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ORIGINAL PAPER

Psychological factors and weight problems in adolescents. The role of eating problems, emotional problems, and personality traits: the Young-HUNT study

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Abstract
Background The associations between psychological factors and weight problems in adolescents are not conclusive. We studied associations between psychological factors, including personality and weight problems, in an adolescent population. In addition, we examined the same psychological factors as predictors for change in weight categories during adolescence.
Method From 1995 to 1997, 8,090 adolescents, aged 13–18 years, participated in the Young-HUNT-I study; of those, 1,619 also participated in a follow-up study in 2000–2001. They completed a questionnaire monitoring eating problems, self-esteem, personality, anxiety, and depression, and had their height and weight measured. Weight problems were defined using the international age-and sex-specific BMI-cut-offs defining underweight, overweight, and obesity. Psychological factors at baseline were studied both in relation to weight categories at baseline, and as predictors for weight change between baseline and the follow-up.
Results Significant sex differences in mean values were found in all psychological factors, with higher scores in girls compared with boys. In the cross-sectional design, eating problems were associated with weight problems, and the two factors of oral control (EAT-A) and food preoccupation (EAT-B) showed an inverse association. Oral control was associated with underweight, while food preoccupation was associated with overweight and obesity in both sexes. Low self-esteem was associated with overweight and obesity in both sexes, but no association was found between emotional problems or personality traits, and weight problems. During the follow-up, oral control was a clear predictor of weight change during adolescence in both sexes. Oral control protected against unhealthy weight gain but also predicted unhealthy weight reduction in both sexes.
Conclusions Girls scored higher on all psychological factors compared with boys, but no sex differences were found with regard to the association between psychological factors and weight problems. Eating problems showed the strongest association with weight problems at baseline and were also the strongest predictor of weight change during adolescence.

Keywords Eating problems · Personality · Self-esteem · Weight problems · Predictors · Adolescents

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Introduction

Psychological correlates or predictors of overweight and obesity have been assessed both in clinical and in epidemiological studies. Factors most often studied include

depression, self-esteem, eating problems, body dissatisfaction, and anxiety, while personality features seldom are included in the studies [1]. While underweight still is the main weight problem worldwide [2], overweight and obesity are increasing in Western countries [3, 4], and the relationship between weight problems and psychological well-being has most often been restricted to overweight and obesity.

Depression is found to be associated with obesity, with higher ratio reported in clinically obese adolescents compared with a non-clinically obese population [1, 5]. Few prospective studies have been conducted, and depression has been reported to be a consequence of obesity [6, 7], as well as a risk factor for developing and persistence of obesity. Minor associations between overweight/obesity and psychosocial well-being in adolescents have been found [8, 9], but research in community samples suggests that despite moderate levels of body dissatisfaction, few obese children are depressed [1].

Self-esteem is also associated with overweight/obesity, both in cross-sectional and prospective studies. In one study, obesity at the age of 11 was found to have a clear and measurable impact on self-esteem [10], yet another study found no association between self-esteem and obesity in preadolescence, but found that a decrease in self-esteem was related to the development of obesity from preadolescence to adolescence [11]. Other studies have not shown that low self-esteem predicts the development of obesity over time [12, 13]. High level of anxiety has also been found to be related to obesity in adults [14].

Eating problems are also associated with weight problems, both underweight and overweight. High scores on the Eating Attitude Test (EAT) as an indicator of eating problems have been found to be related to high BMI [15, 16], but also the opposite [17]. Few have studied the different dimensions of eating problems. Dieting and unhealthy weight control behavior have been associated with overweight and increased risk for overweight [18, 19], and the use of unhealthy and extreme weight control behaviors and binge eating were found to be alarmingly high among overweight youths, particularly girls [20].

Restrained eating, an attempt to restrict eating to obtain weight control, has been reported to be positively associated with BMI in normal weight subjects. However, neither restrained nor emotional eating promoted weight gain [21]. Overeating has been found to be associated with obesity among boys, and the results for girls showed a trend toward the same association [22].

