Motivation for weight-loss diets: A clustering, longitudinal field study using self-esteem and self-determination theory perspectives

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Abstract

Background Gradual elevation of body weight leads numerous individuals to dieting and weight loss behaviours. Nevertheless, the prevalence of obesity continues to rise in industrialised countries. The examination of the motivational determinants of dietary modification ('dieting') in order to identify clusters of individuals in the first 6 months of their effort to control body weight was the aim of the current study. The theories of self-determination and self-esteem formation guided our analysis.

Methods A longitudinal study was conducted with three data collection points (N_1=256; N_2=135; N_3=75). Data were responses on the Treatment Self Regulation Questionnaire, Social Physique Anxiety Scale, Physical Self-Description Questionnaire, Kaiser Physical Activity Survey Questionnaire, and items assessing expectations of achievement and self-confidence.

Results Cluster analyses provided stable and validated cluster profiles for all data sets. In the 1st and 2nd data sets, results revealed three groups of dieters labelled as 'media victims', 'try to feel nice' and 'older and experienced'. For the 3rd data set, results supported a 4-group solution ('less adaptive profile', 'second successful dieters', 'successful dieters', and 'unsuccessful dieters'). The need for autonomous versus controlling dieting reasons based on Self-Determination Theory, along with the need

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for an alternative paradigm in weight management, are proposed.
Conclusions Psychological theories of self-determination and self-esteem provide important ways of understanding and identifying adaptive and less adaptive weight control strategies.

Key words: motivation, self-determination, cluster analysis, self-esteem, physical activity

Background

The condition of being overweight in modern society is often considered undesirable and unhealthy. The health priority to reduce obesity has strengthened dieting and weight loss behaviours over recent years. It has been estimated that between 40 to 70 per cent of adults are using some method to lose weight at any given time. Further, it has been suggested that even though much of the population of Western countries are dieting for weight loss, and many resources are being used in an effort to reduce or eliminate the problem of obesity, its occurrence continues to rise[1].

'Dieting' is defined as the replacement of internally regulated eating with cognitively determined and planned, diet-approved eating. When dieting becomes chronic, ignoring internal hunger signals, it disrupts normal caloric regulation, resulting in increased susceptibility to respond with increased food consumption in a variety of emotionally distressed or dysphoric conditions[2]. This fact, coupled with decreased levels of self-esteem and an increased tendency for anxiety and neuroticism, make restrained eaters more susceptible to eating disorders[2]. Based on this, critics of the current weight management model have called for a moratorium on dieting efforts because they demoralise patients, make future weight loss attempts more difficult, and relate to increased morbidity and mortality due to weight fluctuation[3]. Nevertheless, as many medical benefits are credited with weight losses of as little as 5–10 per cent, moderate and sensible weight loss could play an important role in health improvement and illness prevention[4]. Further, 'weight cycling' relates more to aggressive diets aimed at rapid weight reduction, leaving unaffected those seeking more moderate weight losses and committing to long-term weight stability[5].

According to Devlin, Yanovski, and Wilson[6], '…the patient's motivation must be assessed, and interventions must be geared to his or her readiness to undertake the difficult tasks involved in losing weight.' (p.859). In this way, it can be concluded that reasons for dieting behaviour *per se* could be blamed on weight fluctuation and health consequences. Reasonable weight reduction and long-term behavioural changes can play a major role in illness prevention and psychological wellness.

Understanding motivation through Self-Determination Theory

One motivational theory which attempts to explain human behaviour in various settings is Self-Determination Theory[7,8]. According to this theory, two types of motivation exist, predicting long-term maintenance of behaviour: *autonomous* and *controlling* motivation.

Autonomous motives emanate from one's true nature and one's own choice and are related to a sense of freedom. In contrast, controlling motives are experienced as coming from an external agent or an intrapsychic force, and thus have an external locus of causality.

According to Deci and Ryan[9], reasons for engaging in certain behaviours emanate from dispositions individuals possess, and also on the functional significance these personal factors give to various contextual conditions. Results of studies have shown that when the functional significance of the events is autonomy supportive, positive emotional states, creativity, persistent behaviour change, and cognitive flexibility can result. In therapeutic settings, when behaviour change results from external controls, it is less likely to persist following the termination of treatment than change that is due to more autonomous reasons[9].

For dieting behaviours, Self-Determination Theory (SDT) posits that enduring behaviour change emanates from the internalisation of the relevant behaviours and values combined with their integration in one's true 'sense of self' in order to become the basis of autonomous regulation[7]. Thus, long-term maintenance of weight reduction simply means the successful completion of a diet programme that comes with personally valued reasons for engaging in this behaviour, that is health benefits.

Studies have also shown that controlling motives are related to rigid and intense dieting behaviours, contributing to poorer wellbeing[10]. In addition, autonomous reasons for participation, coupled with the tendency to be autonomy-oriented, are important predictors for the long-term successful completion of a diet programme[11].

Vallerand[12] proposed that three types of consequences emanate from controlling and autonomous motives, these being cognitive, affective and behavioural. Cognitive consequences emanating from various types of motivation for controlling body weight are related to learning how to control one's own thoughts, attending to the right stimuli, and cognitively analysing hunger and satiety signs, as well as situations that could endanger the weight regulation efforts[13,14]. Affective states in weight regulation relate to satisfaction, positive emotions, and enhanced moods, or discouragement, depending on whether the programme has been successful or not. Finally, some of the behavioural consequences of weight regulation are related to physical exercise, persistence, effort exerted, dropout, and final accomplishments. Vallerand[12] proposed that the more positive consequences result from more self-determined forms of motivation while negative outcomes are produced by the least self-determined (controlling) types of motivation.

Understanding motivation through Self-Esteem Theory

The level and type of self-esteem could be considered as outcomes of the two major motivational styles, as the more controlling are the reasons for getting involved in a behaviour, the more contingent on the outcomes of the behaviour will be one's self-esteem. This is what is referred to as 'contingent self-esteem'[15]. Conversely, in the case of a sound and stable sense of self, extrinsic regulations have been integrated, intrinsic

motives are maintained, and a full regulation of one's emotions has been developed. This is referred to as 'true self-esteem'.

