



Perceived stress and freshman weight change: The moderating role of baseline body mass index



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HIGHLIGHTS

- On average, freshman students gain body weight during their first academic year.
- We investigated how baseline BMI and stress interacted to predict weight change.
- Students with high levels of stress and high baseline BMIs gained weight.
- Students with high levels of stress and low baseline BMIs lost weight.
- Weight-management interventions should target students with high stress levels.

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ABSTRACT

The transition from high-school to university is a critical period of weight change. Popular media suggest that freshman students gain 15 lb (6.80 kg) of body weight during their first year at university (i.e., the freshman 15). In contrast, a recent meta-analysis calculated freshman weight gain to be 1.75 kg, with statistics suggesting that only a proportion of freshman students are prone to gain weight. Researchers are beginning to investigate how certain variables and interactions between such variables predict freshman weight status. The current study focused on body mass index (BMI) and psychological stress. In isolation, previous research has tested how these two variables predict freshman student's weight status. However, because BMI and stress interact to predict weight gain *and* weight loss in adult samples, the current study tested the interaction between student's baseline BMI and baseline stress levels to predict weight change in a New Zealand sample of freshman students ($N = 65$). Participants completed two separate online surveys in March and October 2012 (i.e., New Zealand's academic year). Although only three students gained over 6.80 kg (i.e., the freshman 15), participants did gain a statistically significant 1.10 kg of body weight during the year. Consistent with previous research, students with a higher baseline BMI gained a higher amount of body weight. However, this main effect was qualified by an interaction between stress and BMI. Students who entered university with high levels of stress gained weight if they also had high BMIs; if they had lower BMIs then they lost weight. In order to reduce unhealthy levels of freshman weight change, vulnerable students need to be taught stress-reduction techniques and coping strategies early in the academic year.

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1. Introduction

Recent statistics indicate that 35% of all adults are overweight or obese [16]. By the time a person becomes overweight, it is difficult to lose weight, and it is likely that even more weight will be gained [18]. It is important to identify critical periods of weight change and to develop targeted interventions that are aimed at preventing the initial weight gain.

1.1. Freshman weight change

The transition from high-school to university has been identified as one such critical period. Not only do students have to get used to a new academic environment, the transition involves changes in stress levels, social networks, living conditions, and lifestyle behaviours [7, 13]. Although popular media claim that students gain the “freshman 15” (6.80 kg) during their first academic year, a meta-analysis by Vella-Zarb and Elgar [40] showed that the average weight gain is much less (i.e., on average 3.86 lb or 1.75 kg) and that not all students gain weight (some even lose weight) (see also [17]). However, although much less than the “freshman 15”, students *on average* do gain weight, and gain weight at a significantly higher rate than do young adults not

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attending university [27,28]. It is therefore important to identify factors that predict who is at risk for freshman weight gain and weight loss.

1.1.1. Predictors of weight change: psychological stress and BMI

Most studies have focused on living situation and changes in health behaviours as potential weight change predictors during the freshman year (e.g., [3,39]). For instance, Vella-Zarb and Elgar [39] found that freshman students gained significantly more body weight if they lived on campus, rather than at home with their parents. However, the freshman year is also a period of increased stress [13]. Stress can lead to both weight gain and weight loss depending on whether energy intake exceeds energy expenditure or vice versa. Indirectly, stress may lead to weight change by triggering unhealthy behaviours such as increased or decreased food intake and/or physical activity (e.g., [23,31]). Directly, stress may affect weight through hormonal changes resulting from continued hypothalamic–pituitary–adrenal (HPA) axis activation which has been linked to increased abdominal adiposity [10].

The evidence linking freshman stress to body weight is inconsistent. Although some studies report non-significant effects [14,39], others have associated high freshman stress with greater risk of both weight gain and loss [35]. A recent meta-analysis of longitudinal studies examining the relation between psychological stress and weight change in the general population concluded that stress was a risk factor for weight gain, but that the effects were very small and that future research should investigate variables that might interact with stress to predict weight change [42].