The relationship between personality and weight problems in adolescents is not thoroughly investigated, and to our knowledge, no study has investigated these relationships with different kinds of weight problems. A study on personality and BMI in adults reported that extroversion and psychoticism were associated with overweight, while neuroticism was associated with underweight [23].

Although the associations between psychological factors and weight problems have been analyzed in different studies, the results are partially inconsistent. Studies have focused on anorexia nervosa, but underweight in general is seldom studied. The present study is one of the few investigating the association between psychological factors and the whole range of weight problems. Due to the importance of this age span for future weight problems and the consistent lack of studies in this area, we aimed to assess the associations between different psychological factors in all types of weight problems (underweight, overweight and obesity) in a large adolescent population of age 13–18 years in the county of Nord Trøndelag, Norway. In addition, we investigated potential psychological predictors of change in weight categories during adolescence, and focused on sex differences.

On the basis of current review, we investigated several hypotheses stating that eating problems were to be related to weight problems in adolescents [15, 16, 18–20]. EAT subtype oral control (EAT-A) was hypothesized to have a positive association with underweight and a negative association with overweight and obesity, whereas EAT subtype food preoccupation (EAT-B) was hypothesized to be associated with overweight and obesity. Emotional symptoms were likewise hypothesized to be associated with overweight and obesity [24]. Low self-esteem was hypothesized to be important for weight problems and would predict unhealthy weight increase [12, 13]. Neurotic personality traits were hypothesized to be associated with underweight, while extroversion was hypothesized to be associated with overweight and obesity [23].

Methods

The study population

The county of Nord Trøndelag is situated in the middle of Norway. Young-HUNT is the youth part of the Nord-Trøndelag Health Study (HUNT), Norway [25]. From 1995 to 1997, all students in junior high schools (13–16 years) and high schools (16–19 years) in the county were invited to participate in the Young-HUNT-1 study and 9,130 adolescents 13–19 years old (91%) did participate. A questionnaire covering different themes concerning physical and mental health was completed during one school hour. Single questions and scales or parts of scales were used to assess different psychological items. In the clinical part of the study, specially-trained nurses measured each subject's weight and height within 1 month after completion of the questionnaire. In 2000–2001, students in

the last 2 years of high school, including the youngest students from the 1995 to 1997 study, were invited to Young-HUNT-2. Out of 2,700 adolescents, 80% of the invited participated, while 2,400 participated in both waves of Young-HUNT. Here 1,619 completed the questionnaire and had their height and weight measured. The same questionnaires and clinical investigations as in Young-HUNT-1 were administered in Young-HUNT-2.

In this paper, both cross-sectional data from Young-HUNT-1 and follow-up data from Young-HUNT-2 are presented. We studied associations between weight categories and psychological factors using the cross-sectional data for those who had completed both the questionnaire and had anthropometric measures in the age group of 13–18 years in Young-HUNT-1, a total of 8,090 students. In addition, we used data from the students who participated in both waves of Young-HUNT in a follow-up to study psychological predictors of change in weight categories during adolescence.

Questionnaires

Eating problems

Eating problems were measured using a 7-item version of the Eating Attitude Test (EAT-7). The original instrument developed by Garner and Garfinkel [26] contained 40 items, which was later shortened to 26 items by the same authors. EAT-12 was constructed based on a study of the psychometric features of EAT-26, containing three factors: dieting, bulimia and food preoccupation, and oral control [27]. In Young-HUNT, EAT-12 was reduced to EAT-7, including the two factors of oral control (EAT-A) and bulimia and food preoccupation (EAT-B). Oral control included four questions (max score 8), while bulimia and food preoccupation included three questions (max score 6) from EAT-12. The 7-item-version has been validated towards the 12-item version [28]. In this paper, the latter factor is called food preoccupation to distinguish it from the diagnostic term bulimia.

Self-esteem

A Norwegian version of the Rosenberg Self-Esteem Scale (RSES) vas validated in a former study of adolescents [29], and after analyzing the full scale from this former study, the four questions, each correlating 0.80–0.95 with the total score in the 10-item version, were chosen. Those four questions predicted the result from the whole scale better than any other of the 10 questions in the original scale. The 4-item-version of RSES was also used in the Norwegian Mother and Child Cohort Study [30]. The max sum-score on RSES was 12, indicating high self-esteem. The Cronbachs alpha for the 4-item version of RSES in this material was 0.74.