Screening dieters based on the proposed motivational sequence model[12] has not been attempted until now. Further, analysing the long-term consequences of dieting, when having certain motives versus others, could shed light on the ability of SDT to describe success and failure outcomes within this context.

Factors hypothesised to act as consequences of the motivational types held by those trying to decrease their weight, are the following:

- Physical activity is a public health problem. In industrialised societies, inactivity is an important cause of various health problems. As obese and overweight individuals generally have lower activity levels[16], and physical activity is an important health behaviour, the assessment of this behaviour is necessary in many different studies and programmes[17]. Regular, moderate physical activity holds great potential for increased metabolism and significant health improvements[18,19]. This adds to the importance of its assessment when trying to describe an overweight and/or obese sample.
- Physical and global self-esteem descriptions were deemed important since many researchers have argued about the stigmatisation of overweight individuals in modern Western societies[20,21,22]. Further, a recent meta-analysis shows lower self-esteem being associated with heavier weight[23].
- In the same domain, the self-enhancement principle posits that individuals will direct the self towards domains that hold a high possibility of success, discounting and withdrawing from situations that tend to generate failure and lack of success[21]. Assessing the difference between the ideal and real physical-self could significantly contribute to the comprehension of each individual's self-system.
- Social Physique Anxiety (SPA) has been proposed as a construct that measures the degree to which individuals become anxious when their physique is evaluated or observed by others[24]. SPA has been found to correlate significantly with body weight, suggesting that this construct may be salient in overweight and/or obese individuals[25]. Further, SPA has been proposed as one mechanism explaining decreased involvement in exercise programmes[24,26], while increased age has been proposed to moderate SPA's effects on behaviour[27].

Clustering dieters based on the consequences that certain types of motivation may have[28] has not yet been attempted. The aim of this study, therefore, was:

a) to cluster dieters according to important psychological variables, and
b) to describe the changing pattern of psychological variables held by dieters within the first 6 months of dieting.

It was hypothesised that autonomy motives would be related to the most adaptive psychological profiles and, conversely, the more controlling reasons for dieting would be related to the least adaptive psychological profile. Further, increased levels of self-esteem and low discrepancy scores between the ideal and real physical appearance would

be related to less controlling dieting motives. Dieters with lower BMI scores* were hypothesised to show a more positive pattern of psychological features. Those having high BMI scores have been proposed as having increased health risks[29], decreased self-esteem[23], and body-related anxiety[25]. Additionally, BMI scores would differentiate dieters' psychological characteristics[23] and physical activity patterns[21].

Method

The study was located in 16 dieting centres in six towns in Greece. Obese and overweight individuals presented for counselling on food-related matters aiming to regulate their body weight. In this way, the study was held in ecologically valid conditions that dieticians face in their everyday contact with clients. Sixteen dieticians were invited to participate.

All new clients presenting for treatment were invited to take part in the study during their first visit. They were informed about the duration of the study and the fact that three questionnaires were to be completed during the following 4 to 6 months of their diet programme, with one questionnaire every two months. Participants completed the first set of questionnaires and were invited to participate in the next two data collections two and four months following. After data analysis, each dietician received the results of the study and dieters received detailed feedback on the psychological characteristics they displayed during the course of the study. Ethical approval was obtained and procedures conformed to guidelines of the British Psychological Society.

After a thorough assessment of nutrition and body composition, the individual followed a weight loss programme that included behavioural advice and an individualised diet which reduced the estimated daily requirement by 500–1000 kcal/day. This energy deficit should result in an appropriate and reasonable rate of weight loss of 0.5–1.0 kg/week. The prescribed diet was about 1000–1200 kcal/day (for the obese or overweight women) and 1500 kcal/day (for the obese or overweight man and/or youngster). The prescribed, hypocaloric diet is a healthy, nutritionally-adequate regime which follows the COMA (Committee on Medical Aspects of Food and Nutrition Policy) dietary guidelines[30] and model of the Mediterranean diet[31]. This diet has been shown to be beneficial for health because it is rich in fruit, vegetables, legumes, seeds, and whole-grain cereals. It includes fish and poultry in moderate amounts, low-fat dairy food on a daily basis, red meat in small amounts, and olive oil as the main source of fat.

No dieters were prescribed a diet greater than 1000 kcal/day restriction in order to avoid a) high attrition rates, b) excessive loss of lean tissue, or c) the possibility of failing to provide essential nutrients in such a restricted diet. Dieters were prescribed 3 meals per day with two snacks of fruits in between those meals. Diets were changed on

*Body Mass Index (BMI: body weight in kg / height in m^2) has been used repeatedly as a definition of overweight (26 kg/m^2 or more) and obese (30 kg/m^2 or more) individuals, signifying the onset of risk factors for several common diseases that result in a higher mortality rate[29].

a weekly or a bi-weekly basis. Individuals visited the dieticians every 7 or 15 days in order to assess the amount and composition of weight loss, and to change menus with the provision of new recipes, thereby helping the individual to establish healthy eating habits.

Sample

Two hundred and fifty-six individuals (224 females and 32 males, mean age = 33.9 years) volunteered to participate. From those, 137 (117 females and 20 males, mean age = 33.4) completed the questionnaires at phase 2, and 75 (65 females and 10 males, mean age = 33.8) at phase 3. All individuals were Greek Caucasians. Finally, based on the BMI of the participants at the beginning of the programme, 107 were considered obese (BMI≥30, Mean BMI = 35.05), 71 were considered overweight (26≤BMI<30, Mean BMI = 28.90) and 75 had normal weight (BMI<26; Mean BMI = 24.09)[29].

