

**Associations between aspects of body image and lifestyle
behaviours and attitudes in Otago adolescents**

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Abstract

Background: Little is known about how New Zealand adolescents feel about their eating and bodies and how it is associated with body composition.

Objective: To determine the association between food, feelings, behaviours and body image and (a) body composition and (b) other related factors in Otago adolescents.

Design: Six hundred and eighty one adolescents between the ages of 15-18 years completed the Otago Students Secondary School Lifestyle Survey 2 (OSSLS2) in 2011. Height and weight were measured by trained research professionals. For this study we examined four subscales from the Food, Feelings, Behaviours and Body Image Questionnaire (FFBBQ): concern about eating and weight; fear of weight gain; dietary restraint; and figure dissatisfaction. Associations between the four subscales and body composition, gender, physical activity, attitudes towards healthy eating and Diet Quality Index (DQI) scores were investigated using regression models.

Results: There were significant differences in scores for concern about eating and weight, fear of weight gain, dietary restraint and figure dissatisfaction for males and females, and those at different weight status. Overweight and obese adolescents and female adolescents had significantly higher scores for all four subscales (all $P > 0.001$) compared to normal weight adolescents and male adolescents, respectively. Overweight, obese adolescents and female adolescents were more

concerned about their weight, practiced more dietary restraint, were more afraid of weight gain and were more dissatisfied with their figure. While 54% of female adolescents felt their body was “too fat”, only 28% of the females surveyed were classified as overweight or obese. While 26% of the males surveyed were overweight or obese, only 22% of males felt their body was “too fat”. Those who were meeting the physical activity guidelines had significantly lower figure dissatisfaction and concern about eating and weight scores. There were no statistically significant findings between any of the subscales and DQI score or attitudes towards healthy eating.

Conclusion: There is a high prevalence of body dissatisfaction among Otago adolescents, which was more common in girls than boys, and not restricted to those carrying excess weight. Those who met the guidelines for physical activity reported lower figure dissatisfaction and less concern about eating and weight, compared to those not meeting the guidelines.

Preface

This study analysed data from the FFBBQ, which comprised questions from the OSSLS2. As this thesis involved secondary data analysis, ethical approval and data collection had already been completed. Supervision for this thesis was kindly carried out by Jill Haszard and Paula Skidmore from the Department of Human Nutrition, University of Otago. Project advice was also kindly given by Anna Howe.

The candidate was responsible for:

- Literature search
- Compilation and interpretation of statistical results with guidance from biostatistician Jill Haszard
- Drawing study conclusions
- Drafting all sections of the thesis

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List of Abbreviations

OSSLS2 – Otago Secondary Schools Lifestyle Survey Two

FFBBQ – Food, Feelings, Body Image and Behaviour Questionnaire

BMI – Body Mass Index

SES - Socio-economic status

DQI – Diet Quality Index

NZ-EWI – New Zealand Eating Behaviour and Weight Problems Inventory

NZdep06 - New Zealand Deprivation Index Score

DEBQ – Dutch Eating Behaviour Questionnaire

TFEQ – Three Factor Eating Questionnaire

FFQ – Food Frequency Questionnaire

1. Introduction

The prevalence of obesity in adolescents has not only risen in New Zealand, but also worldwide (1). Sixteen percent of 15-17 year olds and 22% of 18-24 year olds in New Zealand are obese (2). Obesity prevention is now one of the priorities for public health set by the New Zealand government (3). Adolescence is a stage where many are already concerned about their appearance and figure, and there is a vast body of research showing that low body image is linked with increased weight status in this age group (4) (5) (6). Additionally, low body image and body dissatisfaction have been linked with eating disorders (5, 7) (8). Therefore, it is vital to investigate factors that may influence adolescents' weight and health, and the association with body image.

While a higher BMI has been linked with lower body image (6), normal weight and underweight adolescents may also have perceptual body image concerns as well. Pich et al (9) found in Spain that 57% of normal weight girls reported having been on a diet or having been concerned about their weight. There is also evidence that adolescents with low body image are undertaking unhealthy behaviours to attempt to control their weight (4) (8). Alarming, these behaviours have also been found in normal and underweight adolescents, and are a risk factor for disordered eating behaviours (10) (11). Both unhealthy dieting behaviours and being obese have been linked with not only negative physical consequences, but also mental health consequences such as depression (4) (12) (13). There is limited research looking at

how diet quality, activity and body image are related to each other. The research that has been done, has linked lower quality 'junk' food consumption and low participation in physical activity to a more negative body image (14) (15). With negative health consequences associated with negative body image, it is vital to understand the relationship between body image weight and lifestyle factors such as diet quality and physical activity.

Body image is multi-factorial concept which includes perceptual, affective, cognitive and behavioural aspects (7). The current research in New Zealand adolescents covers perceptual aspects of body image such as social and cultural factors and behavioural aspects, such as disordered eating habits (16, 17) (18). With the research in New Zealand being limited, there is a need for more research on all four aspects of body image in New Zealand adolescents. While there is research worldwide on body image and diet and activity correlates, to our knowledge, this is the first study involving New Zealand adolescents.

2. Literature Review

2.1 Body image

Body image has been defined as perceptions, thoughts and attitudes towards one's body (19). This can include negative and/or positive thoughts, beliefs and behaviours (20). Although there is no universally agreed definition of body image, it can be characterised by four aspects, as defined by the National Eating Disorder Collaboration in Australia (7):

1. Perceptual body image is defined as how you see your body, which may not always reflect reality. For example, perceiving yourself as overweight when you are a normal weight.
2. Affective body image is how you feel about your body. This is a part of body satisfaction and dissatisfaction.
3. Cognitive body image is about the thoughts you have about your body. For example, preoccupation with thoughts about a desired body shape, and whether this would make you feel better about yourself.
4. Behavioural body image is defined as what behaviours you participate in as a result of your body image. This could include dieting and exercising.

Adolescence is well known to be a time for body image concerns to be heightened, especially in relation to physical traits such as weight. Adolescence is a crucial period of development, particularly for healthy body image (5). There is also an increasing amount of literature looking at affective body image, particularly body

dissatisfaction. Body dissatisfaction has been defined as negative thoughts and evaluations of ones' body, and can be considered a component of affective body image (7, 21). It is vital that the mechanisms behind body image development are understood, as low body image and body satisfaction have been linked with negative physical and psychological factors, for example low self esteem, depression, and eating disorders (5, 13, 22).

Firstly, it is important to acknowledge that other factors not covered in this thesis can possibly impact body image. For example, there are previously established relationships between body image, peer pressure, culture and the media (7) (19, 23). These other relationships reinforce that body image is multi factorial. For the purpose of this thesis, body and figure dissatisfaction, concern about eating and weight, fear of weight gain and dietary restraint will be investigated, along with how these constructs are associated with the four aspects of body image.