Emotional symptoms

Symptoms of anxiety and depression were measured by using the SCL-5 (Symptom Check-List), a five-item scale based on SCL-25, which has been proven reliable in previous studies [31, 32]. A principal-component analysis with Eigenvalue >1 gave only one factor, making it impossible to distinguish between anxiety and depression in this material. The Cronbachs alpha for SCL-5 in this material was 0.79. The max score on SCL-5 was 20, and higher scores indicate more emotional symptoms.

Personality

The questions concerning personality were based on a short form of EPQ (Eysenck Personality Questionnaire). The present 18-item version was developed for this study by multivariate analyses of data from the original Norwegian translation of EPQ [33, 34]. The two subscales of extroversion and neuroticism showed good internal consistence (Cronbachs alpha 0.62 and 0.65, respectively) while the psychoticism scale had poor internal consistence (0.35) and was omitted from the analyses.

Smoking and inactivity

The adolescents were asked if they smoked and in case they did, how often and how many cigarettes. Smoking was defined as daily smoking.

The question: "How many days a week do you play sport or exercise to the point where you breathe heavily and/or sweat?" had eight alternative answers from everyday to never. Inactivity was defined as less than 1 day a week.

Measurements

Height and weight

Trained nurses, using internally-standardized meter measures and weight scales, measured height and weight. The subjects wore light clothes (t-shirts and trousers) without shoes. Height was measured to the nearest cm and weight to the nearest kilo.

Weight category

Underweight was defined using age- and sex-specific BMI-cut-offs corresponding to BMI 18.5 in adults [35], while overweight was defined using the international accepted

age- and sex-specific BMI-cut-offs corresponding to BMI 25 and beyond in adults [36].

Healthy weight change was defined as a move from weight problems toward normal weight, e.g., from underweight or overweight to normal weight, and from obesity to overweight or normal weight. Unhealthy weight change was defined as a change from normal weight to weight problems, e.g., from normal weight to underweight, overweight or obesity, and from overweight to obesity.

Statistics

Data were analyzed with SPSS (SPSS Inc) version 14.0. Differences in mean values between boys and girls and between weight categories within each sex were calculated using Mann–Whitney *U*-tests.

Logistic regression analyses were used to study the associations between psychological factors and weight categories both for the cross-sectional analyses and for the follow-up analyses. First, each item was tested using bivariate analysis, and then multivariable models controlling for possible confounding factors (smoking and inactivity) and interactions. Finally, the contribution of the psychological factors to weight problems was analyzed in two models, one with eating problems, self-esteem, anxiety, and depression adjusting for daily smoking and inactivity, and one with the two factors of the Eysenck Personality Questionnaire (EPQ), also here adjusted for daily smoking and inactivity. In both models, weight problems were compared to normal weight, and significance was set as $p = 0.05$ with 95% confidence intervals.

Psychological factors at baseline (Young-HUNT 1) were studied as predictors for weight change between baseline and the follow-up with the same procedure as in the cross-sectional analyses, but with all factors, both eating problems, emotional problems, and personality factors in the final full model.

Significant interactions were found between sex and several of the psychological factors, and hence, sex-specific analyses were performed. The analyses were also performed for stratifying age groups 13–15 and 16–18 years. This did not yield information different from the analyses of the total population and therefore data for these analyses are not shown.

Results

Description of the cohort

From Young-HUNT-1, a total of 8,090 adolescents between the ages of 13 and 18 years (4,018 boys and 4,072 girls) were included in the cross-sectional analysis. They answered the questionnaire and had measurements taken of their heights and weights. Mean age in both sexes was 15.8 years. The follow-up sample consisted of 747 of boys and 872 girls who participated in both waves of Young-HUNT. The mean age at follow up was 18.1 years. No significant sex differences in mean age or age range in the cross-sectional and in the follow-up study were found.

