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Readiness for behaviour change in non-alcoholic fatty liver disease: implications for multidisciplinary care models

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Abstract

Background & Aims—Weight management is a cornerstone of treatment for overweight/obese persons with non-alcoholic fatty liver disease (NAFLD). This exploratory study sought to: (i) evaluate readiness to change weight-related behaviours; (ii) assess psychosocial characteristics that may interfere with weight loss; and (iii) evaluate how baseline psychosocial features associate with 6-month change in weight in persons with NAFLD receiving standard medical care. The purpose of this investigation was to develop hypotheses regarding relationships between psychosocial factors and weight for use in future fully powered studies and clinical interventions

Methods—Fifty-eight overweight/obese participants with NAFLD completed baseline measures of personality, psychiatric symptoms and readiness for behaviour change and were followed up for 6 months in standard care.

Results—One-third of participants (31.0%) were not interested in making weight-related behaviour changes; 58.6% were considering making a change, and 10.4% of individuals were actively working on or preparing to change. Six-month change in weight was non-significant and was not associated with baseline readiness for change. Depression, low conscientiousness and high neuroticism were associated with higher weight at 6-month follow-up with small to large effect sizes.

Conclusions—Although participants received nutritional education and guidance, very few individuals presented in the active stage of change. Although readiness for change did not predict subsequent change in weight, personality factors and psychiatric symptoms were associated with weight outcomes. Integrated multidisciplinary approaches that address psychiatric needs and provide behavioural support for weight loss may help patients with NAFLD implement sustained lifestyle changes.

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Keywords

NAFLD; obesity; personality; psychiatric symptoms; readiness to change

Non-alcoholic fatty liver disease (NAFLD) is the most common cause of chronic liver disease in the USA and affects 10–30% of adults (1). The clinical–histological phenotype of NAFLD extends from a non-alcoholic fatty liver (NAFL) to non-alcoholic steatohepatitis (NASH) (2). NASH can progress to cirrhosis in 15–20% of subjects and is also associated with increased mortality from cardiovascular disease and malignancies (3). There are currently no approved therapies for NAFLD.

The principal risk factors for NAFLD include obesity and insulin resistance (4). The severity of insulin resistance and the development of multiple features of the metabolic syndrome especially type 2 diabetes is linked to the presence of NASH, the more aggressive phenotype of NAFLD (4). Also, progressive weight gain is associated with disease progression (3). The close link-age between excess body weight and the development of insulin resistance and NAFLD makes the treatment of underlying obesity a key component of the therapeutic strategy against NAFLD (4). While intense lifestyle interventions have been shown to be effective at producing clinically significant weight loss (5–10% initial body weight) (5), they are resource intense and many subjects return to pre-intervention lifestyles when the interventions are discontinued (6). In real-world clinical practice which reflects standard of care, most subjects are only given routine diet and lifestyle counselling. There is thus a need to define the psychological and behavioural factors that drive the outcomes of such real-world management approaches to more fully address the needs of individuals seeking care in the medical setting.

The transtheoretical model of behaviour change posits that individuals move both forward and backward through a series of stages of readiness when it comes to changing behaviour. These stages include precontemplation (not considering change), contemplation (considering change, but not yet planning to do so), preparation (getting ready to change), action (beginning to make changes) and maintenance (continuing sustained change) (7). Individuals presenting for medical treatment of an obesity-related medical condition like NAFLD may present with different readiness profiles than those seeking behavioural weight loss services (i.e. individuals seeking behavioural treatment for weight loss may be more ‘ready’ to make behavioural changes than individuals seeking medical treatment of an obesity- related condition). Little is known about readiness for behaviour change in persons with NAFLD and how this readiness relates to treatment outcomes. One cross sectional study has documented that a majority of individuals presenting for medical treatment of NAFLD were in the contemplation and preparation stages of change with few individuals in the action and maintenance stages (8), but no known studies have compared baseline readiness to prospective change in weight while undergoing standard care treatment of NAFLD.

