

Einar Kjelsås

## **Eating disorders and physical activity in non-clinical samples**

## Acknowledgements

The present work was conducted at the Department of Neuroscience, Faculty of Medicine, Norwegian University of Science and Technology, Trondheim.

I am thankful to the Research Council of Norway for supporting my project (project number 134183/320)

I would like to express my sincere gratitude to my supervisors Dr. Polit Liv Berit Augestad, and Professor K Gunnar Gøtestam, for their support and guidance throughout this process. Liv Berit introduced me to the scientific research of physical activity and pathological eating behaviors and attitudes when I was a Cand.Polit-student at the Department of Sport Sciences, NTNU, and her work and skillful comments has been a great inspiration for my thesis. I am very grateful to K Gunnar, for believing in me, for his continuous enthusiasm and generosity, and for his outstanding problem solving skills.

I also want to thank:

Professor Dana Flanders, co-author on Paper V, for valuable statistical and methodological advice, and Cathriona Turner for proof reading.

My other co-authors; Christian Bjørnstrøm, Camilla B. Gudde and Irja Børsting. Professor Stewart Agras for encouraging comments on earlier drafts of Papers IV and VI.

Kathrine Bjørgen, Christian Bjørnstrøm, Tone Kjelsberg, Even Rotevatn, and Hilde Sandberg for assistance with data collection.

Colleagues at the Department for a nice working environment, and especially the secretarial staff, Magnhild Hagen, Greta Klevset, Siri Aakre Kolstad and Sidsel Myhr Nilsen for providing excellent support, and Reidar Roksvaag for excellent library service.

My friends in Trondheim, Øyvind Bjerke, Egil Gjølme, Ingar Mehus, Øivind Rognmo, and Lars Halvas Svendsen, and my friend and cousin Fredrik Ringdal for valuable social buffering when I got too caught up in my work.

My parents, Martin and Sigrun Kjelsås for providing me with an exploring mind, and inspiring me to stretch my limits, and my brother, Trond Kjelsås, and my sisters, Gry Lalande, Siv Kjelsås and Rita Kjelsås for support and encouragement.

My mother and father in law, Aase Vedul and Magne Moen, my sister in law, Guro Vedul Moen, and my uncle in law, Olaf Vedul for their interest and encouraging remarks.

Finally, very special thanks to my loving wife, Vigdis Vedul Moen for unconditional support, encouragement and patience. You are my joy and inspiration, and without you this thesis would have been impossible. I dedicate this thesis to you and our beautiful little son, Sander.

Trondheim, 2003.

Einar Kjelsås

**List of papers**

- I Kjelsås, E., Augestad, L.B., & Gøtestam, K.G. Exercise Dependence in Physically Active Women. *European Journal of Psychiatry* 2003;17(3):145-155.
- II Kjelsås, E., & Augestad, L.B. Gender differences in competitive runners and their motive for physical activity. *European Journal of Psychiatry* 2003;17(3):157-171.
- III Kjelsås, E., & Augestad, L.B. Gender, eating behavior and personality characteristics in physically active students. Accepted 2003 in *Scandinavian Journal of Medicine and Science in Sports*.
- IV Kjelsås, E., Bjørnstrøm, C., & Gøtestam, K.G. Prevalence of eating disorders in female and male adolescents (14-15 years). Accepted 2003 in *Eating Behaviors*.
- V Kjelsås, E., Augestad, L.B., & Flanders, W.D. Screening of males with eating disorders. Accepted 2003 in *Eating and Weight Disorders*.
- VI Kjelsås, E., Børsting, I., & Gudde, C.B. Antecedents and consequences of binge eating episodes in women with an eating disorder. Accepted 2003 in *Eating and Weight Disorders*.

## Contents

<b>Introduction</b> .....	<b>4</b>
<b>Eating disorders</b> .....	<b>4</b>
Historical background .....	4
Classification of eating disorders .....	6
Prevalence of eating disorders.....	7
Measurement of eating disorders .....	9
Mechanisms of binge eating.....	12
Eating disorders and personality traits .....	13
Management of eating disorders .....	13
<b>Physical activity</b> .....	<b>15</b>
Historical background .....	15
Motives for physical activity.....	16
Physical activity, eating disorders and personality traits .....	16
The female athlete triad.....	18
Exercise dependence .....	18
<b>Empirical study</b> .....	<b>22</b>
<b>Study objectives</b> .....	<b>23</b>
Major goals.....	23
Sub-goals .....	23
<b>Material and method</b> .....	<b>24</b>
Participants and procedures.....	25
Instruments .....	27
Statistical analyses.....	31
<b>Results (summary of the papers)</b> .....	<b>33</b>
<b>Discussion</b> .....	<b>36</b>
<b>Physical activity and exercise dependence</b> .....	<b>36</b>
Predictors of physical activity .....	36
Predictors of exercise dependence .....	37
<b>Eating disorders</b> .....	<b>38</b>
Predictors and associated features of eating disorders .....	38
Prevalence of eating disorders in both genders.....	39
Mechanisms of binge eating episodes .....	40
<b>Problems and limitations</b> .....	<b>41</b>
<b>Implications for the prevention of eating disorders</b> .....	<b>42</b>
<b>Future applications</b> .....	<b>43</b>
<b>Main conclusions</b> .....	<b>46</b>
<b>References</b> .....	<b>49</b>
<b>Appendix</b> .....	<b>64</b>

## Introduction

Eating disorders (ED) are characterized by severe disturbances in eating behavior. The different subtypes of ED, anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), and eating disorders not otherwise specified (EDNOS) constitute a significant source of psychiatric morbidity (Fairburn & Cooper, 1993; DSM-IV, American Psychiatric Association, 1994). Pathological eating attitudes and behaviors are an important health concern in the Western world (Wakeling, 1996), and are of great interest to the public, of perplexity to researchers, and a challenge to clinicians. Their cause is elusive, although social, psychological, and biological processes seemingly play a major part. Eating disorders is a common problem among adolescent girls and young adult women, and although less frequent in boys and men, research on eating disorders should undoubtedly include both sexes.

Physical activity is a complex behavior and can be defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (Caspersen, Powell & Christenson 1985). Empirical data have indicated that regular physical activity may have both physiological and psychological beneficial consequences (Bouchard, Shephard & Stephens, 1994, 2000; Martinsen & Morgan, 1997). Physical inactivity is a major public health problem in industrialized societies, and cardiovascular disease, diabetes, and colon cancer may be attributed to a sedentary life-style (Blair, 1995). Paradoxically, despite the numerous benefits of physical activity, there is an informal consensus that exercise may produce negative effects in some individuals (Szabo, 1998).

## Eating disorders

### Historical background

Anorexia nervosa (AN; greek: an-orexis, freedom from material needs) is not an new disorder. Early religious literature contains many descriptions of what was probably AN (Silverman, 1997), and the description of AN in the medical literature was evident as early as the 17<sup>th</sup> century. It was understood as a miraculous loss of hunger, closely connected with the combination of Christian ascetics ideals and philosophical dualism - “anorexia mirabilis” (Rampling, 1985). Probably the earliest medical report of AN was that by Richard Morton in 1689 which was largely focused on the physical manifestation of the disorder including the absence of fever or other signs of known diseases (Romano, 1999<sup>a</sup>).

Two prominent physicians separately described anorexia nervosa in 1873, Professor Charles Lasègue of clinical medicine in the Faculty of Medicine in Paris and physician to La Pitié Hospital, and Sir William Gull, physician at Guy's Hospital. The term "anorexia nervosa" was first used by Gull (Silverman, 1997). According to both clinicians it was a psychogenic affliction that occurred predominantly in girls and young women. The characteristics described by Gull and Lasègue are still valid today: severe weight loss, amenorrhea, constipation, restlessness, and no evidence of underlying organic pathology (Vandereycken, 2002).

Self-starvation was taken up as a rather prestigious activity by some "hunger artists" as well as by those expressing deeply religious commitments (Vandereycken et al., 1990). After thorough investigations by theologians and physicians, some of them were exposed as "fakers", and others were condemned as witches possessed by the devil or were posthumously awarded sainthood. Many of these "hunger artists" were young girls from poor material conditions trying to make their fortune. Others may have resorted to fasting to achieve perfectionism, overstating moral and religious standards. Today, a similar kind of cultural exaggeration seems to be present, whereas focus upon slimness and "the perfect body" are enlarged and influenced by the fashion industry and the mass media.

Bulimia nervosa, like AN, represents a clinical syndrome with multiple factors to its etiology. The term bulimia is from the Greek meaning "oxhunger" (derived from Greek word *limos* meaning "hunger" with the prefix *bou* meaning "bull" or "ox"), and is an adequate description of the primary feature of the disorder, binge eating (Romano, 1999<sup>b</sup>). Compared to AN, bulimia nervosa is a new and distinctive disorder that identified in the late 1970s, but presumably commenced at some uncertain period between the 1940s and the 1960s (Russell, 1997). The London psychiatrist Gerald Russell was the first to describe BN as a distinct syndrome in 1979, as he identified a number of his AN patients who had an "omnious variation" of the disorder, being that they periodically went on eating binges. However, already in the 13<sup>th</sup> and 14<sup>th</sup> centuries some authors regarded BN as a genuine somatic disease of the digestive system, leading to weight loss (Glanville, 1535).

The phenomenon of bulimia (episodic overeating) and purging have been recognized since antiquity. Self-induced vomiting were, in fact, once established forms of cure, and prescriptive methods of treatment can be traced back to earlier civilizations (Nasser, 1993). In ancient Egypt a great part of the Eber Papyrus was dedicated to the virtues of emesis (Ebbel, 1937), containing several means of emptying the stomach. In the Syriac Book of Medicine, vomiting was advocated for the healing of the bestial lust for food and the episodic ingestion

of considerable amounts of food, referred to as asthmatic lust which bears resemblance to the familiar binge eating. In Greek medicine it is acknowledged that Hippocrates advised the use of vomiting for two consecutive days each month. As for the Romans, they are known for the invention of the vomitorium that allowed them to indulge in excessive eating and relieve themselves by vomiting. One should avoid jumping to the conclusion that overeating or vomiting in ancient accounts is equivalent to the disorder we know as bulimia nervosa. Eating disorders are characterized with severe pathology and psychiatric morbidity.

### **Classification of eating disorders**

The understanding of the psychopathology of eating disorders has undergone several changes with consequences for diagnoses and classification (Thaw, Williamson & Martin, 2001). In this thesis eating disorders were classified according to the *Diagnostical and Statistical Manual of Mental Disorders (DSM-IV, APA, 1994)*. In Paper IV, the *DSM-III-R (APA, 1987)* was also included. Eating disorders are in *DSM-IV* divided into three diagnostic categories: anorexia nervosa, bulimia nervosa, and the not otherwise specified (or atypical) eating disorders (EDNOS) (Appendix). The EDNOS group comprises individuals with an eating disorder with clinical severity, but do not meet all diagnostic criteria for AN or BN. In addition, binge eating disorder (BED) has been outlined in the *DSM-IV* as a possible distinct disorder. The principal feature of BED is recurrent binge eating episodes without the regular use of compensatory behaviors such as purging or the attitudinal disturbance required for bulimia nervosa (Spitzer et al., 1992).

Some studies have suggested that the changes in the revisions of the *DSM-IV* criteria may improve the boundaries of ED diagnoses (Drewnowski et al., 1994; Hay & Fairburn, 1998; Wilson, 1992). However, others have argued that the subgroups of eating disorders have weak scientific and clinical validity, and that recent efforts to update the classification scheme is unlikely to improve these concerns (Beumont, Garner & Touys, 1994; Waller, 1993).

Furthermore, Fairburn and Harrison (2003) have in a recent review suggested that the existing scheme for classifying eating disorders may be viewed as unsatisfactory and anomalous, as so many subjects fall into the EDNOS group (Thaw, Williamson & Martin, 2001). This was also reflected in Papers IV-VI considering the relatively large EDNOS-groups. Furthermore, in clinical practice it seems that about half the cases are relegated to an atypical or not otherwise specified group. Some view the current classifying system as a

historical accident that need to be rectified, since far more unites the three categories of ED than separates them (Fairburn et al., 2003).

### **Prevalence of eating disorders**

Eating disorders are commonly described as an increasing problem in the Western world (Andersen, 1990; O'Dea & Abraham, 2002; Pyle, et al., 1991). In the instance of bulimia, this notion could well be true (Kendler, 1991; Soundy et al., 1995; Turnbull et al., 1996), however the apparent increase in anorexia nervosa may have plausible alternative explanations (Lucas et al., 1991), such as greater help-seeking, better detecting and changes in diagnostic practice (Fombonne, 1995; Van Hoeken, Lucas, & Hoek, 1998). Eating disorders are typically most common among female adolescents and young adults.

Hsu (1996) has in a review referred to a prevalence of 0.5% for AN and 2% for BN in the general population. Fairburn & Harrison (2003) have recently described similar figures; AN 0.7% among young women, and BN 1-2% among 16-35 year-old females. They have also referred to an incidence rate of 19 females and 2 males per 100 000 per year for AN, and 29 females, 4 males for BN. A prevalence of approximately 0.2% for BN have been reported in young males (McCallum, 1993). Fairburn and Beglin (1990) have in a review found increased consensus that the prevalence rate of BN among adolescent and young adult women was about 1%. McCallum (1993) refers to a prevalence in white adolescent female community samples in Western countries of approximately 1% for anorexia nervosa (AN), and 2-4% for bulimia nervosa (BN).

The prevalence of binge eating disorder (BED) in the community has not been satisfactorily established, and figures fluctuates from 0.7-4.6%. BED is reported to be present in 5-10% of those seeking treatment for obesity, with females approximately 1.5 times more likely to have this eating pattern (DSM-IV, APA, 1994). There has been little research done on the distribution of EDNOS, yet it is described as the most common of the eating disorders. This diagnosis is given to 25-50% of patients presenting with disordered eating, and it is estimated that 4-6% of the general population (both female and male inclusive) has EDNOS (Herzog & Delinsky, 2001).

In a representative sample of the general female population of Norway, a lifetime prevalence of 8.7% with a point prevalence of 3.8% was reported (Götestam & Agras, 1995). These authors found that the lifetime prevalence of AN was 0.4%, BN 1.6%, BED 3.2%, and EDNOS 3.0%, with point prevalences AN 0.3%, BN 0.7%, BED 1.5%, and EDNOS 1.3%.



Krøglund, Torgersen and Cramer (2001) have reported a lifetime prevalence of 3.0% for AN and BN in women (point prevalence 1.2%), and 0.2% in men (point prevalence 0%) in Oslo. These figures seem to be in accordance with other studies in the Western world (Fairburn & Harrison, 2003). Moreover, Rosenvinge and Gøtestam (2002) have reviewed well-controlled normal population studies, and concluded that among females aged 15-44, the point prevalence for AN and BN may be estimated to about 2% (AN 0.2-0.5% and BN 1.5%). Of these about 50% with BN and nearly 100% are estimated to be in need of treatment. The same authors have estimated that about 50,000 Norwegian women may suffer from eating disorders where treatment is required, and about 600 may need highly specialised services. These scientifically-based estimates were requested by the national health authorities.

Rosenvinge et al. (1999) reported point prevalences 0.4% with AN, 1.1% with BN, and 1.5% with BED among 15 year-old girls. None of the 214 boys in this study met criteria for an ED. These figures equal those for older age groups (Hoek, 1993; Fombonne, 1995), but are somewhat lower than corresponding numbers reported by Fairburn & Harrison (2003), and McCallum (1993). Lavik, Clausen and Pedersen (1991) found that 8-9% of adolescent girls reported eating behavior symptoms indicative of eating disorders. Lau & Alsaker (2001) have reported dieting behavior in Norwegian adolescents, girls 27.4% and boys 9.0%. In a large study of the general adolescent population in Norway, a total of 3.4% (1992), and 4.2% (1994) reported disordered eating (Wichstrøm, 2000).

Gøtestam, Eriksen & Hagen (1995) have studied the prevalence of eating disorders in the total inpatient and outpatient Norwegian psychiatric population. For the inpatient population 3.8% of the women and 1.6% of the men reported eating disorders. In the outpatient group the prevalences of AN and BN was 7.3% and 8.9% for women, and 1.0% and 1.0% for men, respectively.

#### *Comments on the distribution of eating disorders in men*

Pathological eating behavior is suggested by some to be increasing among young men in Western society (Andersen, 1990; O'Dea & Abraham, 2002; Carlat, Camango, & Herzog, 1997), perhaps with a later onset (20 y) than among women (17 y) (Braun et al., 1999). Sexual role patterns in the Western society seem to be shifting, and this may affect men's attitude to their physical appearance. While women still bear the brunt of appearance-oriented problems, greater numbers of men seem to be affected by body-image concerns. Body dissatisfaction in men may be associated with a desire for larger muscle mass rather than thinness, as well as striving for low body fat.