2.2 Body and figure dissatisfaction

Body and figure dissatisfaction are a part of the affective aspect of body image. This includes satisfaction or dissatisfaction with your weight, figure or specific body parts (7). In the Growing Up Today Study, a prospective cohort study conducted in the USA involving nearly 17,000 9-18 year olds, the likelihood of body dissatisfaction being reported increased with each unit increase in BMI percentile. Having a BMI above the 50th percentile and being female, increased the odds (OR =1.96, 95% CI =1.85, 2.09) of participants reporting body dissatisfaction, in

comparison to being below the 50th percentile. Interestingly, in males this differed. Males reported high body dissatisfaction being below the 25th percentile for BMI, and reported significantly higher body satisfaction above the 75th percentile for BMI (6). Cortese et al (24) found that in 678 adolescents body size dissatisfaction increased with an increase in BMI. When looking at the results by weight category, it was found that slightly underweight, average weight and overweight females wanted to be slimmer. It is of concern that Cortese et al (24) found that slightly underweight and average weight females desired a slimmer body. From Project EAT-II involving 2156 adolescents, it was found that even after adjusting for BMI, body dissatisfaction was still associated with binge eating and unhealthy weight control behaviour (8). This shows that body dissatisfaction and unhealthy weight control measures aren't limited to those with a larger BMI.

Most studies conducted in this area have focused on females. Despite there being less research in male adolescents, studies have still found positive associations between BMI and body dissatisfaction in males. For example, in 1499 males aged 7-17 years, both BMI and percentage body fat were found to be significantly related to body dissatisfaction (25). In a review of 17 studies on body dissatisfaction in males, Cohane et al (26) found that even though boys showed less concern about their bodies than girls, it was still prevalent across ages. However, the studies in this review failed to distinguish between muscularity and fat in males (26). Muscularity has been found to be one of the main body concerns in males (5). Voelker et al (5) found that in adolescent males, muscularity and thinness concerns were predictors

of body dissatisfaction, however BMI was only positively associated with thinness concerns, not muscularity. Overall, the research suggest that BMI does have a positive relationship with body dissatisfaction in adolescent males, however like females there are other factors that contribute to males overall body image (5). These concerns highlight the need for more research into adolescent males' body dissatisfaction.

Bucchianeri et al (27) from Project EAT III in the USA, found that an increase in BMI lead to decreased body satisfaction over time. As this study was longitudinal, the 1902 adolescent participants age increased over the study period, which showed that the transition into young adulthood also plays a role in decreasing body satisfaction (27). Hong et al (10) found that out of 3,227 Korean participants ranging from primary school to university age, 49.7% of males and 51.2% of females surveyed had a distorted body image. Interestingly, the highest prevalence (55.3%) of distorted body image was in females aged 10-12 years (10). However, this study was only from a few specific schools in Korea so the relevance of these findings may be limited to this location.

Swami et al (23) examined body image and perceived body weight ideals in 7437 participants of varying ages from colleges and communities across ten different geographic regions, covering parts of USA, Europe, Asia and Africa. Interestingly, they found it was in the higher socio-economic status (SES) areas there was higher levels of body dissatisfaction. Also, there was higher body satisfaction in rural areas

compared to urban areas, which Swami et al (23) suggested could be related to the degree of Westernisation the location had been exposed to. Scheider et al (28) found a similar relationship between body satisfaction and SES; in that low SES was significantly related to reported higher body dissatisfaction. However, this was in a relatively small sample of 144 girls aged 14-17 years old.

There is limited research on figure dissatisfaction and dissatisfaction towards specific body parts in adolescents. The research that has been done has been on body dissatisfaction in general or has mainly focused on the desire to be slim in females, which again highlights the need for more research in males. However, most of the research seems consistent; female adolescents desire to be thinner than they are, while males are happy or would like more muscle than they currently have (5) (9). Lokken et al (29) found that out of 60 undergraduate age participants, females showed greater body dissatisfaction in comparison to males. Similarity in 454 students, females desired a thinner body than how they perceived their current body, while males generally accepted their body shape/size. They also found a positive linear relationship between age and body dissatisfaction among females, but not males (30). Mellor et al (31) reported that Malaysian and Australian high school students were dissatisfied with their face when it came to specific body area dissatisfaction. One common trend again found by Tigemann et al (32), is the difference in body size satisfaction between sexes, with girls reporting more body dissatisfaction than boys. The 14-15 year old adolescent female participants, like the adult female participants above, reported significant body dissatisfaction, unlike the

male participants. These findings show the differences between sexes in perceptual and affective body image.

2.3 Concern about eating and weight

The majority of the literature on the relationship between concerns about eating and weight and BMI have consistent findings. In general, a higher BMI is related to negative body image (5). Overweight and obese adolescent females have been shown to have more body image concerns than average weight adolescent females (33). In a 2015 article, Voelker et al (5) found that studies consistently reporting a higher BMI were linked to increased concerns about weight in adolescents. In a sample of 846 adolescents 50% of the female participants felt that they were too fat, and wanted to lose weight (34). Overweight, normal weight and underweight adolescents have also been found to have low body image as well. Pich et al found that out of 1961 adolescents between 12-17 years, 57% of the normal weight females reported monitoring their weight, and had tried to become slimmer (9). These results show that it may be body image, not body size, that is associated with reported behaviours to change their weight, in an effort to become slimmer.

Additionally, these results show an aspect of perceptual body image, in that over half of normal weight females were concerned enough about their weight to attempt to become slimmer, when in fact they were not overweight in the first place.

There are also ethnic differences in weight concerns and weight perceptions.

Wardle et al (35) found that from 18,512 university students, males and females

from Asian countries had the highest levels of trying to lose weight across all weight deciles. Women from Mediterranean countries reported feeling less overweight, and the least concerned. Contrary to Wardle et al's expectations, American and UK participants expressed only moderate levels of concern about weight, while Asian participants expressed high levels. This shows that perceptual body image can differ across geographical areas and between individual's ethnicities. Ethnic differences can occur due to different perceptions of and values placed on weight between ethnicities.

2.4 Fear of weight gain

The fear of weight gain is a component of cognitive body image, as negative impacts on body image can lead to fears and a preoccupation with weight. Having a fear of becoming obese has found to be related to malnutrition, resulting in short stature and/or delayed puberty in 14 out of 201 adolescents surveyed (36). Pugliese et al (37) hypothesized that being told the 'horrors' and consequences of obesity, plus an adolescents' susceptible personality, may have lead to this fear. Even underweight adolescent girls have been shown to be fearful of becoming obese. However, these studies were conducted in the 1980s and the rate of obesity and awareness of the consequences of obesity have only increased since then, so these associations need to be reexamined.

A fear of being fat has been documented in children as young as eight years (22). Shapiro et al (22) found in a study of 239 8-10 year olds from the USA that 78% of

boys and 75% of girls agreed with the statement that 'it is bad to be fat', and the majority of participants expressed concern about gaining weight. Shapiro et al (22) expressed concern about the reported results, due to the young age of these participants and the risk for malnutrition and developing more extreme diet measures if children of this age were dieting. In college age adolescents the fear of being fat drove dieting behaviours rather than the desire to be thin (38).