A number of psychosocial factors are associated with obesity, eating behaviour and outcomes in weight loss interventions. Neurotic individuals, who are prone to negative emotionality, engage in more emotional and externally cued eating, are less restrained in

their eating (9) and are at greater risk of being obese (10, 11). Conversely, conscientious individuals are less likely to be emotional eaters, report greater restraint in eating, (9) have lower body weight (10) and gain less weight in middle age (11). Individuals high in neuroticism and/or low in conscientiousness, therefore, may require more intensive behavioural support to successfully lose weight. Depression and anxiety are associated with greater risk of obesity (12, 13) and depression is linked to lower success for individuals engaging in a weight loss programme (14). Obesity also is associated with decreased cognitive performance, especially executive function (15). Poor executive function performance is predictive of increased discrepancies between intended and actual eating behaviour, indicating that this cognitive capacity is integral in successful regulation of eating behaviour (16) and poor baseline cognitive performance has been linked to suboptimal outcomes in weight loss efforts (17).

Persons with NAFLD have reported increased rates of depression compared to rates seen in the general population (18); vague cognitive complaints that precede hepatic encephalopathy have also been reported by patients with NAFLD (19). Little is known, however, about rates of anxiety and personality styles of individuals presenting for treatment of NAFLD that may impact efforts at weight loss. Assessing how these factors associate with body weight and changes in weight over time would be beneficial in developing comprehensive weight management programming that can suit the diverse needs of persons presenting for medical treatment of NAFLD and will likely be applicable in other obesity-related conditions.

The purpose of the present pilot study was to obtain data that may be helpful in the development of future fully powered studies and clinical-based weight management programmes for persons with NAFLD. Specifically, we sought to (i) assess readiness for change; (ii) describe psychosocial characteristics (neuroticism, conscientiousness, depression, anxiety and cognitive complaints); and (iii) analyse the relationships between these factors and weight over a 6-month standard care follow-up in a sample of individuals with NAFLD.

Methods

This study was performed in a dedicated multidisciplinary clinic for the management of non-alcoholic fatty liver disease (NAFLD) in the authors' institution. Consecutive subjects seen for routine management of NAFLD who were either overweight or obese and who provided informed consent were enrolled. This study was approved by the institutional IRB (VCU IRB 1960).

Subjects

Fifty-eight overweight/obese (BMI ≥ 25) adults with biopsy-proven NAFLD were recruited during their routine follow-up medical appointments. All subjects in our clinic receive 'standard-of-care' recommendations and counselling regarding diet and lifestyle at each of their medical appointments. This includes a discussion of how excess calories lead to obesity, consequences of being overweight or obese, fatty liver disease, interaction of alcohol consumption and obesity, methods to reduce weight including diets and common

diets popular in the lay literature, healthy eating habits, portion control and value of physical activity. Subjects also receive brief nutritional guidance (10–15 min) at each visit with a registered dietician including a 24-h dietary recall followed by recommendations for improving their diet and physical activity. Upon providing informed consent, each participant completed the psychosocial measures at the time of their medical appointment.

Measures

Neuroticism and conscientiousness were measured using the NEO-Five Factor Inventory (NEO-FFI) (20). *T*-scores (mean = 50, SD = 10) are calculated, with higher scores indicating a greater amount of that personality characteristic; cut-off scores of below 45 and above 55 are recommended to identify individuals who are either ‘low’ or ‘high’ (respectively) on these traits. The NEO-FFI has good internal consistency, test–retest reliability and has demonstrated validity (20). Readiness for weight-related behavioural change (both physical activity and eating habits) was measured using the University of Rhode Island Change Assessment scale (URICA) (21). Participants were instructed to rate their agreement with 32 statements regarding their readiness for changing both their physical activity and their eating habits. A continuous readiness to change (RTC) composite score is calculated (22) and DiClemente *et al.* (7) recommend a scoring approach that trichotomizes continuous scores on the URICA into three stages of readiness (precontemplation, contemplation and preparation/action). The URICA demonstrates good internal consistency (21) and demonstrates concurrent and convergent validity with other measures of readiness to change health behaviours (21, 23). Psychological symptoms were assessed using the 52-item Brief Symptom Inventory (BSI) (24). The BSI produces *t*-scores (mean = 50, SD = 10) for 12 domains, however, only depression, anxiety and obsessive–compulsive anxiety/cognitive complaints were used in this study because of their potential relationships with obesity. Notably, the obsessive–compulsive/cognitive complaints scale contains items consistent with vague cognitive complaints (e.g. ‘trouble remembering things,’ ‘mind going blank’ and ‘trouble concentrating’), and some have argued that particularly in medically ill populations, scores on this domain of the BSI may reflect cognitive symptoms rather than obsessive–compulsive symptoms (1). Thus, we have considered this a measure of cognitive complaints. *T*-scores of 63 or greater on the BSI are considered a positive ‘case’ (24). The BSI demonstrates good internal consistency, test–retest reliability, convergent and discriminant validity. Participants also rated their quality of life (QOL) using a 1–10 Likert scale with 1 representing poor QOL and 10 representing high QOL.