Studies of adolescents have found that although boys report less body dissatisfaction than girls do, significant numbers of boys (5%-20%) report restrained eating, vomiting, laxative abuse, or smoking cigarettes for weight control (O'Dea & Abraham, 1996; Wertheim et al., 1992; Worsley et al., 1990). Earlier studies have suggested that approximately 10% of individuals who have anorexia nervosa (AN) and bulimia nervosa (BN) and 25% of those with binge eating disorder (BED) are men (APA, 1994; Fairburn & Beglin, 1990). The findings from recent community-based epidemiological studies of AN and BN suggest a ratio of one male case to about six female cases. In clinical samples the ratio is somewhat lower with 10 to 20% of cases of anorexia being male.

Male cases of BN are uncommon, however, a recent study have reported almost gender parity in groups with partial BN (men to women 1:1.8), and in groups with partial syndromes of AN (men to women 1:1.5) (Woodside et al., 2001). Moreover, Kinzl et al. (1998<sup>a</sup>) and Kinzl (1998<sup>b</sup>) found that the gender-specific prevalence of eating disorders is closer to each other than often believed, and Westenhoefer (2001) has supported this by finding that the prevalence of eating disorders among men is comparable to that of women. Woodside et al. (2001) have reported a higher prevalence of AN in men (15 years or older) (0.16%) than in clinically derived estimates (0.05%-0.10%), suggesting a community reservoir of undiagnosed men (Andersen, 2001).

### **Measurement of eating disorders**

Various assessment methods have been developed for evaluating features of eating disorders, such as clinical interviews, self-report measures, self-monitoring, direct behavioral observation, symptom checklists, clinical rating scales, the Stroop color-naming task, and standardized test meals. The most commonly used methods in clinical and research settings are semistructured clinical methods, self-monitoring, and self-report measures. The Eating Disorder Examination (EDE), the best-validated interview, has generated a large body of research. It is an investigator-based, semistructured interview for assessing psychopathology specific to eating disorders, and is the current interview method of choice (Garner, 2002).

The two most widely used self-reports in clinical and research settings are the Eating Attitudes Test (EAT) (Garner et al., 1982), and the Eating Disorder Inventory (EDI) (Garner, 2002). In Norway, a new 5-item scale for the screening of problematic eating disorders, the Eating Disturbance scale (EDS-5) has been developed. This instrument is reported to be sensitive to disordered eating patterns and appears promising for screening purposes in community samples (Rosenvinge et al., 2001).

### *Assessing non-clinical samples*

Screening for disease control can be defined as the examination of asymptomatic people in order to classify them as likely to have the disease that is the object of screening (Greenberg, 2001). The goal of screening for eating disorders (ED) is to reduce morbidity or mortality from the disease among the people screened, a goal hopefully attained by early treatment of the cases discovered. Secondary prevention by means of early detection of ED is important, and recovery appears to be best for patients treated early in their course (Lockett al., 2001).

The purpose of epidemiological studies in eating disorders is to provide statistics concerning the degree of morbidity in a population, and relate such statistics to the environment and characteristics of the population to detect its relationship with possible causative factors (Hsu, 1996). When referring to prevalence figures for the eating disorders one should use caution, due to methodological problems and limitations in several of the existing studies. Shortcomings include periodical changes in the diagnostic criteria for ED, use of different measurements and procedures for case detection, and sample limitations.

Use of only self-report questionnaires generally gives higher numbers of ED, and some core features of eating disorders are more accurately assessed using an interview instead of a self-report questionnaire (Carter et al., 2001). Moreover, items left blank may create problems for analysis and interpretation. Providing additional explanation of some of the most difficult concepts, such as “large amounts of food, loss of control, binge eating, and over-concern about weight and shape” may improve scores on a questionnaire (Passi et al., 2002).

When studying large samples it is cumbersome and expensive to conduct individual clinical interviews. An interview requires a trained interviewer, and it is not suitable when anonymity or group administration is required. In population-based studies the preferred design often involves two steps, where the first step includes screening with self-report questionnaires. Then, all subjects above a certain cut-off point are investigated with a semi-structured interview to establish the diagnosis (Hoek, 1993).

Keel et al. (2002) have stated that questionnaire assessments may not be inferior to interviews, but may reveal different aspects of disordered eating. Their findings support the possibility that increased rates of eating pathology when using self-reports may be due, in part, to increased candor on sensitive or embarrassing topics when subjects feel more anonymous (Fichter et al, 1998; Black & Wilson, 1996). This may represent an advantage to

using questionnaires to assess eating pathology. In addition, self-reports are not susceptible to bias from interviewer-subject interactions.

The issues of concern just described when using self-report, are likely to be even more relevant among adolescents, with respect to their cognitive developmental level. However, Passi (2002) have found that adolescents with anorexia nervosa reported information on a self-report (EDE-Q) as well as any other population. Yet, other methodological issues may be a challenge when assessing disordered eating in young individuals. For example, 14-15 year-old girls may have large variations in their BMI figures depending on the onset of puberty. Furthermore, young girls in general often menstruate irregularly in the first 1-2 years after menarche (Emans, 1990), and one might suggest that using amenorrhea as one of the criteria for AN, may be tentative for some young girls.

#### *Comments on screening of males with eating disorders*

How should we screen and measure ED in men? ED are generally considered a “woman’s disease”, and most of the available screening instruments are designed primarily for women. Which factors require attention when screening ED in males? According to Laporte (1997) questions about binge eating and excess concern with body and shape may be viewed and expressed differently by men and women. This may lead to an underreporting of ED in men compared to women when questionnaires are used. Accordingly, items in the EDI sub-scale body dissatisfaction (BD), such as “I think my thighs are too large”, “I like the shape of my buttocks”, and “I think my hips are too big”, may be perceived differently by men. For instance, men are probably less concerned with whether their hips are too big than are women.

Studies have found that women and men with eating disorders suffer similar psychosocial morbidity, as well as course and outcome of the illnesses (Woodside et al., 2001; Eliot & Baker, 2001), which is reassuring in terms of making diagnoses and carrying out treatment.

ED behavior seems to have similar pattern for both sexes, but men and women may develop ED using different paths (Andersen & DiDomenico, 1992). Men with ED seem to prefer a lean body shape, in contrast to men with normal eating patterns that strive for a V-shaped body (Striegel-Moore & Kearney-Cooke, 1994). Paper IV points out the importance of the EDI scales DT and B for identification of men with eating disorders. The substantial role of drive for thinness is also well documented in female samples (Ghaderi & Scott, 2002;

Joiner & Heatherton, 1998). This supports the claim that at least some of the characteristics of males with eating disorders are very similar to those of females (Burns & Crisp, 1990).

A DSM-IV diagnosis of AN requires amenorrhea among women (criterion D). Thus, for men, there are only three criteria available for diagnosing AN. This may be a diagnostic problem, however an interesting Canadian study found that amenorrhea did not discriminate between women with anorexia nervosa and women with all the other features except amenorrhea across a number of relevant variables (Garfinkel et al., 1996). As a consequence these authors question the utility of amenorrhea as a diagnostic criterion. If amenorrhea is not essential for classification of AN, the three criteria used for AN in men may be adequate in a questionnaire setting. However, when screening for ED, as well as in clinical settings and treatment of male AN, one may also include issues such as loss of sexual interest, impotence and serum testosterone-levels when diagnosing and treating men with AN (Andersen, 1990).

## **Mechanisms of binge eating**

### *Antecedents and consequences of binge eating*

In DSM-III-R, “binge eating” is defined as “Recurrent episodes of binge eating (rapid consumption of large amounts of food in a discrete period of time). A feeling of lack of control over eating behavior during the eating binges”. Describing the function of binge eating behaviors for each individual may be essential for maximizing treatment effectiveness. Recent studies (Lee & Miltenberg, 1997; Meyer, Waller & Waters, 1998; Waters, Hill & Waller, 1999) have suggested that treatment for binge eating individuals must address the antecedents of bingeing and the following consequences in order to optimize treatment. Developing treatment programs based on an individual case formulation rather than generic formulation, may be more effective as the necessary components of treatment logically would differ depending on the function served by the binge eating behavior (Stickney, Miltenberg & Wolff, 1999).

Negative affect has been identified as the most frequent antecedent of binge eating (Polivy & Herman, 1993), and greater negative affect has also been pointed out as a factor that terminates a binge eating episode (Lynch et al., 2000). Frequently reported negative emotions initiating binge eating are feeling depressed, angry, empty, hopeless, worried or dissatisfied. In addition to emotional factors, Vanderlinden et al. (2001) have pointed out physiological antecedents of bingeing. Consequences of binge eating include relief from

negative thoughts and feelings, as well as decreasing hunger or craving (Stickney, Miltenberg & Wolff, 1999).

### **Eating disorders and personality traits**

Clinical observation and earlier research have suggested a link between personality traits and eating disorders (Perry et al., 2002; Pryor & Wiederman, 1996; Cachelin et al., 1997; Mitchell-Gielegem et al., 2002; Pearson et al., 2002). ED have been associated with personality traits such as neuroticism, introversion, conformity, perfectionism, “high-achievement”, rigidity, obsessive-compulsive features, hostility and guilt (Stonehill & Crisp, 1977; Davis, Claridge, & Brewer, 1996; Augestad, Sæther & Gøtestam, 1999).

Additionally, in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) it is suggested that hostility and mistrust may appear in individuals with ED (APA, 1994). In the US, the National Institute of Mental Health (NIMH) has pointed to personality traits as one of the issues influencing the development of ED, in which future prevention research in eating disorders are encouraged (Pearson et al., 2002). Based on Eysenck’s personality theory, some individuals may have personality characteristics that are more predisposed to developing ED (Eysenck, 1981). The Eysenckian tradition includes three superfactors denoted as E (extroversion-introversion), N (neuroticism-stability) and P (psychoticism-superego)(Eysenck et al., 1982). It is assumed that these three factors have a strong genetic basis, and psychophysiological theories have been elaborated, linking E with the reticulocortical arousal loop, N with the limbic system (visceral brain) and P with the androgen hormone system.

In non-clinical samples of college women a relationship between neuroticism and ED symptomatology has been suggested as well as a lack of relationship between extraversion and ED symptomatology (Janzen et al., 1993). In a recent review, Claridge and Davis (2001) have reported that neuroticism has been described in several studies as the single strongest correlate of poor body image, low self-esteem, and general negative affectivity.

### **Management of eating disorders**

The cause of ED is complex and poorly understood. Hence, eating disorders are difficult to treat, with some patients actively resisting attempts to help them. However, there is progress to report both in terms of their understanding and treatment. Over the past 20 years the treatment of bulimia nervosa has attracted considerable research attention, and evidence-based management is now possible (Fairburn & Harrison, 2003). There have been few

randomized controlled studies into the treatment of AN or EDNOS, thus in their instance treatment recommendations have to be tentative.

In a recent review, Fairburn and Harrison (2003) have stated that cognitive behavior therapy (CBT) is the clear treatment of choice for BN. It is not a panacea, although it has the potential to benefit many patients. Paradoxically, clinical experience and research evidence indicate that few patients receive such therapy (Crow et al., 1999; Mussell et al., 2000). The use of antidepressiva in BN has received some support, and such drugs may be most useful as a readily-delivered initial intervention, which is followed by full cognitive behavior therapy (Fairburn & Harrison, 2003).

Evidence-based guidelines may not be formulated for the treatment of those patients who do not respond to CBT. However, exposure with response prevention and interpersonal psychotherapy has indicated some beneficial effects for BN. In addition, an interesting Norwegian study has found that physical exercise appeared more effective than CBT on several aspects of BN pathology (Sundgot-Borgen et al., 2002). This is underscored by Pendleton et al. (2002) who found that adding exercise to cognitive-behavioral therapy in the treatment of binge eating, enhances outcome and contributes to reductions in binge eating and BMI. The therapeutic effect of physical activity is also described in the treatment of depression and anxiety disorders (Martinsen, 1990; Stewart, McMullen & Rubin, 1994). Fairburn and Harrison (2003) did not consider the therapeutic role of physical exercise in their review on eating disorders.

In the treatment of AN, the mainstream opinion seems to include four aspects of management: The first is to help patients realize that they need help, and to maintain their motivation thereafter. The second aim is to gain enough weight to reverse the malnutrition, and usually weight restoration alone leads to substantial improvement in the patient's overall state. Thirdly management of AN addresses patients' overevaluation of shape and weight, eating habits, and their general psychosocial functioning. One approach that has some research support, is a family-based treatment (Lock et al., 2001), which seems to be of most help to younger patients (Russell et al., 1987). Cognitive behavior therapy is a logical alternative for older patients, in view of its effectiveness in bulimia nervosa. However, its use in AN has not been well documented, and there is little evidence to support it. The fourth aspect, use of compulsory treatment, is only relevant to a few cases. Reconciling respect for patient's wishes and their right to receive good treatment can be difficult, and compulsory treatment, though legally permissible, should never be undertaken lightly (Goldner et al., 1997; Russell, 2001).

Drug treatment does not have an established place in the management of anorexia nervosa.

Treatment of EDNOS has received sparsely research attention. Hence, the only advice that can be given is for clinicians to follow the guidelines for treatment of BN in instances in which there is binge eating, and those for AN in instances where weight is low. The EDNOS category is typically regarded as residual and a diagnosis of EDNOS could be misinterpreted as indicating problems of minor clinical significance, whereas it is often accompanied by levels of distress (Garfinkel et al., 1995) similar to those associated with a full-syndrome ED (Hadigan & Walsh, 1991).

In the Western world today, obesity is an increasing problem, and there is an ongoing discussion whether obesity should be included in the DSM-IV as an eating disorder. In obese patients physical exercise may reduce overeating or bulimic binge eating (Levine, Marcus & Moulton, 1996).

In Norway, there is a need for increased treatment capacity, better clinical skills and better organization of treatment services for patients with eating disorders (Rosenvinge & Gøtestam, 2002). Throughout the country, clinical work is organized in many satellites that are randomly in contact and each one developing its own treatment model (Skårderud & Rosenvinge, 2001). Well-documented treatment methods, such as cognitive behavioral therapy and interpersonal psychotherapy are sparsely used in Norwegian treatment services (Rosenvinge & Gøtestam, 2002). A recent Norwegian study has used a multicomponent inpatient treatment programme for BN consisting of cognitive-behavioral group and individual therapy, physical training and steps to normalize eating patterns (Rø, Martinsen, and Rosenvinge, 2002). The results indicated significant improvement with respect to bulimic as well as general psychiatric symptoms.

## **Physical activity**

### **Historical background**

Physical activity has been a significant factor in the evolution of the modern human. The hominid *Australopithecus* can be traced back about 4 million years. Our own species, *Homo sapiens*, appeared for the first time some 50,000 years ago, and for another 40,000 years we were roaming hunters and food gatherers. Thus, during more than 99% of our existence physical activity has been a condition of human life. After a “brief” spell in an



agrarian culture (10000 years ago), most of us now live in an urbanized, highly technological society.

Today, physical exercise is not necessary for everyday survival, although for an optimal function of the human body, regular physical activity is essential. There are many scientific efforts that study effects of physical training and an active lifestyle in a broad sense in the field of primary and secondary prevention of specific diseases (Åstrand & Rodahl, 1986).

### **Motives for physical activity**

Physically active individuals may have quite different reasons for their participation in sports, such as challenge, fitness, elevated mood, time to be alone, competition, enjoyment, weight control, the opportunity to meet people, and well-being (Clough, Shepherd, & Maugan, 1990; Johnsgaard, 1985). Competitive athletes may exercise for competitiveness, and to be successful in their sports, while recreational athletes may be motivated by other factors such as friendship, pleasure, joy and health (Augestad, 2000). Female sport participants may focus on weight reduction, altering body shape, and increased energy expenditure (Hubbard, Gray, & Parker, 1998). Augestad (2000) have reported that competitive female athletes are more satisfied with their bodies than less competitive female athletes. Men may also be occupied with weight reduction and low body fat, yet men tend to strive for a V-shaped body and increased muscle mass (Striegel-Moore & Kearney-Cooke, 1994).

### **Physical activity, eating disorders and personality traits**

There is a considerable body of research on the relationship between sports participation and eating problems (Sundgot-Borgen, 1993, 2002; Smolak, Murnen, & Ruble, 2000). Athletes today are travelling frequently, and focus greatly on excelling in their sports. Their lifestyle may be stressful, and may lead to hormonal changes and dysfunction (Warren & Perloth, 2001). Participants in some particular sports have been found to have a high prevalence of eating disorders (Sundgot-Borgen, 1993). Recent prevalence figures for ED in the entire population of male and female Norwegian elite athletes have suggested that 3.2% of the athletes, and 1.2% of the controls met the DSM-IV criteria for AN and BN. Moreover, 20% of the female athletes and 8% of the male athletes met criteria for subclinical or clinical ED. Among the controls, corresponding figures were 9.0%, and 0.5%, respectively.