The mean values of all psychological factors were higher in girls compared with boys (Table 1).

No sex differences in weight categories were found in the cross-sectional sample. In boys, 5.3% (CI 4.6–6.0) were underweight, 14.4% (CI 13.3–15.5) were overweight, and 3.2% (CI 2.7–3.7) met the criteria for obesity, while the prevalence in girls was 6.4% (CI 5.7–7.2), 14.2% (CI 13.1–15.3) 2.9% (CI 2.4–3.4), respectively. At follow-up, the prevalence of underweight in boys (3.1%, CI 1.9–4.3) was significantly lower compared with girls (6.3%, CI 4.7–7.9) and also significantly lower compared with baseline.

The prevalence of underweight, overweight, and obesity at baseline in the population participating in the follow-up study did not differ significantly form the prevalence in the total population at baseline. (Data not shown).

Cross-sectional analyses

Eating problems

Eating problems were associated with weight problems as oral control (EAT-A) decreased with increasing weight, while food preoccupation (EAT-B) increased with increasing weight (Table 1). The two subscales of EAT demonstrated opposite associations with weight in both sexes. Oral control (EAT-A) was positively associated with underweight, OR 1.4 (CI 1.3–1.6) in boys, and OR 1.6 (CI 1.4–1.7) in girls. Oral control also showed a negative association with overweight (OR 0.6, CI 0.6–0.7) in both sexes, and obesity (OR 0.4, CI 0.3–0.6) in both sexes (Table 2).

Food preoccupation (EAT-B) was positively associated with overweight (OR 1.5, CI 1.3–1.7) and obesity (OR 1.5, CI 1.2–1.9) in boys. Food preoccupation was less, but also significantly associated with overweight in girls (OR 1.1, CI 1.0–1.3) and was negatively associated with underweight in boys (OR 0.7, CI 0.5–0.9) and in girls (OR 0.6 CI 0.5–0.8).

Emotional symptoms

Weak associations were found between emotional problems (measured by SCL-5) and weight problems, the only significant association existing with overweight in girls (OR 0.9, CI 0.91–0.99).

Table 1 Mean values in psychological measures at T1 stratified by sex and weight category, compared with normal weight

	Weight category								Sex difference in mean		
	Boys				Girls						
	Under (*N* 212, 5.3%) Mean (SD)	Normal (*N* 3,102, 77.1%) Mean (SD)	Over (*N* 580, 14.4%) Mean (SD)	Obese (*N* 129, 3.2%) Mean (SD)	Under (*N* 264, 6.5%) Mean (SD)	Normal (*N* 3,111, 76.4%) Mean (SD)	Over (*N* 578, 14.2%) Mean (SD)	Obese (*N* 119, 2.9%)) Mean (SD)	All boys (*N* 4,023) Mean (SD)	All girls (*N* 4,072) Mean (SD)	*p*-Value
Eating problems											
EAT-A	1.0 (1.1)*	0.6 (1.0)	0.3 (0.9)*	0.2 (0.6)*	1.5 (1.2)*	0.8 (1.2)	0.4 (0.9)*	0.2 (0.5)*	0.6 (1.0)	0.8 (1.1)	<0.001
EAT-B	0.2 (0.5)	0.2 (0.7)	0.4 (0.8)*	0.4 (0.9)	0.2 (0.6)*	0.5 (0.9)	0.5 (1.0)	0.6 (0.9)	0.3 (0.7)	0.5 (0.9)	<0.001
Self esteem											
RSES	8.5 (2.2)	8.7 (2.0)	8.3 (2.3)*	8.0 (2.3)*	7.7 (2.0)	7.5 (2.1)	7.1 (2.3)*	6.6 (2.5)*	8.6 (2.1)	7.4 (2.2)	<0.001
Anxiety/depression											
SCL-5	6.7 (2.1)	6.7 (2.1)	6.8 (2.2)	6.5 (2.0)	7. 7 (2.5)	7.8 (2.6)	7.7 (2.5)	8.0 (2.6)	6.7 (2.1)	7.7 (2.6)	<0.001
Personality traits											
EPQ-N	2.5 (1.8)	2.3 (1.7)	2.4 (1.8)	2.2 (1.7)	3.0 (1.7)	3.1 (1.7)	3.1 (1.8)	3.3 (1.6)	2.4 (1.7)	3.1 (1.7)	<0.001
EPQ-E	4.3 (1.6)	4.5 (1.4)	4.4 (1.5)	4.5 (1.3)	4.5 (1.4)*	4.7 (1.3)	4.6 (1.5)	4.5 (1.4)	4.5 (1.4)	4.6 (1.4)	<0.001

