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2 **Psychological Needs and Well-Being of Individuals Engaging in Weight Management: The Role of**
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4 Predicting Psychological Needs and Well-Being of Individuals Engaging in Weight

5 Management: The Role of Important Others

6 **Abstract**

7 **Background.** Using the self-determination theory (SDT) framework, we examined how
8 significant others might support or thwart psychological needs of people with weight
9 management goals, and in turn might affect their psychological well-being and weight control
10 behaviors.

11 **Design.** Longitudinal design with three sets of questionnaires administered over a six-month
12 period.

13 **Methods.** 156 eligible participants (age = 31.01 ± 13.21 years) were asked to complete
14 questionnaires of SDT-based constructs, weight management behaviors, and psychological
15 well-being. Hypotheses were tested using Bayesian path analysis.

16 **Results.** Perceived autonomy support from significant others was related to psychological
17 need satisfaction, while controlling behaviors by others were associated with need thwarting.
18 In turn, need satisfaction was associated with some beneficial outcomes such as life
19 satisfaction, and need thwarting was related to some maladaptive outcomes such as higher
20 levels of depressive symptoms and increases in unhealthy diet behaviors.

21 **Conclusions.** Our findings indicate that the quality of interactions between individuals
22 engaged in weight management and their significant others matters in terms of predicting the
23 psychological needs and well-being of the former.

24
25 *Keywords:* psychological needs; autonomy support; controlling behaviors;
26 psychological well-being; Bayesian path analysis

27

Predicting Psychological Needs and Well-being of Individuals Engaging in Weight

Management: The Role of Important Others

Overweight and obesity were identified by the World Health Organization (2011) as risk factors for non-communicable diseases such as cardiovascular illnesses and type II diabetes. In 2009, more than 60% of the UK population was classified as overweight or obese (OECD, 2011). This percentage is predicted to increase, and as a result, health care costs associated with related diseases is estimated to rise by £2 billion per year (Wang, McPherson, Marsh, Gortmaker, & Brown, 2011). Although local governments, universities, and commercial companies have developed weight loss or maintenance (referred to as weight management hereafter) programs to address the problem of overweight and obesity, research has shown that attrition rates from these programs is rather high (Gill et al., 2012). Adherence to weight management behaviors, such as regular physical activity and a healthy diet, is imperative to successful weight loss or maintenance. In the current study, we examined how important others support or undermine engagement in these behaviors. Rather than examining the quantity of support provided, we were interested in how different types of support by significant others satisfy or thwart key psychological needs and subsequently lead to contrasting outcomes. To this end, self-determination theory (SDT; Deci & Ryan, 2000) was chosen as an appropriate framework for this study.

Self-determination Theory

Proposed by Deci and Ryan (1985, 2000), SDT provides a conceptual framework to explain both antecedents and consequences of personal motivation. Researchers have utilized SDT to study health-related behaviors, including weight management (for a recent meta-analysis, see Ng et al., 2012). Empirical research in this area has been influenced by Ryan, Patrick, Deci, and Williams' (2008) model which is an application of basic needs theory, one of the mini-theories of SDT, to the health-related contexts. Using the model, Ryan et al.

1 described how contextual factors (e.g., perceived behaviors of others) may enhance
2 individuals' satisfaction of three basic psychological needs. These are the need for autonomy
3 (i.e., being the origin of one's behavior), competence (i.e., feeling effective), and relatedness
4 (i.e., perception of being cared for by others). In turn, psychological need satisfaction leads to
5 improved physical and psychological well-being, and promotes health-conducive behaviors
6 including physical activity and a healthier diet.

7 Within SDT, one important antecedent of need satisfaction is an individual's
8 perception of received autonomy support from the social environment. Autonomy support is
9 characterized by behaviors such as provision of choices, meaningful rationale for task
10 engagement, and acknowledgment of negative feelings (Deci & Ryan, 1987). In support of
11 the tenets of SDT, Williams, Grow, Freedman, Ryan, and Deci (1996) found that
12 participants' perceived autonomy support by health-care providers was associated with
13 participants' autonomous motivation (doing a behavior for enjoyment or its valued outcomes)
14 for weight loss, which in turn predicted attendance to a 6-month weight loss program, weight
15 loss during the program, and maintenance of weight loss at a 23-month follow-up. In another
16 study, Williams et al. (2006) found that participants' perceived autonomy support from
17 important others predicted autonomy and competence need satisfaction and lower fat and
18 calorie intake five months later. Similarly, Silva et al. (2010) found that in a group of female
19 participants attempting to lose weight, autonomy support by instructors predicted autonomy
20 and competence need satisfaction, and in turn autonomous motivation and more physical
21 activity.

22 In contrast to being autonomy supportive, Ryan and Deci (2000) also posited that the
23 social environment can be controlling and thwart psychological need satisfaction, leading to
24 low behavioral adherence and ill-being. Controlling behaviors, such as the use of contingent
25 rewards, intimidation, and conditional acceptance have been found to thwart the needs of

1 autonomy, competence, and relatedness, and lead to ill-being in the context of sport
2 (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Bartholomew,
3 Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). Studies in the sport domain have
4 suggested that need satisfaction and thwarting may be orthogonal constructs, and that
5 psychological need thwarting is not equivocal to low levels of need satisfaction (e.g.,
6 Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011). The evidence from this line
7 of work suggests that need thwarting is a stronger predictor of ill-being and maladaptive
8 behaviors, whereas need satisfaction is a stronger predictor of well-being and adaptive
9 behaviors. In our current study we assessed simultaneously both need satisfaction and need
10 thwarting.