2.5 Dietary restraint

Dietary restraint is when food intake is intentionally restricted or limited for the purpose of losing weight (39). Internal hunger and satiety cues can also be ignored (40). Dietary restraint is therefore a dieting behaviour, and can be considered to be a behavioural component of body image. There have been various tools used to measure dietary restraint, with the majority of research on dietary restraint has been in the adult population. The Restraint Scale (RS) was one of the first to be developed. However, it has some limitations (41), which prompted the need for other scales to be developed, such as the Dutch Eating Behaviour Questionnaire (DEBQ) (42) and the Three Factor Eating Questionnaire (TFEQ) (43).

Whether dietary restraint is a desirable trait to have or is helpful in terms of weight loss is debatable, especially in younger age groups. Gallant et al found that dietary restraint is a trait that is more likely to present in overweight adolescents, along with rigid dietary control when using the TFEQ in 60 adolescents (44). Braet et al found that in a study of 1016 adolescents, using the DEBQ, all overweight

participants displayed a degree of dietary restraint (45). The Restraint Theory agrees with these findings, saying that being on a diet and ignoring physiological internal cues is impossible to maintain in the long run (40). Extreme measures of dietary restraint have been linked to development of eating disorders in adolescents (33).

Additionally, some studies have shown adverse physical and behavioural consequences of dietary restraint behaviour. In a study of 1490 Canadian high school students, higher restrained dietary behaviour was linked to having a higher BMI and adiposity, compared with those students not showing restrained dietary behaviour (13). Goldfield et al (13) also highlight the possible mechanism behind these longitudinal study results, namely that dieting is not a sustainable solution in the long term for weight loss.

The DEBQ was used by Snoek et al (46) to investigate the relationship between eating behaviours and BMI trajectories in adolescents from 328 families. They found that those with high restrained eating scores on the DEBQ were more likely to follow the higher BMI trajectories. However, they importantly also point out that this does not justify the theory that restrained eating causes a higher BMI, and suggest the relationship could be the other way around.

Conversely, dietary restraint has been shown to be helpful in prevention of weight gain without adverse consequences in adults. In a review on dietary restraint and

self regulation in eating, Johnson et al (47) report that across studies on dietary restraint, positive, negative and null associations have been found between BMI and restraint. Interestingly, they report in normal weight groups, restraint has a positive association with BMI, but in some obese populations a negative association. Which raises the point that some amount of restraint or regulation may be needed for weight control, and that dietary restraint in normal weight populations could mask for overeating practices. Johnson et al also argue that clinical studies using a restrained approach, rather than an 'undieting' approach show better results in weight loss. However, these results have mostly been shown in adult populations, not in younger adolescent participants.

In a broader sense, dietary restraint can be a behaviour that is associated with the general behavior of dieting and a behavioural aspect of body image (7). Whether dieting in adolescence is successful in the long term is questionable. In a follow up after three years, the adolescents that reported dieting gained more weight than the non-dieters (48). Field et al (48) came to the conclusion that dieting in adolescents, unless medically supervised, may be ineffective. Neumark-Sztainer et al (12) found similar results in a 10 year longitudinal study, that dieting not only was ineffective, but promoted weight gain. Females who were dieting or practising weight control behaviours at baseline had a BMI increase of 4.63 units at follow-up three years later, in comparison to those who were not dieting.

2.6 Diet quality and physical activity

Diet quality and participation in physical activity are related to many aspects of health. The reasons why people choose to eat healthily or participate in physical activity may also be behavioural aspects of body image. For example, people may eat lots of fruit and vegetables or exercise regularly in order to look good. Evidence is lacking on the relationship between dietary intake and physical activity and body image. Backman et al found that in 780 adolescents, those who had positive attitudes towards healthy eating believed it would help them to feel good about themselves and lose or maintain weight (49). From Project EAT, it was found that unhealthy weight control methods were associated with a poorer nutrient intake in comparison to those not controlling their weight, or using healthy weight control methods (50). From Project EAT II, lower body satisfaction predicted lower levels of physical activity, even when controlling for BMI. Interestingly, before controlling for BMI, fruit and vegetable intake was associated with lower body satisfaction as well. (8). Data from a systematic review of 137, 593 children and adolescents showed that overweight and obesity were not associated with soft drink or fruit and vegetable intake (51). In another systematic review of 15 papers on physical activity and obesity, it was found that there were many individual barriers that prevented overweight and obese adolescents from participating in physical activity, and negative body image was one of these (14).

2.7 Questionnaires

There are various questionnaires and methods that can be used to measure body image, weight and diet. Common questionnaires that have been used in literature are the Dutch Eating Behaviour Questionnaire (DEBQ), which measures external eating, emotional eating and restrained eating (52). Also, the Three Factor Eating Questionnaire TFEQ which measures behavioural and cognitive components of eating (53). However, these questionnaires are not specifically designed for an adolescent population. There was a need for a reliable questionnaire for use in New Zealand adolescents, which prompted the development and reliability testing of the New Zealand Eating Behaviour and Weight Problems Inventory (NZ-EWI) (unpublished). The NZ-EWI was based on Eating Behaviour and Weight Problems Inventory for Children (54). The EWI questions, and the 11 subscales adapted for use in OSSLS2 were: hunger level and susceptibility to food cues, importance and impact of eating on sense of well-being, eating as a means of coping with emotional stress, concern about eating and weight, dietary restraint, attitude toward healthful nutrition, attitude toward the obese, pressures to eat from parents, fear of weight gain and figure dissatisfaction.

2.8 New Zealand research

To our knowledge, there is limited research on body image and dieting in adolescents in New Zealand. In Christchurch, New Zealand 363 adolescent females were surveyed on disordered eating habits and figure ideals. Seventy one percent of the females reported wanting to be thinner than they are, and 54% reported having

been on a diet before. Similar to other studies, a higher BMI was associated with greater disordered eating attitudes (18). Miller et al, in a study of 181 Otago University adolescents found that females experienced body dissatisfaction typical of Western culture, yet males did not. However, this study was focused on media consumption and internalisation of thin ideals (17). McCabe et al, as part of the Pacific Obesity Prevention in Communities, looked at body image messages being received in 748 Fijian, Tongan, Tongan New Zealanders and European Australian adolescents. Similar to other studies, they found that socio-cultural factors influenced perceptions such as parents, the media, peers and religious groups in the participant's respective countries. Interestingly, they also found that these influences were linked to the food consumption and exercise involvement (16).

As previous research shows that more than one aspect of body image is related to BMI and that the role of body image on diet quality and physical activity levels is less clear, particularly in New Zealand adolescents, it is important that these associations are investigated.

3. Objective Statement

The aims of this present study are to;

(a) determine the prevalence of body image concerns in Otago adolescents.