ED behavior such as fasting, dieting, and an overemphasis on thinness have been reported in ballet dancers and long-distance runners ideals (Garner et al., 1987; Weight & Noakes, 1987). Gymnasts, swimmers and wrestlers have indicated ED behavior more similar to bulimia nervosa, such as self-induced vomiting and laxative and diuretic use (Warren, Stanton, & Blessing, 1990). One may assume that competitive athletes in sports who emphasize leanness or benefit from a thin body for performance or aesthetics seem to be at a high risk for developing ED (Sundgot-Borgen, 1994). However, there are also studies suggesting that athletes do not seem to be at higher risk of developing an ED (Rosenvinge & Vig, 1993; Warron, Stanton & Blessing, 1990). One should notice that athletes with restrictive eating patterns, who may appear extremely slim, do not necessarily have eating patterns indicative of an eating disorder.

Emotional reactivity based on Eysenck's neuroticism scale has been found to be a predictor of weight and diet among high performance female athletes (Davis, 1992). On the other hand, physical activity has been reported negatively associated with neurotic traits and positively associated with extraversion (Augestad & Levander, 1992; Eysenck et al., 1982). Higher scores on personality factors such as perfectionism and high achievement may be found in ED patients (Bastiani et al., 1995), as well as in those engaging in some types of competitive physical activity (Brownell et al., 1992).

Women with high weekly hours of physical activity seem to be more satisfied with their bodies, whereas preoccupation with body weight is often associated with a negative body perception (Davis & Fox, 1993; Augestad, 2000). Furthermore, Davis et al. (1991) have found that physically active men are more satisfied with their bodies than sedentary men, and neuroticism seems to be associated with a negative body perception in men.

It has been suggested that elite athletes, but not recreational athletes, with high weekly hours of exercise have a higher risk of ED behavior (Augestad, 2000). Moreover, in a population-based Swedish study (Seigel & Hetta, 2001) eating disorder symptoms were not strongly associated with exercise quantity. Smolak, Murnen, & Ruble (2000) have reported that there appear to be circumstances under which sports participation by women constitutes a risk factor for certain elements of eating problems, yet in other situations athletic participation may be protective against eating problems.

### **The female athlete triad**

The “female athlete triad” is a term that was coined by the American College of Sports Medicine in 1992 to describe three interrelated conditions – amenorrhea, osteoporosis, and disordered eating, that often occur together in female athletes (Yeager, Agostini, & Drinkwater, 1993). In the belief that leanness will optimize athletic performance, some athletes excessively reduce the amount of body fat to excel in their sports. The pressure for low body fat may be self-imposed, although attitudes and comments from coaches, leaders, and co-athletes may be triggering factors. Methods used to obtain such slimness include caloric restriction, prolonged fasting, self-induced vomiting, diet pills, laxatives and diuretics, as well as the use of nutritional supplements believed to “burn off fat”. Amenorrhea may be primary or secondary, where the first implies no menstrual period by the age of 16, while the latter is absence of at least 3-6 consecutive menstrual cycles in a woman who has been menstruating. Osteoporosis implies reduced bone mass associated with pathological factors, pain and disability, and bone mineral density is more than 2.5 SD below the young adult reference mean (WHO, 1994). This condition is related to amenorrhea and a low estrogen state. In addition to elite athletes, the female triad can be seen in any woman who participates in regular physical activity, where nutritional intake is insufficient for energy requirements (Golden, 2002).

### **Exercise dependence**

Treating habitual physical activity as prima facie evidence of a disorder is a disservice to those who exercise for health and enjoyment reasons. However, exercise attitudes and behaviors may have negative physiological and psychological consequences for some individuals (Hausenblas & Symons Downs, 2002<sup>a</sup>; Szabo, 1998; Veale, 1995). Exercise dependence was first considered by Baekeland (1970), and since then about 100 empirical studies have been published in the US, Canada, England and Australia exploring excessive exercise and exercise dependence (Davis & Fox, 1993; Davis, 2000; Thornton & Scott, 1995, Adams & Kirkby, 1998; Davis, Katzman, & Kirsh, 1999; Hausenblas & Symons Downs, 2002<sup>a</sup>). In this thesis aspects of exercise dependence have been studied.

The exercise dependence literature has been plagued by a myriad of terms, definitions, and measurements making conclusions regarding its existence, predisposing, precipitating, and perpetuating factors difficult. Few studies have examined excessive physical activity in

both women and men, yet two recent studies have found interesting gender differences in exercise dependence (Hausenblas, 2002<sup>c</sup>; Tata et al., 2001).

### **Defining exercise dependence**

Similar to other addictive behaviors, a standard definition of exercise dependence does not exist (Hausenblas & Symons Downs, 2002). In spite of a modest amount of research in the last three decades, the phenomenon of exercise dependence is still poorly understood. Definitions of exercise dependence have included behavioral factors (e.g. exercise frequency), psychological factors (e.g. pathological commitment), and/or physiological factors (e.g. tolerance). However, the definition that has gained the most recognition was proposed by Veale (1987, 1995) who recommended a set of standards for diagnosing dependence based on the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV) criteria for substance dependence which includes both a biomedical (e.g. tolerance, withdrawal) and psychosocial perspective (e.g. interference with social and occupational functioning).

Expanding upon Veale's definition it has been recommended that, based on DSM-IV diagnostic criteria for substance dependence (APA, 1994), exercise dependence be operationalized as a multidimensional maladaptive pattern of exercise, leading to clinically significant impairment or distress (Hausenblas & Symons Downs, 2002<sup>a</sup>). In addition, it is possible to specify whether the individual has physiological dependence (i.e. evidence of tolerance or withdrawal) or not.

Veale (1995) has proposed that a diagnostic hierarchy must occur to validly identify exercise dependence. He argued that a clinical diagnosis of an eating disorder must first be excluded before a diagnosis of primary exercise dependence can be made. Hence, primary exercise dependence can be differentiated from an eating disorder by clarifying the ultimate objective of the exerciser. In primary exercise dependence, the physical activity is an end in itself. In contrast, for secondary exercise dependence, the compelling motivation for physical activity is the control and manipulation of body composition (Hausenblas & Symons Downs, 2002<sup>a</sup>).

### **Exercise dependence and elite athletes**

The discussion of competitive elite athletes versus non-competitive recreational athletes in regard to exercise dependence was not given specific attention in Papers I or II. Elite athletes exercise mainly to enhance performance in their sport, and are generally motivated by the desire to be the best. Nevertheless, they may still be at risk of substantial

psychopathology regarding their physical training, if they are strongly and emotionally fixated and committed to their exercise activity (Ackard, Brehm, & Steffen, 2002). Having said this, one must remember that most elite athletes exercise excessively as a necessary action to excel in their sports. Hence, as a mere consequence of their high exercise load, they may score high on exercise dependence instruments. In order to decide whether such athletes may have a pathological relationship to their exercise, further investigations should be carried out, such as clinical interviews.

We may have a different situation regarding individuals who engage in strenuous physical activity for several hours every day, yet do not take part in teams or organized sport groups, or participate in any competitions. Which factors may motivate them? One may speculate that some of these are likely to have a dependent relationship to their exercise.

### **Exercise dependence and eating disorders**

Much of the attention regarding “over-exercising” has come from the area of eating disorders because hyperactivity is a pronounced clinical feature of many patients with these disorders. Approximately 80% of female AN patients and 50% of BN female patients exercise excessively during an acute phase of their disorder (Davis, 1999). Very high levels of exercise have also been observed among men, and some have suggested that compulsive exercise is the male analogue of an eating disorder (Yates, Leehey, & Shisslak, 1983; Katz, 1986).

Studies have repeatedly found that excessive exercisers of both genders share several psychological characteristics with eating disorder patients such as perfectionism (Brehm and Steffen, (1998), addictive personality traits (Estok & Rudy, 1996), and greater depression, anxiety, and fatigue (Ogden, Veale & Summers, 1997). Brehm and Steffen (1998) and Davis, Brewer and Ratusny (1993) have found strong evidence that weight preoccupation or a desire to change body shape is the strongest predictor of compulsive (even pathological) attitudes to exercising. Proportionally, Davis et al. (1999) has suggested to consider the concept of compulsive exercise/exercise dependence within the concept of AN, given the very frequent co-occurrence of these two problem behaviors. However, Blaydon & Lindner (2002<sup>ab</sup>) have intimated the existence of primary exercise dependence, yet they question the distinction between it and secondary dependence.

The possible relationship between exercise dependence and the eating disorders is still an ongoing discussion, and while some studies have suggested a relationship, others have found no such association. These conflicting results may be related to the populations studied. Earlier studies have typically compared behavioral and psychological characteristics of small

homogenous, but highly selective groups, such as marathoners and ED patient populations. More recent studies that have compared groups drawn from similar populations would be more likely to find commonalities between excessive exercisers/exercise dependence and eating disordered individuals.

In addition, disparate results may also be attributed to the variety of methods to identify this problem behavior, including direct questions or unidimensional scales that assess only the frequency and intensity of the exercise. Analyses from our data (not published in the Papers in this thesis) indicate a relationship for both genders in the different non-clinical subgroups used in Papers I and II (Table 1).

Table 1. Relationship between high and low scores on the EDI and the EDQ<sup>1</sup> among students.

	Females			Males		
	High EDI N (%)	Low EDI N (%)	RR (95%CI)	High EDI N (%)	Low EDI N (%)	RR (95%CI)
High EDQ	19 (61.3)	12 (38.7)	3.4 (2.5-4.8)	6 (30.0)	14 (70.0)	5.9 (2.7-12.8)
Low EDQ	131 (17.7)	611 (82.3)	1.0	22 (5.1)	407 (94.9)	1.0
Total	150 (19.4)	623 (80.6)		28 (6.2)	421 (93.8)	

Corresponding risk ratios for female half marathoners, RR=5.3, 95% CI: 2.5-10.9, female competitive athletes, RR=4.7, 95% CI: 2.3-9.4, and male marathoners, RR=5.3, 95% CI: 2.5-10.9.

<sup>1</sup>The Exercise Dependence Questionnaire (Ogden, Veale, & Summers, 1997).

## Empirical study

Eating disorders are the main topic in this thesis. However, proportionally with my primary research interest, the first two Papers focused on psychological aspects of physical activity. Eating disorders have been viewed as a type of dependency or addictive behavior (Davis & Claridge, 1998) with associations to substance abuse disorders (Wiederman & Pryor, 1996; Wilson, 1991). Similarly, extreme exercising has also been described as a form of addiction or dependence (Griffiths, 1997), hence in Paper I the focus has been on possible negative effects of excessive physical activity.

The cause as well as the clinical severity of exercise dependence is unclear, and a premature attempt to address these ambiguities in this thesis has not been attempted. However, in Paper II, gender and motives for physical activity among long distance runners, as well as predictors of exercise dependence characteristics have been studied. This may be a contribution to the understanding of exercise dependence in women and men. Paper II indicated gender differences in motives for physical activity. Hence, an interesting continuation would be, in Paper III, to include issues on personality traits and their relationship to exercise and gender. Furthermore, one further step was taken when these issues were explored in relation to pathological eating behaviors.

Paper III opened for appealing research questions in terms of further screening of eating disorders. The high frequency of student scores above 40 on the EDI, motivated for further studies to find out whether this indicated a trend among students, and if so, would a similar tendency be present in younger community samples. Moreover, the EDI was not developed for making classifications of ED, hence a diagnostic survey was included in the following papers. Finally, Paper III indicated similar personality traits for women and men with eating problems, and relatively large percentage of men with high EDI scores. This brought attention to the screening of eating disorders in males, and how they should be assessed in community samples.

When conducting population-based epidemiological studies on eating disorders it seemed convenient to start with a young sample (14-15 years) given the high numbers reported for adolescents in both epidemiological and clinical studies (Fairburn & Beglin, 1990; Hoek, 1993; Fairburn & Harrison, 2003). Proportionally, Gøtestam & Agras (1995) found the highest lifetime prevalence of ED in the youngest age cohort (18-29) in their general population-based study, which encouraged further studies on younger individuals as a

risk group. Furthermore, Rosenvinge et al. (1999) have studied the prevalence and psychological correlates of anorexia nervosa, bulimia nervosa and binge eating among adolescents using DSM-IV criteria. Inspired by these empirical findings, the prevalence of AN, BN, BED and EDNOS in adolescents using both DSM-III-R and DSM-IV criteria have been given attention in Paper VI.

The relative high ED figures in male adolescents in Paper IV were intriguing, and gave further rise to the screening of ED in young adult males. Also, the body of literature on such issues are very scarce, and research on eating disorders among males have more or less been overlooked, due to the mainstream opinion of ED as a female disorder. However, recent studies indicate a rather high percentage of males with ED and body concerns (O'Dea & Abraham, 2002; Carlat, Camango, & Herzog, 1997). Thus, in Paper V the focus was on screening of ED in young adult men using two different instruments.

The causes of ED are elusive, and an attempt to give a tentative answer is not provided in this thesis. However, in Paper VI, a step is taken up from the mere screening of ED to exploring mechanisms of binge eating episodes (antecedents and consequences) among women classified as having an ED based on the SEDs. Such factors may have a maintaining function for eating disorders in some individuals.

## **Study objectives**

### **Major goals**

The main objective for this thesis was to study eating disorders and physical activity in different non-clinical samples. The first step included possible relationships between scores on the Exercise Dependence Questionnaire, physical activity, and gender, while the second step included screening of eating disorders, as well as aspects of pathological eating behavior and their relations to physical activity, personality traits, gender, and age.

### **Sub-goals**

The main aim of Paper I was to analyze scores on the Exercise Dependence Questionnaire (EDQ) among 1221 physically active females. The possible difference between women with high and women with low weekly hours of physical activity in relation to high scores on the EDQ was studied. The purpose of Paper II was to evaluate gender differences in competitive runners and their motive for physical activity. In Paper III the main aim was to study associations between personality traits, ED behavior, exercise behavior and gender in a student population. Then, in Paper IV the aim was to collect questionnaire information on an



adolescent sample of both genders, to give DSM-IV and DSM-III-R-based diagnoses of AN, BN, BED and EDNOS. We were also interested in the patterns of ED, as well as the relationship between body perception and self-reported weight. In Paper V the purpose was to evaluate two different questionnaires for screening of ED in males; the Eating Disorders Inventory (EDI) and the Survey for Eating Disorders (SEDs). Finally, in Paper VI, the aim was to explore antecedents and sequelae of binge eating episodes in women taken from a general population based study. We were interested in binge eating behavior among individuals that met the DSM-III-R criteria for an eating disorder diagnosis based on a self-report questionnaire.

### **Material and method**

All studies in this thesis are cross-sectional and based on self-report questionnaires. Due to somewhat different sample procedures, they vary in methodological strength. This may have important implications for the conclusions that can be drawn from them. In cross-sectional designs participants are selected and assessed in relation to current characteristics. This is distinguished from studies that are designed to evaluate events or experiences that occurred in the past (retrospective studies) or that will happen in the future (prospective studies). The goal of a cross-sectional case-control study is to examine factors that are associated with a particular characteristic of interest (Kazdin, 2003). Participants are identified and assessed on multiple characteristics beyond those used to delineate their status as cases or controls.

Cross-sectional designs are useful for identifying correlates and associated features, and these findings may be quite informative and significant. They are well suited when studying conditions or characteristics that are relatively infrequent in the population. However causal relations cannot be directly demonstrated, and sampling biases may occur, depending on how the cases were identified (Kazdin, 2003). Moreover, one should avoid derailing into a “the more the better” axiom as a compensation for a weak design, as this axiom may increase the risk for type I statistical errors and ad hoc theoretical constructions from statistically significant results.

## Participants and procedures

Included subjects were from five different non-clinical populations:

1. Sport participants, two subgroups:
  - a. Long distance runners, 462; 236 females, and 226 males.
  - b. Competitive female athletes, 182.
2. University students, 1482; 905 women and 577 men.
3. Adolescents, 1960; 1026 girls, and 934 boys.
4. Male military recruits, 1196.
5. Women taken from a general population-based study, who classified as having an eating disorder, 154.

### *Sport participants*

*Long distance runners.* Questionnaires were sent to 500 of the female and 500 of the male participants randomly selected from those completing Oslo Marathon 1997. Every fifth person aged 18 to 60 years who completed the race had a questionnaire mailed to their home address, with envelopes and postage included to facilitate return. Female participants in the *half-marathon* (21 km) were chosen due to limited participation in the full marathon. Completed questionnaires were returned by 236 (47.2%) of the original 500 women, and 226 (45.2%) of the 500 men. After disregarding 25 forms that were incorrectly addressed and returned to sender, the final response rate was 462 (47.4%). In Paper I the female long distance runners were included, and in Paper III both female and male runners were included.