11 Previous research has also examined the effects of having social support from
12 important others on weight management outcomes. For instance, Wing and Jeffery (1999)
13 found that participants who received support from friends or family members, compared to
14 those who did not have the same support, had better adherence to a weight loss treatment
15 program and were more successful in maintaining their weight loss. In contrast, Beverly,
16 Miller, and Wray (2008) found that excessive control by spouses may lead to lower self-
17 control, or perceived lack of support in patients diagnosed with type II diabetes. From a SDT
18 perspective, it is not only the extent of support by significant others (e.g., spouse, offspring,
19 close friend) that matters but also the nature of that support (autonomy supportive vs.
20 controlling). For instance, an individual could have a big network of family and friends
21 supporting her weight management regime (i.e., having high levels of social support), yet
22 these significant others may not provide her with choices or meaningful rationales (i.e.,
23 autonomy support), but instead try to support her by exerting pressure (i.e., being controlling).
24 As explained earlier, autonomy support and controlling support from significant others
25 differentially predicts psychological needs, motivation, and behavioral/emotional investment

1 of individuals undertaking a weight management program.

2 **The Current Study**

3 The purpose of this study was to examine how important others' autonomy supportive
4 and controlling behaviors might predict individuals' psychological need
5 satisfaction/thwarting when engaged in weight management. Also, we investigated how
6 psychological needs predict changes in exercise and diet behaviors, and psychological
7 well/ill-being over a six-month period. Using a longitudinal design, we tested a SDT-based
8 model of weight management. The current study extends the SDT literature in a few ways.
9 First, previous studies have examined the effects of perceived autonomy support on weight
10 management outcomes and behaviors. However, no studies have looked at how controlling
11 behaviors of important others may also affect these outcomes. In their meta-analysis, Ng et al.
12 (2012) found only one study which measured controlling behaviors in relation to health-
13 related outcomes. According to Ryan and Deci (2000), these behaviors may have detrimental
14 consequences in terms of health outcomes. Hence, it is important to assess such behaviors in
15 health-related studies examining social interactions. Further, this is the first study within a
16 weight management context that has simultaneously examined the effects of adaptive (e.g.,
17 need satisfaction) and maladaptive (e.g., need thwarting) factors at the level of psychological
18 needs. The construct of need thwarting has not been previously examined within a context of
19 weight management, but was found to be related to outcomes such as depressive symptoms
20 and disordered eating in athletes (Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011). Thus,
21 our study advances previous literature by simultaneously examining multiple adaptive and
22 maladaptive motivational factors at both the contextual and personal level.

23 In the current study, we specifically looked at the influence of the most prominent
24 important other nominated by each participant. This is because Rouse, Ntoumanis, Duda,
25 Jolly, and Williams (2011) showed that different important others can have differential

1 impact on motivation and well-being of clients enrolled in an exercise program for weight
2 reduction. Specifically, Rouse et al. found that the strength of relations between autonomy
3 support and mental health and physical activity outcomes varied as a function of who
4 provided the support (e.g., partner, physician, or offspring). We hypothesized that
5 participants' perceived autonomy support received from important others (referred to as
6 "perceived autonomy support" hereafter) would predict the satisfaction of the formers' basic
7 psychological needs. In contrast, controlling behaviors of important others would predict
8 participants' psychological need thwarting. Based on the basic needs theory model by Ryan
9 et al. (2008), we also hypothesized that psychological need satisfaction would predict
10 increased use of behaviors associated with weight management (more exercise and healthy
11 diet, less unhealthy diet) and heightened levels of psychological well-being (more life
12 satisfaction and self-esteem, less depressive symptoms). In contrast, we hypothesized that
13 need thwarting would predict a reduction in exercise and healthy diet behaviors, an increase
14 in unhealthy diet behaviors, and lowered psychological well-being (less life satisfaction and
15 self-esteem, more depressive symptoms).

16 **Method**

17 **Participants and Procedures**

18 Participants were recruited from community settings in the United Kingdom using
19 posters at fitness centers and messages sent through electronic mailing lists. Participants were
20 eligible if they had been attempting to manage their body weight by engaging in exercise, diet,
21 or both types of behaviors. They were informed that they had to complete three sets of
22 questionnaires over a 6-month period (questionnaires were administered three months apart).
23 As long questionnaires have been shown to lead to lower participation rates and reduced
24 quality of responses (Galesic & Bosnjak, 2009), only selected variables were measured at
25 each time point. Both paper and online questionnaires were available to participants at all

1 time points. Paper questionnaires were sent to participants by post. They were returned by
2 post using pre-paid envelopes provided to them. Online questionnaires were sent to
3 participants who preferred completing questionnaires using this format via email. Four £50
4 vouchers were offered in a prize draw to participants who completed all three sets of
5 questionnaires. All procedures and questionnaires of the study were approved by the ethical
6 review committee of a British university.

7 At baseline (T1), 399 respondents completed the first set of questionnaire. In this
8 questionnaire set, participants reported their weight management goal (i.e., lose *or* maintain
9 weight), demographic variables, and their current body height and weight. Participants were
10 also asked to report their diet or exercise behaviors associated with weight management.
11 Further, they reported their feelings of life satisfaction and self-esteem (as indicators of
12 psychological well-being), and depressive symptoms (to tap ill-being). Three months later
13 (T2), participants were invited to complete the second set of questionnaire. Invitations were
14 sent by post or email, depending on the preference of the respondent. Questionnaires were
15 sent to all 399 respondents who completed the questionnaire at T1, but only 207 (52%)
16 questionnaires were completed and returned. Similar attrition rates were observed in another
17 longitudinal study by Georgiadis, Biddle, and Stavrou (Georgiadis, Biddle, & Stavrou, 2006).
18 Similar to our study, this study applied SDT to study motivation in a weight management
19 context, and had 3 time points over a 4 to 6 month period. Our T2 questionnaire included
20 measures of perceived autonomy support, controlling behaviors, need satisfaction, and need
21 thwarting. Two sets of measures, one focused on exercising and one on dieting, were
22 administered to all participants. Participants were asked to respond to either or both sets of
23 measures, depending on what types of weight management behaviors they were engaging in.

