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BODYDYSMORPHIC DISORDER AND BODYBUILDING: INFLUENCE OF A WORKOUT ON BODY IMAGE PERCEPTION AND – SATISFACTION

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Inga Petersen
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Erstgutachter: Prof. Dr. F. Rist

Zweitgutachter: Prof. Dr. R. Pietrowsky

Nebenfachprüfer: Prof. Dr. V. Arolt

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEUTSCHE ZUSAMMENFASSUNG

Körperdysmorphe Störung und Bodybuilding: Einfluss des Trainings auf Zufriedenheit und subjektive Körperwahrnehmung

Theoretischer Hintergrund

Bodybuilding und damit einhergehend tägliches, stundenlanges Krafttraining - wer hat sich nicht schon die Frage gestellt, woher die Motivation für diese Anstrengung stammt? Viele Männer scheinen auf dem Weg zu einer muskulösen Figur zu großen Opfern bereit zu sein. Sogar gesundheitsschädliche Maßnahmen (z. B. die Einnahme von Steroiden und Anabolika) werden zur Verbesserung der Figur eingesetzt (Schwerin et al. (1996)). Pope et al. (1997) berichten in diesem Zusammenhang von einer Unterform der körperdysmorphen Störung: der Muskeldysmorphophobie. Bei einem Teil der Betroffenen kann, in Anlehnung an Erkenntnisse aus der Essstörungsforschung, eine veränderte Körperwahrnehmung vermutet werden. Auf Grundlage von Befunden, dass körperliches Training sich bei Essgestörten unmittelbar positiv auf das Körperselbstbild auswirkt (Loumidis & Wells, 2001) vermuten wir, dass Bodybuilding einen ähnlichen Effekt auf ein gestörtes Körperbild bei Bodybuildern haben könnte.

Fragestellung

In dieser Studie soll überprüft werden, ob Bodybuilder mit körperdysmorphen Ängsten, ein extremeres Körperideal aufweisen, ihren Körper stärker verzerrt wahrnehmen, und ob sie durch eine typische Trainingseinheit einen größeren Zuwachs an Körperzufriedenheit sowie eine akkuratere Körperwahrnehmung erlangen als unbeeinträchtigte Bodybuilder und eine Vergleichsgruppe von Triathleten. Weiter wird untersucht, ob Depressionen, Angst vor sozialer Bewertung, der Gebrauch anaboler Steroide und suchthaftes Trainieren bei diesen Personen häufiger auftreten.

Methode

29 Bodybuilder und 20 Triathleten (Durchschnittsalter 31 Jahre) wurden in zwei örtlichen Fitnessstudios und drei Sportvereinen rekrutiert. Zehn Personen aus der Gruppe der Bodybuilder waren nach von Pope et al. (2000) aufgestellten Kriterien mindestens zu einem leichten bis mittleren Ausmaß von körperdysmorphen Ängsten betroffen. Vor und nach einer typischen Trainingseinheit schätzten die Teilnehmer die Zufriedenheit mit ihrem Körper ein. Die subjektive Körperwahrnehmung wurde mit Hilfe einer computergestützten Bildverzerrtechnik erfasst. Zu einem der zwei Datenerhebungspunkte wurden Körpergröße, -gewicht, Körperfettanteil sowie die ideale Körperform (ebenfalls computergestützt) gemessen; hieraus wurden der Body Mass Index (BMI) sowie der Fat Free Mass Index (FFMI) berechnet. Drei unabhängige, trainierte Rater schätzten die objektiven Körpermaße anhand der somatomorphen Matrix (Gruber et al., 1999) ein. Die Teilnehmer wurden zu Essverhalten, Substanzgebrauch und körperdysmorphen Störungen (Benutzung des entsprechenden Abschnitts des SKID-I, Strukturiertes Klinisches Interview für DSM-IV, Achse I, Wittchen et al., 1997) durch ausgebildete Interviewer

befragt. Zwischen beiden Terminen füllten die Teilnehmer anonym ein Fragebogenpaket aus. Die Auswertung der Daten erfolgte durch die Berechnung von multivariaten und univariaten Varianzanalysen, Kovarianzanalysen sowie korrelativen Zusammenhängen, und für den Vergleich der einzelnen Gruppen untereinander wurden Post-hoc-Tests nach Tukey benutzt.

Ergebnisse

Beide Bodybuildinggruppen strebten im Vergleich zu den Triathleten ein extremeres Körperideal an. Je muskulöser der Sportler war, desto extremer war auch das Idealbild, und je größer die Diskrepanz zwischen Ideal und tatsächlichem Aussehen war, desto unzufriedener war der Teilnehmer und desto mehr körperdysmorphe Ängste berichtete er. Das Trainieren führte in allen drei Untergruppen zu mehr Zufriedenheit, wobei körperdysmorphe Bodybuilder insgesamt weniger zufrieden mit ihrem Körper waren als die Triathleten. Die körperdysmorphen Bodybuilder sowie die Triathleten schätzten ihren Körper schmaler ein als er wirklich ist, unbeeinträchtigte Bodybuilder verfügten über eine akkurate Wahrnehmung der Körpergröße. Tendenziell führte das spezifische Training bei beiden Bodybuilding-Gruppen zu einer Zunahme an wahrgenommener Körpergröße, bei den Triathleten hingegen eher zu einer Abnahme. Substanzgebrauch wurde ausschließlich von Bodybuildern berichtet, ebenfalls verstärkt in der körperdysmorphen Untergruppe. Bezüglich Depressionen, sozialer Ängste oder suchthaftem Trainingsverhalten gab es keine Unterschiede zwischen den Gruppen.

Schlussfolgerungen

Der Massezuwachs durch Bodybuilding scheint die Diskrepanz zwischen wahrgenommener und idealer Körpergröße nicht zu verkleinern, da sich das Ideal trotz zunehmender Muskulatur zu vergrößern scheint. Als Erklärung könnten hier Einflüsse aus der sozialen Umgebung wie beispielsweise Ermunterungen durch Trainer und Mittrainierende, Wettbewerbe auf immer höherer Ebene oder die Auswahl neuer, noch muskulöserer Vorbilder dienen. Als Folge bleibt die Körperzufriedenheit trotz des Massezuwachses gering und die Motivation, das Training fortzuführen, gleichermaßen hoch. Sportliches Training verbessert die Körperzufriedenheit kurzfristig, scheint auch die Wahrnehmung des eigenen Körpers in spezifischer Weise zu verändern, erhöht jedoch nicht generell die Akkuratheit.

Einerseits können wir auf Grundlage unserer Ergebnisse nicht davon ausgehen, dass Bodybuilding körperdysmorphe Störungen auslöst. Andererseits unterstützen unsere Daten die Vermutung, dass dieser Sport auf Betroffene besonders anziehend wirkt, da sie glauben, durch das Training ihren Problemen und Ängsten etwas entgegensetzen zu können. Da diese Selbsthilfe jedoch nur auf der Symptomebene ansetzt, die grundlegende Selbstwertproblematik jedoch unter Umständen bestehen bleibt, folgt eine Aufrechterhaltung des Problems bei gleichzeitiger Notwendigkeit, das Training mit gleicher oder steigender Intensität beizubehalten.

1 ABSTRACT

Rationale*:* To establish whether male bodybuilders with muscle-dysmorphic concerns due to an extreme ideal body image display a body image disorder opposite to that which can be found in eating disorders, defined by a body size perception distorted to the smaller side, and whether this biased body size perception as well as body satisfaction are influenced by a regular workout session.

Objective*:* To determine whether bodybuilders show higher degrees of body dissatisfaction than non-bodybuiding athletes. In a secondary analysis, the objective is to first find out if bodybuilders with bodydysmorphic concerns (BDBB) have a bigger ideal body image, are less satisfied with their body, and perceive their body with a stronger negative bias than non-bodydysmorphic bodybuilders (nBDBB) or a control group of triathletes. Secondly, to determine whether these bodybuilders show a greater improvement in body satisfaction and a more accurate body size perception after a regular training session when compared to non-bodydysmorphic bodybuilders or triathletes. Third, to find out whether use of anabolic-androgenic steroids (AAS), depression, social anxiety, and excessive exercising occur more often in these athletes than in non-bodydysmorphic bodybuilders or triathletes.

Methods*:* A sample of 29 bodybuilders and 20 triathletes with an average age of 31 years (range 21 – 57 years) was recruited from two local gyms and three sports clubs. Ten bodybuilders had bodydysmorphic concerns to at least a mild to moderate degree. Six bodydysmorphic and six non-bodydysmorphic bodybuilders were current or former AAS-users. Prior to and following a regular workout session all participants rated their body satisfaction. Body size perception was assessed using a computerized digital-image-distortion method.

At one of the two occasions body size, weight and percentage of body-fat were measured, participants answered questions on eating behaviour and substance use. Body dysmorphic disorder was diagnosed according to DSM-IV criteria (APA, 1994). The ideal body image was derived from a different computerized method. Between the two testing occasions all participants completed several questionnaires measuring depression, social anxiety and excessive exercising.

Results*:* Bodybuilders had more bodydysmorphic concerns than non-bodybuilding athletes. Bodydysmorphic (BDBB) as well as non-bodydysmorphic bodybuilders (nBDBB) were striving towards an extremely big body physique, in contrast to the controls. The bigger the perceived and objective body size were, the more extreme the ideal became, and the bigger the discrepancy between perceived and ideal body size grew, the more dissatisfaction and body-dysmorphic concerns were reported. Both bodybuilding groups were less satisfied with their bodies than non-bodybuilding athletes. BDBBs and triathletes perceived their body with a bias to the smaller side, nBDBBs had an accurate body size perception. The training session led to a stable improvement in body satisfaction in all groups. Further, there were trends that bodybuilders perceived their bodies as being bigger after training compared to before training, whereas triathletes perceived their bodies to be smaller after training compared to before training. Substance abuse occurred exclusively in bodybuilders, especially in those with body-dysmorphic concerns. BDBBs reported greater depressivity than nBDBBs, but stayed below the clinical criterion. Groups did not differ considering social anxiety and exercise dependence.