*Competitive female athletes:* Of sixty individual athletes participating in cross-country skiing, orienteering, long-distance running and dancing were sent the questionnaire, 53 (88.3%) returned completed forms. Of 232 team sport athletes (handball, ice hockey, soccer and volleyball) who were given the questionnaire, 129 (55.6%) returned completed forms. A total number of 292 questionnaires were sent to female athletes and 182 (62.3%) returned. These women were included in Paper I.

### *University students*

University students were recruited from the four Universities in Norway, Oslo, Bergen, Tromsø and Trondheim. Students were recruited from the large reading halls available to lower degree students in late autumn 1997. The questionnaires were placed on each student's reading room desk at the start of the day and answered voluntarily. In her or

his own time, each student returned completed forms in a mailbox placed outside the reading room. The incentive for completion was automatic entry to a lottery.

In all, 1489 students returned completed forms, 910 women and 579 men. After excluding those under 18 and over 40 years the study sample consisted of 1482 lower degree students, 905 women and 577 men (Paper III). Of the 905 women, 803 were physically active, and those women were included in Paper I.

Due to the data collection procedure for the students, it is difficult to provide a clear-cut response rate in the student sample, and we should consider the representativity of the student sample with caution. However, based on the gender distribution for each university (Statistics Norway, 1997; Norwegian Social Science Data Services, 1998), we have statistically estimated approximate response rates. The overall estimated response rate was 54.1% (women, 56.6% and men, 50.7%). In each University the estimated response rates were in Bergen, 55.4%, Oslo, 58.9%, Tromsø, 39.4%, and Trondheim 55.8%. A thorough discussion of these limitations, and more details regarding these response rates are provided in Paper III.

### *Adolescents*

In Paper IV a total of 1987 adolescents (1034 girls and 953 boys) aged 14 and 15 years were given a questionnaire in their classrooms during school hours in 13 different secondary schools (9<sup>th</sup> and 10<sup>th</sup> grade) in Sør-Trøndelag County in Norway. The children and their parents received a personal letter inviting the child to participate in the study, which informed about anonymity and that participation was voluntary. The completion of self-report forms took place with an experimenter present. Eleven children did not get consent to participate from their parents, and 16 returned inconsistent forms. Thus, a total number of 1960 subjects (response rate 98.6%) (1026 girls, 99.2% and 934 boys, 98.0% returned completed forms. This sample represents 64.2% of the total number of 14 and 15 year-old girls in Trondheim, and 34.0% of Sør-Trøndelag County as a whole. For boys these figures were 59.3% and 30.7%, respectively.

### *Military recruits*

In 1997, 29821 men were conscripted. After excluding 2443 (8.2%) defined as incapable of completing the military service and a further 2385 (8.0%) whom chose to undertake civil work, the initial military group consisted of 24993 men. Of the 2443 men defined as incapable of completing the military service, 81.4% were excluded due to medical

or physical problems, and 18.6% due to mental problems. Healthy servicemen from the Norwegian Royal Army, Air Defense and Navy located in the three separate military quarters in geographically different parts of the country were randomly selected. The duty officers were responsible for the organization of the soldiers during the data collection. All soldiers in each quarter received questionnaires, which they all completed voluntarily. The total sample thus consisted of 1196 men. These young men should provide a fairly good representation of Norwegian males 19-21, and were included in Paper IV.

#### *General population-based study of women with an eating disorder*

In Paper VI included participants were women classified as having an eating disorder based on questionnaire information in a general population-based study. A total of 2500 women, representatively sampled from the Norwegian population in 1991 were sent a questionnaire. Of these, 30 could not be traced because of unknown addresses, giving a total number of possible respondents of 2470 (98.8%). Nonresponders were reminded in a second letter, and a lottery was used to increase the total response rate. A total number of 1849 subjects (74.9%) returned completed forms. Of the total sample, 160 responded positively to the gate question, which indicated some kind of eating disorder. However, 6 of the 160 did not fill in the specific eating-related questions. Thus, in the detailed description of the different eating disorders, 154 (8.3%) ED subjects were included, and analyzed in Paper VI.

### **Instruments**

Self-constructed inventories were used in Papers I-VI including questions on demographics, height and weight, weekly hours of training (Papers I-III), motives for physical exercise (Paper II), type of physical activity (Paper III). In addition, standardized surveys on exercise dependence (Papers I and II), eating disorders (Papers III-VI), and personality traits (Paper III) were distributed:

#### *The Exercise Dependence Questionnaire (EDQ)*

Ogden et al. (1997) developed the Exercise Dependence Questionnaire (EDQ) with 29 items and 8 sub-scales designed for the assessment of different aspects of exercise dependence. Each unit is answered on a seven-point Likert scale where 1 means “strongly disagree” and 7 means “strongly agree”. Bamber et al. (2000) have suggested a score on the EDQ of  $\geq 116$  (at least four per item) to be viewed as a high score, and based on the EDQ high-scoring individuals may be considered as exercise dependent. These authors argued that

their cut-off was insufficiently rigorous. Among the women the mean score on the EDQ was 103.0 (SD=16.76, range 41-169), and for the men 100.70 (SD=17.21, range 50-149), respectively. As a consequence, we have in the Paper II used an EDQ score of  $\geq 130$  as a cut-off score (at least 4.5 per item).

The choice of EDQ to assess possible exercise dependence was based on various factors. Most of the existing instruments for exercise dependence are based on runners, while the EDQ was designed to be applicable in different types of sports. In addition, the EDQ is multidimensional scale meant to assess both biomedical and psychosocial aspects of dependence, and has indicated promising psychometric qualities (Ogden et al., 1997; Cockerill & Riddington, 1996). Thus, at the time of the data collection we considered the EDQ the best instrument of choice. Hausenblas & Symons Downs (2002) have recently developed a promising survey, Exercise Dependence Scale (EDS) which operationalizes exercise dependence based on the DSM-IV criteria for substance dependence.

Since the theoretical framework, definitional criteria and clinical features of exercise dependence, is still an open discussion (Seigel & Hetta, 2001; Bamber, 2000; Davis, 2000, Hausenblas, 2002<sup>a</sup>), we have in Papers I and II suggested defining possible exercise dependence as high scores on the EDQ, hence the term EDQ-based exercise dependence.

### *The Eating Disorder Inventory (EDI)*

The Eating Disorders Inventory is a widely used and recommended screening instrument for eating attitudes in large non-clinical populations (Garner, Olmstead, & Polivy, 1983). The EDI is a self-rating inventory with 64 items and 8 scales designed for the assessment of attitudes and behavioral dimensions related to anorexia and bulimia nervosa. The EDI was designed to provide a measure of both the specific and general psychopathology found in ED patients. The reliability and validity of the EDI support its use as an economical instrument for evaluating behavioural and psychological traits common to individuals with eating disorders.

A cut-off "sum score" equal or higher than 40 on the EDI has been used to identify subjects with eating disorders, and other studies refer to a cut-off score of 14 on the subscale of Drive for Thinness (Sundgot-Borgen, 1993). Most of the studies have focused on female samples. We think it is reasonable to use the same cut-off levels for men, since findings of other studies suggest clinical similarities between men with ED and women with ED, and

since both groups suffer similar psychosocial morbidity (Olivardia et al., 1995; Woodside et al., 2001). The EDI was used in Papers III and IV.

#### *The Survey for Eating Disorders (SEDs)*

The SEDs was developed by Göttestam and Agras (1995), containing 36 items, including six demographic questions and 30 regarding eating habits and problems. One question was a “gate question” dividing the sample into people without, with current, or with lifetime disorders. The subquestions for subjects classified as having an eating disorder included questions that allowed full diagnosis of AN, BN and EDNOS based upon DSM-III-R criteria.

Different versions of the SEDs have occurred since the first version, and both DSM-IV and DSM-III-R criteria have been included. It has been modified and updated by Ghaderi and Scott (2002) to address the potential shortcomings pointed out by the constructors of the questionnaire. The newest version consists of 39 questions 18 of which are necessary for diagnosis, five are demographic, and the others provide helpful information regarding age of onset for dieting and binge eating and antecedents as well as triggers of dieting and binge eating. Only the original version of the SEDs specified a “gate question”. The SEDs has been used in several population-based studies of both genders, and a promising preliminary validation of the SEDs has been done on a Swedish material (Ghaderi & Scott, 2002). In Paper VI the original SEDs was used, while in Papers IV and V modified versions.

The SEDs was chosen in Papers IV-VI based on the decision to use an instrument with the potential of assessing the whole spectrum of ED according to DSM-IV. The DSM-IV has relied more on empirical data than its predecessors, and may be considered empirical and accessible (Nathan, 1994). The SEDs also include DSM-III-R criteria, and in Paper IV both manuals were used. One should note that classifying cases based on self-report questionnaires without additional interviewing is not sufficient in terms of identifying individuals with clinical eating disorders.

#### *The Karolinska Scales of Personality*

Self-report personality inventories are standardized for quantifying individual differences in habitual overt behavior, preferences, cognitive style and reaction to given situations. In Paper III we used the Karolinska Scale of Personality (KSP), consisting of 135 items which form 15 scales (Schalling & Edman, 1987). The response format in KSP is a four-point scale, from “does not apply at all” (1) to “applies completely” (4). The KSP

inventory should be regarded primarily as an instrument for operationalizing theoretical constructs that appear promising to psychobiological research. The aim of the inventory is to measure personality correlates to some psychiatric disorders in order to define vulnerability factors, which may help to identify individuals at risk for developing disorders.

#### *Working definition and classifications of physical activity*

Physical training was defined as sports and physical exercise in Papers I, II, and III. Physical exercise was defined as hours spent doing physical exercise each week. The average time spent on physical activity each week was assessed. This approach provided a fairly good method for differentiating physical activity between the participants. For some of the analyses it was sufficient to dichotomize the physical activity variable. This was done in slightly different approaches.

In Papers I and II the classifications of high physical activity were based upon the average hours of physical activity (about 5 hours). In Paper I two groups of “high physically active women”, exercising 5 hours or more and 10 hours or more per week were calculated. Similar criteria have been used elsewhere (Veale, 1987; Nudelman, Rosen, & Leitenberg, 1988). In Paper II, “high level runners” were defined as those exercising 7 hours or more per week, while low level runners were defined as those exercising less than 7 hours each week.

The students in Paper III who exercised seven hours or more represented about the 90<sup>th</sup> percentile on the variable “hours of weekly physical activity” (n=203, 13.7% of the sample). Thus, high level exercisers (HLE) were defined as those exercising seven hours or more per week, while moderate level exercisers (MLE) were defined as those exercising less than seven hours each week. This cut-off was similar to definitions that have been used elsewhere (Davis et al., 1993; Seigel & Hetta, 2001).

#### *Body Mass Index*

Self-reported height and weight were converted to Quetelet’s index of body mass (BMI; weight in kilograms divided by height in meters squared). In Paper IV BMI was further classified into four groups partly based on the original groups suggested by Van Itallie (1985); underweight (BMI < 21), average weight (BMI 21-27.29), obese (BMI 27.3-32.29), and severely obese (BMI ≥ 32.3). Among adolescents no clear-cut groups have been delineated, although, modified values were chosen for underweight (BMI < 19) and average weight (BMI 19-24.9) that may be more appropriate for adolescents (Gilbert, 1986;

Rosenvinge, Sundgot-Borgen, & Børresen, 1999). To meet today's standards, a more recent classification was used in paper IV (NHLBI, 1998): Underweight (BMI  $\leq 18.5$ ), average weight (BMI 18.5-24.9), overweight (BMI 25.0-29.9), obese (BMI 30.0 or higher). A weakness of BMI is that individuals with a muscle mass will have high BMI figures, although they may have a low percentage of body fat.

### **Statistical analyses**

All analyses were conducted by using SPSS, version 9.0, 10.0 and 11.0, and SAS (version 8.01, Paper V). P-values of  $<0.05$  were considered to be statistically significant.

### **Paper I**

Internal reliability analyses (Cronbach's alpha) were performed on the factors and on the total EDQ. One-way ANOVA (t-test) was used to compare scores on the EDQ among high- and low physically active women. Stepwise multiple regression was used to analyze predictors of high physical activity using the continuous variable hours of exercise per week as the dependent variable.

### **Paper II**

Firstly, univariate statistical analyses on scales or sums of scales were performed. Chi-square tests were used to examine associations between high EDQ scores and gender. Secondly, multivariate statistical methods, linear regression and discriminant analyses were used.

### **Paper III**

Univariate statistical methods on raw data or sums of raw data (scale level) were performed. Risk ratios (RR) and 95% confidence limits were calculated as the risks within a specific category (gender and type of sport activity) divided by the total risk for the whole class of categories. To deal with possible mass significance problems a principal components analysis (eigenvalues  $> 1$ , Rotated Varimax) was conducted on the KSP, reducing the number of personality factors from 15 to 3 compound scales. Subsequently, a stepwise multiple regression was done to examine predictors of high physical activity, and a stepwise discriminant analysis was applied to the data set to assess differences between students with ED behavior and students with normal eating behaviors based on the EDI.



### **Paper IV**

Analyses were done using t-tests and  $\chi^2$ .

### **Paper V**

Odds ratios (OR) and 95% confidence intervals (CI) were used to analyze associations of the presence of a SEDs-based ED with other factors. The sensitivity and specificity of the summary score were calculated for the EDI, by using the SEDs diagnosis as the reference “gold standard” diagnosis. Multivariate logistic regression was used to assess predictive ability of the EDI subscales. The area under the ROC curve was used to assess the discriminatory ability of the EDI. We used results of the logistic models to construct a predictive score from subscales of the EDI that had been selected in stepwise regression as the most predictive.

We calculated the score for each person and formed an EDI-based classification by classifying people as having EDNOS if the score was greater than a selected cut-off and as healthy otherwise. This approach is standard for using logistic regression results to categorize subjects (Flanders et al., 1999).

### **Paper VI**

Chi-square and one-way ANOVA were used to identify differences in demographic variables between the different ED-diagnosis. One-way ANOVAs with Tukey HSD post hoc comparisons were used to identify possible differences between the ED-subgroups in frequency of binge eating episodes. To assess possible differences in frequency of antecedents and consequences of binge episodes, a chi-square was used.

## **Results (summary of the papers)**

### **Paper I**

#### **Exercise dependence in physically active women**

Exercise and sport may increase the quality of life. Nevertheless, some habitual exercisers may not always associate physical activity with the feeling of well-being and health promotion. When does physical activity become negative for somatic and mental health? In Paper I the aim was to analyze exercise dependence characteristics among 1221 physically active Norwegian females using the Exercise Dependence Questionnaire (EDQ). The relationship between weekly hours of exercise and scores on the EDQ was analyzed.

The results indicated that the two strongest predictors of high physical activity were higher scores on “interference with social life” and higher scores on “withdrawal symptoms”. A strong relationship was found between hours of physical activity and EDQ-scores. The task of solving the dysfunctional aspect of physical activity is still an ongoing discussion. A reasonable objective for athletes, coaches, therapists and health professionals would be to ensure exercise adherence without the negative aspects of an addiction or dependence.

### **Paper II**

#### **Gender differences in competitive runners and their motive for physical activity**

The aim of the present study was to analyze gender differences, age and BMI in competitive runners and their motives for physical activity. The subjects, 236 female and 226 male competitive runners, filled out a questionnaire including weekly hours of exercise, motive for physical activity and The Exercise Dependence Questionnaire (EDQ). Female runners were more concerned with stress relief, improving their physical performance and to improve their mood than were men. Women and men with a high amount of weekly exercise wanted to feel good about their personal health.

High scores on the EDQ were associated with more weekly hours of physical activity, exercise to improve physical performance and for enjoyment.

The present study indicated that there are gender differences in competitive runners and their motive for physical activity. However, there was no strong evidence for a gender difference in relation to high scores on the EDQ. This study suggests that EDQ-based exercise dependence is not more common among male runners than female runners.

### **Paper III**

## **Gender, eating behavior and personality characteristics in physically active students**

The aim was to examine associations between personality traits, eating disorder (ED) behavior, exercise and gender. The participants (n=1482, 905 women and 577 men) were students from the four universities in Norway. The subjects filled out a compound questionnaire including demographics, weekly hours of exercise, type of sport, Karolinska Scales of Personality (KSP), and the Eating Disorder Inventory (EDI). The results indicated that the RR for women who scored 40 or higher on the EDI was 3 times higher compared with men. ED behavior did not seem to be associated with high weekly hours of physical activity in general. There were significant gender differences in personality traits. However, women and men with high scores on the EDI indicated no differences on the KSP-scales except on “detachment” and “indirect aggression”.

The most important predictors for weekly hours of physical activity were the EDI-scales “drive for thinness”, and “body dissatisfaction”, and the personality variables “extraversion” and “neuroticism”. The factors that contributed most to the differences between students who scored 40 or higher on the EDI and those who scored below 40 on the EDI were neuroticism, BMI, gender and age.