24 Of the 207 participants who received T2 questionnaires, some respondents were
25 trying to gain weight ($n = 14$), and some were not attempting to lose or maintain body weight

1 by exercising or dieting ($n = 37$). Their responses were excluded from the analyses. The final
2 sample included in our analyses constituted 156 participants (age = 31.01 ± 13.21 years, 80%
3 were female, 65% were white). Of these participants, 73 had a weight loss goal and 83 had a
4 weight maintenance goal. In terms of responses with respect to physical activity and diet
5 behaviors, we received 129 responses in reference to exercise, and 91 in reference to diet (i.e.,
6 64 participants completed questionnaires in reference to both exercise and diet). The final set
7 of questionnaires was sent to participants three months after T2 (T3). At T3, participants were
8 asked to complete the same measures of behaviors associated with weight management (i.e.,
9 physical activity, healthy and unhealthy diet behaviors), and psychological well- and ill-being
10 (as in T1, so we could examine changes in these variables across the 6-month period. Ninety
11 eight questionnaires (63% of T2) were returned, corresponding to 80 sets of responses in
12 reference to exercise and 57 in reference to diet (39 participants completed both sets of
13 questionnaires). Again, a similar attrition rate from the second to third time point was found
14 in the study by Georgiadis et al. (2006).

15 **Measures**

16 **Autonomy support and controlling behaviors.** Participants were asked to nominate
17 one “important other” who had the greatest impact on their weight management plans and
18 behaviors. Participants who did not have such an important other were asked to skip this
19 section of the questionnaire. They then reported their perceived autonomy support and
20 controlling behaviors from this important other. The Health Care Climate Questionnaire
21 (HCCQ; Williams et al., 1996) was adapted to measure participants’ perceived autonomy
22 support. Ten items from the original HCCQ that were relevant to the context of exercise and
23 diet behaviors were used (e.g., “My important other listens to how I would like to do things”).
24 Important others’ controlling behaviors were measured by an adapted version of the
25 Controlling Coach Behaviors Scale (CCBS; Bartholomew, Ntoumanis, & Thøgersen-

1 Ntoumani, 2010). Items from the original sport-specific scale that captured relevant aspects
2 of weight management behaviors were used. Six items were thus modified to measure
3 controlling behaviors in this study (e.g., “My important other is less supportive of me when I
4 don’t stick to my diet regime”). Responses for the two scales were made using a 7-point scale
5 (from *strongly disagree* to *strongly agree*).

6 **Satisfaction of basic psychological needs.** Four items for autonomy (e.g., “I feel it is
7 my own decision to diet”) and competence (e.g., “I can overcome challenges when I diet”)
8 need satisfaction from the Basic Needs Satisfaction in Sport Scale (Ng, Lonsdale, & Hodge,
9 2011) were modified to measure the corresponding constructs in terms of exercise and diet
10 behaviors. Satisfaction of the need of relatedness was measured using four items adapted
11 from Richer and Vallerand’s (1998) scale (e.g., “With respect to my exercise engagement, I
12 feel understood”). For all three needs, a 7-point scale was used (from *strongly disagree* to
13 *strongly agree*).

14 **Psychological need thwarting.** The 12 items of the Psychological Need Thwarting
15 Scale (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011) were modified to
16 measure thwarting of autonomy (e.g., “I feel others push me to behave in certain ways”),
17 competence (e.g., “Situations occur in which others make me feel incapable”), and
18 relatedness (e.g., “I feel others reject me”) with respect to exercise and diet behaviors.
19 Responses were made using a 7-point scale (from *strongly disagree* to *strongly agree*).

20 **Exercise behaviors.** The Godin leisure-time exercise questionnaire (Godin &
21 Shephard, 1985) was used to measure participants’ exercise behaviors. Specifically,
22 participants were asked to report the number of times they engaged in strenuous (e.g.,
23 running), moderate (e.g., brisk walking), and mild exercise (e.g., golf) for at least 15 minutes
24 in the last seven days. Each type of physical activity was assigned a different metabolic
25 equivalent of task (MET) weight (strenuous, 9; moderate, 5; mild, 3). The frequencies of the

1 three types of activity were multiplied by their respective weights, and then summed to form
2 a MET score of exercise behaviors.

3 **Healthy and unhealthy diet behaviors.** Participants' diet behaviors were measured
4 using a scale by Neumark-Sztainer, Story, Hannan, Perry, and Irving (2002). The scale
5 measured both healthy (3 items; "ate less sweets", "ate more fruits and vegetables", and "ate
6 less high-fat foods") and unhealthy (5 items; "skipped meals", "made yourself through up",
7 "taken diet pills", "fasted for a day or more", "taken laxatives or water pills") diet behaviors.
8 Participants were asked to respond to how often they engaged in behaviors described in the
9 items using a 5-point scale (from *never* to *always*).

10 **Psychological well-being.** Life satisfaction was measured using a scale developed by
11 Diener, Emmons, Larsen, and Griffin (1985). The five-item scale was designed to measure
12 respondents' overall life satisfaction (e.g., "In most ways my life is close to my ideal"). A 7-
13 point scale was used for responses for life satisfaction (from *strongly disagree* to *strongly*
14 *agree*). To measure self-esteem, a scale developed by Rosenberg (1965) was used (10 items;
15 e.g., "I feel I have a number of good qualities"). Responses for self-esteem were made using a
16 4-point scale (from *strongly disagree* to *strongly agree*).

17 **Psychological ill-being.** Participants' depressive symptoms were measured using the
18 seven depression items from the Hospital Anxiety and Depression Scale (e.g., "I have lost
19 interest in my appearance"; Zigmond & Snaith, 1983). Responses were given using 4-point
20 scales (the anchors varied across items).