Specific body image factors to be investigated are concern about eating and weight, fear of weight gain, figure dissatisfaction and dietary restraint.

(b) Investigate associations between body image and BMI, sex, diet quality and activity.

4. Subjects and Methods

This methods section has been adapted from previously published work (55), (56), (57).

4.1 Otago School Students Lifestyle Survey Two

Data analysed for this thesis was collected as a part of the Otago School Students Lifestyle Survey Two (OSSLS2). OSSLS2 was a cross sectional survey carried out between February - June 2011. The survey included questions on food choice, psychosocial correlates of diet, eating behaviours and body composition. The sample was recruited from Dunedin secondary schools, and included 15 to 18 year olds. Six schools out of a total of 24 were excluded, due to a less than forty students in combined school Years 11 to 13. Eleven schools out of the 18 were eligible to participate. Classes were randomly selected from Years 11 to 13, with one class from each school year in smaller schools and up to four classes per Year in larger schools being invited to participate. Nine hundred and thirty three students were eligible, and from these 788 were available on the survey day at the school, and 730 took part in the survey. The final number of participants made up a quarter of all year 11 to 13 students in the Otago region.

An information pack on participating in the OSSLS2 was given to students and parents the week before the survey. Parents had the option to complete an opt-out form, which meant their child did not have to participate in the study. Participants also had to provide written consent if they wanted to participate, and were made aware they could withdraw from the study at any time even after signing the

consent form. The study was approved by the University of Otago Human Ethics Committee.

4.2 Questionnaire

For OSSLS2, the questionnaire was based on a modified version of the Eating Weight Inventory (EWI) questions (54) and adapted Health Behaviour in School-aged Children questionnaire (HSBC) questions (58). The EWI was specifically designed for adolescent participants, and has been validated (unpublished data). The Food, Feelings, Body Image and Behaviour Questionnaire (FFBBQ) was developed for the Otago Secondary Schools Lifestyle Survey Two (OSSLS2). Within the FFBBQ, there are four constructs that measure particular aspects of body image and related concepts. It is beyond the scope of this thesis to look at all 11 subscales of the OSSLS2, therefore, this thesis will focus on the following four subscales: concern about eating and weight; fear of weight gain; dietary restraint; and figure dissatisfaction which made up the FFBBQ (Appendix A). These were chosen because they have all previously been linked to aspects of body image, and all fit under one or more of the four aspects of body image (7).

The questionnaire was completed online at each participating school's computer lab using an online program, Limesurvey. The students self-reported their residential address, date of birth, age, gender and ethnicity. The first section contained 60 questions, and included questions from the validated NZ-EWI (54). The second section contained 6 questions adapted from the HBSC (58). The questionnaire used

had been pretested and validated in a group of Otago adolescents (59). The language of the questionnaire was modified for New Zealand adolescents.

4.3 Demographics

Ethnicity was self reported using the New Zealand census questions (60). Ethnicity was prioritised into Maori, Pacific, or New Zealand European or Other (NZE0) which included Asian, European and any other ethnic group which had a too small population for separate analysis.

Socio-economic status (SES) was derived using the New Zealand Deprivation Index Score (NZDep06) which was determined from the participants self reported residential address. NZDep06 comprises 9 variables including income, owning a house and access to a car. (61). NZDep06 has a scale of 1 to 10, however this has been collapsed into three categories. Low SES (high deprivation: NZDep06 score of 8-10); medium SES (NZDep06 score of 4-7); and high SES (low deprivation: NZDep06 score of 1-3). School decile rating is a proxy socio-economic indicator based on the students' families' socio-economic status. (62) School decile was categorised into Medium (4-8), and High (9 & 10). No participating school was from a low (1-4) decile school.

4.4 Diet quality assessment (DQI)

A food frequency questionnaire (FFQ) was used to assess food consumption. The FFQ used, New Zealand Adolescent FFQ was adapted from the Health Behaviour in School-aged Children FFQ (58). The FFQ had been pretested through group interviews with students of a similar age (59). Survey participants were asked 'On average, how many times a week do you usually eat or drink any of the following foods?' for a range of food items including: 'fruit', 'vegetables', 'sweets', 'chocolate confectionary', 'standard milk', 'other milk', 'cheese', 'breakfast cereals', 'white bread', 'brown/wholegrain bread', 'potato crisps', 'hot chips/fries', 'artificially sweetened soft drink', 'regular soft drink', 'energy drinks', 'sports drink', 'fruit juice/fruit drink', and 'alcohol'. Regular soft drink energy drinks and sports drinks were collapsed into one category for analyses (called sugar-sweetened soft drinks). These items were then combined into a score by categorizing into frequency of servings per day and assigning values to each category according to the recommendations for five major food groups as depicted in the New Zealand Food and Nutrition Guidelines for Healthy Adolescents (63) (Appendix B). These values were then totaled, giving a score that assesses overall diet quality from a range of 0 to 100 (64).

4.5 Physical activity

Participants were asked "Are you involved in any sport or do you belong to any sport team?" and "how many hours per week do you spend in sport in school or sport out of school" with the response options as follows: "<1 hour per week", "1-2

hours per week” “3-5” hours per week, or “6 or more hours per week”. Afterwards, due to the small number of participants a category was created of “up to hours per week” comprising of the “<1 hour per week” and “1-2 hours per week”. These were questions from the New Zealand Youth 2007 Survey (65). The threshold value of at least 60 minutes of moderate to vigorous physical activity was used to identify participants meeting the physical activity guidelines. If the participants did not play sport, they were asked what possible barriers were preventing them from doing so.

4.6 Measurements

Height (cm) was measured twice to the nearest mm using a calibrated portable stadiometer (University of Otago), and the average of these measurements calculated. If the two measurements were greater than 5 mm apart a third measure was taken and the average of the two closest readings were used. Participants were asked to remove their shoes for the height measurement.

Weight was measured using a calibrated segmental Bio-electrical Impedance Analysis (BIA) machine (BC-418, Tanita Corporation, Japan). The age and sex of the participant being measured was entered into the BIA machine. Socks and shoes were removed for the BIA machine. Measurements were taken in a private room or area and were carried out by trained research assistants.

4.7 Body-Mass Index (BMI)

BMI was calculated as weight (in kilograms) divided by height squared (in metres). BMI z-scores were calculated using the 2007 WHO method so that age and sex were accounted for (66). WHO categorization of BMI was also used: underweight (z-score <-2, n=6), normal weight (n=491), overweight (z-score >1, n=133) and obese (z-score >2, n=51). Those with a low BMI for age (underweight) were combined with the normal weight category for data analysis because of the small amount of participants in that weight category.

4.8 Statistical Analysis

The FFBBQ subscale scores were calculated by adding up the scored responses to the questions in each individual subscale divided by the number of questions in the specific subscale, then multiplied by 10. If participants were missing more than 25% of a subscale then a score for that scale was not calculated for them and was instead coded as missing. If participants were missing items within a scale, but still less than 25% missing, then the missing items were imputed as the mean of the remaining items in that scale. A higher score indicated higher dysfunction. The mean and SD were calculated for each of the four subscales in the FFBBQ. Cronbach's alpha assessed internal reliability of the subscales and correlation coefficients were calculated to determine any correlation between the subscales in the FFBBQ.