Conclusions*:* Gaining body size through bodybuilding does not seem to diminish the discrepancy between perceived and ideal body size, because the latter seems to adapt to the new state and environment. Accordingly, in the long run satisfaction stays low and motivation to keep up the training amount is constantly high. Training itself does improve body satisfaction for a moment, and

tends to influence the way athletes perceive their own bodies in a specific way. Bodybuilding cannot be considered to cause body dysmorphic disorders, but offers to vulnerable men a promising strategy to temporarily overcome their concerns, however without solving the problem.

Keywords: Body image – body dysmorphic disorder – bodybuilding – anabolic-androgenic steroids – ideal body image

2 INTRODUCTION

2.1 Body image

Research on body image goes back to the 1920s, when the medical discipline of neurology started to investigate neuropathological forms of body experience, including such phenomena as “phantom limb” or “anosognosia” (see Fisher, 1990). In this course, the construct of body image, or body schema, was understood as a somatosensoric representation of one’s own body (Head, 1920), which formed the basis for proprioceptive perception of the body’s position and direction of movement. As this mental representation cannot be directly observed and therefore stays a theoretical construct, until today researchers face difficulties in its explanation and explicit operationalisation. (Slade, 1994; Tuschen et al., 1993).

Cash (1990) states that “body image refers to the multifaceted psychological experience of embodiment, especially but not exclusively one’s physical appearance. (…) It encompasses one’s body-related self-perceptions and self-attitudes, including thoughts, beliefs, feelings, and behaviours”. Therefore, body image is an individual and unique experience of one’s body. Thompson (1998), however, criticizes the term as being almost useless without a specification of which particular subjective, affective, cognitive, behavioural, or perceptual processes are involved. He further states that body image may as well focus on specific body sites as on the more global aspect of overall body appearance. Thompson et al. (1999) differenciate 14 terms that have been used to refer to some aspect or dimension of body image. Such a variety, however, may be confusing and may lead to mislabelling, imprecise assessment and

misinterpretation of a construct, as Thompson (2004) later points out. In an attempt to reduce terms to central dimensions, Cash (2002) stresses the perceptual and the attitudinal body image as two major components. The latter comprises an evaluative-affective and a cognitive-behavioral dimension.

Our research project will thus refer to body image as a multifaceted, internal representation of one's body and appearance, with a perceptual aspect (body size perception), and an evaluative, or attitudinal, aspect (body satisfaction and body esteem) that taps as well affect as cognition. For this research study, we will use the following definitions for these three terms, following Thompson et al. (1998), and will refer to the different parametre-values by the following adjectives:

Body size perception / Body size perception accuracy

Accuracy of estimation of the size of body sites, which is commonly referred to as body image distortion. Body size perception (BSP) may either be accurate, or inaccurate respectively distorted.

Further we refer to the consistency with which an individual correctly identifies a given picture of the body as being either smaller or wider than his or her perceived body as *perceptual discrimination consistency (PDC)* in body size perception. An individual's PDC may therefore be low respectively high, which means to inconsistently respectively consistently detect even finest differences between a presented picture and the perceived body image, and which has to be distinguished from the term of accuracy used above. For example, a person might have an accurate body size perception, meaning that on average he or she estimates her body size right to objective standards, but at the same time have a low discrimination consistency, meaning that he or she is bad in detecting small differences.

Body satisfaction

Satisfaction with an aspect of one's body; usually the separate body sites are rated on separate scales (e.g., waist, hips, thighs, breast, hair, etc.). In contrast, appearance satisfaction aims at overall appearance; usually scales contain items that address issues such as facial features, weight-related areas, and hair; items might also address broader features, such as sex appeal. In this research study we will speak of high and low body satisfaction. Body *dis*satisfaction will be used as the lowest extreme of the dimension of body satisfaction.

Body esteem

Probably most similar to body satisfaction, body esteem reflects agreement with positive versus negative features of one's body; it may also capture broader concepts (e.g. "I am proud of my body").

We will further use the term "real" body image or body size to describe the objective body size of a person (respectively his or her original photograph in our research study), the term "perceived" body image or body size to distinguish the first from what the person thinks he or she looks like, and "ideal" body image or body size to describe what the person would like to look like.

The concept of body image is meant to describe a continuum, reaching from great satisfaction over slight concerns with specific or global aspects of one's physical appearance, up to a clinically relevant body image disorder. As with many other continuous constructs, it is difficult to decide at what point to distinguish between 'normal' concerns and clinically relevant distress. Worse cases of body image disorder, however, cause an impairment of social or professional functioning and imply serious suffering.

According to Thompson (1992) a body image disorder is defined as

"A persistent report of dissatisfaction, concern, and distress that is related to an aspect of physical appearance. Some degree of impairment in social relations, social activities, or occupational functioning must be present."

The APA (1994), however, does not include the syndrome as a separate disorder. Nevertheless, it occurs among the diagnostic criteria of several disorders, such as, for example, anorexia nervosa: "Disturbance in the way in which one's body weight, size or shape is experienced, e.g. denial of seriousness of current low body weight, or undue influence of body shape and weight on self-evaluation". Since the beginnings of scientific research on eating disorders, investigations of body image disorders mainly focused on anorexic women, who represent at least 85% of all cases in this group of psychological disorders (Leon et al., 1995). However, men may be just as affected by body image disturbance as women, but in a gender-specific way.

We will first describe the body dysmorphic disorder, and then specify a typically male form of body image disturbance and its behavioural consequences: muscle dysmorphic disorder and bodybuilding. As a next part, we give an overview of the current knowledge of body image in men. As the muscle dysmorphic disorder shows similar features as anorexic disorders in women, although to an opposite direction, we will take a short outlook on research on body image disturbance in eating disorders and the methods and techniques of assessment used in this context, before coming to body image in muscle dysmorphic disorder.

2.2 Body dysmorphic disorder and "muscle dysmorphia"

2.2.1 Diagnostic criteria for body dysmorphic disorder

Dysmorphic concern, an obsessive concern with an imagined or slight defect in physical appearance, is a symptom which by itself can occur in a number of different disorders, for example schizophrenia or eating disorders. However, in 1980 it was included as an independent subgroup of the somatoform disorders in DSM-III-R, the Diagnostic and Statistical Manual of Mental Disorders, 3rd edition, presented by the American Psychiatric Association (APA). The ICD-10 Classification of Mental and Behavioural Disorders by the World Health Organization (1992) still groups the body dysmorphic disorder (BDD) with hypochondria instead of accepting it as a separate psychological disorder. In fact, there is not only a substantial overlap of BDD with hypochondria, but with obsessive-compulsive disorder, social phobia and depression as well (Phillips, 1995). The most recent edition, DSM IV (1994), until now offers the most widely used operationalized diagnostic criteria. These provide the guidelines for making a particular diagnosis. An individual must exhibit all of the attributes indicated by letters of the alphabet in the list of criteria.

Patients' complaints mainly focus on subjectively experienced appearance deficits, often focussing at the face, the skin or the hair, further at proportions of body parts such as breasts or genitals. In order to deal with the 'defect' patients spend several hours a day camouflaging (i.e. hiding it with make-up, clothing or body position) or checking (e.g. repeatedly looking into the mirror). Additionally they tend to avoid situations where the defect might be noticed by others, and in severe cases become housebound. These behaviours usually cause a strong

impact on social and occupational life, and can lead to depression or suicide. Phillips et al. (1995) found 29% of BDD patients to have made suicide attempts. Patients are most commonly met in clinics for plastic surgery or dermatology, requesting treatment of the imagined defect. Psychiatric or psychological treatment, in contrast, is hardly ever seeked, because insight in the psychological nature of the problem usually is poor or patients are embarrassed to admit the extent to which they suffer and may not reveal it unless specifically asked about it. Causes of the disorder are still unclear (Stangier et al., 2000); biological, psychodynamic as well as cognitive-behavioural models are discussed. Prevalence data suggest that 1-4% of the population have body dysmorphic disorder, with females being equally affected as men. According to Phillips et al. (1994), BDD usually begins in adolescence and appears to be chronic, with a reported mean duration of illness of 16 years.

A. Preoccupation with an imagined defect in appearance. If a slight physical anomaly is present, the person's concern is markedly excessive.

B. The preoccupation causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

C. The preoccupation is not better accounted for by another mental disorder (e.g. dissatisfaction with body shape and size in anorexia nervosa.).

Figure 1. Diagnostic criteria for body dysmorphic disorder according to DSM-IV

2.2.2 Diagnostic criteria for muscle dysmorphic disorder

Central feature of the clinical syndrome is a preoccupation with muscularity, with the individual believing that he or she is small, weak or otherwise inadequate. This belief is commonly incorrect with reference to an objective rating. A typical symptom is that patients engage in compulsive bodybuilding and consumption of bulking-up foods and other substances such as anabolic androgenic steroids, yet they maintain the elevated level of muscularity insecurity. Most avoid beaches, swimming pools, or locker rooms, where their bodies might be exposed. Some even draw back from intimate relationships for the same reason. All this is usually accompanied by a serious impact on social, affective and professional life.

When trying to find an appropriate clinical category to describe the need to develop an exaggerated amount of muscularity, several different psychological disorders share common features with this psychological state. The group around Pope first named the syndrome “reverse anorexia” (1993), presuming a connection with eating disorders. Harvey and Robinson (2003) note that the criteria for anorexia nervosa, however, set a clear emphasis on the body weight issue compared to the disturbed body image and that in the syndrome described above the opposite is rather the case. As the disturbance of body image is the central feature, out of the spectrum of eating disorders, obsessive compulsive disorder, social phobia, and body dysmorphic disorder, the latter so far seems to address the subject best. Still, as the upper definition (Figure 1) shows, it gives only a broad description and describes the specific clinical picture insufficiently. Therefore it seems helpful to concretise criteria and denominations for this subgroup of body dysmorphic phenomena. In later publications, the research group around Pope agreed on the term ”muscle dysmorphia” (Pope, 1997) with

respect to the proneness to body dysmorphic disorder. Muscle dysmorphia since then has been considered a subtype of the body dysmorphic disorder, but has not yet been mentioned in DSM-IV. Pope et al. (2000) offer proposed operational diagnostic criteria (see Figure 2) for this particular condition, formulated in the same style as DSM-IV.