21 **Results**

22 **Descriptive Statistics, Cronbach Alphas**

23 With reference to exercise, 47% of participants nominated their spouse or romantic
24 partner as the most influential important other, and 32% of participants nominated a close
25 friend. With reference to diet, 71% nominated their spouse or romantic partners, while 15%

1 of participants reported that one of their parents had the most impact on their diet behaviors.
2 To examine whether results might have been biased due to participant dropout, we compared
3 (using one-way ANOVAs) T1 scores of all measured variables for participants who
4 completed T2 questionnaires versus those who did not complete the T2 assessments. No
5 significant differences were found. Similarly, we compared scores of variables measured at
6 T2 for participants who completed T3 questionnaires versus those who did not. Again, no
7 significant differences were found. Descriptive statistics and Cronbach alphas of all measured
8 variables are presented in Table 1. Cronbach alphas for healthy and unhealthy diet behaviors
9 measured at both T1 and T3 were low ($\alpha = .41$ to $.61$). This might be because the items
10 measured distinct behaviors that correspond to healthy and unhealthy dieting¹. The Pearson
11 correlation between need satisfaction of competence, autonomy, and relatedness was
12 significant with reference to both exercise and diet ($.25$ to $.66$ for exercise, $.55$ to $.76$ for diet;
13 $p < .01$). Similarly, psychological need thwarting of competence, autonomy, and relatedness
14 was significantly associated with one another ($.72$ to $.81$ for exercise, $.78$ to $.84$ for diet; p
15 $< .01$). To eliminate possible multicollinearity effects in the path analyses, the unweighted
16 means of satisfaction and thwarting of the three needs were used as scores for need
17 satisfaction and need thwarting, respectively².

18 **Predicting Psychological Needs, Weight Management Behaviors, and Well/Ill-being**

19 We conducted path analyses using the Bayesian approach to test our hypotheses
20 because this approach was found to produce more accurate evaluations of model fit and
21 parameter estimates when sample sizes are small or when the assumption of normality is
22 violated (Asparouhov & Muthén, 2010; Lee & Song, 2004). Analyses were conducted with
23 Mplus 7 (Muthén & Muthén, 2008). Unweighted mean scale scores were used as observed
24 variables in the analyses. Missing data were treated using a full-information estimation
25 method so that all available data were used. Model fit was evaluated using posterior

1 predictive checking (PPC; Gelman, Carlin, Stern, & Rubin, 2004). Specifically, a χ^2 test is
2 conducted to compare the observed data with model estimates. A 95% confidence interval for
3 the PPC- χ^2 is generated for each tested model (the actual χ^2 value is not given by the
4 software). A model is deemed well-fitting if its corresponding PPC- χ^2 confidence interval
5 encompasses 0, or equivalently has a Posterior Predictive p -value between .05 and .95
6 (Gelman et al., 2004). In the Bayesian approach a 95% credibility interval (95% CI) is
7 generated for each estimated parameter; the median was used as the point estimate. If the
8 95% CI for that estimate did not encompass 0, a true relation between the variables would
9 likely exist.

10 We tested models, separately for exercise and diet contexts, with perceived autonomy
11 support predicting need satisfaction, controlling behaviors predicting need thwarting, and
12 need satisfaction/thwarting in turn predicting outcomes measured at T3 (Figures 1 & 2).
13 Outcomes measured at T1 were used as control variables for the corresponding T3 outcomes
14 in these models. Residual variances between psychological well- and ill-being outcomes
15 (with reference to both exercise and diet), as well as those between healthy and unhealthy diet
16 behaviors (with reference to diet) were allowed to correlate as we hypothesized that these
17 variables are related.

18 With reference to exercise, the initial model we tested had a poor model fit: PCC- χ^2
19 confidence interval [18.30, 118.21], Posterior Predictive p -value < .001. We found that
20 exercise behaviors and the indicators of psychological well-being/ill-being were very stable
21 across the 6-month period (range of stability coefficients in the path model = .48 to .80; M
22 = .60), and there was no change that could be predicted by psychological needs. Thus, we
23 tested a different model by excluding the T1 measures, so that we could test how
24 psychological needs predict physical activity behaviors and psychological well-being/ill-
25 being at one point in time, as opposed to *change* in these variables. A good model fit was

1 found for the modified model: PCC- χ^2 confidence interval [-26.13, 27.11], Posterior
2 Predictive p -value = .51 (Figure 1). In this model, autonomy support predicted need
3 satisfaction ($\beta = .52$, 95% CI [.35, .66]) and controlling behaviors predicted need thwarting (β
4 = .23, 95% CI [.00, .43]). Real effects were likely to exist from need thwarting to life
5 satisfaction ($\beta = -.26$, 95% CI [-.44, -.05]), self-esteem ($\beta = -.36$, 95% CI [-.53, -.15]), and
6 depressive symptoms ($\beta = .42$, 95% CI [.22, .58]). We also found indirect effects from
7 controlling behaviors, via need thwarting, to depressive symptoms ($\beta = .09$, 95% CI
8 [.00, .21]).

9 * * * * *

10 Insert Figure 1 here

11 * * * * *

12 A similar approach was used to examine the model with reference to diet behaviors.
13 That is, we first examined the model with need satisfaction/thwarting predicting outcomes
14 measured at T3, controlling for their corresponding T1 scores. The initial model did not fit
15 well: PCC- χ^2 confidence interval [7.06, 95.24], Posterior Predictive p -value = .01. Again, we
16 found high stability in the outcome variables (range of stability coefficients = .53 to .69; M
17 = .61), with the exception of diet behaviors (stability coefficients = -.18 [healthy diet] and .16
18 [unhealthy diet]). Thus, we reexamined the model by removing the T1 variables of the
19 psychological well- and ill-being outcomes. The modified model (Figure 2) had a good fit:
20 PCC- χ^2 confidence interval [-40.38, 33.41], Posterior Predictive p -value = .54. As
21 hypothesized, perceived autonomy support predicted need satisfaction ($\beta = .60$, 95% CI
22 [.40, .73]) and controlling behaviors predicted need thwarting ($\beta = .48$, 95% CI [.24, .65]).
23 The 95% CIs of the paths from need satisfaction to life satisfaction ($\beta = .26$, 95% CI
24 [.01, .48]) and self-esteem ($\beta = .25$, 95% CI [.01, .46]) did not encompass zero. Also, we
25 found that need thwarting predicted unhealthy diet behaviors ($\beta = .38$, 95% CI [.06, .62]),