NAFLD and obesity-related measures

All subjects had detailed clinical assessment at entry. Comorbidities and concomitant medications as well as symptoms were recorded directly from the subject during the visit. Anthropometrical measures were obtained, and routine liver enzymes and liver function tests were performed. In all cases, the presence of other concomitant liver diseases (viral hepatitis, Wilson disease, haemochromatosis, cholestatic liver diseases, etc.) was excluded by appropriate laboratory testing. All subjects had biopsy-proven NAFLD. The liver histology was graded and classified by the NASH CRN criteria as previously described (25). Subjects were seen at 6-month intervals from their index visit. During the 6-month follow-up visit, the subjects weight and vital signs were obtained.

Plan of analysis

The first objective was to assess readiness for behaviour change, then rates of psychiatric symptoms and personality types, and then to determine the relationships between these factors and weight over a 6-month follow-up period. NAFLD severity consisted of three categories: (i) steatosis; (ii) NASH; and (iii) cirrhosis. BMI and weight were analysed as continuous variables. Each of the five psychosocial domains were analysed both continuously and dichotomously (normal range vs. problematic score). First, the data were examined and no problems with normality or outlier data were identified. Descriptive statistics were used to characterize the cohort of subjects enrolled. Rates of endorsement of significant psychosocial problems were compared to rates seen in normative samples. Pearson correlation coefficients were used to examine relationships between continuous variables. Independent samples *t*-tests were used to compare mean BMIS/weight/weight loss across dichotomized measures of each of the five psychosocial domains. Analysis of variance was used to compare means in analyses with more than two groups (i.e. three levels of liver disease severity) with respect to continuous variables that were normally distributed. Proportions were compared by chi-square or Fisher's Exact test. Statistical significance was set at a P value of 0.05, effect sizes were calculated using Hedge's g.

Results

Sample demographical and health status

The sample was primarily female (62%) and Caucasian (91.4%), with 5.2% African American and 3.4% Hispanic participants. Their average age was 49.5(9.5), BMI was 33.4(5.2), waist–hip ratio was .92(.07) and per cent body fat was 35.6(13.5). Sixty-nine per cent of the sample reported completing coursework beyond the high school level. Twenty-four per cent held bachelor's degrees and 7% completed advanced degrees. Steatosis was diagnosed in 5% of participants, NASH in 79% and cirrhosis in 16% of participants. Common comorbidities included hypertension (52%), diabetes (40%), chronic pain syndrome (21%) and GERD (19%). Twenty-six per cent were prescribed antidepressant medication, 10% were prescribed anxiolytics and 2% were prescribed "other" psychiatric medications. Twenty-one per cent were prescribed narcotic pain medications. Mean quality of life was 7.1 of 10 (SD = 1.6). Table 1 presents the demographics and health status of the sample.