Instruments

Reasons for dieting A Greek-language version of the Treatment Self Regulation Questionnaire (TSRQ)[32] was used to assess autonomous and controlling reasons for participation in a diet programme. The questionnaire presents individuals with the stem 'I am staying in the weight-loss programme because…' followed by several reasons that represent autonomous reasons (for example, 'I believe it is the best way to help myself'), controlling reasons (for example, 'I want others to see that I am really trying to lose weight'), and amotivated reasons (for example, 'I really don't know why'). Each reason was rated on a 5-point scale ranging from 'not true at all' (1) to 'very true' (5). Confirmatory factor analysis (CFA) of the questionnaire, based on the responses of the first data collection, revealed two clear factors labelled *Controlling* (seven items) and *Autonomous* (four items) reasons (X^2/df=2.35; CFI=.94; RMSEA=.074). The proposed amotivation factor was not supported**.**

Social Physique Anxiety (SPA) Social physique anxiety was assessed using a Greek language version of Hart et al's[24] SPA scale. Items were presented on a 5-point scale. The single-factor 7-item solution that was proposed by Motl and Conroy[33] was supported by CFA (X^2/df=2.15; CFI=.96; RMSEA=.068).

Physical self-perceptions A Greek language version of the Physical Self-Descriptive Questionnaire (PSDQ)[34] was used to assess physical and general self-perceptions. Seventy items measuring 11 subscales (strength, body fat, activity, endurance/fitness, sports competence, coordination, health, appearance, flexibility, general physical self-concept and self-esteem) were responded to on 6-point scales. Evidence for the psychometric properties of the questionnaire are available for both the English[34] and Greek[35] versions. CFA provided some support for the 11-factor solution presented by Marsh et al[34] in a simple, first-order analysis (X^2/df=2.33; CFI=.88; RMSEA=.053).

Physical activity The Kaiser Physical Activity Survey (KPAS)[36] is an adaptation

of the Baecke questionnaire[37] that is an accepted assessment of self-reported levels of physical activity[38]. Because the KPAS includes separate measurement of housework and care-giving activities, it is thought that it more accurately represents physical activity in women than other measures.

The Greek version of the KPAS was administered in all three data collection periods. KPAS is a self-administered, 8-page instrument containing 75 items. For the purposes of the current study, only the first 38 items that classify physical activity status were used. The first four summary activity indexes of KPAS used were housework/care giving, active living habits, exercise/sports, and occupational physical activity. With the exception of the care-giving section, summary indexes are computed from responses to questions about participation in various activities. Responses range from 'Never' (1) to 'Always' (5). Ainsworth et al[36] provided evidence for acceptable test-retest reliability and comparison with direct and indirect measures of physical activity. Intra-class correlations (ICC) of the Greek KPAS, based on 137 individuals who completed the questionnaire across a two-month interval, were: Care giving = .86; Occupation = .92; Active living habits = .62; Sports and exercise = .64; Σ Physical Activity = .73; Σ Physical Activity without Occupation = .75. For the assessment of the sports/exercise index, the compendium of physical activities was used[36].

Self-confidence Four items were provided to assess perceptions of ability to maintain a healthy diet and the ability to succeed in the programme. Items were responded to on a 7-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (7).

Expectations of achievement Expectations of achievement for losing weight were assessed by 19 items stemming from the statement '…in relation to the programme you attend what do you expect to achieve in the next two months?' A 5-point scale ranging from 'strongly disagree' (1) to 'strongly agree' (5) was used, and the items were formed based on the results of interviews, open-ended questions and a pilot study. CFA provided support for a 3-factor solution: food-related expectations, expectations based on significant others, and expectations based on objective measures (X^2/df=2.39; CFI=.92; RMSEA=.074).

Data analysis

Cluster analysis was used to identify theoretically meaningful subgroups of individuals sharing common characteristics based on their responses. Cluster analysis is a set of multivariate techniques having as a primary purpose to assemble objects based on the characteristics individuals possess. Thus, cluster analysis deals with the classification of objects (that is, respondents) so that each object is similar to others in the cluster with respect to predetermined selection criteria. The final aim is to form clusters that exhibit high internal (within-cluster) homogeneity and high external (between-cluster) heterogeneity[39].

Selection of variables should be based on sound, theoretical criteria[40]. In the

current study, selected variables were guided by Self-Determination Theory[7,8] and concepts from self-perception/esteem research, including physical self-perception[21,41].

Following the recommendations of several authors[39,42], a combination of the two major clustering methods (hierarchical/agglomerative and non-hierarchical) was used. Scores were standardised using z-scores and Ward's hierarchical method was used to establish the number of clusters and profile the cluster centres. These analyses were based on the Squared Euclidian Distances that created the similarity matrices between the observations.

The number of clusters was based on a) the agglomeration (or else fusion) coefficient that represents the average within-cluster distance (a sudden increase of this coefficient indicates that two dissimilar clusters have been merged), and b) considerations about a logical interpretation of the clusters.

Cluster centres found in the previous method were used as seed-points for the non-hierarchical method of k-means. Observations were assigned to the nearest seed-point. Non-hierarchical methods can fine-tune the results by minimising the within-cluster variance and by maximising the between-cluster variance. The cluster solution was validated with the use of two techniques suggested by Aldenderfer and Blashfield[40]. The first involves the degree of replicability of a certain cluster solution across various sub-groups of the same population, and the second is related to tests of significance comparing the extracted clusters on the variables not used in the formation of the cluster solution.

Results

Descriptive statistics

All subscales showed an acceptable level of internal consistency (alphas .70 to .91). Means and standard deviations for the 1st, 2nd and 3rd data sets are presented in *Table 1*. Physical activity scores, compared with data presented by Sternfeld, Ainsworth and Quesenberry[43], are lower for the current sample with the Occupation Index and the Overall Activity scores (including occupation index) showing the largest difference. Less positive self-descriptions were evident in the 2nd data collection. This trend did not characterise any other variable of the 2nd data set.