As muscle dysmorphia is not yet accepted as a formal diagnosis, we cannot report any official prevalence data yet. A survey by Jacobi and Cash (1994) provides some information on the muscularity satisfaction levels of a sample of American college men: they found that 91% of the men wanted to be more muscular. In consequence, bodybuilding, a sport which aims at maximisation of muscularity (see next section), is constantly gaining in popularity. Goldfield et al. (1998) estimate that at least 5 million persons hold gym memberships in the USA alone, which – even with small percentages of fitness participants who have muscle dysmorphia – would still give a substantial number. In this regard, Pope et al. (1997) diagnosed 'reverse anorexia' in 10% of an unselected sample of 165 male bodybuilders. Given that cultural pressures to be muscular are presumably much stronger for men than for women, they suppose that muscle dysmorphic disorder is more common in men than in women. However, women who are involved in fitness and bodybuilding may report similar symptoms. The authors further state that it is unclear whether this form is a relatively new form of body image disturbance, if the generations before did not display similar preoccupations, or if the phenomenon is simply more widely recognised today.

A. Preoccupation with the idea that one's body is not sufficiently lean and muscular. Characteristic associated behaviours include long hours of lifting weights and excessive attention to diet.

B. The preoccupation is manifested by at least two of the following four criteria:
   1. The individual frequently gives up important social, occupational, or recreational activities because of a compulsive need to maintain his or her workout and diet schedule.
   2. The individual avoids situations where his or her body is exposed to others, or endures such situations only with marked distress or intense anxiety.
   3. The preoccupation about the inadequacy of body size or musculature causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.
   4. The individual continues to work out, diet, or use ergogenic (performance-enhancing) substances despite knowledge of adverse physical or psychological consequences.

C. The primary focus of the preoccupation and behaviours is on being too small or inadequately muscular, as distinguished from fear of being fat as in anorexia nervosa, or a primary preoccupation only with other aspects of appearance as in other forms of body dysmorphic disorder.

Figure 2. Diagnostic criteria for muscle dysmorphic disorder, Pope et al. (2000).

2.3 Male beauty ideals

Research studies on western-cultural beauty ideals show that men prefer a lean though muscular, hypermesomorphic (V-shaped) body. Mesomorphic means to be well-proportioned, average build as opposed to being either fat or thin. Furthermore, the hyper-mesomorphic type is characterized by "a well-developed chest and arm muscles and wide shoulders tapering down to a narrow waist." (Mishkind et al., 1986). The muscular mesomorphic male stereotype is considered to be stronger, more attractive, healthier, happier, braver, and having more friends than either the thin (ectomorph) or fat (endomorph) type (Kirkpatrick and Sanders, 1978). Beyond that, this stereotype is expected to profit from the various advantages that research has found society to offer to attractive people, such as better job chances or higher starting salaries (Hatfield and Sprecher, 1986). Mishkind et al. (1986) resume that this stereotype exists across social classes and cultures, gains increasing strength especially in young adulthood and may lead men to aspire to resemble it and to feel dissatisfied if they do not.

The hypermesomorphic shape, in comparison with skinny female beauty ideals brings a different perspective into body image management: the focus on muscle gain. Andersen et al. (1992) report that men's magazines publish significantly more advertisement and articles about changing body shape than about losing weight. This is a proceeding trend, as an ingenious study by Pope et al. (1999) on the development of the ideal male body over the past twenty years shows. They examined the evolution of boys' action toys such as GI Joe, a toy soldier, and found that these became increasingly muscular over time; with many contemporary figures having a body by far more muscular than is humanly attainable. Leit et al. (2000) followed this idea by comparing 115 male centrefold

models from the past 25 years in 'Playgirl', a magazine focusing on male beauty and having a print run of 300.000. They found that the centrefold models became increasingly "dense" and more muscular over time, as indicated by the significant correlation between BMI (BMI = kg / m^2), FFMI (BMI adjusted by the approximate amount of body fat, also see chapter 3.3.5, formula 1), and year of publication.

As noted above, strict submission to a bodily ideal, especially one that is not physically attainable, may lead to various psychological and behavioural problems. Moreover, if an attribute is as highly linked to a sex role as is muscularity to masculinity, it is likely that many men are receptive to internalising this as an ideal. Therefore we can suspect that a considerable amount of men experience clinically relevant distress.

2.4 Bodybuilding

2.4.1 Description of the sport

Bodybuilding is defined as a process of developing the musculature of the body through specific types of diet and physical exercise, such as weightlifting (The American Heritage Dictionary of the English Language, 4th Ed., 2004). Men specifically try to lose fat, but at the same time try to gain size and weight through musculature.

The aim of shaping one's body in such a way usually is a competitive exhibition. Competitive bodybuilders display their physiques to a panel of judges, who assign points to the contestant's outward appearance. Bodybuilders aspire to develop and maintain an aesthetically pleasing body (by bodybuilding

standards) and a balanced physique. A bodybuilder's size and shape are far more important than how much weight he or she can lift. Bodybuilding is therefore not to be confused with powerlifting, where the emphasis is on actual physical strength, or with Olympic weightlifting, which equally stresses strength and technique. Though it might superficially look similar to the casual observer, the subgroups follow different guidelines of training and diet and display a different basic motivation.

According to Hatfield (1984), in order to achieve muscle growth, bodybuilders focus on three main lines of action:

1. Resistance weight training

   Bodybuilders focus on the shape and looks of their musculature. In preparation for a contest, heavy weights with low repetitions are used in daily resistance training. The more muscle fibres are recruited for an exercise, the greater becomes the extent to which the entire muscle is remodelled.

2. Special nutrition

   Nutrition aims at an increased caloric intake, low in fat at the same time. Generally speaking, bodybuilders require between 500 and 1000 calories above their maintenance level of food energy in order to increase lean body mass. Bodybuilders split their food intake for the day into 5 to 7 meals of roughly equal nutritional content and attempt to eat at regular intervals (normally between 2 and 3 hours). Hereby they hope to achieve a greater absorption of nutrients and increase the basal metabolic rate. Additional food supplements usually include extra protein, vitamins and creatine. Creatine is a compound that is used as an energy source for muscle activity by convertion to creatinine. The amount of both creatine and creatinine depend on muscle mass, so bodybuilders have an increased

need of it. Shortly before a contest, the level of food energy is reduced to sub-maintenance and is combined with cardiovascular exercise to lose body fat and make muscles and veins more visible.

3. Planned rest to facilitate growth

   Without quality rest and sleep the body does not have an opportunity to recover and build. About eight hours of sleep a night is essential for a bodybuilder to be refreshed and ready for the next session.

Pope et al. (2000) further describe behavioural particularities observed in elite-level bodybuilders. Some may wear overly heavy clothing in order to look bigger. Others, especially a few days or hours before a contest, may use diuretics or sweat excessively (for example, by working out with too warm clothing or going to the sauna) in order to withdraw fluid from the tissue. Water and sodium keep it swollen, which can obscure the muscles and definition under the skin - an undesirable condition known in the sport as "spillover." Within the bodybuilding community the state of dehydration is usually referred to by the term of “being tight”. Another common strategy is to get a deep tan and use bronzing and shimmering lotions to enhance the visibility of muscles and veins. After all, several months of intense and disciplined preparation for a bodybuilding contest aim towards a physical state of maximal musculature, dehydration and minimal percentage of fat which cannot be maintained for more than a few hours. Yet, this ideal competition image is a standard against which male and female bodybuilders judge their off-season bodies.

2.4.2 Bodybuilding and use of anabolic androgenic steroids (AAS)

The use of anabolic androgenic steroids (AAS) in bodybuilding continues to be a source of controversy. Many bodybuilders use illegal drugs to gain an advantage over results due to natural hypertrophy. In competitive bodybuilding, the use of anabolic steroids and precursor substances such as prohormones therefore are essential to remain competitive in world-class competitions. Most steroids allow the human body to be in a more anabolic state. It is alleged that 75% of athletes attending bodybuilding competitions are taking AAS despite the fact that most of these substances are illegal in many countries (Lindstom et al., 1990).

Wroblewska (1997) gives a review on the development of intake of AAS in young men in which she describes that these substances are derived from testosterone and grouped in the oral androgenic steroids, the injectable structured agents and the nortestosterone derivatives. Human Growth Hormone (HGH) and insulin are also used by some of the larger bodybuilders. HGH is incredibly expensive compared to AAS, whereas insulin is very readily available yet fatal if misused. In order to maximize the muscle-building effect but minimize the risk of detection, bodybuilders either mix different drugs and forms of application (i.e. injectable and oral) or “pyramid” by beginning with low doses and slowly increasing the amounts. A so-called “cycle” is an application of the drug during 4-12 weeks, with a succeeding 4-12 weeks of intermission. The pause is usually scheduled with respect to the competition and drug testing dates.

The direct effects of AAS-intake will be an increase in synthesis of protein in skeletal muscle, a promotion of nitrogen retention and a subsequent increase in lean body mass (Wroblewska, 1997). At the same time, on the psychological

side, an increase in aggression, respectively a decrease in tolerance of frustration, can be observed. Bodybuilders ‘on a cycle’ feel not only more irritable, but also euphoric and more self-confident. In several cases even manic or psychotic syndromes have been described (Uzych, 1992). Negative side-effects caused by long-term steroid abuse, according to Wroblewska (1997), include liver damage, prostate cancer, impairment of thyroid functioning, an increased risk of cardiovascular disease, and a decline in the body's own testosterone production, which can cause atrophy of the testicles and possibly infertility. Choi (1993) further reports an increasing incidence of AIDS within the bodybuilding population due to needle sharing. Withdrawal symptoms appear similar to the withdrawal of other drug types and may include depression, fatigue, restlessness, loss of appetite, insomnia, decreased libido and headaches.