1 self-esteem ($\beta = -.29$, 95% CI [-.51, -.04]), and depressive symptoms ($\beta = .39$, 95% CI
2 [.15, .59]). We found an indirect effect from autonomy support via need satisfaction to life
3 satisfaction ($\beta = .17$, 95% CI [.01, .37]) and self-esteem ($\beta = .17$, 95% CI [.01, .36]).
4 Similarly, indirect effects from controlling behaviors, through need thwarting to self-esteem
5 ($\beta = -.14$, 95% CI [-.30, -.02]), depressive symptoms ($\beta = .18$, 95% CI [.06, .36]), and
6 changes to unhealthy diet behaviors ($\beta = .19$, 95% CI [.03, .42]), were different from zero^{2, 3}.

7 * * * * *

8 Insert Figure 2 here

9 * * * * *

10 Discussion

11 The purpose of this study was to examine how autonomy supportive and controlling
12 behaviors from important others might affect individuals' psychological need
13 satisfaction/thwarting when engaged in weight management. Furthermore, this study also
14 investigated how psychological needs predict behaviors associated with weight management
15 (i.e., exercise and healthy diet) and psychological well/ill-being. In line with our hypotheses,
16 we found that perceived autonomy support provided by important others predicted higher
17 levels of need satisfaction in individuals with weight management goals. Also, when
18 important others used more controlling behaviors, individuals reported higher levels of need
19 thwarting. In terms of the predictive paths from need satisfaction/thwarting to behavioral and
20 well-being outcomes, the results were mixed. We hypothesized that need satisfaction
21 (thwarting) would predict increases (decreases) in adaptive weight management behaviors
22 and psychological well-being outcomes. Further, we expected that need thwarting
23 (satisfaction) would predict increases (decreases) in maladaptive weight management
24 behaviors and psychological ill-being. However, we found that some of the outcomes,
25 including exercise behaviors and psychological well- and ill-being, were very stable across

1 the 6-month period. As a result, need satisfaction/thwarting did not predict *changes* in these
2 variables as hypothesized. Therefore, instead of examining changes in these variables, we
3 examined how need satisfaction/thwarting predicted these behaviors and perceptions
4 measured three months later. In terms of behavioral outcomes, we only found that changes in
5 unhealthy diet behaviors were predicted by need thwarting. Inconsistent with our hypotheses,
6 both need satisfaction and thwarting did not predict physical activity and changes in healthy
7 diet behaviors. The predictive paths from need satisfaction/thwarting to psychological well-
8 and ill-being outcomes were in the directions we hypothesized. However, the 95% CIs of
9 paths from need satisfaction to life satisfaction (exercise), self-esteem (exercise), and
10 depression (exercise and diet) encompassed zero. With reference to diet, the 95% CI of the
11 path from need thwarting to life satisfaction also included zero.

12 One possible explanation for the null findings in terms of need satisfaction and
13 thwarting predicting changes in the outcomes is that these SDT variables may fluctuate more
14 on a daily basis (Bartholomew, Ntoumanis, Ryan, Bosch, et al., 2011; Reis, Sheldon, Gable,
15 Roscoe, & Ryan, 2000). Although the general perceptions may be stable across six months,
16 as found in our study, fluctuations within shorter periods of time were not detected because
17 SDT-variables and the outcomes were measured three months apart, and not simultaneously
18 within the same time point.

19 Our findings have implication for important others (e.g., spouse, close friends) who
20 are trying to help individuals manage their weight. Important others should use more
21 autonomy supportive behaviors (e.g., acknowledging negative feelings, providing rationales,
22 and choices). In our study we found that when participants perceived more autonomy support
23 from their important other, their psychological needs were satisfied. In line with SDT, we
24 also found that need satisfaction, with respect to diet behaviors, predicted life satisfaction.
25 Although the corresponding 95% CIs marginally encompassed zero, true effects may also

1 exist from need satisfaction to life satisfaction (95% CI [-.02, .37]) in reference to exercise. In
2 contrast, important others should avoid using controlling behaviors (e.g., contingent rewards,
3 conditional regard) when helping others manage their weight, even if these behaviors are
4 based on good intentions. In our study controlling behaviors predicted need thwarting.
5 According to Deci and Ryan (2000), the thwarting of needs would lead to involvement in
6 compensatory activities that undermine health and optimal human functioning. In our study
7 need thwarting predicted lower life satisfaction (exercise), lower self-esteem (exercise and
8 diet), more depressive symptoms (exercise and diet), and unhealthy diet behaviors (diet).

9 Our results also have implications for SDT-based research on weight management
10 and perhaps health behaviors in general. First, our study extends the existing SDT literature
11 in a weight management context by including measures of controlling behaviors and
12 psychological need thwarting. Previous work in this context has not examined these
13 constructs which, according to Ryan and Deci (2000), have important repercussions for
14 psychological health and can result in experiences of ill-being. Our findings suggest that
15 these constructs do contribute independently to the prediction of weight management
16 behaviors and psychological ill-being. Researchers have also shown that controlling
17 behaviors may be related to eating disorders, such as anorexia and bulimia. For instance,
18 Soenens et al. (2008) found that eating disorder patients reported higher levels of parental
19 control. Thus, controlling behaviors of important others, and hence psychological need
20 thwarting, appear to be important predictors of eating pathology. Our findings also provide
21 further support in terms of the orthogonality between autonomy support and controlling
22 behaviors, as well as between need satisfaction and thwarting. Specifically, we found that
23 autonomy support and controlling behaviors are orthogonal constructs (factor correlations = -
24 .15 and -.23 in reference to exercise and diet respectively, the corresponding 95% CIs
25 encompassed zero), and so are need satisfaction and thwarting (Pearson $r = -.16$, $p = .07$, and

1 -.24, $p = .02$, in reference to exercise and diet respectively). This pattern has also been
2 observed in previous research in the sport domain (e.g., Bartholomew, Ntoumanis, Ryan, &
3 Thøgersen-Ntoumani, 2011) and supports Bartholomew, Ntoumanis, Ryan, and Thøgersen-
4 Ntoumani's (2011) arguments that need satisfaction and thwarting are not bi-polar constructs.
5 Thus, we feel it is important that controlling behaviors and need thwarting are incorporated
6 into future SDT-based research in the health-related contexts.