Differences between gender and weight status for each of the subscales were determined using mixed regression models, with school as a random effect and age

as a covariate. To investigate if the relationship between the subscale scores and weight status was different by gender, an interaction term between gender and weight status was included in the model and if it was significant ($p < 0.05$) then results were stratified by gender.

If participants had a mean score above 30 for the questions in a subscale, then they were categorised as concerned about their eating and weight, practising dietary restraint, feared weight gain, or dissatisfied with their figure. This categorization was based on the response scale for each question, which were 'always', 'sometimes', 'hardly ever' or 'never,' or similar responses depending on the question (Appendix A). Prevalence of these behaviours and 95% confidence intervals were then calculated by gender.

Predictors of subscales were found using mixed regression models, where BMI-z score sex, age, DQI, and meeting physical activity guidelines (compared to not) were entered in the model. Regression coefficients, 95% confidence intervals and p-values were calculated for each subscale. After adjusting for weight and gender, logistic regression was carried out to determine any associations between subscales and attitudes towards health eating and physical activity, with a sandwich estimator for school clusters. Prevalence of dissatisfaction with specific body parts were stratified by the 5 possible answers for each question (Appendix A), and stratified by gender.

Statistical analyses was undertaken using STATA software version 14.1(StataCorp, College Station, Texas).

5. Results

Table 1. Demographic characteristics of participants in the OSSLS2

	n	(%)
All	681	
Age (years)*	16.3	0.9
Gender		
<i>Male</i>	297	44
<i>Female</i>	384	56
Ethnicity		
<i>NZ European</i>	511	75
<i>Maori</i>	59	9
<i>Pacific islander</i>	10	1
<i>Asian</i>	48	7
<i>Other</i>	53	8
Socio-economic status (n=664)		
<i>High</i>	350	53
<i>Medium</i>	218	33
<i>Low</i>	96	14
School decile		
<i>High</i>	277	61
<i>Middle</i>	413	39
Weight (kg)*	66.1	12.8
Height (cm) *	170.9	8.8
BMI*	22.6	3.6

n = mean and % = standard deviation

The final number of participants was 681, and just over half were female. The majority of the participants were NZ European and of high socio-economic status (SES). While most participants were of normal weight, 23.6% of females and 16.4% of males were overweight, and 4.7% of females and 9.6% of males were obese. There was a significant difference in weight category distribution between males and females ($P = 0.007$) (*data not shown*).

Table 2. Pairwise correlation between FFBBQ subscales

	Concern about eating and weight	Dietary restraint	Fear of weight gain
Dietary restraint	0.86*		
Fear of weight gain	0.86*	0.86*	
Figure dissatisfaction	0.59*	0.49*	0.60*

*P value = <0.001

The correlation coefficients (0.86) between the subscales of dietary restraint, concern about eating and weight and fear of weight gain show strong correlations between these subscales. There was also a moderate correlation between figure dissatisfaction and concern about eating and weight, dietary restraint, and fear of weight gain (Table 2). These correlations indicate the practices of having concerns about weight, dietary restraint, fear of weight gain and figure dissatisfaction are interrelated concepts, meaning many of the participants who scored higher responses to the questions in one subscale, would also be more likely to score high in the other three subscales.

Table 3. Mean (SD) for FFBBQ subscale scores by gender and internal consistency of subscales

	n	Mean	SD	P value *	Cronbach's alpha
Concern about eating and weight	591	22.2	8.1		0.90
<i>Female</i>	251	25.2	7.7		
<i>Male</i>	340	20.0	7.8	<0.001	
Dietary restraint	591	22.5	8.3		0.92
<i>Female</i>	251	25.5	8.1		
<i>Male</i>	340	20.4	7.7	<0.001	
Fear of weight gain	593	23.7	10.1		0.89
<i>Female</i>	251	28.6	9.6		
<i>Male</i>	342	20.1	8.9	<0.001	
Figure dissatisfaction	577	27.2	4.7		0.87
<i>Female</i>	246	29.7	4.4		
<i>Male</i>	331	25.3	4.1	<0.001	

*between genders, adjusted for school

Participants with higher scores for each subscale indicates the participants had more concerns about their weight, practiced more dietary restraint, were more afraid of weight gain and were more dissatisfied with their figure, compared to those with a lower score. The highest mean score, 27.2 in both males and females, was in the subscale 'figure dissatisfaction', which was significantly higher in females (Table 3). The lowest mean score of 22.2 was for 'concerns about eating and weight', and was significantly lower for males, with a mean score of 20, compared to 25 for females. Significant differences were seen between genders in each of the four subscales (all $P < 0.001$), with females scoring higher in comparison to males. (Table 3).

Cronbach’s alpha values of the four subscales ranged from 0.87 (figure dissatisfaction) to 0.92 (dietary restraint). These Cronbach’s alpha values show that all four subscales have a relatively high internal consistency (Table 3), meaning that the questions in each in subscale are strongly correlated with each other, exhibit ‘uni-dimensionality’ and are therefore likely to be measuring the same construct.

Table 4. Mean (SD) of subscales stratified by weight status

	Normal weight n= 497	Overweight n= 133	Obese n= 51
Concern about eating & weight	21 (8)	27 (7)*	27 (5)*
Dietary restraint	22 (8)	25 (7)*	25 (7)*
Fear of weight gain	22 (10)	28 (10)*	26 (9)*
Figure dissatisfaction	26 (4)	30 (4)*	30 (5)*

For every subscale, the mean score is higher in overweight and obese adolescent participants, compared to normal weight ($p < 0.001$). This indicates that overweight and obese participants had more concerns about their weight, practiced more dietary restraint, were more afraid of weight gain and were more dissatisfied with their figure (Table 4). The associations between weight status and subscales scores were not moderated by sex (all $p > 0.05$), meaning that, while mean subscale scores were higher in females, the relationship between weight status and subscale score was not different between males and females. The highest mean score was seen in obese females for the ‘figure dissatisfaction’ subscale, and the lowest was seen in normal weight males for the subscale ‘concern about eating and weight’ (Table 4).

Table 5. Prevalence of FFBBQ scores by gender

	Male			Female		
	n	Prevalence	95% CI	n	Prevalence	95% CI
Concern about eating and weight	340	8%	(5%, 11%)	251	29%	(23%, 35%)
Dietary restraint	340	7%	(5%, 11%)	251	29%	(24%, 35%)
Fear of weight gain	342	10%	(7%, 13%)	251	43%	(36%, 49%)
Figure dissatisfaction	331	11%	(7%, 14%)	246	48%	(41%, 54%)

Nearly half of females were dissatisfied with their figure, and 43% feared gaining weight (Table 5). Nearly a third of females also had concern about eating and weight, or practised dietary restraint. There was as high as a 37% difference between genders in figure dissatisfaction. (Table 5).