2.4.3 Bodybuilding and muscle dysmorphia

Bodybuilding seems to be extremely attractive to muscle dysmorphic men. Several research studies successfully linked both fields to each other. Goldfield et al. (1998) presented a research review in which they included studies examining body image concerns as well as data on risks for eating problems. Their analysis revealed that male bodybuilders showed more severe body image disturbance and eating problems than matched athletic control groups. Lantz et al. (2002) investigated if associated characteristics of muscle dysmorphia were different between elite-level competitive bodybuilders and power lifters and found the bodybuilders more likely to report body size and -symmetry concerns, dietary behaviour and pharmacological use. Comparable to the fact that body-dysmorphic patients are most often found in clinics for plastic surgery, muscle

dysmorphic men are met in gyms trying to improve their body-esteem through bodybuilding workout.

2.5 Body image in men

A gap in knowledge about body image in men has persisted over the years, because research focussed on body image in eating disordered women. Women usually manage and improve their body image through diet and exercise (Cash, Novy, Grant, 1994; Fisher, Thompson, 1994). In men, however, completely different forms of dieting as well as addictive exercising and use of anabolic androgenic steroids or similar substances can be observed.

As we noted above, muscle dysmorphia used to be termed “reverse anorexia” by Pope et al. (1993), because the syndrome comprises similar, however opposite, features. Mangweth et al. (2001) could show that bodybuilders exhibit a pattern of eating and exercising as obsessive as that of subjects with eating disorders, but with a 'reverse' focus of gaining muscle as opposed to losing fat. In measures of body satisfaction, bodybuilders resemble men with eating disorders in being more dissatisfied with their bodies than the average men. The authors conclude that, as well on measures of body image as on those of eating behaviour, bodybuilders share many features with individuals with eating disorders. As knowledge about body image in eating disorders is profound thanks to great scientific interest, and as a variety of methods aiming at the perceptual component have been developed in this context, we would like to give an overview of both these areas before coming back to body image in men.

2.5.1 Measurement of size perception accuracy in eating disorders

Smeets (1997) gives an overview as well as a comparison of the different methods. She states that studies using so-called 'body-part-methods' can be opposed to 'whole-body-methods'.

Body-part-methods include the 'visual size estimation task' (Slade and Russel, 1973) which uses spots of light projected at a wall to be manipulated unless the expected body shape is shown, and the 'image marking procedure' (Askevold, 1975), in which participants are asked to make a cross for certain body parts on life-size paper, between which the distance can be measured. To rule out the possibility of a generalized perceptual deficiency, it seems advisable to include a shape estimation of a dummy or neutral object. Smeets further assumes that these strategies measure the visual image one has memorized of his or her own body rather than size perception accuracy.

Whole body methods, in contrast, offer the participant a picture of his or her entire body at a time, with the task to find the dimensions he or she thinks are accurately depicting the real body shape. The 'distorted photograph technique' lets participants manipulate a picture unless the size seems to be properly displayed (Glucksman and Hirsch, 1969), whereas the 'distorted video technique' has them adjust a video recording of their body in width and height on a monitor (Allebeck, 1976). A further development of this technique is the 'life-size screen distortion' (Probst, 1995). A different approach within the whole body methods is to show the participants silhouettes of varying degrees of thinness and obesity out of which they have to choose the appropriate picture (Williamson, 1985).

A meta-analysis by Smeets et al. (1997) conducted on 33 studies in which body size estimates from anorexic women were compared to those of normal controls revealed that, no matter which method is used, they seem to assess correlated aspects of body image. On average, there is a noticeable difference between groups with a medium effect size of d=0.43, with d being computed as the mean difference between the anorexic and the normal groups divided by the pooled estimate of the within-groups standard deviation, a procedure proposed by Hedges and Olkin (1985). Whole body methods (d=0.38), and image marking procedures in particular (d=1.01), simply give a more consistent proof of overestimation of body size in anorexic women than body part methods (d=0.29).

2.5.2 Body image in eating disordered women

Today we commonly take it as a fact that females with eating disorders are more dissatisfied with their body size relative to other women and tend to overestimate it (Shaffran and Fairburn, 2002). On the background of a society placing high emphasis on the necessity for a woman to be thin in order to be viewed as attractive, successful and sympathetic (Tiggeman and Pickering, 1996), girls start to internalise an underweight ideal body image in an early age already. Trying to reach this ideal image through dieting, excessive exercising and in more severe cases also purging behaviour might soon become a major goal in life. In order to keep their eating behaviour restrained, anorexic women constantly compare themselves to their unrealistic ideal image. They complain that, in spite of objectively being thinner than the average woman, they still feel too fat and dissatisfied with themselves.

Taking a look at body image, anorexic patients tend to judge their bodies as being ‘too fat’, even if they are underweight – although they openly admit to being aware of this fact from the rational side. By taking their inappropriate self-evaluation for real, they develop strong feelings of disgust, hatred or anxiety towards their bodies, leading to typical behavioural problems. For example, they start to avoid seeing their shape or weight in mirrors, or repeatedly squeeze the skin of stomach, hips or waist in order to check if they are fat (Shaffran and Fairburn, 2003).

The concept and existence of body image disturbance in eating-disordered women, although part or the official criteria for diagnosis (see the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition), were and still are discussed controversially. The first one to focus on this area was Hilde Bruch (1962, 1973). She postulated three ways by which anorexic patients are impaired: overall feelings of personal ineffectiveness, misinterpretation of affective and physiological states, and the body image disturbance.

In the following decades, a variety of research methods were developed to further investigate body size perception accuracy (see section 2.5.1). Results of studies are conflicting. Some support the assumption that anorexic women overestimate their body size and that this bias is reduced as treatment with psychotherapy progresses (Slade and Russell, 1973; Shaffran and Fairburn, 2002), whereas others found evidence that overestimation is not universal to anorexic women but also found in non-clinical female samples (Button et al., 1977; Skrzypek et al., 2001). Smeets (1997) relates these contradictions mainly to methodological and conceptual confusion and concludes that overestimation clearly seems to be part of anorexic women’s body size perception.

Smeets further does not attribute the bias in body size estimation to a disturbance of body size perception on a neurological background. Her studies including neutral objects and bodies indicated that women with a disturbed judgement of their own body size were accurate in detecting size differences on other persons' bodies. Instead, she finds that the mental representation of the body in the process of body size estimation is consulted and therefore, "if overestimation in anorexic women takes place, has to be fatter" than the real body size is. Searching for an explanation of why and how body image gets affected, we need to focus on the bodily ideals.

2.5.3 Ideal body image and its influence in body image disturbance

The techniques described in section 2.5.1 were also used to assess ideal body. Patients were given the modulated instruction to choose a shape or a picture they would favour. This information is particularly interesting, because the difference between ideal and perceived body is often used to describe the degree of body satisfaction. We will however discuss this equalisation from a critical point of view in section 2.6. Additionally, it is probable that a body size perception inaccuracy like the overestimation in women who have anorexia nervosa is triggered by the thin ideal they have in mind. Therefore, researchers started to investigate not only if eating disordered women have a biased body size perception, but also what impact the ideal has on body size perception accuracy, be it in eating disorders or healthy persons.

Tovée et al. (2003) specifically designed a software system that uses biometric data based on real body shapes, instead of simply stretching or compressing images of the body. Participants (30 anorexic, 30 bulimic and 137

healthy women) were asked to alter the single body parts separately from each other while choosing the ideal shape and the perceived self. The results support the notion of false body size estimation against direction of ideal self in subgroups placing high emphasis on bodily appearance, as we mentioned above for body size perception in anorexic women.

But what *exactly* happens, when a person is confronted with his or her bodily ideal? *How* does this ideal influence the actual body size perception? To give an example, picture a young woman who has submitted to an absolute ideal of slim body shape and low weight. The need to maintain severe discipline in dieting and exercise grows and at the same time any piece of information concerning certain foods, the weight or the outward appearance gains importance and starts to pose a threat. As a result, her attention focuses more on and perception becomes more sensitive to the slightest bodily deficiencies, and the woman increasingly experiences that she is not able to meet the idealised shape. The mental image of her own insufficient body is formed against direction of the ideal and consolidated every time a confrontation with either herself or her ideal takes place. Now, when someone else makes a rather harmless statement about her outward appearance, she might misinterpret it as a criticism, take it as a proof of her insufficiency, feel worthless, and at the same time affirmed in her inadequate body image. In consequence, she will use these emotions to develop new motivation to exercise or diet even harder in order to lose more weight or get in better shape. A hypothetical reasoning like this exemplary one depicts the influence of ideal body image on actual body image and its role in the maintenance of symptomatic behaviour.

Studies measuring the effect of ideal body image on body size perception accuracy commonly use methods confronting participants vulnerable to body image disturbance with pictures of ideal physiques. Participants respond not only with an immediate negative affect (Hausenblas et al., 2003; Irving, 1990), but

also with increasing body size perception inaccuracy, which therefore seems not to be a stable parameter, but to be modified by affective and cognitive-evaluative processes. For example, Hamilton and Waller (1993) showed photographs of idealized female bodies in women's fashion magazines to women with and without eating disorders. The latter were not affected by any kind of photographs that they saw, but eating-disordered women were: they overestimated their own size and shape more when they had seen the pictures of women than when they saw photographs of neutral objects. This reaction can be best explained by group-specific ways of information-processing.

To further test whether information on ideal and personal body image is processed differently in groups holding a different cognitive-evaluative schema, researchers increasingly have included performance-based methods such as the emotional Stroop paradigm to obtain a better understanding of theses processes (see Williams et al., 1996). When compared to control participants, women who report bulimic behaviours tend to take longer to name the colour of body-, weight,- and eating-related words than of neutral words; the strength of this effect correlates with the severity of the eating problem; and these differences diminish with effective treatment (Cooper et al., 1992). This finding indicates that the higher a person values his or her outward appearance, as is the case in eating disorders, the more time and cognitive effort takes the processing of information concerning the actual or ideal body, which leads to the interference effects described. Moreover, it is highly probable that the same cognitive schema that causes the interference and the emotional reaction to confrontation with ideal physiques (Hamilton and Waller, 1993), also contributes to the biased body size perception. Further, behavioural symptoms that aim at assimilation of one’s body to the ideal physique, as for example dieting in anorexia nervosa, are maintained through schema-consistent processing of information (Vitousek, 1996).