Readiness to change

The average readiness to change score (M = 8.8, SD = 1.6) was consistent with the 'contemplation' stage, indicating participants were considering changes, but were not yet taking action. Most participants (59%) scored in this range. One-third (31%) scored in the 'precontemplation' stage, indicating they were not considering making behaviour changes related to their weight. Only six individuals (10%) achieved a score in the 'planning/action' stage indicating they were either preparing to or actively making lifestyle changes. Higher BMI at baseline was associated with greater readiness for change (r = 0.27, $P < 0.05$), but not with change in weight over 6-month follow-up. Severity of NAFLD was not associated with readiness for change or with change in weight.

Psychosocial characteristics

Mean *T*-scores for personality were within the normal range for neuroticism (*M* = 48.72, SD = 9.59) and conscientiousness (*M* = 46.8, SD = 10.04) compared to adult non-psychiatric patient norms. About one-fifth of the sample (21.1%) scored in the elevated range ($t > 55$) for neuroticism and 38.6% scored in the low range ($t < 45$) for conscientiousness. Comparing these rates to normative data, 32% of individuals in the general population would be expected to score in each of these ranges, indicating that the current sample reported relatively infrequent problems with neuroticism and an increased frequency of low levels of conscientiousness.

Mean scores for depression (*M* = 53.0, SD = 9.3), anxiety (*M* = 52.3, SD = 9.6) and cognitive dysfunction (*M* = 57.3, SD = 10.5) were in the average range. Using the suggested cut-off of *T* = 63, rates of clinically elevated scores were 20% for depression, 12% for anxiety and 33% for cognitive dysfunction. Compared to normative data, only 9% of individuals in the general population would be expected to score in this range for any symptom area, indicating that these symptoms were more frequent in the current sample than in the general population, especially depression and cognitive dysfunction. Baseline BMI and severity of NAFLD were not associated with any of the affective, cognitive or personality variables. Table 2 presents complete data for the psychosocial measures.

Relation of readiness and psychosocial variables to baseline BMI and 6-month change in weight

Six-month follow-up data were available for 42 individuals. Baseline demographics (gender, age), medical status (BMI, severity of NAFLD), and psychological status (continuous scores for readiness for change, neuroticism, conscientiousness, depression, anxiety and cognitive dysfunction) were evaluated to determine if individuals completing follow-up differed from those who did not. Women were less likely than men to attend follow-up at 6 months $\chi 2(1, N = 58) = 5.2$, $P = 0.02$. Participants who did not return for a 6-month appointment were less conscientious (*M* = 42.20, SD = 8.60, vs. *M* = 48.45, SD = 10.10), less anxious (*M* = 46.60, SD = 8.54, vs. *M* = 53.74, SD = 9.42) and had fewer cognitive complaints (*M* = 50.80, SD = 7.54, vs. *M* = 59.03, SD = 10.54) at baseline than those who completed follow-up. No other baseline variables were associated with likelihood of returning for follow-up. Unfortunately, data collection did not include contacting individuals who did not present for follow-up, so we do not have the ability to determine individual reasons for failing to attend follow-up. At 6 months, average weight loss among those presenting for follow-up was 0.7 kg (1.5 lbs) (SD = 6.5 kg or 14.3 lbs). This decrease in weight was not significant and change in weight was not associated with baseline readiness for weight-related behaviour change.

High neuroticism was associated with greater readiness for behaviour change ($r = 0.27$, $P < 0.05$), but not with change in weight. No other psychosocial variables were significantly associated with either readiness for change or with change in weight when using continuous scores on all the measures. However, when using recommended cut-offs to identify individuals with and without clinically significant problems in each domain, patterns were noted with regard to weight and psychosocial variables. Depressed individuals presented with higher BMI at baseline (*M* = 32.6 kg/m^2, SD = 5.7 vs. *M* = 33.5 kg/m^2, SD= 5.3,