7 Of all participants who completed both exercise- and diet-specific questionnaires
8 regarding important others, 88% reported that the same individual had the most influence on
9 both the exercise and diet behaviors. This may explain why the associations between
10 important others' behaviors with respect to exercise and diet were high ($r = .69$ to $.56$, $p < .01$,
11 for autonomy support and controlling behaviors respectively). Moreover, researchers have
12 shown that motivational "spill-over" effects may exist between exercise and diet behaviors
13 (Mata et al., 2009); we found strong correlations between need satisfaction/thwarting with
14 respect to exercise and diet ($r = .75$ to $.77$, $p < .01$, for need satisfaction and thwarting
15 respectively). This suggest that when individuals manage their weight by engaging in both
16 exercise and diet behaviors, their need satisfaction/thwarting, and also their motivation, in
17 reference to the two behaviors may be related.

18 **Limitations and Future Directions**

19 There are a few limitations to this study. For instance, although all participants were
20 managing their weight, only a minority of them were either overweight or obese (about 37%).
21 Nevertheless, our study was about weight management and not necessarily weight loss. Also,
22 similar to other research on weight management (Williams et al., 1996), most participants in
23 our study were female (about 80%). However, the proportion of overweight or obese men is
24 also high – about 66% of males and 57% of females in UK were overweight or obese in 2009
25 (OECD, 2011). Moreover, for participants who indicated they were managing their weight by

1 doing physical activity, some differences may exist between the types of exercise behaviors
2 they engaged in and their sport participation history. These factors could be measured in
3 future research as they might influence mean levels of physical activity.

4 The self-reported nature of weight management behaviors of participants is also a
5 limitation of the study and might be a possible reason for the lack of prediction of exercise
6 behaviors and healthy diet behaviors. For instance, previous research has shown that self-
7 reports of physical activity are prone to biases (Helmerhorst, Brage, Warren, Besson, &
8 Ekelund, 2012). Measures for healthy/unhealthy diet also tap only a few distinct behaviors; it
9 is possible that participants might have utilized other dietary means to manage their weight,
10 such as reducing portion sizes. However, currently there are no valid objective measures for
11 dietary intake outside lab settings. Future research may incorporate daily diary measures for
12 both exercise and diet behaviors. Although these are still self-reported measures, they may be
13 more accurate when compared to questionnaires that require memory recall.

14 Apart from measurement issues, there may be other plausible explanations for our
15 non-significant findings regarding physical activity and diet behaviors. For example, it is
16 possible that other SDT constructs not measured in this study, such as different types of
17 motivation, may be better suited in predicting these outcomes (Mata et al., 2009). For
18 instance, Teixeira, Carraça, Markland, Silva, and Ryan (2012) suggested that need
19 satisfaction may not predict exercise behaviors directly, but instead through autonomous
20 forms of motivation. In addition to other SDT constructs, behavior intentions (based on the
21 theory of planned behavior; Conner, Norman, & Bell, 2002) and self-regulation cognitions
22 (based on self-regulation theory; Kalavana, Maes, & De Gucht, 2010) were found in previous
23 studies to predict behaviors related to weight management. These constructs might be better
24 predictors of actual behavioral engagement in weight management contexts. Future studies
25 may examine whether these variables might mediate the relations between need

1 satisfaction/thwarting and weight management behaviors.

2 We suggested above to examine daily fluctuations in basic needs
3 satisfaction/thwarting, behaviors associated with weight management, as well as
4 psychological well- and ill-being outcomes. Studies could recruit participants who have just
5 started a new weight management program. As a result, daily fluctuations in these variables
6 may be more apparent when compared to general changes over a longer period (e.g., six
7 months).

8 In the current study, we only asked participants to report behaviors of one important
9 other; future research may examine how outcomes may differ when participants interact in
10 their weight management efforts with important others with conflicting interpersonal styles.
11 Finally, research has shown that low need satisfaction may cause participants to become more
12 susceptible to temptations (Schüler & Kuster, 2011). Future research should investigate
13 whether controlling behaviors of important others and need thwarting may also affect
14 participants' susceptibility to temptations. Despite these limitations, our results provide initial
15 support for the importance of examining both adaptive and maladaptive motivation-related
16 variables at the contextual and personal level in an effort to better understand and predict
17 behavioral responses and affective experiences of individuals with weight maintenance goals.

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Footnote

¹ To ensure that the low internal consistency of the measures for diet behaviors did not affect our results, we tested different models in which the mean scores for healthy or unhealthy diet were replaced by scores from only one of the items for the construct. We found that the credibility intervals of the path coefficients between the needs variables and healthy and unhealthy diet in the different models overlapped irrespective of which item we used to represent the broader constructs. Therefore, we feel that it was appropriate to keep all items as indicators of healthy or unhealthy diet.

² We conducted two path analyses using the Bayesian estimator in Mplus, separately for exercise and diet, to determine whether there were differences between the paths from autonomy support to each of the three need satisfaction variables, and from controlling behaviors to each need thwarting variable. The 95% CIs of the paths from autonomy support to autonomy, competence, and relatedness need satisfaction were compared. For both exercise and diet, the 95% CIs were found to overlap substantially, suggesting no differences between the paths. This was also the case for the paths from controlling behaviors to each need thwarting variable.