2.5.4. Body satisfaction in men

With regard to the low prevalence of eating disorders in men, one would first suggest them to be more satisfied with their bodies than are women. Newer studies confirm that males are indeed less dissatisfied with their bodies than women, but still not fully content (Furnham and Calnan, 2002). The authors assume that men "do not seem to associate self-esteem with the concept of body dissatisfaction as opposed to female self-esteem which is clearly affected by body dissatisfaction". This statement is debatable and probably does not apply to men in general, considering certain groups of men who place high emphasis on their outward appearance, especially in certain sports or in adulthood. In a publication from 1988, Silberstein et al. presented findings from a study in which they questioned 92 men and women on their body satisfaction, self-esteem, dieting, and exercise behaviour. They found men to be just as dissatisfied with their bodies as women.

This finding indicates that there exists a considerable degree of body dissatisfaction in men. At the same time, men show a smaller tendency of developing eating disorders, which becomes understandable as the direction of dissatisfaction is taken into account. In contrast to women, body satisfaction in men seems to be lowered to equal parts by feelings of being too fat or being too small in body size compared with the increasingly extreme standards (Drewnowski et al., 1987). According to Cash (1986), being underweight, as closely as it is linked to eating disorders, "appears to have a different meaning for the two sexes. Underweight men seem unhappy with their body weight, whereas underweight women appear satisfied". Silberstein et al. (1988) reported that only 4.4% of the women wanted to gain size compared with 46.8% of the men. When evaluating their body, men and women take different aspects into account. Franzoi and Shields (1984) factor-analyzed the Body Esteem Scale (see chapter

3) and showed that in contrast to women, who defined attractiveness by “sexual attractiveness”, “weight” and “physical condition”, for men body esteem comprised “upper body strength”, “physical attractiveness” and “physical condition”. Therefore, dieting for men seems to be of marginal interest and only in a special way: not to lose weight, but to lose fat and change shape and outlooks. Harvey and Robinson (2003) claim that “it may be more meaningful to evaluate a male patient’s percent body fat than to assess if his body weight is below 85% of what is expected for his age and height” when trying to find criteria for the diagnosis of a typically male eating disorder.

2.5.5 Body size perception accuracy in men

We noted above that women, especially those who value their outward-appearance high as is the case in eating disorders, commonly overestimate their body size and weight. Men who have either anorexia or bulimia nervosa show a similar evaluation of body size. They report to feel twice as fat as they actually are (Mangweth et al., 2003; Olivardia et al., 1995), although this is not the same as body size perception inaccuracy, following Thompson’s (1998) definition. However, men who do not have anorexia or bulimia nervosa wish to be over- rather than underweight concerning muscularity, but at the same time stay as sensitive towards having too much body fat as women. Therefore, we cannot simply generalise the finding of body size overestimation in eating disorders, which would include musculature as well as body fat.

According to a study of 62 healthy males of varying weight the average man tends to perceive himself as weighing less than he actually does (Gray, 1977). However, the percentage of body fat in relation to what would be expected for

age and height, as well as a man's perception of this parametre, in this context might have more meaning for the male body perception than the absolute weight. Pope et al. (2000) tried to separate between perception of fatness and muscularity. They developed a computerized instrument to measure body size perception and offered it to an unselected group of 200 men from three countries (i.e. neither eating disordered nor body dysmorphic men). For this technique they used 100 images of men, arranged in a matrix, with degrees of fatness varying from 4% to 40% body fat and muscularity ranging from FFMI = 16.5 to 30.0 (see formula 1, chapter 3.3.5). This matrix, belonging in the group of whole body methods (see above), was named the 'somatomorphic matrix'. The results showed that men estimate their percentage of body fat quite accurately and slightly overestimate their muscularity ($p < .05$), but to a degree which would barely be noticeable to the eye.

To summarise, research studies on body size perception accuracy in men are still rare. Scientific interest has focused mainly on eating disorders and therefore on women. In recent years, with the upturn of health sciences, more studies started to deal with body image in athletes, which is naturally associated with weight loss, respectively reduction of body fat percentage, and muscle gain at the same time. Research has confirmed that physical activity in its many forms may contribute to enhanced self-esteem (Kirkcaldy et al., 2002). According to Williams et al. (2001), participation in a 6-week circuit weight training program significantly improved evaluation of participants' appearance as well as body satisfaction. Koivula (1999) reported a more positive perceived body image in individuals who participate in sports than in individuals who do not. These studies, however, did not focus on sports which put high emphasis on outward-appearance as does bodybuilding.We will therefore find out more about body size perception in men in the context of body image in muscle dysmorphia respectively bodybuilders.

2.5.6 Body image in muscle dysmorphia

As we explained above, women with eating disorders perceive themselves as being bigger than they really are; a bias to the opposite of the bodily ideal. If muscle dysmorphia in men can be regarded the reverse of anorexia nervosa in women, similar mechanisms should be at work in the development and maintance of the disorder. We would in the beginning like to mention a critical point: many studies investigate aspects of body image in bodybuilders and do not separate for muscle dysmorphia. We consider this a limitation to the generalisability of results and will pay attention to this aspect in our own research project.

We expect muscle dysmorphic men to experience a similar body image disturbance as do anorexic women. This implies that muscle dysmorphic men should be equally dissatisfied with their bodies as anorexic women. Mangweth et al. (2001) compared male bodybuilders to men with eating disorders and control men regarding body image and found bodybuilders to resemble men with eating disorders, as both groups, but not the control group, reported low satisfaction with their bodies. Blouin and Goldfield (1995) gave measures of body satisfaction, of feelings of personal effectiveness and of self-esteem to 43 bodybuilders, 48 runners and 48 martial artists, with the bodybuilders displaying significantly greater impairment on all of these measures compared to all other groups.

Regarding the perceptional component of body image one finds the same differences between regular sports and bodybuilding. Most sports which athletes who are not prone to body image disturbance engage in, improve accuracy of body size perception. Rossi et al. (1979) required 20 male athletes and 20 control subjects to make estimates of the length of their body dimensions and of external

comparison objects. Athletes were more accurate in judging dimensions of their body than of comparison-objects whereas the opposite was observed in non-athletes. However, an assessment of body size perception in bodybuilders showed that they tend to underestimate their size by 15% (Loosemore, et al., 1989). Furthermore, as mentioned above, they express less satisfaction with their perceived body. Still, as bodybuilders do not necessarily display signs of muscle dysmorphia and these studies did not separately analyse a muscle dysmorphic and a healthy subgroup, it is possible that bodybuilders without bodydysmorphic tendencies might have a quite accurate body size perception whereas bodydysmorphic individuals do not profit from physical workout.

Etiological considerations take similar concepts for the development of muscle dysmorphia as for the development of eating disorders into account, such as being teased about the bodily appearance in adulthood, for example about being too skinny or too fat (Pope et al., 1996). The extent to which body satisfaction and body esteem in the end become components of overall self-esteem, be it in men or women, probably is equivalent to the degree to which an individual learns to place emphasis on his or her body appearance. Having undertaken a qualitative study, Klein (1986) concludes that poor physical self-esteem is what initially made bodybuilders start working out. Pope et al. (1997) further state that individuals with a pre-existing body image disturbance become highly attracted to bodybuilding. They seem to profit from muscle workout in a way that maintains or exacerbates the underlying disorder.

2.5.7 The vicious circle in muscle dysmorphia

Instead of learning how to develop appropriate self- and body-esteem, muscle dysmorphic men try to alter their appearance according to the idealised physique, no matter which long-term health consequences might follow. By approaching respectively reaching their goals, they experience self-efficacy, body satisfaction and a rise in body-esteem, which seems to compensate for the lack of self-esteem. Hurst et al. (2000) suppose that an additional factor in the establishment of a better self-esteem might be the social support muscle-dysmorphic men find in their gyms. This, however, includes the need to maintain a high amount of training to stay accepted there. All in all, the authors draw a parallel to dependence disorders and conclude that, as bodybuilders who initially had low self-esteem become more muscular, they may overcome inferiority feelings and become dependent on feeling good about their physiques through working-out.

As bodybuilding receives a function in establishing a better self-esteem, individuals might start to rely on this major source exclusively (Lantz et al., 2001). A muscle dysmorphic man will hope to improve his self- and body esteem by pumping iron – however, results of research studies show that body satisfaction stays equally low or even diminishes in the long-run. Phelps et al. (2001) report that body satisfaction remains unimproved in male bodybuilders, although they have been engaging in bodybuilding for a long time. Therefore, the sport itself does not appear to generate bodily contentment, or, which is even more likely, certain bodybuilders are not able to experience an increase in body satisfaction. Instead, Phelps and collegues hint that these bodybuilders, who might in fact be identical to the muscle dysmorphic subgroup, seem to set higher and higher goals for themselves, i.e. they push their ideal image forward making

it impossible to ever reach it, which in turn would produce the satisfaction they long for.