Two recent longitudinal studies among large adult samples examined baseline BMI as a potential moderator in the relationship between psychological stress and prospective weight change. Kivimäki et al. [24] found that high work-related stress was related to weight gain in adult men with high baseline BMIs, but related to weight loss in men with low baseline BMIs. Similarly, Block et al. [6] found that psychosocial stress was related to weight gain in individuals with higher baseline BMIs, but not in individuals with lower baseline BMIs. To date, freshman studies have only examined baseline BMI as a univariate predictor of weight change. While some find that students with higher baseline BMIs gained more weight during their freshman year than did those with lower BMIs [22,30], other studies find the opposite [28]. Perhaps these freshman effects are inconsistent because the relation between BMI and weight change depends on the amount of stress perceived by freshman students (cf. [6,24]).

1.2. The present study

Mirroring research in adult samples, we examined the interaction between baseline BMI and perceived stress in university freshman. We hypothesised that freshman with high levels of baseline stress would only gain weight if they entered university with a high BMI, but lose weight if they entered university with a low BMI. Because previous research has shown that changes in freshman health behaviours (e.g., [3]) and living arrangement (e.g., [39]) may be related to weight gain, we measured these variables and controlled for them where appropriate. In addition, because unrealistic weight-change estimates are an important variable to target in freshman intervention programmes [19]; we also examined estimated weight change as a second outcome variable. We expected BMI to exert a significant main effect on participants' estimated weight change (e.g., [15]), and also explored whether or not this main effect would be qualified by an interaction between BMI and stress.

2. Method

2.1. Participants

Participants were New Zealand university students. In March 2012 (New Zealand's academic year begins in late February), first year psychology students were sent an email inviting them to participate in a

study on health behaviours. The email explained that participation involved completing two brief online surveys (7 months apart) for which they would not receive any reimbursement (i.e., money or course credit). One hundred and seventy-five participants completed the online survey (Time 1, T1). Towards the end of the academic year (October 2012), participants were re-contacted and asked to complete the second online survey (Time 2, T2). After two reminder emails, 99 participants completed the T2 survey (57% retention). Data from 34 participants could not be used because 2012 was not their first year at university. Therefore, the final sample consisted of 65 freshman students who completed both T1 and T2, with a mean baseline age of 18.20 ($SD = 0.79$, range 17–21), a mean body weight of 67.64 kg ($SD = 18.94$, range 47–186), and a mean BMI of 23.83 ($SD = 5.86$, range 17.48–51.52) at baseline. The sample was predominantly female (69%) and of New Zealand European decent (83%). The freshman returnees ($N = 65$) did not differ significantly from the freshman non-returnees ($N = 55$) on baseline age, sex, living situation, BMI, stress levels, exercise frequency, or their unhealthy or healthy (i.e., fruit and vegetable intake) eating scores ($t_s < 1.45$, $p_s > .15$).

2.2. Procedure

Similar to other freshman studies (e.g., [22,28]), participants completed two self-report online surveys 7 months apart ($M = 34$ weeks). Although participants were informed that the study was about health behaviours, they were not informed that we were targeting freshman students or their body weight.

2.3. Measures

Descriptive statistics and correlations between key variables are presented in Table 1.

2.3.1. Demographics

Data were collected on age, sex, ethnicity, and living situation (e.g., hall of residence) at T1.

2.3.2. Body weight

Similar to previous freshman research (e.g., [21,33]), participants self-reported their height and their weight at T1 and 7 months later at T2. Research has demonstrated high correlations between self-reported and measured body weight [14]. These data were used to calculate BMI (kg/m^2) and actual weight change ($T2-T1$). In addition, at T2 participants estimated how much they thought that their body weight had changed since beginning university (e.g., [19]).

2.3.3. Perceived stress

At T1, participants responded to two questions: "please rate the stress you currently feel due to academic demands" and "please rate the general stress you currently feel" (1 = no stress, 5 = extreme stress). The two items ($r = .51$) were averaged to form a composite measure.

2.3.4. Health behaviours

Nine questions measured health behaviours (assessed at T1 and T2). Fruit and vegetable intake (FV intake) were assessed with two items [36]. Participants were asked how many pieces of fruit and how many portions of vegetables (excluding potatoes) they ate on a typical day (1 = less than one serving a day, 5 = 4 or more servings a day). The two items were combined to form one scale. Unhealthy eating behaviours were measured with three items (e.g., [4]). Participants reported how many days they currently ate junk food, fast food, or overate/kept eating while already full. Items were scored on a 5-point scale ranging from 1 = every day to 5 = less than once a week and were combined to form an unhealthy eating behaviour index (reverse coded so that higher scores = healthier eating). Physical activity was assessed with two items asking participants how often (1 = every day, 5 = less

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