² We also analyzed path models using maximum likelihood to examine whether the results would be similar. For both exercise ($\chi^2[13] = 9.68, p = .72, CFI = 1.00, TLI = 1.05$) and diet ($\chi^2[35] = 39.54, p = .27, CFI = .97, TLI = .95$) the models had good fit.

³ Separate path analyses were conducted by controlling for participants' sex, age, weight management goal, or body mass index. Path coefficients remained largely unchanged (median of changes was .004) compared to the initial model. With reference to diet, a small number of paths that were different from zero initially encompassed zero when control variables were included. This might be due to the small sample size for diet. Details of these analyses could be requested from the first author.

Table 1

Descriptive Statistics and Internal Reliability Coefficients of All Measured Variables

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	Range	Skewness	Kurtosis	Cronbach's α
<u>Variables measured at T1:</u>							
Exercise behaviors	129	43.97	28.12	0 – 147	1.07	2.21	–
Healthy diet behaviors	66	3.64	0.70	2.33 – 5.00	-0.11	-0.49	.42
Unhealthy diet behaviors	66	1.32	0.44	1.00 – 2.80	1.48	1.79	.41
Life satisfaction	129	4.51	1.29	1.00 – 6.80	-0.64	-0.28	.87
Self-esteem	129	2.89	0.52	1.50 – 4.00	-0.29	-0.19	.89
Depression	129	1.60	0.46	1.00 – 3.43	0.93	1.21	.73
<u>Variables measured at T2:</u>							
Exercise autonomy support	75	5.61	0.86	3.10 – 6.90	-1.00	0.85	.88
Exercise controlling behaviors	75	3.18	0.96	1.00 – 5.67	-0.28	-0.13	.67
Exercise need satisfaction (combined)	128	5.50	0.75	2.00 – 7.00	-1.08	3.09	.89
Exercise competence satisfaction	128	5.64	0.88	1.00 – 7.00	-1.63	6.08	.86
Exercise autonomy satisfaction	128	5.99	0.90	1.00 – 7.00	-2.46	9.65	.88

Exercise relatedness satisfaction	128	4.86	1.12	1.75 – 7.00	-0.41	-0.16	.90
Exercise need thwarting (combined)	128	3.46	1.19	2.00 – 7.00	0.10	-0.12	.93
Exercise competence thwarting	128	3.65	1.42	1.00 – 7.00	0.11	-0.45	.85
Exercise autonomy thwarting	128	3.04	1.22	1.00 – 7.00	0.51	0.28	.81
Exercise relatedness thwarting	128	3.68	1.26	1.00 – 6.75	0.01	-0.52	.77
Diet autonomy support	55	5.47	1.30	1.40 – 7.00	-1.31	1.52	.95
Diet controlling behaviors	55	2.79	1.42	1.00 – 7.00	0.97	0.67	.87
Diet need satisfaction (combined)	91	5.12	1.17	1.00 – 7.00	-1.22	1.74	.93
Diet competence satisfaction	91	5.08	1.37	1.00 – 7.00	-1.01	0.81	.90
Diet autonomy satisfaction	91	5.71	1.28	1.00 – 7.00	-1.60	2.96	.91
Diet relatedness satisfaction	91	4.56	1.40	1.00 – 7.00	-0.62	0.31	.91
Diet need thwarting (combined)	91	3.13	1.43	1.00 – 6.58	0.47	-0.63	.95
Diet competence thwarting	91	3.31	1.59	1.00 – 6.75	0.25	-0.87	.90
Diet autonomy thwarting	91	2.90	1.54	1.00 – 7.00	0.64	-0.48	.89
Diet relatedness thwarting	91	3.19	1.47	1.00 – 6.75	0.41	-0.71	.85

Variables measured at T3:

Exercise behaviors	99	39.04	23.42	0 – 130	0.88	1.53	–
Healthy diet behaviors	41	3.83	0.83	2.00 – 5.00	-0.49	-0.42	.61
Unhealthy diet behaviors	40	1.45	0.40	1.00 – 2.60	0.84	0.32	.47
Life satisfaction	99	4.57	1.37	1.00 – 6.80	-0.57	-0.35	.91
Self-esteem	99	2.86	0.55	1.40 – 4.00	-0.07	-0.32	.91
Depression	99	2.05	0.50	1.43 – 4.00	1.16	1.62	.80