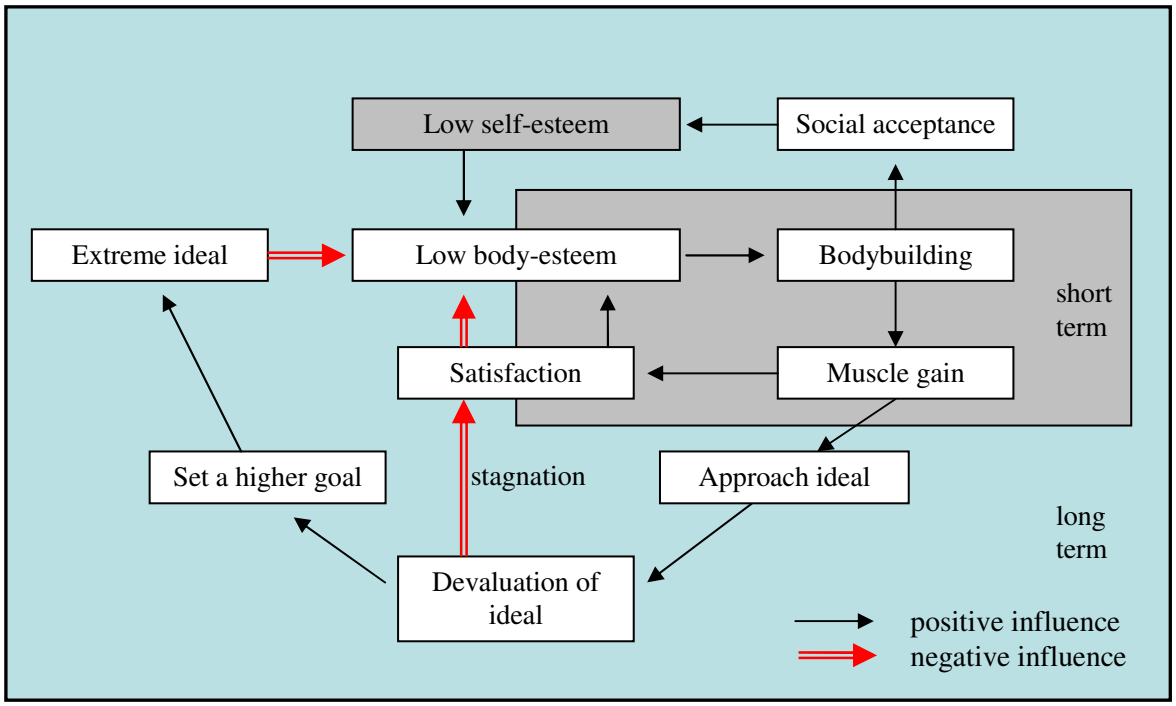

Figure 3. Vicious circle in muscle dysmorphia (MD).

Smith, Hale and Collins (1998) propose the term "exercise dependence" to describe a "process that compels an individual to exercise in spite of obstacles, and results in physical and psychological symptoms when exercise is withdrawn". The huge amount of time spent on exercising may lead to a neglect of family, social or work obligations. Further consequences are feelings of depression and guilt when not being able to exercise as planned (Sachs and Pargman, 1979). Also, the high volume of exercise can lead to health problems, such as immune system damage (Wichmann and Martin, 1992), and severe injury. Morrow (1995, personal communication between Morrow and Smith) proposed diagnostic criteria for the syndrome according to the official criteria for substance dependency, including "self-depracating or anxious thoughts when unable to exercise as much as planned, and the altering of normal priorities to the extent that exercise is placed above other activities, with resulting social or

occupational consequences. The individual will also have irrational expectations regarding the amount of exercise needed to maintain his/her desired body shape and will persist in exercising in the face of physical consequences such as injuries. In addition, the individual will ruminate about the effects of any decrease in exercise levels, real or potential." (cited after Smith et al., 1998). We regard this concept as fitting and important in the context of bodybuilding and muscle dysmorphia and will therefore include it in our research study.

To conclude, we would again like to mention that all these results so far do not allow linking bodybuilding and muscle dysmorphia in a causal way. The fact that 90% of leisure bodybuilders do not report bodydysmorphic concerns (Pope et al., 1997) indicates that it is not bodybuilding alone which causes body image disturbance.

2.6 Concepts used in this research study

Before specifying this research study's hypotheses, we would like to gather all concepts that we consider to be important in investigating muscle dysmorphia according to the considerations above. Figure 4 shows all concepts on a glance.

A disturbed body image, with the attitudinal and the perceptive component, as defined in section 2.1, represents the central feature of muscle dysmorphia. The criteria for muscle dysmorphia naturally imply low body satisfaction. Because body satisfaction as a state measure might nevertheless vary between different testing occasions, we will stick to measuring it separately. Cash (2002) noted that body esteem, which can rather be considered a trait measure, represents a dimension just as important as body satisfaction and we will therefore include this measure in our investigation as well. We will use a whole body method to find out about body size perception accuracy in muscle dysmorphic men, because Smeets (1996) evaluates this way of measurement as leading to more consistent results in the context of eating disorders (see section 2.5.2). Our method will give additional information about perceptual discrimination consistency, meaning the level to which participants consistently detect small differences between a presented picture and their perceived body size.

We further plan to assess ideal body image following two ideas: (a) to support the basic assumption that muscle dysmorphia is connected to an exaggerated body ideal, and (b) to investigate if in our sample a greater difference between ideal and perceived body has to do with lower body satisfaction. Body image evaluations stem from the degree of discrepancy or congruence between self-perceived physical characteristics and personally valued appearance ideals (Cash and Szymanski, 1995). Many researchers, however, equate both concepts

unquestioned – a step which we do not support. For example, a man might firmly believe that his physical appearance does not resemble his ideal at all, however, in the course of accepting this as a matter of fact, will be able to feel satisfied.

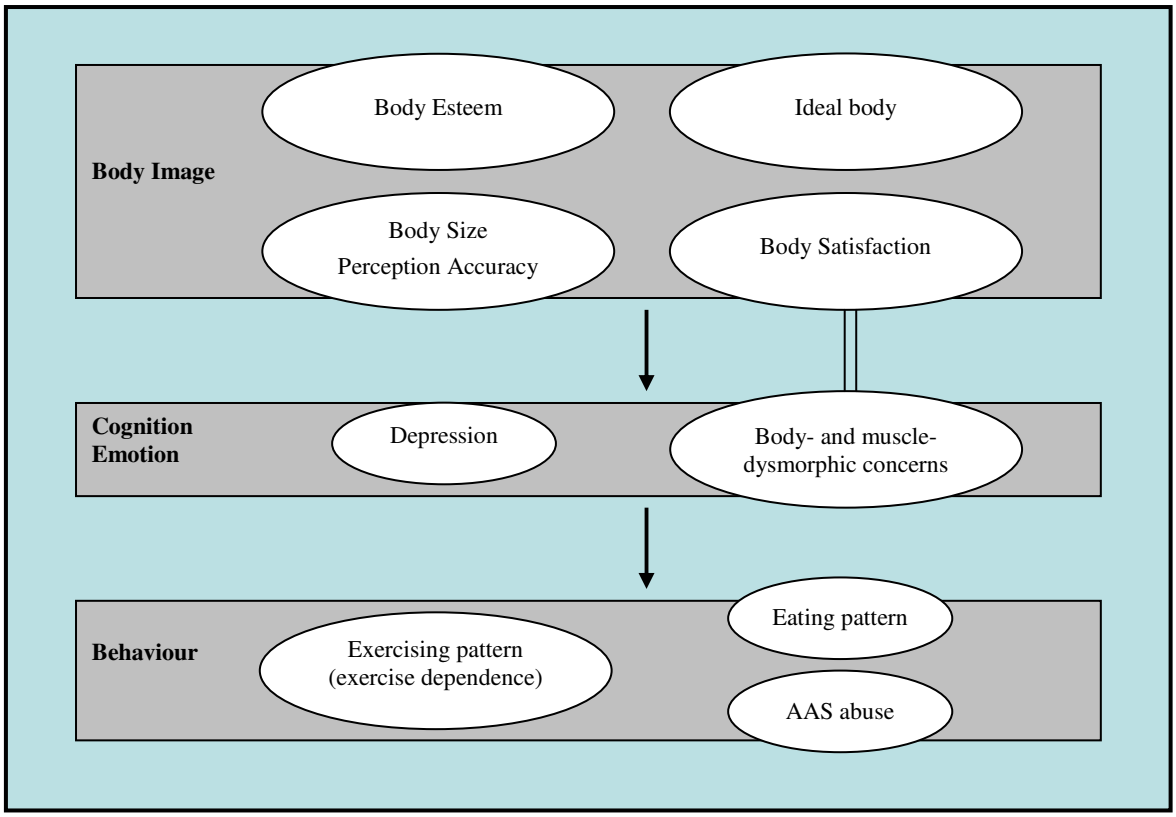

Figure 4. Concepts included in our research study.

As a body image disorder, following the definition, is an individual experience of the body with specific behavioural consequences, we will collect data on exercising behaviour (respectively exercise dependence), eating behaviour (respectively unusual eating patterns), and abuse of anabolic androgenic steroids, which we consider to be the three most important concepts.

Last, body dysmorphic disorder is known to have a high comorbidity with depression. A similar connection to depression can be assumed for the muscle dysmorphic disorder, so that we will also assess depressivity in our study.

2.7 The purpose of this study

Our primary research interest aims at a comparison of bodybuilders and non-bodybuilding athletes. We expect bodybuilders to report higher degrees of muscledysmorphic concerns, respectively fulfill the criteria for a bodydysmorphic disorder according to DSM-IV (APA, 1994) more often.

According to diagnostic criteria proposed by Pope et al. (2000), the body image disturbance represents a central factor in Muscle Dysmorphia. Low body satisfaction and a distorted body size perception are assumed to be the two major components of a disturbed body image. The first, low body satisfaction, is already part of the diagnostic criteria and therefore essential to the diagnosis. Body size perception accuracy, however, has hardly been investigated yet, although it is most likely to be affected in muscle- respectively bodydysmorphic men. Lantz et al. (2001) suggest that future research should seek to gather more knowledge of this component of body image in men.

Many studies further have not clearly distinguished between bodydysmorphic and non-bodydysmorphic bodybuilders. As noted above, the conclusion that bodybuilders necessarily have an impaired body image must not be drawn from analyses comparing bodybuilders and other groups. As about 10% of bodybuilders are said to have muscle- respectively bodydysmorphic disorder (Pope et al., 1997), we will undertake a secondary analysis focussing on this subgroup's psychopathology, if group sizes allow it.

Furthermore, until today there has not yet been any clear distinction between short- and long-term effects of bodybuilding on body image. According to the considerations above, long-term effects might not be as positive as one might think at first and as muscledysmorphic bodybuilders might expect and hope. The

reason lies in a slow upward shift in ideal body image. However, models of learning theory assume that aversive behaviours such as pumping iron, dieting or dehydrating need to be positively reinforced to become a routine, for example by an immediate improvement of body satisfaction or improvement of accuracy of body size perception. We would like to find out more about the consequences that positively reinforce bodybuilding from a short-term perspective.

We resume the purposes of this study as follows:

1. The primary purpose is to investigate body image in our sample by comparing bodydysmorphic concerns between bodybuilders and triathletes. We expect bodybuilders to report higher degrees of bodydysmorphic concerns, and to have bodydysmorphic disorder more often than non-bodybuilding athletes.