## **Paper IV**

### **Prevalence of eating disorders in female and male adolescents (14-15 years)**

The main aim in Paper IV was to establish the prevalence of eating disorders (ED) in adolescents of both genders. To our knowledge, such data has not previously been published using both DSM-IV and DSM-III-R criteria. The study sample consisted of 1960 adolescents (1026 girls and 934 boys), 14-15 years of age. Lifetime prevalence of any ED among girls was 17.9%, anorexia nervosa (AN) 0.7%, bulimia nervosa (BN) 1.2%, binge eating disorder (BED) 1.5%, and eating disorders not otherwise specified (EDNOS) 14.6%. Corresponding numbers for boys were any ED 6.5%, AN 0.2%, BN 0.4%, BED 0.9%, and EDNOS 5.0%.

DSM-III-R and DSM-IV give corresponding numbers on total lifetime and point prevalence of ED. Some inconsistencies were found regarding the pattern of the different subtypes. Our prevalence rates on AN, BN and BED largely support previous school/community-based studies, while our figures on EDNOS were rather high. Generally, we found high numbers for boys with ED, with male-female ratios of any ED 1:2.8, AN 1:3.5, BN 1:2, BED 1:1.7, and EDNOS 1:2.9.

## **Paper V**

### **Screening of males with eating disorders**

The purpose of Paper IV was to evaluate two different questionnaires for screening of eating disorders (ED) in males; the Eating Disorders Inventory (EDI) and the Survey for Eating Disorders (SEDs). The study sample consisted of 1196 Norwegian males serving as compulsory military recruits (mean age 19.9, SD=1.4). The best predictors for having a SEDs-based diagnosis of ED were the EDI scales Drive for thinness (DT), Bulimia (B), Ineffectiveness (I) and Interpersonal awareness (IA). When we classified men with an EDI sum score of 40 or higher as having an eating disorder (ED), the sensitivity was 47% and the specificity was 91%, compared to the SEDs diagnosis of ED. Our results suggest modest agreement between the ability of the EDI and that of the SEDs to identify men with ED. Our results indicate the need of further studies including clinical samples to validate the EDI against the SEDs.

### **Paper VI**

#### **Antecedents and consequences of binge eating episodes in women with an eating disorder**

The aim of Paper V was to explore antecedents and sequelae of binge eating episodes. A sample of eating disorders (N = 154 women) was selected from a total of 1849 female respondents (out of 2500) recruited as part of a general population-based survey. Included participants met DSM-III-R criteria for anorexia nervosa (AN), bulimia nervosa (BN) or eating disorder not otherwise specified (EDNOS) based on the Survey for Eating Disorders (SEDs). Preliminary criteria for binge eating disorder (BED) were added. Results indicated that the most frequently reported antecedents and consequences of binge eating were emotional and physiological factors. There were significant differences between the different ED subgroups in their frequency of binge eating episodes. Regarding antecedents of a binge eating episode, the SEDs-defined ED subgroups had overall differences in frequency on “stomach feeling”. In particular, the BN-group reported “euphoria” more frequently than the BED and EDNOS-groups. Concerning consequences of a binge eating episode, there were overall differences between the ED subgroups on “fall asleep”, and in addition a borderline significance was found for “disturbed by others” ( $p = .059$ ). None of the eight women in the AN group reported “euphoria” as a factor that terminated a binge eating episode. The findings may have important implications with regard to prevention and treatment of ED.

## Discussion

### Physical activity and exercise dependence

#### Predictors of physical activity

Paper I suggested that the two strongest predictors of high physical activity among females are when exercise disturbs the social life, and the athlete experiences distinct withdrawal symptoms. High physically active females scored lower for health reasons and lower for weight control than the low physically active. Interestingly, the 10-hour group had the lowest means on these factors. Hence, the health perspective may be of generally low priority among women who exercise a lot, and other stronger factors may be motivating them. For women who engage in occasional exercise the motive for a better health may be a significant factor.

However, in Paper II, female high exercising runners indicated personal health as an important reason for their exercise. Thus, these patterns seem to be more complex than suggested in Paper I, where physically active women from different populations were studied together. Unpublished results with the subgroups in Paper I examined separately indicate that female students with high hours of physical activity are less motivated by health issues than female competitive sport participants with high hours of exercise.

In Paper I, the high physically active women scored higher on “interference with social life”, yet also on “exercise for social reasons”. Perhaps these women see themselves as social individuals when they exercise and will consequently have score high such items. However, they may also feel that their exercise level is disturbing their social life (Dishman, 1985). Their social life may be largely restricted to the sports arena, and hence, their participation in other social arenas may be scarce.

Female high level runners had a positive association related to withdrawal symptoms, and a negative association to positive reward after exercise and stress relief. The corresponding male runners also had a negative association with positive reward, and in addition they focused on following a training program. This finding may be confirmed by Crossman et al. (1987), who reported that male athletes suffered greater distress from a scheduled lay-off in training than their female peers. Thus, one could argue that the female runners in Paper II continue exercising because they feel anxious and tense when deprived of training, while men’s commitment to physical activity is more focused around schedules.

In regard to exercise stress relief and improving physical performance was more important for women than men. The women's focus on physical performance was surprising, as they tend to base self-worth on physical appearance, whereas men stress physical effectiveness (Striegel-Moore, Silberstein, & Rodin, 1986). It may be that sociocultural pressure related to thinness and physical appearance encourages women to exercise for physical performance. Moreover, one could argue that men experience an increasing focus on their physical appearance, as indicated in Paper II among men with high scores on the EDQ. Striegel-Moore, Silberstein, and Rodin (1986) is comparatively an older study in this regard.

### **Predictors of exercise dependence**

The results of Papers I and II suggested a strong relationship between increasing hours of physical activity and EDQ-based exercise dependence characteristics. This may be supported by Pierce et al. (1993) who concluded that a tendency towards exercise dependence may motivate participation in competitions of increasing distance. There was no strong evidence for a gender difference in relation to high scores on the EDQ. However, women scored higher on the EDQ-scales "exercise for weight control" and "withdrawal symptoms", and lower on "insight into problems". In addition, hours of weekly exercise did not predict high EDQ scores among women as strongly as for the men. Thus, women's exercise dependence behavior seems to be less focused on the actual amount of physical activity. On the other hand, no significant difference was found in EDQ scores between the women and men with higher amounts of weekly exercise. This finding may be underscored by Carmack and Martens (1979) who found that the difference in "commitment" disappeared at higher training volumes may support this.

Females with high EDQ-scores were concerned with exercise to improve their mood and feel good about personal health. The corresponding male group had hours of weekly physical activity as the strongest predictor. Both female and male runners scoring high on the EDQ had a strong drive in relation to improving physical performance. This drive for enhanced performance in highly physically active individuals with additional high scores on exercise dependence may reflect an increased risk of overtraining in terms of reduced performance and fatigue (Armstrong & VanHeest, 2002). Veale (1991) has reported that overtraining and exercise dependence seem to share several significant characteristics, and Adams and Kirkby (2001) have stated in a recent review that exercise dependence may be a probable cause of overtraining.

Recent studies indicate that exercise dependence may be prominent in certain groups of sport, such as triathletes and body builders. Having said that, a recently described syndrome is muscle dysmorphia, suggested as a specific form of body dysmorphic disorder, where the subject is obsessed with a bodily feature that he or she thinks is deformed or ugly but is, in fact, within the normal range (Pope et al., 1997; Choi et al., 2001; Olivardia et al., 2000). Muscle dysmorphia has been described as a male issue rather than a female issue (Pope et al., 1997). A related aspect of this disorder is the excessive use of anabolic-androgenic steroids and other ergogenic (performance- enhancing) drugs in certain sport groups, which may have severe physiological and psychosocial consequences, sometimes associated with significant morbidity.

## **Eating disorders**

### **Predictors and associated features of eating disorders**

In Paper III, the factors that contributed most to the differences between students with ED behavior and those with low scores on the EDI were neuroticism, BMI, gender and age. Neuroticism was strongly associated with high scores on the EDI for both genders. This finding may be supported by other studies (Geller et al., 2000; Janzen, Saklofske, & Kelly 1993). Augestad, Sæther, and Götestam (1999), and Perry et al. (2002) have also suggested a relationship between eating disorders and personality traits.

In spite of general significant gender differences in personality traits, women and men with high scores on the EDI indicated similar personality traits. This seems to be in agreement with Woodside et al. (2001) whose findings confirmed the clinical similarities that have been found between women and men with an ED, and that both women and men with EDs suffer similar psychosocial morbidity. Olivardia et al. (1995) has indicated that men with an eating disorder were similar to women with bulimia nervosa on several psychological variables. It is also interesting that Davis & Strachan (2001) found that if an athlete develops an eating disorder, their psychological profile is no different from others with this disorder. Thus, we may suggest that those who develop an eating disorder may share many psychological characteristics and psychosocial morbidity.

An important finding was that ED behavior did not seem to be associated with high weekly hours of physical activity in general. This is supported by other recent population-based studies (Augestad, 2000; Augestad & Flanders, 2002; Seigel & Hetta, 2001). In

addition, in this thesis no strong evidence was found for a higher ED frequency in certain types of sports. However, Paper III indicated that women participating in certain both dancing/aerobics and endurance activities or both dancing/aerobics and power training may be at a higher risk of ED behavior. One may speculate that this maybe is due to extra focus on “the perfect body ideal”. Both dancing/aerobics and endurance are, in the literature, considered as ED-risk sports (Sundgot-Borgen, 1993). Combining these types of exercise might offer an increased risk of ED behavior.

In Paper VI a substantial number of young girls and boys seemed to be concerned with their body weight, as over 70 % of the girls and over 60% of the boys who considered themselves obese were underweight or normal weight. In addition, 44.4% of the girls were dieting or felt they should diet. These are alarming figures, which might be an expression of the sociocultural pressure related to thinness and physical appearance in Western societies. Signals and influence presented by the mass media may also reflect and reinforce young peoples body perception and desire for thinness. Western societies seem to encourage and reward the pursuit of a “perfect” body as an ideal that symbolizes the attainment of several personal virtues and achievements. Unfortunately, the body image standards aspired by individuals today are beyond what can be achieved with healthy or sensible levels of dieting or exercise.

## **Prevalence of eating disorders in both genders**

### *Adolescents*

DSM-III-R and DSM-IV gave corresponding numbers on total lifetime and point prevalence of ED among 14-15 year-olds, although some inconsistencies were found regarding the pattern of the different diagnostic categories. DSM-IV identified lower numbers of BN, and higher numbers of EDNOS compared to DSM-III-R. The increase of EDNOS from DSM-III-R to DSM-IV, may reflect Fairburn and Harrison’s (2003) concern that the existing scheme for classifying eating disorders may be viewed as unsatisfactory, as so many subjects fall into the EDNOS group (Thaw, Williamson & Martin, 2001).

The suggested prevalence rates on AN, BN and BED in Paper IV largely support previous non-patient school/community-based studies, with somewhat higher figures for boys. Generally, the suggested figures on EDNOS were rather high. The BN rates almost equals those of older cohorts (1%) (Fairburn & Beglin, 1990; Hoek (1993) and is higher than the figures reported by most studies comprising the age group 11-16 years (Santonastaso et



al., 1996; Steinhausen, et al., 1997). This may indicate that BN appear more frequent in younger adolescents than previously suggested.

The suggested AN rates equals those reported in some school based samples (Råstam, Gillberg, & Garton, 1989; Patton et al., 1999), as well as suggested figures for AN in the US (0.48-0.7%) among teenage girls (Fairburn & Harrison, 2003; Lucas et al., 1991). However, compared to two-step design study in Norway (Rosenvinge et al., 1999), Paper IV indicated somewhat higher AN figures.

### *Adults*

In Paper VI, women from a general population-based study were classified as having an ED based on the SEDs (DSM-III-R), AN 0.4%, BN 1.6%, BED 1.0%, and EDNOS 5.3%. Corresponding figures among young adult men were in Paper V (DSM-IV), AN 0.08%, BN 0.5%, BED 0.4%, and EDNOS 1.9%, with gender ratios of AN 1:5, BN 1:3.2, BED 1:2.5, and EDNOS 1:2.8. These gender ratios indicate rather high figures for men, and seem to be fairly in line with those for adolescents (Paper IV). Accordingly, the male students in Paper III also scored rather high on the EDI, with somewhat higher scores for women. Interestingly, young men classified with BN, EDNOS or any ED in Paper IV had a higher average score on the EDI than corresponding women as described by Augestad and Flanders (2003). The suggested high figures of eating disorders among males in Papers III, IV and V is in accordance with Andersen (1990, 2002) and O'Dea & Abraham (2002). Furthermore, Kinzl et al. (1998<sup>a</sup>) and Kinzl (1998<sup>b</sup>) found that the gender-specific prevalence of eating disorders is closer to each other than often believed, and Westenhoefer (2001) has supported this by finding that the prevalence of eating disorders among men is comparable to that of women.

Paper V suggested modest agreement between the ability of the EDI and that of the SEDs to identify men with ED. The results point out the importance of the EDI scales DT and B for identification of men with eating disorders. The substantial role of drive for thinness is also well documented in female samples (Ghaderi & Scott, 2002; Joiner & Heatherton, 1998). This supports the claim that at least some of the characteristics of males with eating disorders are very similar to those of females (Burns & Crisp, 1990).

### **Mechanisms of binge eating episodes**

The results in Paper VI are in accordance with Polivy and Herman (1993), Lynch et al. (2000) and Vanderlinden et al. (2001), who also found emotional and physiological triggers to be the most important. Paper VI suggested that dysphoria was an important antecedent and

also a factor that terminates a binge eating episode. These results may be supported by Lynch et al. (2000) who has reported greater negative affect before and after binge episodes.

Interestingly, only one women with AN felt that “euphoria” was an antecedent of a binge eating episode, and none of the eight women with AN reported “euphoria” as a factor that terminated a binge eating episode. In addition, all other subgroups also scored rather low on “euphoria” as a terminating factor. These findings appear inconsistent with Stickney, Miltenberg, and Wolff (1999) and Kenardy, Arnow, and Agras (1996) who found that binge eating may serve a negative reinforcement function by providing relief from the aversive antecedent conditions. However, it is plausible that these women may have experienced euphoric mood states during their binge eating, although other factors seemed to be more dominant when a binge was terminated.

Binge eating may serve different functions across ED subgroups and individuals. Our results are in accordance with the DSM-IV (APA, 1994), and support Vanderlinden et al. (2001) who found that binge eating seems to be provoked by a combination of different factors.

### **Problems and limitations**

In this thesis several limitations and methodological issues should be mentioned, and hopefully addressed in future research. One weakness was that identification of ED cases was solely based on self-reports in a one-step design, which is the most economic and time-effective method. Studies on eating disorders based on questionnaires are often criticized in the literature (Fairburn & Beglin, 1990; Hsu, 1996; Rosenvinge, Sundgot-Borgen, & Børresen, 1999), and given the limitations of diagnostic categorization without interviews, one should interpret the results in this thesis with caution.

One consequence of self-report one-step designs is that the instrument in use will be essential for the reliability and validity of the results. Ghaderi and Scott (2002) have reported that the SEDs has reasonable diagnostic psychometric properties. In this thesis we have reported modest agreement between the EDI and the SEDs in young men, and future studies are needed that look more thoroughly at these instruments' ability to distinguish men with ED and men without ED.

A more reliable and valid method would be two-step designs, where the second step includes assessment and case ascertainment based on interviews. A two-step design could have strengthened our results, and made them more interpretable.

The assessment of physical activity in this thesis was based on single self-report questions (Appendix I, Paper III). A more sophisticated measure of physical activity may have strengthened the results. However, Blair (1995) have described that for population-based studies, such simple questions suffice to classify individuals into broad physical activity categories.

The results in Papers I and II should be viewed as preliminary since the theoretical framework, definitional criteria and clinical features of exercise dependence are not sufficiently documented. Given these difficulties, I still think the continued study of exercise dependence remains an important issue. As seen in Papers I and II, common motives for high physical activity and exercise dependence were found, such as improving physical performance, personal health issues, mood improvement, and following a training program. An intriguing question is how some may develop and maintain a healthy relation to sport and exercise, while others may adopt excessive and unhealthy patterns of exercise. The study of exercise dependence is still in its infancy, and further research is needed to better understand the precipitating and perpetuating factors associated with this problem behavior.