* Significant compared with normal weight

Self-esteem

Self-esteem decreased within the higher-weight categories and was significantly lower in overweight and obese adolescents of either sex compared with youths with normal weight (Table 1). High self-esteem was associated with underweight in girls (OR 1.1 CI 1.0–1.2), while low self-esteem was associated with overweight and obesity in both boys (OR 0.9, CI 0.86–0.94) and girls (OR 0.8 CI 0.74–0.92).

Personality traits

The subscales of EPQ showed little association with weight problems, and no significant association was found. In girls, extroversion showed a trend towards a negative association with both underweight (OR 0.9, CI 0.8–1.0) and overweight (OR 0.9, CI 0.9–1.0).

The follow-up analyses

Change in weight category

In those participating in both waves of Young-HUNT, 80.7% of boys and 77.5% of girls remained in the same weight category throughout adolescence, 14.9% of boys (*N* 90) and 15.1% of girls (*N* 115) increased their weight category, while 4.4% of boys (*N* 33) and 7.3% of girls (*N* 64) slimmed down (Fig. 1a, b). Underweight was the most unstable weight category, with only 37.5% of boys and 45.9% of girls remaining underweight, while normal weight was most stable (87.8% of boys and 85.2% of girls). The combined overweight/obese category was also stable, as 81.5% of boys and 68.6% of girls remained within this category.

Unhealthy weight reduction (from normal weight to underweight) was seen in 2% of the adolescents (*N* 22), while 4% (*N* 65) had a healthy weight reduction (from overweight to normal weight, or from obese to overweight). No change from obesity to normal weight or from overweight to underweight was seen.

Healthy weight increase (from underweight to normal weight) was seen in 3.9% of the adolescents (*N* 63), while an unhealthy weight increase (from normal weight to overweight/obesity or from overweight to obesity) was seen in 10.9% (*N* 160).

Psychological predictors of weight change

Low degrees of oral control at baseline predicted unhealthy weight increase in both sexes (OR 0.6, CI 0.4–0.9), but also a healthy weight increase in boys (OR 0.2, CI 0.04–0.9), while high degrees of oral control predicted unhealthy weight reduction in both sexes (Table 3).

Table 2 The association between weight category and psychological measures and personality traits at T1 adjusted for smoking and inactivity (stratified for sex)

Scale	Underweight			Overweight			Obesity		
	OR	95% CI	Sig	OR	95% CI	Sig	OR	95% CI	Sig
Boys									
Psychological items									
EAT-A	1.4	1.28–1.64	<0.001	0.6	0.56–0.74	<0.001	0.4	0.30–0.63	<0.001
EAT-B	0.7	0.54–0.92	0.009	1.5	1.27–1.66	<0.001	1.5	1.16–1.85	0.002
RSES	1.0	0.92–1.08	0.968	0.9	0.87–0.96	<0.001	0.8	0.77–0.92	<0.001
SCL-5	1.0	0.92–1.07	0.854	1.0	0.95–1.05	0.881	0.9	0.84–1.03	0.151
Personality									
EPQ-N	1.0	0.95–1.13	0.399	1.0	0.97–1.08	0.386	1.0	0.86–1.07	0.446
EPQ-E	0.9	0.86–1.04	0.249	1.0	0.91–1.04	0.406	1.0	0.88–1.15	0.920
Girls									
Psycholoical items									
EAT-A	1.6	1.42–1.72	<0.001	0.6	0.56–0.71	<0.001	0.4	0.25–0.51	<0.001
EAT-B	0.6	0.50–0.76	<0.001	1.1	1.04–1.27	0.007	1.2	0.99–1.49	0.064
RSES	1.1	1.02–1.17	0.017	0.9	0.86–0.94	<0.001	0.8	0.74–0.89	<0.001
SCL-5	1.0	0.94–1.05	0.858	0.9	0.91–0.99	0.011	0.9	0.87–1.03	0.202
Personality									
EPQ-N	0.9	0.88–1.02	0.143	1.0	0.92–1.02	0.259	1.0	0.91–1.33	0.778
EPQ-E	0.9	0.83–1.00	0.059	0.9	0.88–1.00	0.060	0.9	0.82–1.08	0.377