2. As a secondary analysis, if group sizes allow, we will separately analyse data from bodydysmorphic participants. Diagnostic criteria imply that bodydysmorphic men are less satisfied with their bodies. At the same time, we expect them to have a bigger bodily ideal. We further expect bodydysmorphic men to report lower body-esteem, and have a less accurate body size perception than other athletes, with a perceptive bias to be smaller than they really are. Hoping that participants will respond openly to questions concerning use of anabolic androgenic steroids, we expect bodybuilders to use these substances more often than triathletes, and bodydysmorphic men to be the strongest users.

3. As a third purpose, we will try to deepen knowledge of the short-term effects of an ordinary bodybuilding workout-session on body satisfaction and body size perception. We hypothesise, that after a regular and satisfactory workout session body satisfaction will improve and body size

perception will become more accurate in all groups. Further, we expect bodydysmorphic men to profit in a different, more intense way from training by showing a greater improvement.

3 METHODS

3.1 Ethics

Ethics approval was granted by the Ethics Committee of the medical faculty of the Westfalian Wilhelms-University of Muenster. Keeping the special requirement for anonymity surrounding the illegal use of drugs in mind, the ethics committee agreed to the use of written informed consent.

3.2 Participants

A total of 30 male bodybuilders were recruited from two bodybuilding gyms and a total of 20 male triathletes were recruited through two local sports clubs and the university triathlon class. To contact competitive bodybuilders, we visited a world championship taking place close-by, and then placed advertisements (see appendix) in the gymnasiums that the bodybuilders had recommended for preparing athletes for contests. Triathlon sports clubs were addressed directly, and participants were recruited by an information event. The investigation took place in the gyms to accommodate the participants as much as possible. We set values on the fact that all athletes should consider themselves to be seriously involved in their respective sport. Female athletes were excluded because bodybuilding is still rare in German women and body image matters might differ between the two genders.

We chose competitive bodybuilders because they are more engaged in their sport than leisure bodybuilders, shown by the higher training frequencies, and because they set a clear emphasis on muscle build. The latter is of importance, as triathletes, our control group, might take part in resistance training in addition to their endurance training. Therefore, by a recruitment of men who work out in leisure gyms, we might run the risk to mix up athletes of both groups.

The sport of triathlon was chosen for recruitment of $n = 20$ controls, because the training focuses equally on all body parts, and as well on strength as on endurance. Therefore, triathletes also pursue a lean but muscular body. Muscularity, however, should be balanced in legs, buttock, arms, shoulders and chest for the requirements of cycling, running and swimming (for further information see appendix) and not exceed an amount that by its weight would take a negative effect on the triathlete's speed in the respective discipline. Additionnally, athletes train frequently, and might therefore be comparable to bodybuilders.

Participants had to be older than 18 years, were informed about the study personally and in written form (informed consent forms see appendix), and had to give written consent to participate in the study (form see appendix). All information was processed anonymously, which was of major importance because for example illegal use of anabolic androgenic steroids (AAS) was assessed. According to Pope and Katz (1994), self-report can be considered a quite accurate measure if assessed anonymously. After completing all measures, participants were paid € 15,00.

We tried to match bodybuilding and triathlon groups as far as possible with regard to education level, age and height (also see section 4.2 and appendix). Concerning education, groups unfortunately could not be parallelised. As recruitment of triathletes took place with help of the university's sports

department and exclusively within a university city it was nearly impossible to find athletes without a college degree. In local sports clubs, however, on average triathletes were much older than in university classes or bodybuilding gyms. Unique recruitment of participants here would have made parallelisation of age impossible, but at the same time automatically would have led to higher educational degrees due to higher age. We therefore combined university and sports club groups and managed to find a bodybuilding sample which at least matched the control group concerning age and height.

3.3 Measures

3.3.1 Measurement of body satisfaction

Body satisfaction (state measure) was investigated by having the participants rate their satisfaction with four muscle-related body-parts (i.e. chest, arms / shoulders, buttock / thighs, stomach), overall musculature and muscle tone, attractiveness and fitness, using a 5-point-Likert-scale ranging from *not satisfied at all* to *absolutely satisfied*. The mean of these items was used as value for body satisfaction. We measured body satisfaction once before and once after a regular training session. As a state measure, body satisfaction is influenced by exterior factors such as mood or recent events. We therefore asked participants after their workout if they were satisfied with their performance by having them rate their feelings on the same 5-point Likert-scale as was used for measurement of body satisfaction. We planned to include this variable as a covariate in further repeated measures analyses of variance.

3.3.2 Measurement of body size perception accuracy

To assess body size perception accuracy and fuzziness we used a standardised digital photograph (neck to knees) of the participant wearing shorts but no t-shirts. The picture was taken directly before computerised assessment of body size perception and ideal body image. A new picture was used for the second testing date. We took the photographs approximately from the height of the participant's eyes to closely mimic the sight he would have when looking into a mirror. A white or otherwise plain wall was chosen as background, so that the participant would not get any cues about distortion degrees from it in the computerised task. The picture was displayed 30 times in a row on a laptop. A specifically designed software* distorted the picture to degrees varying from –10% to +10% in random order. Within the interior range between -5% and +5% the 20 steps in distortion were graded finer (0.5%), and coarser (1%) on the 5 steps of the right respectively left outside margins (see Figure 5).

Not having seen the original first, participants had to decide whether the body displayed in the picture was smaller or wider than their real physique by clicking the appropriate button labelled *smaller* or *wider* (Figure 6). The output of the programme was a row of dichotomous answers, which we ranked according to percentage of distortion of the corresponding picture. Ideally, a person with a perfect body size perception would have answered the first 15 times *smaller* and the last 15 times *wider* (see Figure 5). The exact degree of distortion of body size perception could be assigned to each answer.

* The software programme 'nesnap' was developed by Dr. A.L. Gerlach, University of Muenster, following a similar instrument by Gardner & Boice (2004).

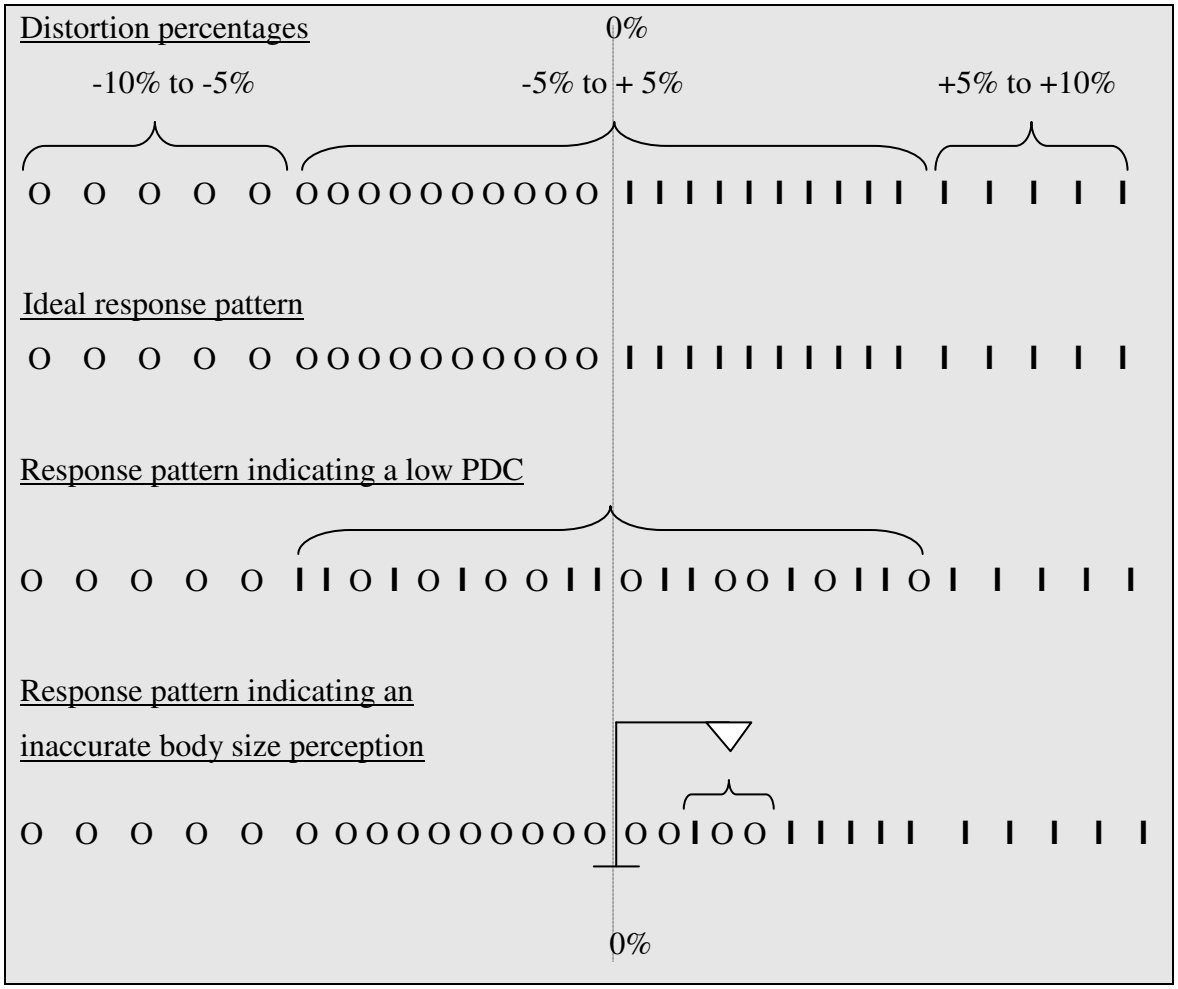

Figure 5. Nesnap output.

O = the participant believes this picture to be smaller than the original.

I = the participant believes this picture to be wider than the original.

Figure 6. Instruction screen.