Correlations between all examined variables for all three phases were examined (full tables available from the corresponding author). There is a trend for positive correlations among the variables examining the positive psychological characteristics and negative correlations among various psychological characteristics and the physiological variables examining the magnitude of obesity.

Group differences

Groups based on BMI scores from the 1st data set (Group 1: BMI<26, N=75; Group 2: 26≤BMI<30, N=71; Group 3: BMI≥30, N=107) revealed significant mean differences,

TABLE 1 Descriptive statistics for all the data sets

Variable	1st Data set		2nd Data set		3rd Data set	
	M	SD	M	SD	M	SD
Discrepancy	1.83	0.88	1.60	0.79	1.57	0.97
Confidence	5.01	1.35	5.00	1.28	4.99	1.34
Autonomy	6.08	0.87	6.06	0.81	6.11	0.80
Control	3.45	1.26	3.36	1.12	3.39	1.23
SPA1	3.28	0.85	3.22	0.81	3.10	0.88
Perceived health	2.49	0.94	1.37	1.48	2.42	1.02
Perceived coordination	3.94	0.92	2.12	2.09	3.95	0.96
Perceived physical activity	2.38	1.31	1.30	1.48	2.41	1.25
Perceived fat	3.68	1.25	1.60	1.67	3.22	1.21
Perceived sport competence	2.61	1.22	1.49	1.64	2.77	1.19
Perceived PSW1	3.13	1.15	1.81	1.89	3.42	1.14
Perceived appearance	4.19	0.87	2.25	2.20	4.25	0.95
Perceived strength	3.55	1.10	1.91	1.96	3.78	1.11
Perceived flexibility	3.55	1.12	1.97	2.00	3.78	1.04
Perceived aerobic ability	2.40	1.09	1.33	1.47	2.52	1.06
Self-esteem	4.68	0.78	2.49	2.42	4.69	0.97
Expectations on food	4.08	0.60	4.02	0.60	3.98	0.67
Expectations on others	3.67	0.81	3.73	0.76	3.73	0.80
Objective expectations	4.40	0.56	4.41	0.57	4.33	0.56
BMI1	29.75	5.65	28.99	5.32	29.39	4.93
KPAS (house activities)	2.34	0.81	2.23	0.77	2.27	0.75
KPAS (occupation activ.)	1.64	1.36	1.64	1.36	1.45	1.31
KPAS (active habits)	2.72	0.68	2.84	0.68	2.90	0.73
KPAS (exercise activities)	2.08	1.17	2.06	1.16	2.01	1.16
KPAS sum with occupat.	8.80	2.06	8.77	2.19	8.66	2.07
KPAS sum no occupat.	7.17	1.73	7.14	1.91	7.21	1.91
Valid N (listwise)	245		136		75	

using ANOVA, for Overall Physical Activity (PA) with Occupation ($F(2,247)=5.61$, $p<.004$), Overall PA without Occupation ($F=3.05$; $df=2,247$; $p<.05$), and the Exercise/Sport PA Index ($F(2,247)=8.91$; $p<.001$).

Cluster analysis

Cluster analysis was based on Self-Determination Theory[7] and self-esteem formation[21,44]. For SDT, only the Controlling motives factor was included in the analysis because the Autonomy factor did not feature as a variable to classify clusters. Further, the discrepancy between the perceived and preferred physical appearance and BMI were used to match the importance of real and perceived physical appearance.

Separate cluster analyses were performed for each data collection period. In order to validate the stability of the clustering solutions for each data set, significance tests were performed on the variables not used to generate the cluster solutions. According to the results of ANOVA, using all 21 external variables, both clustering methods that were contrasted for the 1st data set revealed significant differences in 12 variables: Perceived Health, Perceived Co-ordination, Perceived Fat, Perceived Sport Competence, Physical

Self Worth, Perceived Appearance, Perceived Strength, Perceived Flexibility, Perceived Aerobic Ability, Social Physique Anxiety, KPAS, KPAS (no occupation). The 2nd and 3rd data sets revealed significant differences in unequal numbers of variables between the two clustering methods.

In checking the reliability of the hierarchical clustering solution, the first data set was randomly split in half and the cluster solution was compared for the two data sets. Both data sets were classified with the same solution while using both hierarchical and non-hierarchical methods. Discriminant analysis was used to assess the stability of cluster solution for each data set. Results revealed an acceptable percentage of cases correctly classified for each data set (68.4–90.1 per cent).

Cluster characteristics

Figures 1, *2* and *3* show the cluster profiles for each data set expressed in z scores. The following description of the profiles is based on the clusters of the first data set (*Figures 1* and *4*).

Cluster 1 ('*media victims*', 21 per cent of sample, N=55) of the first data set reveals a group of individuals having the highest BMI score (z = +0.74), the lowest self-esteem (z = −1.2), the highest control score (z = +0.79), and a high discrepancy score (z = +0.44). Further, this cluster reveals the lowest autonomy score (z = −2.6), lowest physical self worth (PSW) (z = −0.85), lowest perceived appearance (z = −0.74), and the lowest perceived strength (z = −0.43) scores. Based on these characteristics, the individuals in

FIGURE 1 Description of the 3 clusters for the 1st data set (z-scores) based on scores of BMI, self-esteem, controlling motives, and discrepancy score.