Hedge's g = 0.16) than non-depressed participants. They also gained weight while the non-depressed individuals lost weight (*M* = +1.6 kg, SD = 5.0 vs. *M* = −1.3 kg, SD = 6.9, Hedge's g = 0.44). The net effect of these small to moderate differences in baseline and 6-month change in weight translated into a more notable difference in body weight in these two groups at 6 months (*M* = 97.7 kg, SD = 5.7 vs. *M* = 94.4 kg, SD = 3.6, Hedge's g = 0.79). While these findings were not statistically significant, the effect sizes range from what would conventionally be considered a 'small' effect size (~0.20) at baseline to a 'large' effect (~.80) at 6 months (25). If depression is indeed contributing to weight gain in this population, this trajectory would certainly lead to clinically significant weight gain for individuals with depression over a longer time frame. A similar pattern of higher initial BMI, 6-month weight gain and higher 6-month weight was noted for neurotic and non-conscientious individuals with small to medium effect sizes. Small effect sizes were noted for lower baseline weight and subsequent increase in weight for anxious individuals. Individuals with cognitive complaints weighed less than the comparison group both at baseline and at 6 months (small effect sizes). Participants reporting significant cognitive complaints remained relatively weight stable (+.02 kg ± 4.6 kg) compared to weight loss observed in the comparison group (small effect size). Table 3 documents differences in initial BMI/weight, 6-month change in weight and 6-month weight between individuals in the normal vs. problematic range for each psychosocial variable as well as effect sizes for these observed differences. Only participants with available follow-up data are included in Table 3.

Discussion

This study provides information on psychosocial status and readiness for behaviour change in persons presenting for standard medical care of NAFLD, an obesity-related condition. Readiness to change weight-related behaviours (both physical activity and eating habits) was low and was not associated with severity of liver disease in the current sample, suggesting that being diagnosed with and treated for NAFLD is insufficient to propel people into the 'preparation/action' stage of change. This is not surprising given that NAFLD is often asymptomatic (26) such that patients do not 'see' their condition. However, their failure to appreciate their medical situation is concerning given that patients were regularly advised by their physicians about the importance of weight loss for their condition, educated about the severity of their disease based on their biopsy and laboratory data, and provided with brief nutritional guidance by a registered dietician. Clearly, information and advice to change was an insufficient intervention. A more powerful brief intervention thus is needed to reach patients who do not feel sick. In contrast, BMI was positively associated with readiness for change, but not with weight loss over 6-month follow-up. Heavier patients may experience greater daily physical and social challenges, leading to greater problem awareness and readiness for change, even if that readiness does not translate into actual weight loss.

Overall, participants reported normal personality and psychological functioning; however, rates of clinically significant depression, anxiety, cognitive complaints and low levels of conscientiousness were reported more frequently than would be seen in the general population according to normative data. Twenty per cent of our sample reported clinically significant depressive symptoms and 26% were prescribed antidepressant medications.

Although not statistically significant, the difference in weight between depressed and nondepressed individuals at the end of 6 months was of 'large' magnitude. This is consistent with findings that depression is associated with increased risk of obesity possibly because of its association with poorer overall nutrition quality, increased intake of sugar, saturated fat and sodium (12,27). Depressed individuals also typically lose less weight than non-depressed individuals in weight loss programmes (14). Fortunately, participation in a formal weight loss programme often results in improvements in depressive symptoms even without expressly addressing depression (28), and sequential treatments that target first depression and weight loss result in even greater improvements in depressive symptoms (29), although greater weight loss may not necessarily be achieved. Given that individuals who experience greater reduction in depressive symptoms also experience greater weight loss (30), it is important to continue to integrate treatment of depression into weight loss interventions for those with comorbid depression and to pursue ongoing work into improving both weight loss and depression in this complex population. Contrary to previous work, anxiety symptoms in our sample were associated with lower initial body weight (small effect size). However, anxious individuals gained weight while non-anxious individuals lost weight (small effect size) suggesting that anxiety may be a barrier to success with weight loss, which could be related to using food to reduce stress. Further research should seek to clarify the nature of the relationship between anxiety, weight and outcomes in weight loss interventions. Sequential behavioural treatments for depression and weight loss appear to hold some potential, but could require adaptation to further improve weight loss and no known studies have implemented this approach in a medical setting with individuals who were not seeking behavioural weight loss treatment.