Emotional symptoms and self-esteem at baseline did not predict weight change during adolescence.

In boys, a high degree of extroversion predicted healthy weight increase (OR 3.2, CI 1.3–8.0).

Discussion

This study of 8,090 adolescents in Young-HUNT confirmed that eating problems and self-esteem were associated with weight problems. The two sub-scales of EAT, oral control, and food preoccupation, demonstrated opposite associations with weight problems, a finding which had not been reported earlier.

High self-esteem was associated with underweight in girls, while low self-esteem was associated with overweight in both sexes. Emotional problems and personality features, however, showed only minor associations with weight problems.

Few psychological factors predicted weight change. Oral control protected against weight increase during adolescence, while food preoccupation did not predict any weight change.

Eating problems

In both girls and boys, a high degree of oral control and low degree of food preoccupation was associated with underweight. A high degree of food preoccupation was associated with overweight and obesity, more so in boys compared to girls. A low degree of oral control predicted unhealthy weight increase and protected against unhealthy weight decrease, but no psychological factor was found to predict healthy weight reduction.

This association was in accordance with our hypotheses and supported earlier studies on the relationship between EAT and obesity [5, 15] and BMI [16].

To our knowledge, this is the first study focusing on the relationship between weight problems and the two factors of EAT, oral control (EAT-A), and food preoccupation (EAT-B). We found that oral control was the factor most strongly associated with weight problems. Oral control predicted underweight and seemed to protect against overweight and obesity, and this finding has not been reported earlier. The Eating Attitude Test is a test developed as a screening instrument for eating disorders, but the characteristics of the factor of oral control in this study may show more resemblance with a trait than a symptom. Oral control and food preoccupation might be important mediators (agents) in the development of weight problems. The Three Factor Eating Questionnaire (TFEQ) has a factor called "dietary restraint", and the Eating Disorder Examination (EDE) has a subscale called "restraint scale". Dietary restraint is a component in a package of genetically determined physiological, socio-cultural, and psychological processes that regulate energy balance [37]. The EAT-factor