Table 6. Prevalence of dissatisfaction with specific parts of the body by gender

	Female		Male	
	n	percentage	n	percentage
Do you think your body is				
<i>Too thin</i>	12	5%	73	22%
<i>Just right</i>	100	41%	187	56%
<i>Too fat</i>	134	54%	74	22%
Do you think your hips are				
<i>Too narrow</i>	16	7%	40	12%
<i>Just right</i>	116	47%	245	74%
<i>Too wide</i>	114	46%	46	14%
Do you think your stomach is				
<i>Too small</i>	4	2%	40	12%
<i>About right</i>	91	37%	215	65%
<i>Too big</i>	151	61%	76	23%
Do you think your bottom is				
<i>Too small</i>	18	7%	26	8%
<i>About right</i>	115	47%	248	75%
<i>Too big</i>	113	46%	57	17%
Do you think your thighs are				
<i>Too small</i>	2	1%	49	15%
<i>About right</i>	73	30%	227	67%
<i>Too big</i>	171	70%	55	17%
I would like to have broader shoulders				
<i>Yes</i>	15	6%	199	60%
<i>No</i>	231	94%	137	41%
I would like to have bigger muscles				
<i>Yes</i>	110	45%	259	77%
<i>No</i>	136	55%	77	23%
I would like to be heavier				
<i>Yes</i>	14	6%	147	44%
<i>No</i>	232	94%	189	56%
I would like to be taller				
<i>Yes</i>	145	59%	217	65%
<i>No</i>	101	41%	119	35%

The majority of males felt their body parts were just right (56%-75%), or they wanted to have bigger muscles (77%) and be taller (65%) (Table 6). The majority of females did not want to be bigger, in fact felt that they were too fat (54%) and their specific body parts were either too big or just right (Table 6). The specific body parts that the most females felt were too fat were their thighs (70%), followed by their stomach (61%). A greater proportion of females felt that their hips, stomach, bottom, and thighs were too big in comparison to males. More than half of participants from both genders desired to be taller (Table 6).

Table 7. Demographic, dietary, and physical activity predictors of body image and dieting subscales

	Regression coefficient (95% CI)	p-value
Concerns about eating & weight		
BMI z-score	3.2 (2.7, 3.8)	<0.001
Sex (male compared to female)	-4.8 (-5.9, -3.6)	<0.001
Age (years)	-0.4 (-1.0, 0.3)	0.260
DQI score	0.0 (-0.05, 0.02)	0.503
Meeting Physical Activity Guidelines (compared to not)	-1.4 (-2.8, -0.1)	0.038
Dietary restraint		
BMI z-score	2.3 (1.7, 2.9)	<0.001
Sex (male compared to female)	-4.6 (-6.0, -3.2)	<0.001
Age (years)	-0.0	0.887
DQI score	0.0 (-0.0, 0.1)	0.259
Meeting Physical Activity Guidelines (compared to not)	-0.85 (-2.3, 0.6)	0.255
Fear of weight gain		
BMI z-score	2.9 (2.2, 3.6)	<0.001
Sex (male compared to female)	-7.9 (-9.5, -6.3)	<0.001
Age (years)	-0.2 (-0.95, 0.6)	0.675
DQI score	0.0 (-0.1, 0.0)	0.391
Meeting Physical Activity Guidelines (compared to not)	-1.6 (-3.2, 0.1)	0.070
Figure dissatisfaction		
BMI z-score	2.0 (1.7, 2.3)	<0.001
Sex (male compared to female)	-4.1 (-4.7, -3.5)	<0.001
Age (years)	-0.2 (-0.5, 0.1)	0.220
DQI score	0.0 (0.0, 0.0)	0.364
Meeting Physical Activity Guidelines (compared to not)	-0.9 (-1.6, -0.2)	0.013

A significant association can be seen between all four subscales and BMI z-score. As BMI z-score increases, so does the score for the subscale. For every 1 point BMI z-score increases, the concern about eating and weight score was on average 3.2 points higher, which is the strongest association compared to the other three subscales, although they were all significantly positive. Adjusted for all other predictors, the largest difference between genders was seen for fear of weight gain, where males scored on average 7.9 points lower than females (Table 7).

Those who were meeting the Physical Activity Guidelines had significantly lower figure dissatisfaction and concern about eating and weight scores than those who were not meeting the guidelines. Those who reported 60 minutes or more daily physical activity scored on average 0.9 less on the figure dissatisfaction subscale than those who reported less than 60 minutes of daily activity ($p=0.013$) and 1.4 lower for concern about eating and weight ($p=0.038$) (Table 7). There was no significance between any of the subscales and age and DQI score.

Table 8. Associations between FFBBQ subscales^a and attitudes to healthy eating

	n (%) [*]	Odds ratio (95% CI)	p-value
Concern about eating & weight			
I like the taste of healthy food	60 (9)	1.26 (0.41, 3.84)	0.684
I will stay in good health	20 (3)	1.82 (0.73, 4.54)	0.198
I will have an attractive body	87 (13)	0.62 (0.20, 1.90)	0.405
Dietary restraint			
I like the taste of healthy food	60 (9)	0.96 (0.26, 3.56)	0.957
I will stay in good health	20 (3)	0.35 (0.07, 1.84)	0.216
I will have an attractive body	87 (13)	0.71 (0.28, 1.79)	0.464
Fear of weight gain			
I like the taste of healthy food	60 (9)	1.36 (0.51, 3.63)	0.536
I will stay in good health	20 (3)	1.20 (0.55, 2.60)	0.644
I will have an attractive body	87 (13)	0.84 (0.46, 1.56)	0.588
Figure dissatisfaction			
I like the taste of healthy food	60 (9)	1.07 (0.39, 2.95)	0.898
I will stay in good health	20 (3)	1.25 (0.49, 3.17)	0.636
I will have an attractive body	87 (13)	1.40 (0.95, 2.06)	0.088

^a Subscales into yes/no as for Table X (above)

^{*} Participants who answered 'yes' to the corresponding question

Those that were concerned about eating and weight, practised dietary restraint, feared weight gain, or were dissatisfied with their figure were no more or less likely to eat healthily because they liked the taste of healthy food, to stay in good health, or to have an attractive body (Table 8).