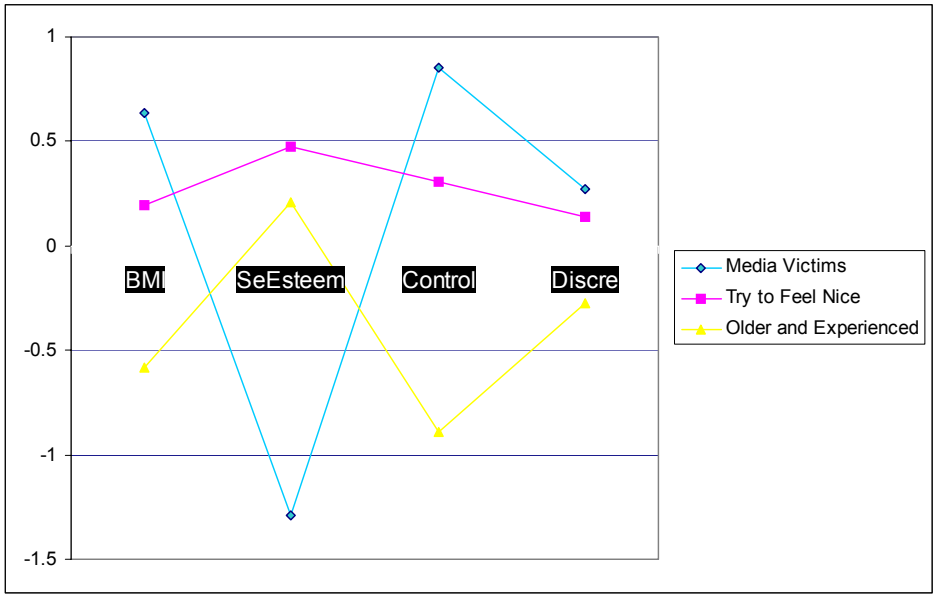


FIGURE 2 Description of the 3 clusters for the 2nd data set (z-scores) based on scores of BMI, self-esteem, controlling motives, and discrepancy score.

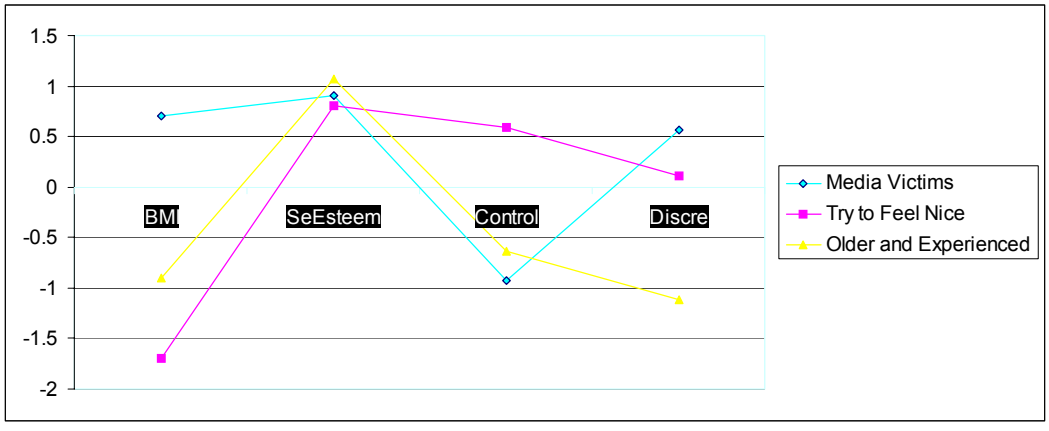
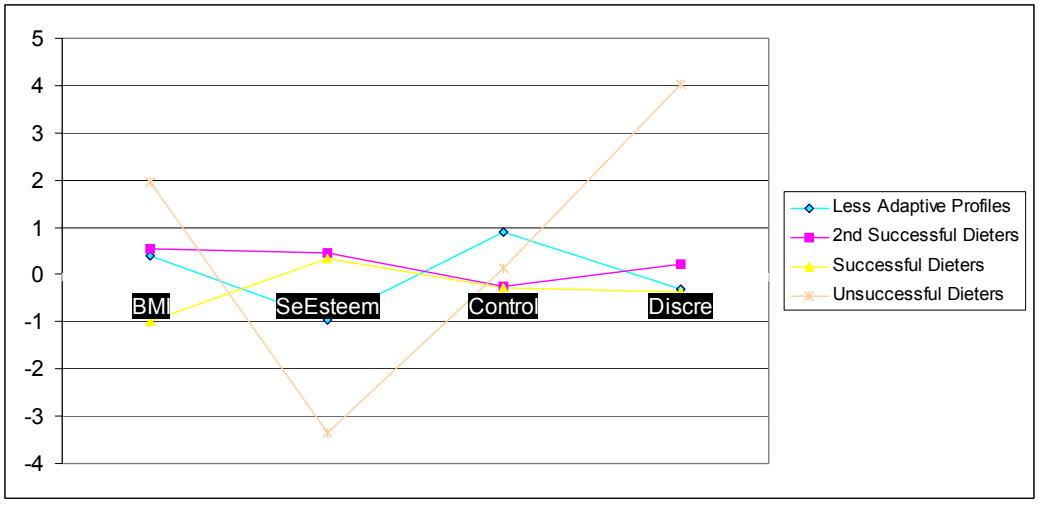


FIGURE 3 Description of the 4 clusters for the 3rd data set (z-scores) based on scores of BMI, self-esteem, controlling motives, and discrepancy score.



this cluster seem to have internalised the social pressure for a lean physical appearance and they seem to feel quite restricted. For this reason they were labelled as *media victims*.

Cluster 2 ('try to feel nice', 41 per cent of sample, N=104) revealed a group of individuals who were older (age z = +3.44), with a high self-esteem (z = +0.47) but also a high discrepancy score (z = +.48). Further, the individuals in this cluster have the highest score in body fat (z = +6.44), but this is coupled with high activity (active habits z = +6.0). This cluster displays middle scores in most subscales of the PSDQ, along with exercise habits. As dieters in this cluster seem to display mixed characteristics, according to the theory of self-esteem formation, these individuals seem to 'try to feel

FIGURE 4 Description of clusters for the 1st data set based on the z-scores of all the examined variables.

