Questionnaire

- This questionnaire contains items that are related to your sessions with your trainers. Trainers have different styles in dealing with clients, and we would like to know more about how you felt about your encounters with your trainers. Your responses are confidential. Please be honest and candid.

When thinking about exercising with your trainers…	**Strongly disagree**			**Neutral**			**Strongly agree**
I felt that my trainer provided me choices and options.	1	2	3	4	5	6	7
I felt understood by my trainer.	1	2	3	4	5	6	7
I was able to be open with my trainer at our meetings.	1	2	3	4	5	6	7
My trainer conveyed confidence in my ability to make changes.	1	2	3	4	5	6	7
I felt my trainer accepted me.	1	2	3	4	5	6	7
My trainer made sure I really understand about my condition and what I needed to do.	1	2	3	4	5	6	7
My trainer encouraged me to ask questions.	1	2	3	4	5	6	7

I felt a lot of trust in my trainer.	1	2	3	4	5	6	7
My trainer answered questions fully and carefully.	1	2	3	4	5	6	7
My trainer listened to how I would like to do things.	1	2	3	4	5	6	7
My trainer handled people's emotions very well.	1	2	3	4	5	6	7
I felt that my trainer cared about me as a person.	1	2	3	4	5	6	7
I don't feel very good about the way my trainer talked to me.	1	2	3	4	5	6	7
My trainer tried to understand how I see things before suggesting a new way to do things.	1	2	3	4	5	6	7
I felt able to share my feelings with my trainer.	1	2	3	4	5	6	7

- We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

	Not True for Me		Sometimes True for Me		Very True for Me
I exercise because other people say should.	0	1	2	3	4
I feel guilty when I don't exercise.	0	1	2	3	4
I value the benefits of exercise.	0	1	2	3	4
I exercise because it's fun.	0	1	2	3	4
I don't see why I should have to exercise.	0	1	2	3	4
I take part in exercise because my friends/family/partner say I should.	0	1	2	3	4
I feel ashamed when I miss an exercise session.	0	1	2	3	4
It's important to me to exercise regularly.	0	1	2	3	4
I can't see why I should bother exercising.	0	1	2	3	4
	0	1	2	3	4

I enjoy my exercise sessions.					
I exercise because others will not be pleased with me if I don't.	0	1	2	3	4
I don't see the point in exercising.	0	1	2	3	4

	Not True for Me		Sometimes True for Me		Very True for Me
I feel like a failure when I haven't exercised in a while.	0	1	2	3	4
I think it is important to make the effort to exercise regularly.	0	1	2	3	4
I find exercise a pleasurable activity.	0	1	2	3	4
I feel under pressure from my friends/family to exercise.	0	1	2	3	4
I get restless if I don't exercise regularly.	0	1	2	3	4
I get pleasure and satisfaction from participating in exercise.	0	1	2	3	4
I think exercising is a waste of time.	0	1	2	3	4

My name is _____ .