Table 9. Associations between FFBBQ subscales and attitudes to physical activity

	n (%)*	Odds ratio (95% CI)	p-value
Concern about eating & weight			
I'm good at it	381 (73)	0.91 (0.62, 1.32)	0.609
It is good for my health	474 (91)	1.13 (0.45, 2.86)	0.796
To look good & have a good body	386 (74)	3.71 (2.22, 6.18)	<0.001
Dietary restraint			
I'm good at it	381 (73)	1.28 (0.82, 2.00)	0.284
It is good for my health	474 (91)	3.14 (1.20, 8.18)	0.019
To look good & have a good body	386 (74)	2.74 (1.32, 5.71)	0.007
Fear of weight gain			
I'm good at it	381 (73)	0.84 (0.57, 1.23)	0.361
It is good for my health	474 (91)	2.47 (0.82, 7.39)	0.106
To look good & have a good body	386 (74)	2.42 (1.82, 3.23)	<0.001
Figure dissatisfaction			
I'm good at it	381 (73)	0.37 (0.26, 0.50)	<0.001
It is good for my health	474 (91)	1.14 (0.44, 2.99)	0.786
To look good & have a good body	386 (74)	1.18 (0.74, 1.90)	0.491

* Participants who answered 'yes' to the corresponding question

Those that were concerned about eating and weight, were practising dietary restraint, or were afraid of weight gain were more likely to be physically active because they believe it will help them to look good and have a good body (Table 9). There was a significant association between the adolescents who practiced dietary restraint and participated in physical activity because it is good for their health. Those that were dissatisfied with their figure were less likely to participate in physical activity, believing that they were not good at it (Table 9).

6. Discussion

To our knowledge, this is the first study to assess constructs covering all four aspects of body image in New Zealand adolescents. There is also limited research worldwide on how adolescents feel about specific areas of their body. This study shows that New Zealand females, and overweight and obese adolescents had more concerns about their weight, practised more dietary restraint, were more afraid of weight gain and were more dissatisfied with their figure than males and normal weight adolescents, respectively.

The results indicate that 54% of female adolescents felt their body was too fat, while only 28% of the females surveyed were actually classified as overweight or obese. However, while 26% of the males surveyed were overweight or obese, only 22% of males felt their body was too fat. Significant differences were seen between males and females for all four subscales in the FFBBQ, with females scoring higher on average. These results are similar to other studies, in that females have a high level of concern with their weight and figure (9) (23) (28) (35) (67).

Males and females were concerned about different body areas, with males tending to be more concerned about muscularity and females about specific areas of the body, such as their stomach and thighs. The high prevalence of males reporting a desire to have bigger muscles (77%) could also reflect the age of the adolescents, as

some of the males could still be in stages of development (68). It has previously been found that males with a low BMI desire a more muscular body (69) (70), and this sample had 74% of male participants of a normal or underweight BMI. More males expressed a desire to be taller, but there were still females who desired this too. This could be related to the age of the group surveyed, as adolescence is the fastest stage of growth second to infancy (68). Previous research shows similar results, with males being concerned about muscle mass (26). This could be related back to the western societal 'ideal' female and male body, with females generally preferring a slimmer body, and males more muscular (16) (23) (70). It is important to note that throughout decades, in Western society the ideal female body shape has changed, from a more curvier figure, to skinny and slim, and now 'curvy' bodies are making a comeback (71). These results highlight affective and cognitive aspects of body image.

When stratified by weight status, the overweight and obese adolescents showed significantly more concern in all FFBBQ questions compared to their normal weight peers. This relationship did not differ between genders. These results are consistent with other literature, that overweight or obese individuals have low body image, and are concerned about their weight (4) (5) (27) (67). However, concern around eating and weight is not limited to the overweight and obese and this is of particular concern. Previous literature has also found similar trends, with over 50% of normal weight adolescents girls reported to have tried to lose weight (9). Trying to lose

weight is an aspect of behavioural body image, which could stem from affective body image from being concerned about one's weight.

Overweight and obese individuals also practised more dietary restraint compared to the normal weight group. This is a relatively consistent finding in other studies (13) (45) (46) (72). However, this relationship cannot determine that dietary restraint causes a higher BMI, as it has been suggested that dietary restraint is used in response to weight gain (47). From longitudinal data, Snoek et al (73) found that BMI predicted restrained eating behaviour more consistently than the opposite way around, concluding dietary restraint did not seem to be a successful weight loss method in adolescents. Restrained eating has also been linked to disinhibited eating styles and disordered eating (13) so the 7% of males and 29% of female adolescents reporting this behaviour is of concern. These reported dietary restraint behaviours show the behavioural aspect of body image. Eating style, dieting and restrained eating are multi dimensional issues and could be influenced by varying factors (7) such as culture, media, peer pressure, and parental influence that are not covered in this study.

Dieting, which could be said to include restrained eating behaviours, is often found not to be a healthy, sustainable behaviour in adolescents (74). Additionally, negative health consequences of dieting have been reported in the literature in adolescents. Project EAT found that dieting predicted weight gain in adolescents in both normal and overweight participants (12). With 29% of females and 7% of males reporting

practising dietary restraint from the FFBBQ and with most of the literature showing negative health consequences of this behaviour, this result is of concern.

Interestingly, there was no association between diet quality and any of the subscales in the FFBBQ. The DQI may not be sensitive enough to show any significant differences because it is frequency based so it is only showing a picture of what the adolescents are eating, but not portions or eating style. This would therefore not necessarily pick up on any strict dieters or dietary restraint patterns.

Although there was no correlation between the subscales and attitudes towards healthy eating, there was an association between some subscales and attitudes towards physical activity. Those who were physically active scored lower on figure dissatisfaction and concern about eating and weight scores. Interestingly, when looking at reasons why adolescents were physically active, there was a strong correlation between being more physically active and relating activity to helping them look good and having a good body. This was for the subscales concern about eating and weight, fear of weight gain and dietary restraint. There was also a significant association between those who practised dietary restraint and participating in physical activity because they believe it is good for their health. From these results, it seems that the adolescents were more likely to be physically active, believing it will give them external results, such as having a “good looking” body. These results show the impact that behavioural body image can have on lifestyle.

This study used cross sectional data, and so therefore we can only look at associations not directions of relationships. The Otago population may not fully represent an adolescent population typical of the whole of New Zealand, with less obese children than the national average and there were no low SES participants (2). Additionally, only 9% identified themselves as Maori, and 1% as Pacific Islander, which is lower than the NZ average (75). However, 75% identified themselves as NZ European, which is similar to the national average so these results still applicable to the majority of the New Zealand adolescent population. Previous research has shown some ethnic differences in body image studies, however not particularly in New Zealand. Australian European female adolescents were found to have had lower body dissatisfaction than Fijian female adolescents (16). Wardle et al found that those from Asian decent were more likely to be trying to lose weight, in comparison with adolescents from 22 countries (35).

Because of the small number of underweight participants, these were grouped in with the normal weight participants. This means we could not determine if there was any significant relationship between the subscales in the FFBBQ specifically in underweight adolescents, which could have been of particular interest.

Advantages of this study were that the questions used in the FFBBQ survey had been pre-tested in a similar population, had been adapted for adolescents and showed good predicted validity (unpublished). The FFBBQ also had relatively high

Cronbach's alpha values, showing that the questionnaire was a reliable measure to be used. The survey also included questions on specific body parts, which there is limited research on in the adolescent population.