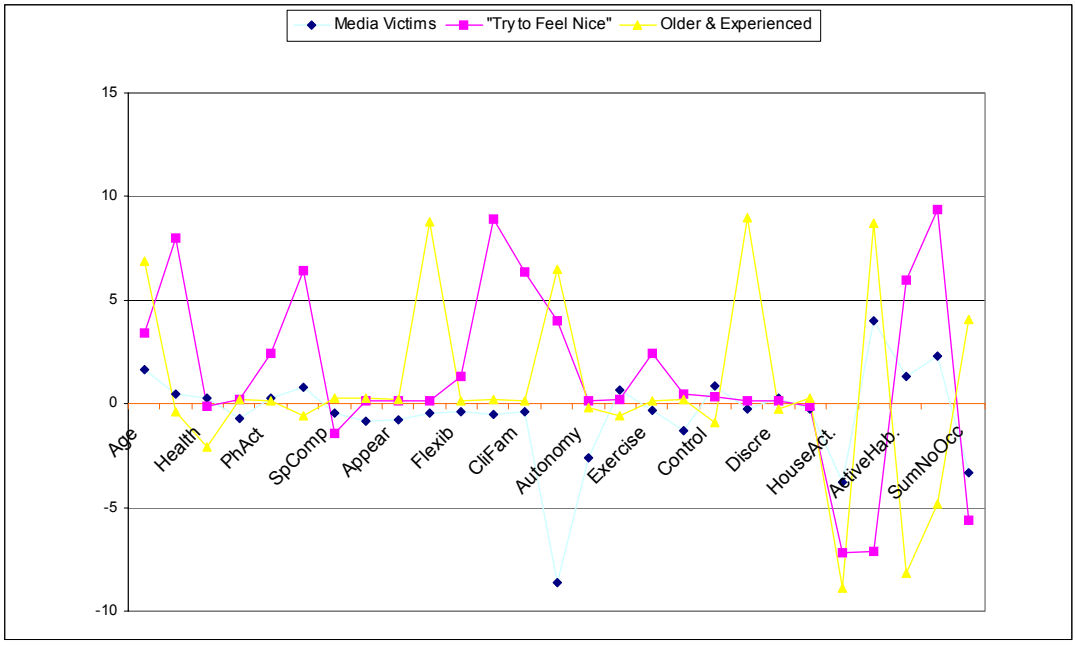
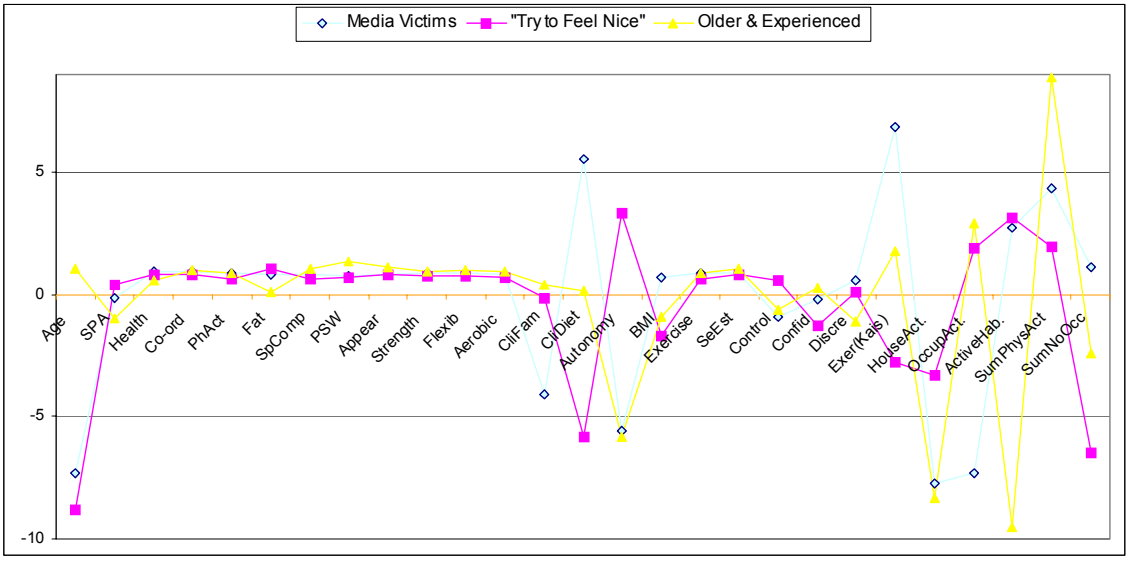


FIGURE 5 Description of clusters for the 2nd data set based on the z-scores of all the examined variables.



nice' about their physical appearance. They present autonomous reasons for doing this particular behaviour.

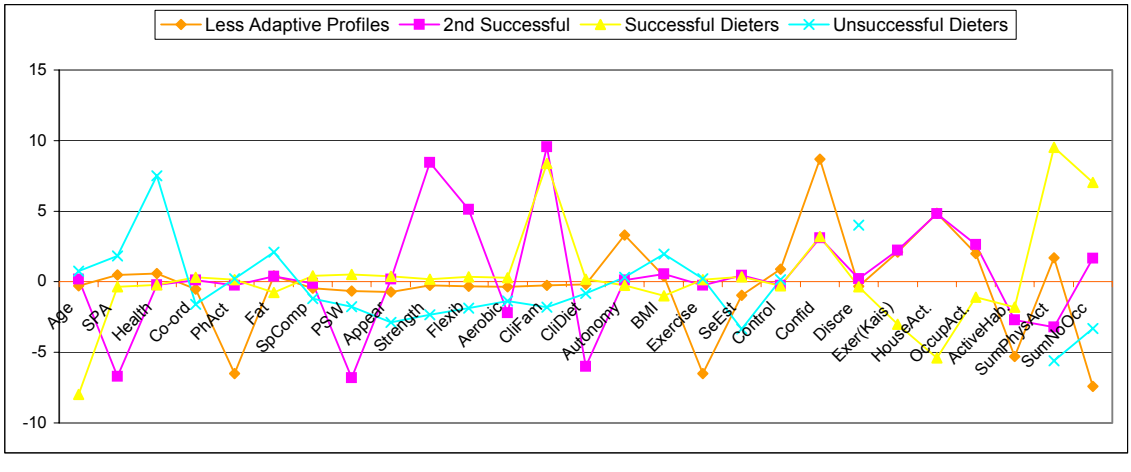
Individuals in Cluster 3 ('older and experienced', 34 per cent of the sample, N=88) are older (z = +6.27) with a lower BMI (z = −0.67). They also present low scores on control (z = −0.58) and discrepancy (z = −0.60). These individuals present positive scores in perceptions of fat (z = −0.56), perceived strength (z = +8.8), and confidence in achieving diet goals (z = +8.9) and occupational activity (z = +8.71). Dieters in this cluster were labelled 'older and experienced' in relation to their dieting behaviour, while they display consistently the most positive psychological profile.