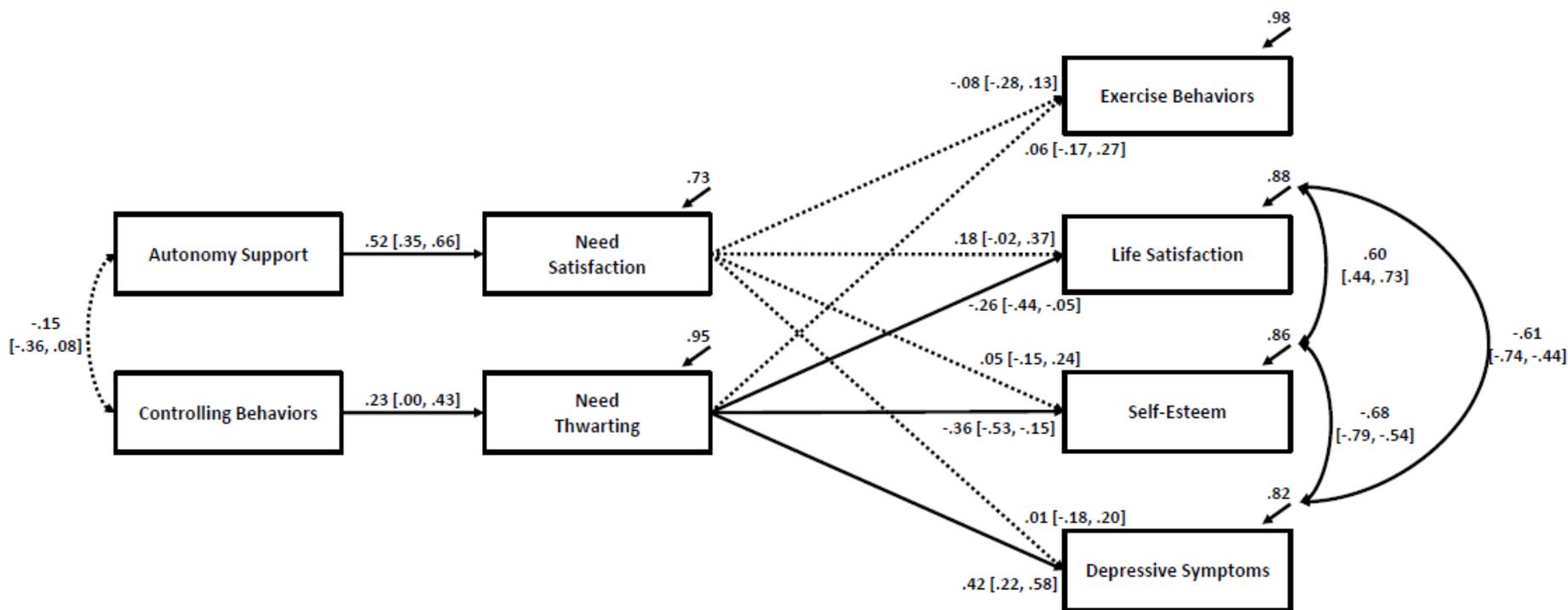


Figure 1. Path model with reference to exercise ($n = 129$). SDT variables are measured at T2; the outcomes are measured at T3. Standardized estimates are shown, and the corresponding 95% credibility intervals are presented in square brackets. Paths whose 95% credibility intervals do not encompass zero are indicated by solid lines.

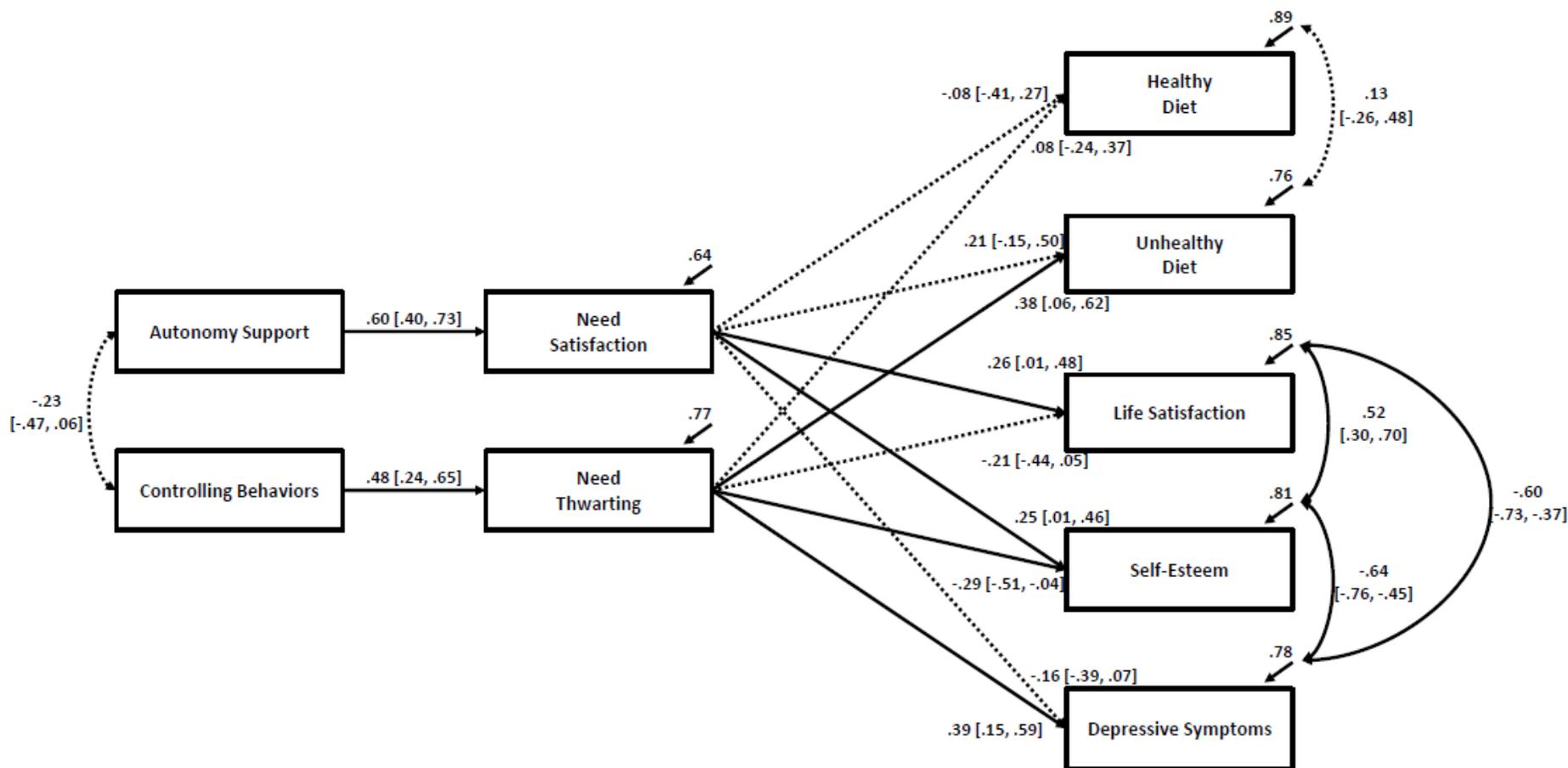


Figure 2. Path model with reference to diet ($n = 91$). SDT variables are measured at T2; the outcomes are measured at T3. Scores of healthy and unhealthy diet behaviors are controlled for their T1 scores, but are not presented for presentation simplicity purposes. Standardized estimates are shown, and the corresponding 95% credibility intervals are presented in square brackets. Paths whose 95% credibility intervals do not

encompass zero are indicated by solid lines.