### **Implications for the prevention of eating disorders**

Although based on self-reports, the results in the thesis at hand may indicate that a large number of adolescents of both genders, and also young males, have subclinical eating disorders with significant body dissatisfaction and weight concerns. These are alarming figures, which might be an expression of the sociocultural pressure related to thinness and physical appearance in Western societies. Hence, this thesis may warrant increasing efforts in terms of initiating and conducting primary prevention among adolescents and young adults. Such efforts may include population-based health campaigns, and school-based programs funded by the national health authorities, as well as seminars and courses on eating disorders specially designed for different populations, such as health personnel, teachers, pupils and parents, coaches and athletes, and other populations. We can encourage young men to share concerns about body image, and diet at an earlier, less severe juncture, assuring them that these issues are also common among males.

In primary prevention emphasis is on the advantage of blocking the development of a behavior over altering the existing behavior. In the case of ED, this may be interpreted as intervening before premorbid weight concerns excede into an eating disorder. Finding factors to better identify those at risk of later development of an eating disorder is necessary for developing primary prevention programs (Leon et al., 1997).

Some broad school-based prevention programs have been carried out, including one in Norway (Børresen Gresko & Rosenvinge, 1998). Carter (1997) has claimed that such programs may be counterproductive in the longer term. However, recent studies focusing on self-esteem in prevention have indicated better long term outcomes in terms of improved body image and self-esteem (O’Dea & Abraham, 2000). In a recent review Rosenvinge and Børresen (1999) have argued that a health promotion model should replace the disease prevention model in school-based primary prevention programs.

It is a considerable challenge trying to counteract the excessive focus on thinness and “ideal body shape” in today’s society. In today’s highly technological and abrupt society we should consider media’s function in this respect, e.g. the internet, of which young girls and boys frequently relate to.

Interestingly, the present thesis did not find a relationship between hours of physical activity and pathological eating behavior, and no strong evidence for an increased risk of ED in certain types of physical activity among recreational athletes. Such associations seem to be more apparent in elite athletes, and this difference is important to have in mind in the promotion of health among physically active individuals.

### **Future applications**

This thesis indicates rather high numbers of individuals developing a problematic relationship to eating behaviors and body shape, and point out the need for more treatment research, also focusing on the often overlooked EDNOS group. Moreover, we should consider reducing the existing professional and administrative boundaries between adolescent and adult eating disorders services. We should also strive for a bridging of the gap between research evidence and clinical experience, which hopefully would provide more patients with appropriate evidence-based treatment. Today, such efforts are being made in Norway with the planning and development of nation wide scientific networks in eating disorder clinical research, as well as co-operation with experienced groups of European researchers (Skårderud & Rosenvinge, 2001).

Moreover, the results have indicated that the ED gender gap may be narrowing, and women and men with disordered eating seem to share similar personality traits. These results are in accordance with other studies (Andersen, 1990; Eliot & Baker, 2001; O’Dea & Abraham, 2002; Woodside et al., 2001), and these issues should be given attention in the promotion of health in today’s society. Further well-designed studies on the screening of

males in community samples, including clinical patients for a better evaluation of the instruments should prove illuminating.

Based on the reported similarities in personality traits, efforts should be made to clarify the pathogenesis of eating disorders. Such efforts may include twin studies and genome research, and the relations between genetic and environmental processes.

One interesting clinical study would be a randomized controlled study exploring and comparing female and male ED patients in regards to psychosocial morbidity, as well as course and outcome of the illnesses. Moreover, a research priority should be to evaluate the existing scheme for classifying eating disorders (DSM-IV) since so many individuals seem to fall into the not otherwise specified group, as seen in Paper IV were the EDNOS group based on DSM-IV was even larger than the corresponding group in DSM-III-R. To facilitate research and clinical practice we should strive for a classificatory scheme that better reflects clinical reality.

In Paper VI, the importance of clinicians identifying the negative factors that initiate and terminate binge eating episodes in order to develop effective intervention and treatment programs was pointed out. In prevention and treatment, these results may be essential elements regarding self-management strategies among patients. Assessment tools such as self-monitoring have proved useful for identifying environmental variables that may control binge eating behaviors, and assist in the development of a case formulation designed to tailor treatment to the individual.

This thesis may be a step towards a better understanding of the relationship between physical activity, problematic eating behaviors, personality traits and gender in the population. In my opinion, there is a need in sports medicine to better understand these complex associations. Future studies should investigate whether females and males with certain personality traits engage in types of physical activity with higher risk of eating disorders and body disturbances. In this thesis ED behavior did not seem to be strongly associated with high weekly hours of physical activity among recreational athletes. In addition, no clear-cut conclusions could be drawn regarding type of sport and risk of ED behavior. Further longitudinal studies on these matters are warranted, including both recreational and elite athletes of both genders, as well as different types of sports.

This thesis points out the need of further studies on exercise dependence, including examinations of positive and negative aspects of habitual exercise across populations representing various branches and levels of exercise. Such studies should be based on theoretical models and employ appropriate and powerful research designs, as well as

operational definitions of exercise dependence. Also, in my opinion, continued efforts to better understand the relationship between exercise dependence and eating disorders should be encouraged. The continued study of muscle dysmorphia are encouraged, and research should go beyond the mere study of professional male body builders, and include individuals of both genders that frequently exercise at health studios.

## **Main conclusions**

Conclusions from this thesis should be outlined with caution due to the mere use of self-reports and the limitations of the one stage design. However, using such methods for identifying Norwegians in different non-clinical populations with suspected eating disorders, as well as scores on exercise dependence, motives for physical activity and personality traits, the following conclusions may be drawn:

### **Paper I**

1. Women with higher amount of weekly hours of physical activity differed strongly in relation to EDQ-based exercise dependence characteristics compared with women with lower hours of weekly physical activity.
2. The concept of exercise dependence needs further clarification, and the task of solving the dysfunctional aspect of exercise is still an ongoing discussion.

### **Paper II**

3. Gender differences in competitive runners and their motives for physical activity were found. Female high level runners experience more withdrawal symptoms, while male high level runners focus more on following a training program.
4. Female and male high level runners had a common desire to feel good about personal health, a decreased experience of positive emotions after physical activity and they feel their exercise is interfering with their social life.
5. EDQ-based exercise dependence did not seem to be more common among male runners than female runners, and no gender differences on total EDQ score were found.
6. Female runners who score high on the EDQ tended to put less focus on weekly hours of physical activity than males, and were more concerned with exercise to improve their mood and feel good about personal health.
7. Both female and male runners scoring high on the EDQ had a strong drive in relation to improving physical performance.

### **Paper III**

8. An association between personality traits, scores on the EDI, weekly physical activity, gender and BMI were found.
9. Women and men with high scores on the EDI seemed to share many personality traits.
10. Neuroticism was strongly associated with high scores on the EDI in both women and men.
11. ED behavior did not seem to be strongly associated with high weekly hours of physical activity.

#### **Paper IV**

12. The life and point prevalence of AN, BN, and BED were consistent with earlier studies in adolescent populations and figures from the American Psychiatric Association (1994), with somewhat elevated figures for boys.
13. Rather high numbers of EDNOS were found in both genders.
14. DSM-III-R and DSM-IV gave corresponding numbers on total ED, with some inconsistencies between the subgroups.
15. Substantial numbers of young girls and boys expressed feelings of overweight when classed as underweight or normal weight based on the BMI.
16. Figures on EDNOS were alarming, and although based on self-reporting, they may indicate an elevated risk potential for ED in 14-15 year-olds.

#### **Paper V**

17. Modest agreement between the ability of the EDI and that of the SEDs to identify men with ED was found.
18. The best predictors for having a SEDs-based diagnosis of ED were higher score on the EDI scales drive for thinness (DT), bulimia (B), ineffectiveness (I) and interpersonal awareness (IA).
19. When we classified men with an EDI sum score of 40 or higher as having an eating disorder (ED), the sensitivity was rather low, while the specificity was high compared to the SEDs diagnosis of ED.



**Paper VI**

20. Binge eating seems to be provoked by a combination of different factors, and results demonstrate the salience of emotional and physiological factors in maintaining binge eating episodes.
21. Significant differences between the different ED subgroups in their frequency of binge eating episodes were found.
22. Some differences were found between the ED subgroups regarding frequency of reporting different antecedents and consequences of binge eating.
23. With regard to prevention and treatment, our results may be essential elements regarding self-management strategies among patients.

## References

- Ackard, D.M., Brehm, J.B., Steffen, J.J. (2002). Exercise and eating disorders in college-aged women. Profiling excessive exercisers. *Eating Disorders*, 10, 31-47.
- Adams, J., Kirkby, R.J. (2001). Exercise dependence and overtraining: The physiological and psychological consequences of excessive exercise. *Sports Medicine, Training and Rehabilitation*, 10, 199-222.
- Adams, J., Kirkby, R.J. (1998). Exercise dependence: a review of its manifestation, theory and measurement. *Sports Medicine in Training and Rehabilitation*, 8, 265-276.
- American Psychiatric Association. (1987). *Diagnostic and Statistical Manual of Mental disorders*, (3<sup>rd</sup>, Revised ed.). Washington, D.C.: American Psychiatric Press, Inc.
- American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental disorders*, (4<sup>th</sup>, Revised ed.). Washington, D.C.: American Psychiatric Press, Inc.
- Andersen, A.E. (2002). Eating disorders in males. In C.G. Fairburn & K.D. Brownell (Eds.), *Eating disorders and obesity – a comprehensive handbook*, 2<sup>nd</sup> edn. (pp. 188-193). New York: The Guilford Press.
- Andersen, A.E. (1990). *Males with eating disorders*. New York: Brunnel/Mazel.
- Andersen, A.E., DiDomenico, L. (1992). Diet vs. shape content of popular male and female magazines: A dose-response relationship to incidence of eating disorders? *International Journal of Eating Disorders*, 11, 283-287.
- Armstrong L.E., VanHeest, J.L. (2002). The unknown mechanism of the overtraining syndrome: clues from depression and psychoneuroimmunology. *Sports Medicine*, 32, 185-209.
- Augestad, L.B. (2000). Prevalence and gender differences in eating attitudes and physical activity among Norwegians. *Eating and Weight Disorders*, 5, 62-72.
- Augestad, L.B., Sæther, B., Gøtestam, K.G. (1999). The relationship between eating disorders and personality in physically active women. *Scandinavian Journal of Medicine and Science in Sports*, 9, 304-312.
- Augestad, L. B., Flanders, W. D. (2002). Eating disorder behavior in physically active Norwegian women. *Scandinavian Journal of Medicine & Science in Sports*, 12, 248-255.
- Augestad, L.B., Flanders, W.D. (2003). Assessment of two self-reporting questionnaires for eating disorders in women. *Eating and Weight Disorders*, 8, 12-19.

- Augestad, L.B, Levander, S. (1992). Physical activity, musculoskeletal pain and personality among employees of a prison and of a psychiatric hospital. *Scandinavian Journal of Medicine and Science in Sports*, 2, 26-31.
- Baekeland, F. (1970). Exercise deprivation: Sleep and psychological reactions. *Archives of General Psychiatry*, 22, 365-369.
- Bamber, D., Cockerill, I.M., Carroll, D. (2000). The pathological status of exercise dependence. *British Journal of Sports Medicine*, 34,125-132.
- Bastiani, A.M., Rao, R., Weltzin, T., Kaye, W.H. (1995). Perfectionism in anorexia nervosa. *International Journal of Eating Disorders*, 17, 147-152.
- Beumont, P.J.V., Garner, D., Touys, S.V. (1994). Comment on the proposed criteria for eating disorders in DSM-IV. *European Eating Disorders Review*, 2, 63-75.
- Black, C., Wilson, G.T. (1996). Assessment of eating disorders: Interview versus questionnaire. *International Journal of Eating Disorders*, 20, 43-50.
- Blair, S.N. (1995). Measurement of physical activity. In K.D. Brownell & C.G. Fairburn (Eds.), *Eating disorders and obesity – a comprehensive handbook*, 1<sup>st</sup> edn. (pp. 111-117). New York: The Guilford Press.
- Blaydon, M. J., Lindner, K. J. (2002). Eating disorders and exercise dependence in triathletes. *Eating Disorders*, 10, 49-60.
- Blaydon, M. J., Lindner, K. J., Kerr J.H. (2002). Metamotivational characteristics of eating-disordered and exercise-dependent triathletes: an application of reversal theory. *Psychology of Sport and Exercise*, 3, 223-236.
- Bouchard, C., Shephard, R.J, Stephens, T. (1994). *Physical Activity, Fitness and Health: International Proceedings and Consensus Statement*. Campaign IL: Human Kinetics Publishers.
- Braun, D.L., Sunday, S.R., Huang, A., & Halmi, K.A. (1999). More males seek treatment for eating disorders. *International Journal of Eating Disorders*, 25, 415-424.
- Brehm, B.J., Steffen, J.J. (1998). Relation between obligatory exercise and eating disorders. *American Journal of Health Behavior*, 22, 1008-1019.
- Brownell, K.D., Rodin, J., Wilmore, J.H. (1992). Eating, body weight and performance in athletes: An introduction. In K.D. Brownell, J. Rodin & J.H Wilmore (Eds.), *Eating, body weight and performance in athletes: Disorders of modern society*. (pp. 1-16). Philadelphia: Lea & Febiger.

- Burns T., Crisp A.: outcome of anorexia nervosa in males. In A. Andersen (Ed.), *Males with eating disorder*. New York, Brunnel/Mazel, 1990, pp. 163-186.
- Børresen Gresko, R., Rosenvinge, J.H. (1998). The Norwegian school-based prevention model. Development and evaluation. In W. Vandereycken & G. Noordenbos (Eds.), *The prevention of eating disorders*. The Athlone Press: London.
- Cachelin, F.M., Striegel-Moore R., Paget, W.B. (1997). Comparison of women with various levels of dietary restraint on body image, personality and family environment. *Eating Disorders*, 5, 205-215.
- Carlat, D.J., Camango, C.A. Jr., & Herzog, D.B. (1997). Eating disorders in males: a report on 135 patients. *American Journal of Psychiatry*, 154, 1127-1132.
- Carmack, M.A., Martens, R. (1979). Measuring commitment to running: a survey of runners attitudes and mental states. *Journal of Sport Psychology*, 1, 25-42.
- Carter, J.C., Aimé, A.A., Mills, J.S. (2001). Assessment of Bulimia Nervosa: A comparison of interview and self-report questionnaire methods. *International Journal of Eating Disorders*, 30, 187-192.
- Carter, J.C., Stewart, D.A., Dunn, V.J., Fairburn, C.G. (1997). Primary prevention of eating disorders: might it do more harm than good? *International Journal of Eating Disorders*, 22, 167-172.
- Caspersen, C.J., Powell K.E., Christenson G.M. (1985). Physical activity, exercise and physical fitness: definitions and distinctions for health-related research. *Public Health Report*, 100, 126-131.
- Choi P.Y., Pope H.G. Jr., Olivardia R. (2002). Muscle dysmorphia: a new syndrome in weightlifters. *British Journal of Sports Medicine*, 36 (5), 375-6.
- Claridge, G., Davis, C. (2001). What's the use of neuroticism? *Personality and Individual Differences*, 31 (3), 83-400.
- Clough, P., Shepherd, J., Maughan R. (1990). Motives for participation in recreational running. *Journal of Leisure Research*, 21, 297-309.
- Cockerill, I.M., Riddington, M.E. (1996). Theory and practice: Exercise dependence and associated disorders: A review. *Counsel Psychol Quart*, 9, 119-129.
- Crossman, J., Jamieson, J., Henderson, L. (1987). Responses of competitive athletes to lay-offs in training: exercise addiction or psychological relief? *Journal of Sport Behavior*, 10, 28-38, 1987.

- Crow, S., Mussell, M.P., Peterson, C., Knopke, A., Mitchell, J. (1999). Prior treatment received by patients with bulimia nervosa. *International Journal of Eating Disorders*, 25, 39-44.
- Davis, C., Brewer, H., Ratusny, D. (1993). Behavioral frequency and psychological commitment: Necessary concepts in the study of excessive exercising. *Journal of Behavioral Medicine*, 16, 611-628.
- Davis, C., Claridge, G., Brewer, H. (1996). The two faces of narcissism: Personality dynamics of body esteem. *Journal of Social and Clinical Psychology*, 15, 153-166.
- Davis, C., Claridge, G. (1998). The eating disorders as addiction: a psychobiological perspective. *Addictive Behaviors*, 23, 463-475.
- Davis, C., Elliott, S., Dionne, M., Mitchell, I. (1991). The relationship of personality factors and physical activity to body satisfaction in men. *Personality and Individual Differences*, 12, 689-694.
- Davis, C., Fox, J. (1993). Excessive exercise and weight preoccupation in women. *Addictive Behaviors*, 18, 201-211.
- Davis, C., Katzman, D.K., Kirsh, C. (1999). Compulsive physical activity in adolescents with anorexia nervosa. A psychobehavioral spiral of pathology. *Journal of Nervous and Mental Disease*, 187, 336-342.
- Davis, C., Strachan, S. (2001). Elite female athletes with eating disorders: A study of psychopathological characteristics. *Journal of Sport and Exercise Psychology*, 23, 245-253.
- Davis, C. (2000). Exercise Abuse. *International Journal of Sport Psychology*, 31, 278-289.
- Dishman, R.K. (1985). Medical psychology in exercise and sport. *Medical Clinics of North America*, 69, 123-143.
- Drewnowski, A., Doris, K.Y., Candace, L.K., Dean, D.K. (1994). Eating pathology and DSM-III-R bulimia nervosa: a continuum of behavior. *American Journal of Psychiatry*, 145, 753-755.
- Ebbel, B. (1937). *The papyrus*. Copenhagen:Levin & Munksgaard.
- Eliot, A.O., Baker, C.W. (2001). Eating disordered adolescent males. *Adolescence*, 36, 535-543.