Based on the cluster solution of the 2nd data set, three clusters were formed on the basis of the same (four) variables previously discussed. Clusters were named in the same way as the clusters previously presented (*Figure 2*). Differences were found in all 3 clusters with the most significant witnessed in the 1st cluster ('media victims'). Here self-esteem and control scores were reversed leaving BMI and discrepancy scores unaffected. In the 2nd cluster ('try to feel nice') even if BMI scores were reduced the scores in all the other variables remained unaffected. Scores of the 3rd cluster ('older and experienced') showed the same adaptive pattern as in the 1st data set. Standardised scores of all the examined variables in relation to the three identified clusters in this data set are displayed in *Figure 5*.

Cluster solution of the 3rd data set revealed 4 clusters. The first was named *less adaptive profile* because it displayed the highest control scores and the second lowest self-esteem score. BMI and discrepancy scores were not greatly differentiated from the two most psychologically adaptive clusters.

The second cluster was named *second successful dieters* as self-esteem and control scores were almost identical as the ones of the most psychologically adaptive (third)

FIGURE 6 Description of clusters for the 3rd data set based on the z-scores of all the examined variables.



cluster. Nevertheless, the scores of BMI and discrepancy differentiated this cluster from the next cluster (*successful dieters*) which was the most adaptive, as it displayed the most positive scores on all the four variables.

Conversely, scores revealed by the 4th cluster (*unsuccessful dieters*) were the least adaptive, displaying the highest BMI and discrepancy scores coupled with the lowest self-esteem score in comparison to the other clusters. Standardised scores of all the examined variables in relation to the four identified clusters in this data set are displayed in *Figure 6*.

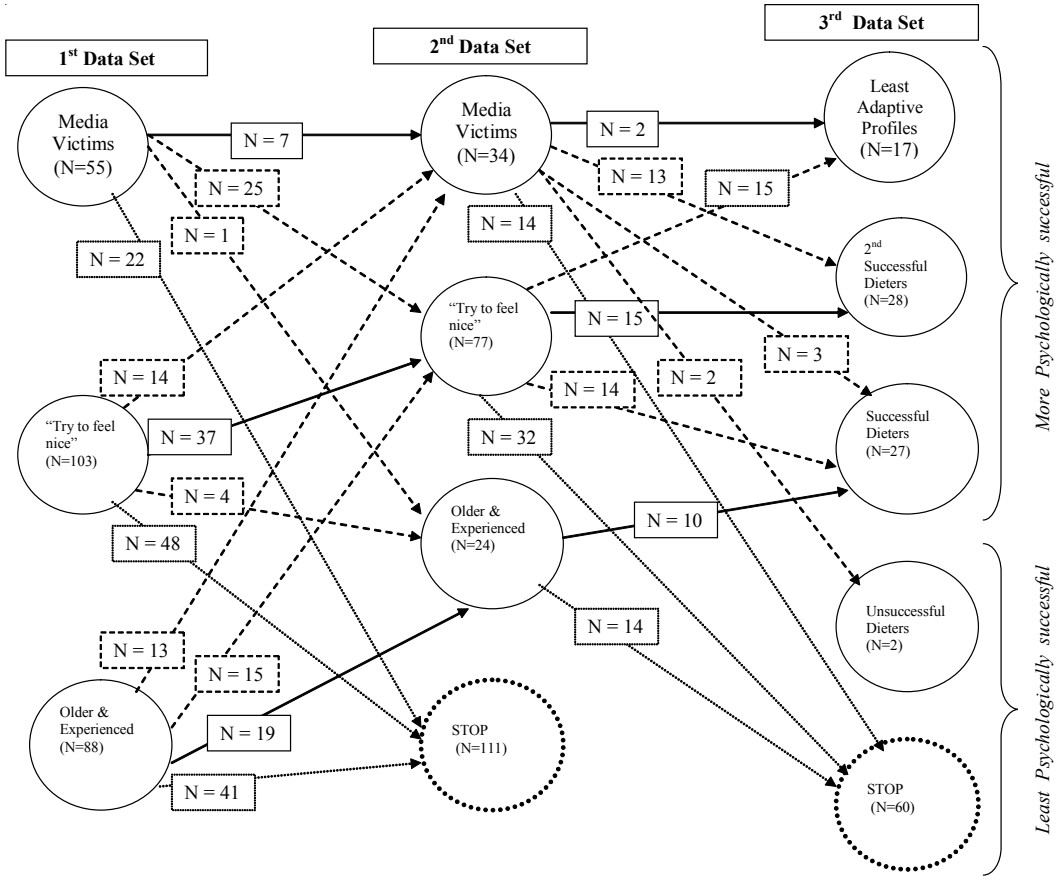
Cluster changes

Table 2 and *Figure 7* display the way dieters changed clusters across the duration of the study. One trend is that there seem to exist groups of dieters with stable psychological