The most common psychological problem area reported was general cognitive complaints although it should be noted that a formal test of cognition was not administered. Still, this finding is consistent with previous reports of cognitive concerns for individuals with NAFLD (19). Further characterization of cognitive functioning in this population is warranted, particularly given that executive function plays a critical role in the self-regulation processes necessary to match behavioural intentions to actual behaviour in regulating food intake (16). Poor presurgical executive function has also been linked to poorer weight loss outcomes in bariatric surgery samples (17). Individuals in the current sample with clinically significant cognitive concerns weighed less than those with fewer of these problems (small effect sizes), and it remains unclear why this might have been the case. These individuals remained relatively weight stable while the comparison group lost weight while receiving standard care, so it is possible that cognitive complaints serve as a barrier to weight loss. Future studies should seek to more clearly describe the nature and severity of cognitive complaints in this population and how these may impact weight loss interventions or general adherence to medical recommendations.

Personality factors were associated with weight outcomes with small to medium effect sizes. Neurotic and non-conscientious participants weighed more at baseline and at 6-month follow-up. Neurotic individuals remained nearly weight stable (up 0.4 ± 5.8 kg), while non-conscientious individuals gained weight (up 1.8 ± 5.1 kg). In both cases, the comparison groups lost weight (small effect sizes). Neuroticism and non-conscientiousness may also serve as barriers to weight loss, and these findings are consistent with previous work

showing that neurotic individuals are more likely to eat in response to negative emotion and environmental cues for eating as well as less likely to restrict their eating behaviour. Non-conscientious individuals are also more prone to these eating problems and are less likely to comply with medical recommendations generally (31). Individuals with these personality characteristics may require more extensive behavioural interventions with greater focus on emotional and behavioural self-regulation to achieve success with weight loss. Future studies should consider these personality constructs and their impact on weight loss efforts

Limitations

The first limitation is small sample size; future studies should include larger sample sizes. Attrition was unequal across gender with women more likely to be unavailable for follow-up. Thus, the current results may not generalize well to female patients with NAFLD. In addition, our sample had a very high representation of Caucasian individuals, thus limiting the generalizability of our findings to the larger population of persons with NAFLD. Psychological variables were also associated with attrition (low conscientiousness, low anxiety, low cognitive complaints), however, this reflects 'real-world' clinical practice and suggests that individuals who may have low level of concern over their health are less likely to remain in follow-up for an illness that is often asymptomatic. Finally, in collecting data, we did not formally track when people declined participation in this study or why they failed to attend 6-month follow-up appointment and we are unable to report such data.

Implications and conclusion

Given the current findings of low readiness for behaviour change, addressing motivation for change (through use of evidence-based interventions such as Motivational Interviewing) and providing ongoing behavioural support for weight loss between clinic visits may help promote successful weight loss in individuals with NAFLD. Motivational interviewing (MI) is a clinical approach that seeks to help patients internalize motivation for change through the resolution of ambivalence (32). MI emphasizes that directive persuasion (as commonly occurs in traditional medical encounters where the provider is the 'expert' and the patient is the 'recipient' of knowledge) is likely to drive the ambivalent individual into the position of defending their reasons against change. Instead, the skilled MI clinician 'rolls with' ambivalence, allowing the patient to explore both sides of the conflict. The MI clinician then evokes and reinforces 'change talk' by guiding the patient through an examination of discrepancies between valued life goals and current behaviour (32). MI has been shown to enhance weight loss outcomes when added to structured weight management interventions (33). Providing MI services in the clinical setting may help to improve weight loss outcomes for most individuals.

In addition to addressing motivation, individuals presenting with psychosocial concerns may require more personalized approaches that include psychological/psychiatric treatment for depression, programmes that enhance skills for tolerating emotional distress for neurotic individuals or targeted information aimed at increasing levels of conscientiousness about health and behaviour. In the interest of personalizing care, future studies should focus on identifying which among these patient characteristics are most closely linked to weight loss outcomes, can be effectively monitored in the clinical setting, and specific intervention

approaches that are best suited to individuals with such characteristics. Providing dynamic, personalized treatment to such diverse individuals with obesity-related medical conditions such as NAFLD will likely require a paradigm shift to a team-based approach that includes both medical and behavioural services, preferably in a single (integrated) setting.