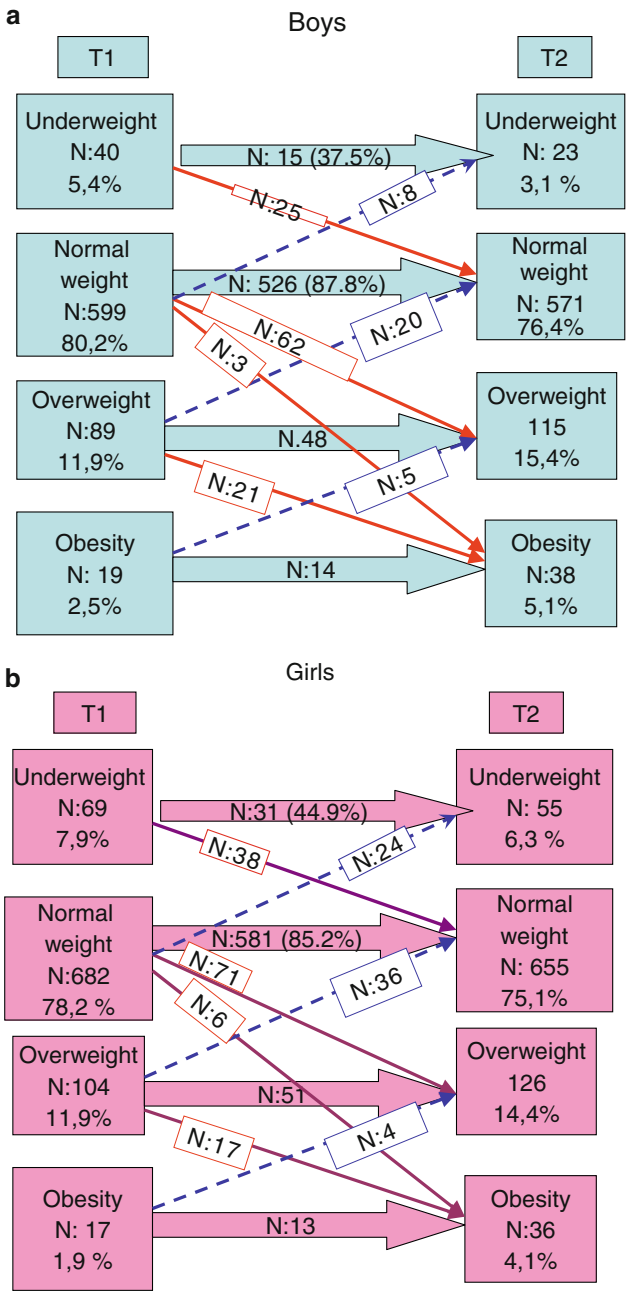

Fig. 1 **a** Changes in weight-category in boys. **b** Changes in weight-category in girls

of oral control has properties resembling dietary restraint, and a high degree of oral control may indicate a predisposition for anorexia nervosa [38].

Self-esteem

In accordance with earlier studies, low self-esteem was associated with overweight and obesity [5] but did not predict, as hypothesized, the development of overweight and obesity during adolescence as earlier reported [13]. High self-esteem was associated with underweight in girls, an interesting finding that should be investigated further.

Emotional problems

We found no support for the hypothesized association between emotional symptoms and weight problems. This is in contrast to other studies in which other measures of depression were used [39, 40], but is in accordance with studies suggesting that obese adolescents in the general population are no more likely to be depressed than their normal weight counterparts [1].

Personality factors

In contrast to our hypotheses, we found no association between weight problems and personality factors at baseline. However, in boys, extraversion was found to predict healthy weight increase. Being extroverted means good social competence, and this indicates that even if underweight in early adolescence, boys with good social competence will normalize their weight during adolescence.

Strengths and limitations

The strength of this study is the high number of participants and a broad spectrum of items measured. The Young-HUNT study is a school-based health-survey with 90% participation, covering the majority of adolescent population in the county of Nord Trøndelag. In addition to the questionnaire, the standardized measurement of height and weight gives a more precise BMI and allocation to weight categories than do self-reported weight and height [41]. With the follow-up in 2000/2001, the longitudinal design made it possible to study changes in weight categories and possible predictive factors for this change during this important period of life. The use of the two factors of EAT, oral control, and food preoccupation, demonstrated an opposite association with weight categories. Typically, many studies have used the sum-score of EAT, and important information may have been lost by this approach.

Limitations in a health-survey like HUNT, covering many different items, symptoms and problems, are the use of single questions or parts of questionnaires, reducing the sensitivity and specificity of the defined problems, and reducing the possibility to compare results with other studies using complete scales. In this study, eating problems were measured by EAT-7, a part of EAT-12, a questionnaire consisting of three factors: oral control, food-preoccupation, and dieting [27]. In Young-HUNT, the dieting factor was omitted and replaced by one question not validated against the dieting subscale in EAT-A prior to the study and was therefore excluded form the analyses.