TABLE 2 Details of cluster changes in each data set

1st Data Set (N=247, Missing N=9)		2nd Data Set (N=136, Missing N=120)		3rd Data Set (N=75, Missing N=181)
Cluster 1 (classified in the 1st data set)				
22 individuals stopped				
3 individuals	→	Cluster 1	→	Stopped
6 individuals	→	Cluster 2	→	Stopped
1 individual	→	Cluster 1	→	Cluster 1
15 individuals	→	Cluster 2	→	Cluster 1
1 individual	→	Cluster 1	→	Cluster 2
3 individuals	→	Cluster 2	→	2 ind. Cluster 2 & 1 ind. Cluster 3
1 individual	→	Cluster 3	→	Cluster 3
2 individuals	→	Cluster 1	→	Cluster 4
Cluster 2 (classified in the 1st data set)				
48 individuals stopped				
5 individuals	→	Cluster 1	→	Stopped
18 individuals	→	Cluster 2	→	Stopped
4 individuals	→	Cluster 3	→	Stopped
9 individuals	→	Cluster 1	→	Cluster 2
11 individuals	→	Cluster 2	→	Cluster 2
8 individuals	→	Cluster 2	→	Cluster 3
Cluster 3 (classified in the 1st data set)				
41 individuals stopped				
6 individuals	→	Cluster 1	→	Stopped
8 individuals	→	Cluster 2	→	Stopped
10 individuals	→	Cluster 3	→	Stopped
1 individual	→	Cluster 1	→	Cluster 1
3 individuals	→	Cluster 1	→	Cluster 2
2 individuals	→	Cluster 2	→	Cluster 2
3 individuals	→	Cluster 1	→	Cluster 3
5 individuals	→	Cluster 2	→	Cluster 3
9 individuals	→	Cluster 3	→	Cluster 3

FIGURE 7 Changes across clusters with time.



characteristics because the same individuals are included in the same clusters (2nd and 3rd clusters). Second, most changes took place between the dieters of the 1st and 2nd clusters. This trend differentiates dieters of cluster 3 from the other dieters of the sample. Third, Cluster 1 included dieters finally clustered in Clusters 1 and 4 that were the least adaptive ones (with the exception of 4 dieters). Fourth, the initial Cluster 3 included dieters that were finally clustered in the most adaptive cluster (Cluster 3) (with the exception of 6 individuals). Thus, it seems that a certain pattern of psychological characteristics could differentiate those who diet and stable cluster solutions can be displayed with the help of the four variables used in the cluster analysis of the current study.

Discussion

Using the theoretical definitions of Self-determination theory[7] and Self-esteem formation[21,45,44] proved fruitful as dieters were successfully classified in clusters over a period of four to six months. Results concerning autonomous reasons for dieting did

not aid clarity of findings. One possible reason is the indirect conduct of the researchers with the dieters (through dieticians) which may have left room for social desirability to intervene as a mediating variable. Possibly dieters were concerned with giving personally-valued reasons for dieting or tried to please dieticians with the importance of their efforts. Equally, high autonomy scores may signify the dieters' need to feel autonomous in a highly controlling context, where they gave reasons for not losing the weight they were expected to lose or not reaching the goals set by external agents. These may be some of the reasons why autonomy failed to cluster dieters in the current study.

Conversely, controlling dieting reasons proved efficient in clustering individuals among adaptive and less adaptive motivational patterns. The fact that high BMI scores were related to the more controlling reasons for dieting confirms the initial hypotheses that were based on the premises of SDT. This study, therefore, provided support to the notion that health professionals should try to lead individuals to more self-determined dieting motives in order to guide them safely to successful long-term weight management.

Various researchers claiming that media messages play a major role in dieting efforts (for example, Davis[46]) were confirmed by many of the results in this study. BMI scores showed that dieting behaviour relates not only to the overweight and obese individuals, but also to individuals with normal BMI scores. Further, self-esteem and discrepancy scores clustered dieters successfully in all data collection periods, denoting the significance of the difference between the ideal and real physiques. Both of these results signify the need to promote 'healthy' instead of 'lean' physiques.

Physical activity scores showed that individuals participating in the current study had lower occupation and overall physical activity scores in comparison to the samples in the United States, presented by Sternfeld and colleagues[36,43]. Possible reasons may relate to dieting behaviour, ethnic origin, BMI scores and/or educational level. Further research is needed in order to highlight possible cultural differences and to better understand physical activity scores among dieters.

It seems that body size plays a significant role in physical activity participation. In the current study body size expressed by BMI scores discriminated participation in exercise and sporting activities as well as overall energy expenditure. Although causality between high BMI scores and low levels of physical activity has not yet been supported, the opposite has been proposed as a cause of weight gain by many researchers[47,48]. More rigorous study designs and statistical analyses are needed in order to draw conclusions for the potential link between body size and physical activity as a means to guide future interventions.

The current study supported the fact that BMI scores are related to differences in various psychological variables. Increased BMI scores are not only related to lower self-esteem but also to lower scores in many self-description variables. Adverse psychological variables may hinder the effort to control body weight, especially in the case of dieters with large physiques. Studies should focus on the modification of these negative

cognitions, beliefs, attributes and mood states, aiming toward adaptive psychological profiles during dieting.

Based on the results of this study, less than 30 per cent of the initial sample can be considered as having an adaptive psychological profile when terminating dieting efforts based on the extracted clusters of each data collection. This finding clearly calls for a shift in judging the outcome of a diet, as dieters need to feel more successful at the end of the treatment. Personally valued and accessible goals, agreed to at the very beginning of the treatment, may be the answer to more positive psychological profiles at the end of the treatment.

The previous finding also gives support to the proponents of a shift from the current weight management paradigm to an alternative paradigm that proposes 'self-acceptance', physical activity and normal eating patterns, relying on the internal cues of hunger and satiety. Variables related to the environmental influences of control and autonomy for certain health behaviours (that is, family climate), could be introduced in order to explain dieting motivations better. Further, examining the predisposition of using autonomous versus controlling reasons in dieting behaviour, would be a step forward from the current study.

Conclusions

Self-determination and self-esteem theories provide important information on successful or unsuccessful attempts at weight control. Interventions aimed at adaptive weight loss strategies need to consider the development of autonomous motivation.

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