Conclusion

In conclusion, significant relationships were found between food, feelings, behaviours and adolescents' bodies in relation to their weight and sex. Our results show the importance of considering all aspects (perceptual, affective, behavioural and cognitive) of an adolescent's body image as an importance factor that could influence their overall health, body composition and dieting status.

Implications for further research

It would be of interest for similar research to be carried out in a different area of New Zealand with different ethnic populations and a larger sample size.

With a larger population size, gaining more underweight participants could be of interest so they could be looked at as their own weight category instead of being group together with normal weight participants. Additionally, as the negative health consequences of the behaviours covered in the FFBBQ, it could be of interested for more research to be carried out on how body image impacts on adolescent's mental and physical health, aside from weight.

7. Application to Practice

With both body image issues and obesity on the rise (2) (7), and the association found between the two, these results should be of interest to the dietetic profession. The high prevalence of concern about eating and weight in this sample of adolescents shows that it is not an uncommon concern, and dietitians should be mindful of any concerns raised by a patient about their weight. As highlighted in the literature review, these concerns can have negative health impacts.

It is important to note that from this study and previous literature, dietary restraint in general has shown negative health impacts on adolescents such as disordered eating (13). Therefore, it is an important issue that needs to be considered when considering talking about dieting in adolescents. Efforts need to be made to ensure that preventative interventions and programs focus on positive healthy behaviours, rather than a focus solely on weight loss and physical appearance.

A recent systematic review (76) has shown promising results in the non-dieting approach, with participants in such programs showing significant improvements in disordered eating, self-esteem and depression. Although no significant amounts of weight was lost overall, the psychological benefits of this approach and the ineffectiveness of promoting dieting in adolescents (12) shows that more research could be beneficial, especially in adolescents.

Obesity prevention methods for adolescents need to be carefully tailored to a broad population and not just cater weight loss messages towards to the obese, rather provide healthy lifestyle advice for everyone without the consequences of negatively effecting ones body image (8). Participation in obesity prevention programs has actually shown to have potential negative side effects on body image (4). Considering body image issues are on the rise (7), this is not a desired effect from an obesity prevention program. Dietitians should and can play a role in ensuring that body image and any perceptual, affective, cognitive and behavioural aspects of body image are discussed in an appropriate manner if they arise with a patient, or when they arise in any area of dietetic practice.

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8. Appendices

8.1 Appendix A - Subscales from the FFBBQ based on the OSSLS2

Concern about eating and weight

Are you trying to eat less?

Do you feel guilty after eating?

Do you think that you weigh too much?

Do you think you would have more self-confidence if you were slimmer?

Do you think you should make more of an effort to lose weight?

Do you feel guilty after you eat?

Do your parents tell you not to eat so much?

Do your parents think that you're too fat?

Possible responses:

always, sometimes,
hardly ever or never.

Dietary restraint

Do you avoid certain foods because you think they are fattening?

While you're eating do you worry that you will gain weight?

Do you eat less than you would like, so that you don't gain weight?

Do you deliberately eat small portions of food so that you don't gain weight?

Do you try to eat as little as possible so that you don't gain weight?

Because you're worried about your figure/shape, do you stop eating even though you're actually still hungry?

Do you pay close attention to your figure/shape and weight?

Possible responses:

always, sometimes,
hardly ever or never.

Fear of weight gain

After eating do you worry that you will get fat?

Possible responses:

always, sometimes,
hardly ever or never.

Do you worry about gaining weight?

Do you fear being too heavy?

Figure dissatisfaction

Possible responses:

I think my hips are...

much too narrow/ thin,
a bit too narrow/thin,
about the right size, a
bit too wide/fat or
much too wide/fat.

I think my stomach is...

I think my bottom is...

I think my figure is...

I think my thighs are...

Other Body Questions

Possible responses:

I would like to have broader shoulders.

definitely, possibly yes,
no I'm happy with
them, maybe not, or
definitely not.

I would like to have bigger muscles.

I would like to be heavier.

I would like to be taller.

I think my figure/shape is...

8.2 Appendix B - Components and scoring of the NZDQI-A (64).

Table 1 Components and scoring of the New Zealand Diet Quality Index for Adolescents (NZDQI-A)

Component	Elements of NZDQI-A				Criteria to achieve maximum component score ⁴
	'Variety' Score ¹ (v/V)	'Adequacy'		Score (A)	
		Indicators in the FQ ²	Cut-offs ³		
FRUIT	v/6	Servings of fruit per day ⁵ .	0 serving/day < 2 serving/day ≥ 2 servings/day	0 10 20	Consumed at least 2 daily servings of fruits from 6 varieties in a week.
VEGGIE	v/6	Servings of vegetables per day ⁶ .	0 serving/day < 3 servings/day ≥ 3 servings/day	0 10 20	Consumed at least 3 daily servings of vegetables from 6 varieties in a week.
CEREAL	v/3	Servings of bread per day. Servings of pasta, rice, muesli, porridge or breakfast cereals per week.	0 serving/day < 6 servings/day ≥ 6 servings/day	0 10 20	Consumed at least 6 daily servings of cereals from 3 varieties in a week.
DAIRY	v/4	Frequency intake of milk (standard and non-standard milk), flavoured milky drink, cheese and yoghurt ⁷	0 serving/day < 3 servings/day ≥ 3 servings/day	0 10 20	Consumed at least 3 daily servings of milk or milk products from 4 varieties in a week.
MEAT	v/7	Servings of meat, chicken, seafood, eggs or meat alternatives eaten per day.	0 serving/day < 1 serving/day 1-2 servings/day > 2 servings/day	0 5 20 10	Consumed 1 or 2 daily servings of meat or alternatives (not including processed meats) from 7 varieties in a week.

$$\text{Total Score} = \sum (v/V) \times A = \text{FRUIT} + \text{VEGGIE} + \text{CEREAL} + \text{DAIRY} + \text{MEAT}$$

Food Questionnaire (FQ), Fruits (FRUIT), Vegetables (VEGGIE), Bread and cereals (CEREAL), Milk and milk products (DAIRY), Meat and alternatives (MEAT).

¹ Ratio calculated as the different sub groups (v) consumed at least once in a week (as indicated in the NZAFFQ) divided by the total sub groups (V) in a food group. The food sub groups are outlined in Additional file 1.

² Refers to questions in the FQ.

³ Based on achievement of the recommended daily servings as suggested by the Ministry of Health [33].

⁴ For each component, a total score is calculated by multiplying 'Variety' (v/V) by 'Adequacy' (A). The possible score range is 0 to 20. E.g. For a person who consumes at least two daily servings of fruits from three varieties in a week, FRUIT score = (3/6) × 20 = 10.

⁵ Include fresh, frozen, canned and stewed fruits.

⁶ Include fresh, frozen and canned vegetables, including potatoes.

⁷ Weekly frequency of intake (times per week) for the four sub groups as reported in the NZAFFQ. Weekly frequencies were summed and converted into daily frequencies. One time per day was equivalent to one serving.