Table 3 Predictors for change in weight category adjusted for smoking and inactivity (full model)

Weight increase												
Scale	Boys						Girls					
	Healthy (under → normal)			Unhealthy (increase above normal)			Healthy (under → normal)			Unhealthy (increase above normal)		
	OR	95% CI	Sig	OR	95% CI	Sig	OR	95% CI	Sig	OR	95% CI	Sig
EAT-A	0.2	0.04–0.9	0.039	0.6	0.4–0.9	0.011	0.8	0.5–1.2	0.253	0,6	0.4–0.9	0.004
EAT-B	5.0	0.2–15.7	0.360	0.7	0.3–1.3	0.217	1.6	0.6–4.4	0.331	1.1	0.8–1.5	0.700
RSES	1.3	0.8–2.3	0.324	1.0	0.9–1.2	0.545	0.8	0.6–1.1	0.147	0.9	0.8–1.0	0.154
SCL-5	2.2	0.8–6.0	0.129	1.1	0.9–1.2	0.471	0.8	0.5–1.1	0.114	1.0	0.9–1.1	0.624
EPQ-N	1.2	0.6–2.2	0.694	1.0	0.9–1.2	0.879	1.2	0.8–1.8	0.332	1.1	0.9–1.3	0.298
EPQ-E	3.2	1.3–8.0	0.014	1.2	1.0–1.4	0.084	1.3	0.9–2.0	0.200	1.2	1.0–1.5	0.051
Weight reduction												
Scale	Boys						Girls					
	Healthy (decrease towards normal).			Unhealthy (normal → under)			Healthy (decrease toward normal)			Unhealthy (normal → under)		
	OR	95% CI	Sig	OR	95% CI	Sig	OR	95% CI	Sig	OR	95% CI	Sig
EAT-A	2.1	0.8–5.5	0.121	1.9	1.1–3.3	0.023	1.1	0.7–1.7	0.813	1.4	1.0–2.0	0.053
EAT-B	0.7	0.4–1.4	0.357	0.5	0.1–2.0	0.350	1.1	0.6–2.0	0.845	1.0	0.6–19	0.925
RSES	0.8	0.6–1.2	0.292	1.4	0.9–2.3	0.147	0.9	0.8–1.2	0.565	0.9	0.7–1.1	0.382
SCL-5	0.8	0.5–1.4	0.461	1.5	0.9–2.5	0.089	1.0	0.8–1.3	0.847	1.1	0.9–1.4	0.457
EPQ-N	1.9	0.6–1.5	0.897	0.8	0.4–1.4	0.375	1.1	0.8–1.4	0.709	0.7	0.5–1.0	0.067
EPQ-E	1.0	0.6–1.5	0.960	1.5	0.7–3.2	0.251	1.0	0.8–1.4	0.826	1.1	0.7–1.6	0.660

Dieting was frequent in all weight categories, although more frequent in girls than in boys, with a total of 48.1% of boys and 78.8% of girls in the overweight/obese category reportedly dieting or having dieting thoughts. This is in accordance with other studies [22]. Omitting the dieting factor in EAT may complicate the comparison with other studies, both concerning the prevalence of eating problems, but also the relationship between eating problems and weight categories, with a stronger association between eating problems and overweight/obesity. As SCL-5 does not distinguish between anxiety and depression, the use of this scale may have undisclosed possible specific associations between anxiety or depression and weight problems, both in the cross-sectional study and as possible predictors of change in weight categories.

Implications for further research

The fact that weight categories are fairly stable throughout adolescence, except for underweight, may indicate that the basis for weight problems in the overweight/obese domain is operating early in life and that prevention of overweight/obesity must start early. The association of weight categories and emotional problems in the cross-sectional study may indicate that the associations start before adolescence. To be able to prevent weight problems as well as eating problems, prospective studies of the associations between psychological factors and weight problems should start in childhood and continue through adolescence.

The associations found between weight problems, eating problems, and self-esteem may also persist into adulthood, and a longitudinal study with repeated measures could elucidate these associations. From HUNT-3 (2006–2008), we will be able trace the weight development and see if the same factors in early adolescence still predict weight problems in young adulthood.

The strong association between oral control and underweight may be a marker for the development of eating disorder and should be further investigated in additional studies.

Conclusion

There is a significant association between eating problems and weight problems in adolescents. A high degree of oral control is associated with underweight and protects against overweight and obesity, while food preoccupation is associated with overweight and obesity. Low self-esteem is associated with overweight, but does not predict overweight/obesity during adolescence. The sex differences in the association between psychological factors and weight problems are minimal.

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Conflict of interest statement None.

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