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Table 1

Characteristics of study sample

Characteristic	
Gender, number (%) female	36 (62.1)
Education, number (%) indicating some college coursework or more	41 (70.5)
Ethnicity, number (%)	
Caucasian	53 (91.4)
African American	3 (5.2)
Hispanic	2 (3.4)
Age, mean (*SD)*	49.5 (9.5)
BMI, mean (*SD*)	33.4 (5.2)
Waist–Hip ratio, mean (*SD*)	92 (.07)
Disease severity	
Steatosis, number (%)	3 (5.2)
NASH, number (%)	46 (79.3)
Cirrhosis, number (%)	9 (15.5)

Table 2

Psychosocial Characteristics

Stage of Readiness	Number (%)
Precontemplation	18 (31.0)
Contemplation	34 (58.6)
Preparation/Action	6 (10.4)

Psychiatric Symptoms (General population *t*-scores, *M* = 50, SD = 10)		
	***M* (SD)**	**Number(%) ≥63**
Cognitive complaints	57.3 (10.5)	16 (32.7)
Depression	53.0 (9.3)	10 (20.4)
Anxiety	52.3 (9.6)	6 (12.2)

Personality Traits (General population *t*-scores, *M* = 50, SD = 10)		
	***M* (SD)**	**Number(%) in Problematic range**
Neuroticism	48.7 (9.6)	12 (21.1)
Conscientiousness	46.8 (10.0)	22 (38.6)

Scores in the 'problematic range' indicate individuals who are *high* for neuroticism (*t*-score > 55) and *low* for conscientiousness (*t*-score < 45).

Table 3

Baseline BMI and weight, change in weight and final 6-month weight by psychosocial status divided into individuals scoring in the 'normal' vs. 'problematic range'

	Baseline BMI (kg/m^2) (*N* = 42) *M* (SD)	**Baseline weight (kg) (*N* = 42) *M* (SD)**	**6-month change in weight (kg) (*N* = 42) *M* (SD)**	**Final 6-month weight (kg) (*N* = 42) *M* (SD)**
Neuroticism				
Average range, *N* = 34	32.6 (5.2)	94.7 (17.1)	−1.1(6.8)	93.3 (19.0)
High, *N* = 8	35.2 (6.4)	102.0 (17.8)	+0.4 (5.8)	103.7 (16.4)
Effect size	0.47**	0.42*	0.22*	0.55**
Conscientiousness				
Average range, *N* = 29	32.2 (5.3)	94.1 (17.5)	−1.8 (6.8)	92.4 (20.0)
Low, *N* = 13	35.1 (5.5)	100.4 (16.6)	+1.8 (5.1)	101.1 (15.0)
Effect size	0.53**	0.36*	0.56**	0.47**
Depression				
Normal range, *N* = 30	32.6 (5.7)	95.9 (17.8)	−1.3 (6.9)	94.4 (3.6)
Depressed, *N* = 9	33.5 (5.3)	96.1 (18.5)	+1.6 (5.0)	97.7 (5.7)
Effect size	0.16*	0.01	0.44*	0.79***
Anxiety				
Normal range, *N* = 33	32.7 (5.2)	96.5 (17.1)	−1.1 (6.7)	95.2 (19.2)
Anxious, *N* = 6	33.3 (7.6)	93.0 (22.4)	+1.8 (5.7)	94.8 (20.9)
Effect size	0.11	0.19*	0.43*	0.02
OC/Cognitive Dysfn				
Normal range, *N* = 23	32.7 (5.0)	98.7 (17.9)	−1.3 (7.7)	97.1 (20.8)
OC/Cog dysfn, *N* = 16	33.0 (6.4)	91.9 (17.2)	+0.2 (4.6)	92.1 (16.8)
Effect size	0.05	0.38*	0.22*	0.25*

*Indicates a 'small' effect size,

**indicates a 'medium' effect size,

***indicates a 'large' effect size. Hedge's *g* was used to calculate effect sizes.