- Emans, S.J., & Goldstein, D.P. (1990). *Pediatric and adolescent gynecology* (third edition). Little, Brown and Company: Boston/Toronto/London.
- Estok, P.J. & Rudy, E.B. (1996). The relationship between eating disorders and running in women. *Research in Nursing & Health*, 19, 377-387.
- Eysenck, H.J. (1981). *A model of personality*. New York: Springer.
- Eysenck, H.J, Nias, D.K.B., Cox, D.N. (1982). Sport and Personality. *Advances in Behavioural Research and Therapy*, 4, 1-56.
- Fairburn, C.G., Beglin, S.J. (1990). Studies of the epidemiology of bulimia nervosa. *American Journal of Psychiatry*, 147, 401-408.
- Fairburn, C.G., Cooper, Z. (1993). Eating disorders. In K. Hawton, P.M. Salkovskis, J. Kirk & D.M. Clark (Eds.), *Cognitive behavior therapy for psychiatric problems. A practical guide* (pp. 277-314). Oxford: Oxford University Press.
- Fairburn C., Harrison P.J. (2003). Eating disorders. *The Lancet*, 361, 407-416.
- Fichter, M.M., Herpertz, S., Quadflieg, N., Herpertz-Dahlmann, B. (1998). Structured interview for anorexic and bulimic disorders for DSM-IV and ICD-10: Updated (Third) revision. *International Journal of Eating Disorders*, 24, 227-249.
- Flanders, W.D., Tucker, G., Krishnadasan, A., Martin, D., Honig, E., McClellan, W.M. (1999). Validation of the pneumonia severity index. Importance of study-specific recalibration. *Journal of General and Internal Medicine*, 14, 333-340.
- Fombonne, E. (1995). Anorexia nervosa: no evidence of an increase. *British Journal of Psychiatry*, 166, 462-471.
- Garfinkel, P.E., Lin, E., Goering, P., Spegg, C., Goldbloom, D., Kennedy, S., Kaplan, S., Woodside, D. (1995). Bulimia nervosa in a Canadian community sample: Prevalence, co-morbidity, early experiences and psychosocial functioning. *American Journal of Psychiatry*, 152, 1052-1058.
- Garfinkel, P.E., Lin, E., Goering, P., Spegg, C., Goldbloom, D., Kennedy, S., Kaplan, S., Woodside, D. (1996). Should amenorrhea be necessary for the diagnosis of anorexia nervosa? Evidence from a Canadian community sample. *British Journal of Psychiatry*, 168, 500-506.
- Garner, D.M., Garfinkel, P.E., Rockert, W., Olmsted, M.P. (1987). A prospective study of eating disturbances in the ballet. *Psychotherapy and Psychosomatics*, 48, 170-175.
- Garner, D.M. (2002). Measurement of eating disorder psychopathology. In C.G. Fairburn, K.D. Brownell (Eds.), *Eating disorders and obesity – a comprehensive handbook*, 2<sup>nd</sup> edn., New York: The Guilford Press.

- Garner, D.M., Olmstead, M.P., Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia and bulimia. *International Journal of Eating Disorders*, 2, 15-34.
- Garner, D.M., Olmsted, M.P., Bohr, Y., Garfinkel, P.E. (1982). The Eating Attitudes Test: Psychometric features and clinical correlates. *Psychological Medicine*, 12, 871-878.
- Geller, J., Cockell, S.J, Goldner, E.M. (2000). Inhibited expression of negative emotions and interpersonal orientation in anorexia nervosa. *International Journal of Eating Disorders*, 28, 8-19.
- Ghaderi, A., Scott, B. (2002). The preliminary reliability and validity of the Survey for Eating Disorders (SEDS): A self-report questionnaire for diagnosing eating disorders. *European Eating Disorder Review*, 10, 61-76.
- Glanville, B. de. (1535). *De proprietatibus rerum*. English translation by J. Trevisa, London: T Berthelet.
- Golden, N.H. (2002). A review of the female athlete triad (amenorrhea, osteoporosis and disordered eating). *International Journal of Adolescent Medicine and Health*, 14, 9-17.
- Goldner, E.M., Birmingham, C.L., Smye, V. (1997). Addressing treatment refusal in anorexia nervosa: clinical, ethical and legal considerations. In D.M. Garner & P.E. Garfinkel (Eds.), *Handbook of treatment for eating disorders 2<sup>nd</sup> edn.* (pp. 450-61) New York: Guilford Press.
- Greenberg, R.S., Daniels, S.R., Flanders, W.D., Fley, J.W., Boring, J.R. (2001). *Medical Epidemiology 3ed.* New York: Lange/McGraw-Hill.
- Griffiths, M. (1997). Exercise addiction. A case study. *Addiction Research*, 5, 161-168.
- Götestam, K.G., Agras, W.S. (1995). General population-based epidemiological study of eating disorders in Norway. *International Journal of Eating Disorders*, 18, 119-126.
- Gotestam, K.G., Eriksen, L., Hagen, H. (1995). An epidemiological study of eating disorders in Norwegian psychiatric institutions. *International Journal of Eating Disorders*, 18, 263-8.
- Hadigan, C.M., Walsh, B.T. (1991). Body shape concerns in bulimia nervosa. *International Journal of Eating Disorders*, 11, 323-331.
- Hausenblas, H.A., Symons Downs, D. (2002<sup>a</sup>). Exercise dependence: a systematic review. *Psychology of Sport and Exercise*, 3, 89-123.
- Hausenblas, H.A., Symons Downs, D. (2002<sup>b</sup>). How much is too much? The development and validation of the exercise dependence scale. *Psychology and Health: An International Journal*, 17, 387-404.

- Hausenblas, H.A., Symons Downs, D. (2002<sup>c</sup>). Relationship among sex, imagery, and exercise dependence symptoms. *Psychology of Addictive Behaviors*, 16, 169-172.
- Hay, P., Fairburn, C.G. (1998). The validity of the DSM-IV scheme for classifying bulimic eating behavior. *International Journal of Eating Disorders*, 23, 7-15.
- Herzog, D.B., Delinsky, S.S. (2001). Classification of eating disorders. In R.H. Striegel-Moore & L. Smolak (Eds.), *Eating disorders - Innovative directions in research and practice*, 1<sup>st</sup> edn. (pp. 31-50) American Psychological Association.
- Hoek, H.W. (1993). Review of the epidemiological studies of eating disorders. *International Review of Psychiatry*, 5, 61-74.
- Hsu, L.K.G. (1996). Epidemiology of the eating disorders. *The Psychiatric Clinics of North America*, 19, 681-700.
- Hubbard, S.T., Gray, J.J., Parker, S. (1998). Differences among women who exercise for food related and non-food related reasons. *European Eating Disorders Review*, 6, 255-265.
- Janzen, B.L., Saklofske, D.H., Kelly, I.W. (1993). Personality and bulimic symptomatology. *Journal of Clinical Psychology*, 49, 649-653.
- Johnsgaard, K. (1985). The motivation of the long-distance runner: I. *Journal of Sports Medicine and Physical Fitness*, 25, 135-139, 1985.
- Joiner, T.E., Heatherton, T.F. (1998). First- and second-order factor structure of five subscales of the Eating Disorders Inventory. *International Journal of Eating Disorders*, 23, 189-98.
- Katz, J.L. (1986). Long-distance running: Anorexia nervosa, and bulimia nervosa: A report of two cases. *Comprehensive Psychiatry*, 27, 74-78.
- Kazdin, A.E. (2003). *Research design in clinical psychology* 4<sup>th</sup> ed. Boston: Allyn and Bacon.
- Keel, P.K., Crow, S., Davis, T.L., Mitchell, J.E. (2002). Assessment of eating disorders. Comparison of interview and questionnaire data from a long-term follow-up study of bulimia nervosa. *Journal of Psychosomatic Research*, 53 1043-1047.



- Kenardy, J., Arnow, B., Agras, W.S. (1996). The aversiveness of specific emotional states with binge eating in obese subjects. *Australian and New Zealand Journal of Psychiatry*, 30, 839-844.
- Kendler, K.S., MacLean, C., Neale, M., Kessler, R., Heath, A., Eaves, L. (1991). The genetic epidemiology of bulimia nervosa. *American Journal of Psychiatry*, 148, 1627-1637.
- Kinzl, J.F., Traweger, C., Trefalt, E., Mangweth, B., Biebl, W. (1998<sup>a</sup>). Eating disorders in males: a representative survey. *Zeitschrift für Ernährungswissenschaft*, 37, 336-42.
- Kinzl, J.F., Traweger, C., Trefalt, E., Biebl, W. (1998<sup>b</sup>). Eating disorders in women: a representative study. *Zeitschrift für Ernährungswissenschaft*, 37, 23-30.
- Kringlen, E., Torgersen, S., Cramer, V. (2001). A Norwegian Psychiatric Epidemiological Study. *American Journal of Psychiatry*, 158, 1091-1098.
- Laporte, D.J. (1997). Gender differences in perception and consequences of an eating binge. *Sex Roles*, 36, 479-489.
- Lau, B., Alsaker, F.D. (2001). Dieting behavior in Norwegian adolescents. *Scandinavian Journal of Psychology*, 42, 25-32.
- Lavik, N.J., Clausen, S.E., Pedersen, W. (1991). Eating behavior, drug use, psychopathology and parental bonding in adolescents in Norway. *Acta Psychiatrica Scandinavica*, 84, 387-390.
- Lee, M.I., Miltenberg, R.G. (1997). Functional assessment and binge eating: A review of the literature and suggestions of future research. *Behavior Modification*, 21, 159-171.
- Leon, G.R., Keel, P.K., Klump, K.L., & Fulkerson, J.A (1997). The future of risk factors research in understanding the etiology of eating disorders. *Psychopharmacology Bulletin*, 33, 405-411.
- Levine, M.D., Marcus, M.D., Moulton, P. (1996). Exercise in the treatment of binge eating disorder. *International Journal of Eating Disorders*, 19, 171-177.
- Lock, J., LeGrange, D., Agras, W.S., & Dare C. (2001). *Treatment manual for anorexia nervosa - a family-based approach*. New York: The Guilford Press.
- Lucas, A.R., Beard, C.M., O'Fallon, W.M., Kurland, L.T. (1991). 50-year trends in the incidence of anorexia nervosa in Rochester, Minnesota: a population-based study. *American Journal of Psychiatry*, 148, 971-922.
- Lynch, W.C., Everingham, A., Dubitzky, J., Hartman, M., Kasser, T. (2000). Does binge eating play a role in the self-regulation of moods? *Integrative Physiological and Behavioral Science*, 35, 298-313.

- Martinsen, E.W., Morgan, W.P. (1997). Antidepressant effects of physical activity. In W.P. Morgan (Ed.), *Physical Activity and Mental Health* (pp. 93-106). Taylor & Francis Publishers.
- Martinsen, E.W. (1990). Benefits of exercise for the treatment of depression. *Sports Medicine*, 9, 380-389.
- McCallum, K. (1993). Eating disorders. *Current Opinion in Psychiatry*, 6, 480-485.
- Meyer, C., Waller, G., Waters, A. (1998). Emotional states and bulimic psychopathology. In: H. Hoek, J. Treasure & M. Katzman (Eds.). *Neurobiology in the Treatment of Eating Disorders* (pp. 263-279). New York: Wiley.
- Mitchell-Gielegem, A.M., Mittelstaedt, M.E, Bulik, C.M. (2002). Eating disorders and childbearing: Concealment and consequences. *Birth*, 29, 182-191.
- Mussell, M.P., Crosby, R.D., Crow, S.J., et al. (2000). Utilization of empirically supported psychotherapy treatments for individuals with eating disorders: a survey of psychologists. *International Journal of Eating Disorders*, 27, 230-237.
- Nasser, M. (1993). A prescription of vomiting: historical footnotes. *International Journal of Eating Disorders*, 13, 129-131.
- Nathan, P.E. (1994). DSM-IV: empirical, accessible, not yet ideal. *Journal of Clinical Psychology*, 5, 103-110.
- NHLBI Obesity Task Force (1998). Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults—The evidence report. *Obesity Research*, 6, supplement 2.
- Norwegian Social Science Data Services (NSD) (1998). Database for Statistics on Higher Education (DBH). Statistics on higher education in Norway.
- Nudelman, S., Rosen, J.C., Leitenberg, H. (1988). Dissimilarities in eating attitudes, body image, distortion, depression and self-esteem between high-intensity male runners and women with bulimia nervosa. *International Journal of Eating Disorders*, 7, 625-34.
- O'Dea, J.A. & Abraham, S. (2002). Eating and exercise disorders in young college men. *Journal of American College Health*, 50, 273-278.
- O'Dea, J.A., & Abraham, S. (1996). Food habits, body image and weight control practices of young male and female adolescents. *Australian Journal Nutritional Dietetics*, 53, 32-38.
- O'Dea, J.A., Abraham, S. (2000). Improving the body image, eating attitudes, and behaviors of young male and female adolescents: a new educational approach that focuses on self-esteem. *International Journal of Eating Disorders*, 28, 43-57.

- Ogden, J., Veale, D.M.W., Summers, Z. (1997). The development and validation of the Exercise Dependence Questionnaire. *Addiction Research*, 5, 343-356.
- Olivardia, R., Pope, H.G. Jr., Hudson, J.I. (2000). Muscle dysmorphia in male weightlifters: a case-control study. *American Journal of Psychiatry*, 157(8), 1291-6.
- Olivardia, R., Pope H.G. Jr., Mangweth, B., Hudson, J.I. (1995). Eating disorders in college men. *American Journal of Psychiatry*, 152, 1279-1285.
- Passi, V.A., Bryson, S.W., Lock, J. (2002). Assessment of eating disorders in adolescents with anorexia nervosa: self-report questionnaire versus interview. *International Journal of Eating Disorders*, 33, 45-54.
- Patton, G.C., Selzer, R., Coffey, C., Carlin JB, Wolfe R (1999). Onset of adolescent eating disorders: population based cohort study over 3 years. *British Medical Journal*, 318, 765-768.
- Pearson, J., Goldklang, D., Striegel-Moore, R.H. (2002). Prevention of eating disorders: Challenges and opportunities. *International Journal of Eating Disorders*, 31, 233-239.
- Pendleton, V.R., Goodrick, G.K., Carlos Poston, W.S., Reeves, R.S., Foreyt, J.P. (2002). Exercise augments the effects of cognitive-behavioral therapy in the treatment of binge eating, *International Journal of Eating Disorders*, 31, 172-184.
- Perry, J., Silvera, D., Rosenvinge, J.H., Holte, A. (2002). Are oral, obsessive, and hysterical personality traits related to disturbed eating patterns? A general population study of 6,313 men and women. *Journal of Personality Assessment*, 78, 405-16.
- Pierce, E.F., McGowan, R.W, Lynn, T.D. Exercise dependence in relation to competitive orientation in runners. *Journal of Sports Medicine and Physical Fitness*, 33, 189-193, 1993.
- Polivy, J., Herman, C.P. (1993). Etiology of binge eating: Psychological mechanisms. In C.G. Fairburn & G.T. Wilson (Eds.), *Binge eating: Nature, assessment and treatment* (pp. 172-205). New York: Guilford Press.
- Pope, H.G. Jr., Gruber, A.J., Choi, P., Olivardia, R., Phillips, K.A. (1997). Muscle dysmorphia. An underrecognized form of body dysmorphic disorder. *Psychosomatics*, 38(6), 548-57.
- Pryor, T, Wiederman, M.W. (1996). Measurement of nonclinical personality characteristics of women with anorexia or bulimia nervosa. *Journal of Personality and Assessment*, 67, 414-421.

- Pyle, R.A., Neuman, P.A., Halvorsen, P.A., & Michael, J.E. (1991). An ongoing cross-sectional study of the prevalence of eating disorders in freshman college students. *International Journal of Eating Disorders*, 10, 667-677.
- Ramplung, D. (1985). Ascetic ideals and anorexia nervosa. *Journal of Psychiatric Research*, 19, 89-94.
- Romano, S.J. (1999<sup>a</sup>). Anorexia nervosa. In D.J. Goldstein (Ed.), *The management of eating disorders and obesity*. (pp. 49-58). Totowa, N.J: Human Press Inc.
- Romano, S.J. (1999<sup>b</sup>). Bulimia nervosa. In D.J. Goldstein (Ed.), *The management of eating disorders and obesity*. (pp. 3-10). Totowa, N.J: Human Press Inc.
- Rosenvinge, J.H., Gøtestam, K.G. (2002). Eating disorders: How should treatment be organized? *Tidsskrift for den Norske Lægeforening*, 122, 285-2288. Norwegian.
- Rosenvinge, J.H., Perry J.A., Bjørgum L., Bergersen T.D., Silvera D.H., Holte A. (2001). A new instrument measuring disturbed eating patterns in community populations. Development and initial validation of a five-item scale (EDS-5). *European Eating Disorders Review*, 9, 123-132.
- Rosenvinge, J.H., Sundgot-Borgen, J., Børresen, R. (1999). The prevalence and psychological correlates of anorexia nervosa, bulimia nervosa and binge eating among 15-year-old students: a controlled epidemiological study. *European Eating Disorders Review*, 7, 382-391.
- Rosenvinge, J.H., Vig, C. (1993). Eating disorders and associated symptoms among adolescent swimmers. Initial screening and a controlled study. *Scandinavian Journal of Medicine and Science in Sports*, 3, 164-169.
- Russell, G.F.M. (2001). Involuntary treatment in anorexia nervosa. *Psychiatric Clinics of North America*, 24, 337-349.
- Russell, G.F.M. (1997). The history of bulimia nervosa. In D.M. Garner & P.E. Garfinkel (Eds.), *Handbook of treatment for eating disorders*. (pp. 11-24). New York: Guilford Press
- Russell, G.F.M., Szmukler G.I., Dare C., Eisler I. (1987). An evaluation of family therapy in anorexia nervosa and bulimia nervosa. *Archives of General Psychiatry*, 44, 1047-1056.
- Rø, Ø., Martinsen, E.W., Rosenvinge, J.H. (2002). Inpatient treatment for bulimia nervosa—results from an eating disorder unit in Norway. *Tidsskrift for den Norske Lægeforening*, 122, 260-265. Norwegian.

- Råstam, M., Gillberg, C., & Garton, M. (1989). Anorexia nervosa in a Swedish urban region. A population-based study. *British Journal of Psychiatry*, 155, 642-646.
- Santonastaso, P., Zanetti, T., Sala, A., Favaretto, G., Vidotto, G., & Favaro, A. (1996). Prevalence of eating disorders in Italy: a survey on a sample of 16-year-old female students. *Psychotherapy and Psychosomatics*, 65, 158-162.
- Steinhausen, H.C., Winkler, C., & Meier, M. (1997). Eating disorders in adolescence in a Swiss epidemiological study. *International Journal of Eating Disorders*, 22, 147-151.
- Schalling, D., Edman, G. (1987). Personality and vulnerability to psychopathology. The development of the KSP inventory Manual. Department of Psychology, University of Stockholm. Stockholm: Karolinska Institute.
- Seigel, K, Hetta, J. (2001). Exercise and eating disorder symptoms among young females. *Eating and Weight Disorders*, 6, 32-39.
- Silverman, J.A. (1997). Anorexia Nervosa: historical perspective on treatment. In D.M. Garner & P.E. Garfinkel (Eds.), *Handbook of treatment for eating disorders*. New York: Guilford Press, pp. 3-10.
- Skårderud, H., Rosenvinge, J.H. (2001). The history of eating disorders in Norway. *European Eating Disorders Review*, 9, 217-228.
- Smolak L., Murnen S.K., Ruble A.E. (2000). Female athletes and eating problems: A meta-analysis. *International Journal of Eating Disorders*, 27, 371-380.
- Soundy, T.J., Lucas, A.R., Suman, V.J., Melton, L.J. (1995). Bulimia nervosa in Rochester, Minnesota from 1980 to 1990. *Psychological Medicine*, 25, 1065-71
- Spitzer, R.L., Devlin, M., Walsh, B.L., Hasin, D., Wing, R., Marcus, M., Stunkard, A., Wadden, T., Yanovski, S., Agras, W.S., Mitchell, J., Nonas, C. (1992). Binge eating disorders: a multisite field trial of the diagnostic criteria. *International Journal of Eating Disorders*, 11, 191-203.
- Stewart, N.J., McMullen, M.L., Rubin, L.D. (1994). Movement therapy with depressed inpatients: a randomized multiple single case design. *Archives of Psychiatric Nursing*, 8, 22-29.
- Stickney, M.I., Miltenberg, G.R., Wolff, G. (1999). A descriptive analysis of factors contributing to binge eating. *Journal of Behavioral Therapy and Experimental Psychiatry*, 30, 177-189.
- Stonehill, E, Crisp, AH. (1977). Psychoneurotic characteristics of patients with anorexia nervosa before and after treatment and follow-up four years later. *Journal of Psychosomatic Research*, 21,187-197.

- Striegel-Moore R.H., Kearney-Cooke A. (1994). Exploring parents' attitudes and behaviors about their children's physical appearance. *International Journal of Eating Disorders*, 15, 377-385.
- Striegel-Moore, R.H., Silberstein, L.R., Rodin, J. (1986). Toward and understanding of risk factors for bulimia. *American Psychologist*, 41, 246-263.
- Sundgot-Borgen, J. (1993). Prevalence of eating disorders in elite female athletes. *International Journal of Sport Nutrition*, 3, 29-40.
- Sundgot-Borgen, J. (1994). Risk and trigger factors for the development of eating disorders in female elite athletes. *Medicine and Science in Sport and Exercise*, 26, 414-419.
- Sundgot-Borgen, J., Rosenvinge, J.H., Bahr, R., Schneider, L.S. (2002) The effect of exercise, cognitive therapy, and nutritional counseling in treating bulimia nervosa. *Medicine and Science in Sports and Exercise*, 34, 190-195.
- Szabo, A. (1998). Studying the psychological impact of exercise deprivation: Are experimental studies hopeless? *Journal of Sport Behavior*, 21, 139-147.
- Tata, P., Fox, J., Cooper, J. (2001). An investigation into the influence of gender and parental styles on excessive exercise and disordered eating. *European Eating Disorders Review*. 9, 194-206.
- Thaw, J.M., Williamson, D.A., Martin, C.K. (2001). Impact of altering DSM-IV criteria for anorexia and bulimia nervosa on the base rates of eating disorders diagnoses. *Eating and Weight Disorders*, 6, 121-129.
- Thornton, E.W., Scott, S.E. (1995). Motivation in the committed runner: Correlations between self-report scales and behavior. *Health Promotion International*, 10, 177-184.
- Turnbull, S., Ward, A., Treasure, J., Jick, H., Derby, L. (1996). The demand for eating disorder care: an epidemiological study using the general practice research database. *British Journal of Psychiatry*, 169, 705-712.
- Vandereycken, W. (2002). History of Anorexia nervosa and bulimia nervosa. In C.G. Fairburn & K.D. Brownell (Eds.), *Eating disorders and obesity – a comprehensive handbook*, 2<sup>nd</sup> edn. (pp. 151-155) New York: The Guilford Press.
- Vandereycken, W., Löwenkopf, E.L. (1990). Anorexia nervosa in 19th century America. *Journal of nervous and mental disease*, 178, 531-535.
- Vanderlinden, J., Grave, D.R., Vandereycken, W., Noorduyn, C. (2001). Which factors do provoke binge eating? An exploratory study in female students. *Eating Behaviors*, 2, 79-83.

- Van Hoeken, D., Lucas, A.R., Hoek, H.W. (1998). Epidemiology. In H.W. Hoek, J.L. Treasure, & M.A. Katzman (Eds.), *Neurobiology in the treatment of eating disorders* (pp. 97-126). Chichester, UK, and New York: Wiley.
- Van Itallie, T.B. (1985). Health implications of overweight and obesity in the United States. *Annals of Internal Medicine*, 103, 983-988.
- Veale, D. (1995). Does primary exercise really exist? In J. Annett, B. Cripps, & H. Steinberg (Eds.), *Exercise addiction: Motivation for participation in sport and exercise* (pp. 1-5). Leicester, UK: British Psychological Society.
- Veale, D.M.W. (1991). Psychological aspects of staleness and dependence on exercise. *International Journal of Sports Medicine*, 12, 19-22.
- Veale D.M.W. (1987). Exercise dependence. *British Journal of Addiction*, 82, 735-740.
- Waller, G. (1993). Why do we diagnose different types of eating disorders? Arguments for a change in research and clinical practice. *European Eating disorders Review*, 2, 74-89.
- Wakeling, A. (1996). Epidemiology of anorexia nervosa. *Psychiatry Research*, 62, 3-9.
- Warren, M.P., Perlroth, N.E. (2001). The effects of intensive exercise on the female reproductive system. *Journal of Endocrinology*, 170, 3-11.
- Warren, B.J., Stanton, A., Blessing, D.L. (1990). Disordered eating patterns in competitive female athletes. *International Journal of Eating Disorders*, 9, 565-569.
- Waters, A., Hill, A., Waller, G. (1999). Bulimics' responses to food cravings: Is binge eating a product of hunger or emotional state? *Behavioural. Research and Therapy*, 39, 877-886.
- Weight, L.M., Noakes, T.D. (1987). Is running an analog of anorexia? A survey of the incidence of eating disorders in female distance runners. *Medicine and Science in Sports and Exercise*, 19, 213-217.
- Wertheim, E.H., Paxton, S.J., Maude, D., Szmuckler, G., Gibbons, K., & Hillier, L. (1992). Psychosocial predictors of weight loss behaviors and binge eating in adolescent girls and boys. *International Journal of Eating Disorders*, 12, 151-160.
- Westenhoefer, J. (2001). Prevalence of eating disorders and weight control practices in Germany in 1990 and 1997. *International Journal of Eating Disorders*, 29, 477-481.
- Wichstrøm, L. (2000). Psychological and behavioral factors unproductive of disordered Eating: a prospective study of the general adolescent population in Norway. *International Journal of Eating Disorders*, 28, 33-42.
- Wiederman, M.W., Pryor, T. (1996). Substance use and impulsive behaviors among adolescents with eating disorders. *Addictive Behaviors*, 21, 269-272.

- Wilson, G.T. (1991). The addiction model of eating disorders: A critical analysis. *Advances in Behaviour Research and Therapy*, 13, 27-72.
- Wilson, G.T. (1992). Diagnostic criteria for bulimia nervosa. *International Journal of Eating Disorders*, 11, 315–319.
- Woodside, D., Garfinkel, P.E., Lin, E., Goering, P., Kaplan, A.S., Goldbloom, D.S., Kennedy, S.H. (2001). Comparisons of men with full or partial eating disorders, men without eating disorders, and women with eating disorders in the community. *American Journal of Psychiatry*, 158, 570-574.
- World Health Organization (1994). Assessment of fracture risk and its application to screening for post-menopausal osteoporosis. Technical Report Series No 843, WHO, Geneva, Switzerland.
- Worsley, A., Worsley, A.J., McConnen, S., & Silva P. (1990). The weight control practices of 15 year old New Zealanders. *Paediatrics in Children's Health*, 26, 41-45.
- Yates, A., Leehey, K., Shisslak, C.M. (1983). Running- an analog of anorexia? *New England Journal of Medicine*, 308, 251-255.
- Yeager, K.K., Agostini, R. Drinkwater, B. (1993). The female athlete triad: disordered eating, amenorrhea, osteoporosis. *Medicine and Science in Sports and Exercise*, 25, 775-777.
- Åstrand, P.O., Rodahl, R. (1986). *Textbook of work physiology*. New York: McGraw-Hill.



## Appendix

### Diagnostical criteria

#### Anorexia nervosa (AN)

##### DSM-III-R (APA, 1987)

- A. Refusal to maintain body weight over a minimum normal weight for age and height, e.g. weight loss leading to maintenance of body weight 15 per cent below that expected; failure to make expected weight gain during period of growth, leading to body weight 15 per cent below that expected.
- B. Intense fear of gaining weight or becoming fat, even though underweight.
- C. Disturbance in the way in which one's body weight, size or shape is experienced, e.g. the person claims to "feel fat" even when emaciated, believes that one area of the body is "too fat" even when obviously underweight.
- D. In females, absence of at least three consecutive menstrual cycles when otherwise expected to occur (primary or secondary amenorrhea). (A woman is expected to have amenorrhea if her periods occur only following hormone, e.g. estrogen administration).

##### DSM-IV (APA, 1994)

- A. Refusal to maintain body weight at or above a minimally normal weight for age and height (e.g., weight loss leading to maintenance of body weight less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to body weight that less than 85% of that expected).
- B. Intense fear of gaining weight or becoming fat, even though underweight.
- C. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.
- D. In postmenarcheal females, amenorrhea, i.e., the absence of at least three consecutive menstrual cycles. (A woman is expected to have amenorrhea if her periods occur only following hormone, e.g., estrogen administration).

*Specify type:*

**Restricting type:** during the current episode of Anorexia nervosa, the person has not regularly engaged in binge-eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

**Binge-Eating/Purging Type:** during the current episode of Anorexia nervosa, the person has regularly engaged in binge-eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas).

**Bulimia nervosa (BN)****DSM-III-R (APA, 1987)**

- A. Recurrent episodes of binge eating (rapid consumption of a large amount of food in a discrete period of time).
- B. A feeling of lack of control over eating behavior during the eating binges.
- C. The person regularly engages in either self-induced vomiting, use of laxatives or diuretics, strict dieting or fasting, or vigorous exercise in order to prevent weight gain.
- D. A minimum average of two binge eating episodes a week for at least three months.
- E. Persistent overconcern with body shape and weight.

**DSM-IV (1994)**

- A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
  - (1) eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitively larger than most people would eat during a similar period of time and under similar circumstances.
  - (2) A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).
- B. Recurrent inappropriate compensatory behavior in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise.
- C. The binge eating and inappropriate compensatory behaviors both occur, on average, at least twice a week for three months.
- D. Self-evaluation is unduly influenced by body shape and weight.
- E. The disturbance does not occur exclusively during episodes of Anorexia Nervosa.

*Specify type:*

**Purging type:** during the current episode of Bulimia nervosa, the person has regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.

**Nonpurging Type:** during the current episode of Bulimia nervosa, the person has used other inappropriate compensatory behaviors, such as fasting or excessive exercise, but has not regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas.

**Eating disorders not otherwise specified (EDNOS)****DSM-III-R (APA, 1987)**

Disorders of eating that do not meet the criteria for a specific eating disorder.

Examples:

- (1) a person of average weight who does not have binge eating episodes, but frequently engages in self-induced vomiting for fear of gaining weight.
- (2) all of the features of Anorexia nervosa in a female except absence of menses.
- (3) all of the features of Bulimia nervosa except the frequency of binge eating episodes.

**DSM-IV (1994)**

The eating disorders not otherwise specified category is for disorders of eating that do not meet the criteria for any specific eating disorder. Examples include

1. For females, all of the criteria for Anorexia nervosa are met except that the individual has regular menses.
2. All of the criteria for Anorexia nervosa are met except that, despite significant weight loss, the individual's current weight is in the normal range.
3. All of the criteria for Bulimia nervosa are met except that the binge eating and inappropriate compensatory mechanisms occur at a frequency of less than twice a week or for a duration of less than 3 months.
4. The regular use of inappropriate compensatory behavior by an individual of normal body weight after eating small amounts of food (e.g., self-induced vomiting after the consumption of two cookies).
5. Repeatedly chewing and spitting out, but not swallowing, large amounts of food.
6. Binge-eating disorder: recurrent episodes of binge eating in the absence of the regular use of inappropriate compensatory behaviors characteristic of Bulimia Nervosa.

**Binge-eating disorder (BED)****DSM-IV (1994)** (suggested research criteria)

- A.** Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
  - (1) eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitively larger than most people would eat during a similar period of time and under similar circumstances.
  - (2) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).
- B.** The binge-eating episodes are associated with three (or more) of the following:
  - (1) eating much more rapidly than normal
  - (2) eating until feeling uncomfortably full
  - (3) eating large amounts of food when not feeling physically hungry
  - (4) eating alone because of being embarrassed by how much one is eating
  - (5) feeling disgusted with oneself, depressed, or very guilty after overeating
- C.** Marked distress regarding binge eating is present
- D.** The binge eating occurs, on average at least 2 days a week for 6 months.
 

**Note:** The method of determining frequency differs from that used for Bulimia nervosa; future research should address whether the preferred method of setting a frequency threshold is counting the number of days on which binges occur or counting the number of episodes of binge eating.
- E.** The binge eating is not associated with the regular use of inappropriate compensatory behaviors (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of Anorexia nervosa or Bulimia Nervosa.