For further use in statistical evaluation we used

(i) The error range, indicating perceptual discrimination consistency (PDC), or in other words, how consistently a participant detects small differences between a presented picture and his perceived body size. It was calculated by the range between the degree of distortion of the first picture on which estimation switched from *smaller* to *wider* and the distortion-percentage of the last picture on which estimation switched again from *smaller* to *wider*. We calculated the absolute difference between the distortion degrees of those two pictures, in percent divided by 100. For example, a person with a very inconsistent perceptual discrimination might show a mixed response pattern on the 20 pictures with distortion degrees between -5 and +5% and would thus have been assigned the value 0.10 for PDC (see Figure 5).

(ii) As average body size perception, we used the centre of the error range. For example, a person with a body size perception distorted by +2%, however consistent, might show a first switch in estimation on the picture distorted by +1.5% and the last switch on the picture distorted by +2.5% (see Figure 5). We would then assign the value 1.02 (the multiplication factor of the original picture) to this participant.

The software creates the percentage adjustions by changing the number of pixel. This, however, represents an absolute instead of a relative size change of the body displayed. In other words, for a body with a large BMI adding one pixel will represent a smaller relative change than for a slim body with a small BMI. Therefore in the following analyses the variables 'body size perception accuracy' and 'perceptual discrimination consistency' will be adjusted by BMI as a covariate.

3.3.3 Measurement of ideal body image

Ideal body image was assessed using the same digital photograph as for measurement of perceived body image. The picture was displayed on the laptop using a second software programme[*]. Participants were asked to tune their picture to ideal size using the left and right arrow key on the keyboard. Pressing the left arrow key once reduces the image width by 5 pixels and pressing the right arrow key once enlarges the image width by 5 pixels. Tuning was possible in forward and backward direction in steps of 0.5% in distortion, so participants could try out and choose the body that matched their ideal best. Once they had

[*] The software programme 'bodyimage' was developed by Dr. A.L. Gerlach, University of Muenster.

decided, the programme recorded only the final choice: programme output was the ideal body's dimension, as represented by the multiplication factor of the original. For example, a participant preferring his actual size would attain the factor 1.0, whereas a person wishing to be bigger (respectively smaller) by 50% would attain the factor 1.5 (respectively 0.5).

Distortion of the chosen ideal image in percent gave information about

a) ideal body size
b) the absolute difference between the ideal and the real body size (100%), telling about how different from their real body size athletes would like to be.
c) the absolute difference between the ideal and the perceived body size, indicating how different from their perceived body size athletes would like to be.

3.3.4 Diagnosis of bodydysmorphic disorder, eating habits and use of anabolic androgenic steroids

For diagnosis of body dysmorphic disorders according to DSM-IV (APA, 1994) the respective section of the German version of the SKID-I interview (Wittchen et al., 1997) was conducted by a trained clinical psychologist. Additional questions about eating patterns covered frequency and amount of food intake, changes in eating patterns required by the sport (for example increased caloric intake) and use of nutritional supplements. Concerning use of anabolic androgenic steroids (AAS) we first asked if participants had ever considered to use illegal drugs, and then asked for recent and actual use and its duration.

According to Pope and Katz (1994), self-report in this context can be considered a quite accurate measure if assessed anonymously.

3.3.5 Measurement of weight, height and body fat content

The participants' height was measured in metres. Weight (in kilograms) and body fat were assessed using an electronic body composition analyser (BF-350, by TANITA). This commercially available device estimates body fat with a foot-to-foot bioelectrical impedance analysis, an estimation of body resistance from a voltage drop initiated from a small current passed between electrodes. The level of impedance, an indication of the water and electrolyte composition of the body, is used to estimate lean tissue content and body water volume. Assuming a hydration fraction of lean tissue, additional regression equations are used to estimate lean body mass and fat mass (Herm, 2003). The validity of bioelectrical impedance analysis has been tested for different levels of physical activity by comparing its measurement with the results of hydrostatic weighing, the gold standard when assessing body fat content. The measurement with the BF-350 is said to be valid and reliable (Swartz et al., 2002).

For use in further analyses we then computed

(i) the Body Mass Index (BMI)*, as given by the formula BMI = kg / m^2, and

(ii) the Fat Free Mass Index (FFMI)*, which uses lean body mass, i.e. the total body weight minus the body weight that is fat, in order to give a more significant estimate of of body mass. The FFMI offers a differentiated

evaluation of an athlete's stature. Men with a high amount of muscle mass usually have a high BMI, so that erroneously a high percentage of body fat might be concluded. That way they cannot be distinguished from obese persons.

The formula used is

$$\text{FFMI} = \frac{\text{weight in kg - (fat percentage * weight in kg * 0.01)}}{\text{height in m}^2} + 6.1(1.8 - \text{height in m}). \qquad (1)$$

Kouri et al. (1995) added the correction of 6.1 * (1.80 m - height) to normalise the values to the height of a 1.80-metre man. In their preliminary study the normalised FFMI values of athletes who had not used steroids extended up to a clear limit of 25.0. By contrast, the FFMI of many of the steroid users in their sample easily exceeded 25.0, and sometimes even 30.

3.3.6 Independent ratings of body shape and size

We asked three trained raters to independently judge the statures of athletes by musculature and fat. They did so by allocating the original pictures which we had taken of the athletes on the testing sessions to an extract of the of the Somatomorphic Matrix (Gruber et al., 1999). This matrix ranks figures of male bodies on the dimensions of muscularity and fatness. It was derived by having a graphic artist draw one hundred different figures of male bodies, according to photographs that had been taken by the authors. The authors chose all levels of muscularity and body fat, from extremely skinny to obese, from not muscular at

* All parametres calculated according to Kouri et al. (1995).

all, to muscular to an extent which can be attained with steroids only. All images were ranked in a 10x10 matrix and imported into a computer database programme, so that people could navigate through them and choose one according to the task given. The somatomorphic matrix in its original form uses 100 images of men with varying levels of muscularity and fat. We however, used the shortened and more convenient version offered by Pope et al. (2000) with 12 images (see appendix). The scale for muscularity had a range from *1* through *4*, the scale for fatness from *1* through *3*. Raters were trained through three trials with two neutral objects and one dummy. The interrater reliability in our study was $r = .79$ for muscularity ratings and $r = .70$ for ratings of body fat.

3.3.7 Questionnaires

If questionnaires were not available in German language, we translated them on our own. All final forms are presented in German language in the appendix. The measures were the following:

Socio-demographic variables

Socio-demographic variables included age, family status, mother language, school graduation, professional education and work status. Furthermore we considered smoking and drinking of alcohol important variables, to check for the extent to which athletes try to live a healthy life. Last, we asked about the number of days of weekly sport exercise and the average duration of daily sport exercise, because a minimum of 3 days of weekly workout was a criterion for an athlete to be included in our study.

The Adonis Complex Questionnaire, (AdCQ, Pope et al., 2000)

The authors devised a paper-pencil-test consisting of 13 items, asking specifically about the ways in which body image concerns may affect daily life. Participants pick one of three possible answers indicating to what extent the statement applies to them respectively how often they behave as described by the item. The first answer scores 0 points, the second 1 and the third 3 points. The sum score varies between 0 and 39, with scores above 9 indicating a mild to moderate form of the so-called *Adonis-complex*, a more catchy and popular expression for bodydysmorphic disorder picked by Pope et al. (2000). Scores

above 19 indicate a quite serious form, and scores above 29 indicate a severe body image disturbance.

Unfortunately, the authors have not offered any psychometric data yet; neither for the AdCQ nor for the MDQ, which will be described in the following section. Therefore, a diagnosis of body- or muscledysmorphic disorder should not yet be given solely relying on these measures. However, as these constructs represent central variables in our study, we will use these questionnaires and hope to attain further information on validity.

The Muscle Dysmorphia Questionnaire, (MDQ, Pope et al., 2000)

In their book about muscle dysmorphic disorders Pope et al. (2000) list some of the questions they usually ask in clinical settings to determine whether a man is experiencing features of muscle dysmorphia. However, they do not explicitly term this list 'a questionnaire'. As diagnostic criteria describing the syndrome have not yet officially been accepted and included in any manual for diagnosis, it is understandable that this matter until now is treated with some reserve. However, other research groups are starting to develop similar instruments, such as 'The drive for muscularity scale' by Mc Creary & Sasse (2000) for use with adolescent boys. Therefore we expect psychometric studies to be undertaken in the future on a representative sample.

We nevertheless offered the list of questions to our study sample. The questions should be answered by *yes* or *no*; answers *yes* score 1 point, answers *no* score 0 points, and both add up to a sum score. We expect sum scores to correlate with scores of the AdCQ, as the concepts of muscle- and bodydysmorphic disorder are closely linked to each other. We therefore might use the MDQ to support results of analyses involving the AdCQ.

The Exercise Dependence Scale (ExDS)

This scale was derived from the Bodybuilding Dependence Scale (Smith et al., 1998), and modified in its formulations by replacing *bodybuilding* by *exercising*, to be applicable to triathletes as well. It was specifically developed to assess exercise dependence in anaerobic sports such as weight or power lifting.

The questionnaire consists of nine Likert-scaled items. Participants are asked to mark how often they behave as described by the statement. Answers vary from *never* to *always*. Statements aim at diagnostic criteria for the syndrome which were proposed by Morrow (personal communication between Morrow and Smith, 1995, cited after Smith et al., 1998) according to the official criteria for substance dependency. They include anxious thoughts when unable to exercise as much as planned; the altering of normal priorities to the extent that exercise is placed above other activities, with resulting social or occupational consequences; irrational expectations regarding the amount of exercise needed to maintain the desired body shape; persistent exercising in the face of physical consequences such as injuries; and ruminating thoughts about the effects of any decrease in exercise levels (cited after Smith et al., 1998).

Smith et al. (1998) report construct and concurrent validity to be satisfactory for the original body building dependence scale, especially of those items referring to social aspects of bodybuilding. They suggest, however, that further research examining the validity and reliability is necessary. Nevertheless, we included the questionnaire in our study, as the construct in general is of importance and no alternative, better validated mean of measurement exists until today.

The Body Esteem Scale (BES, Franzoi & Shields, 1984)

This questionnaire was derived from the Body Cathexis Scale (Secord et al., 1953) and was originally administered to adolescents. It assesses satisfaction with a wide range of aspects of the body, by having the participant judge 35 body parts and body functions on a 5-point scale, varying from *I have strong negative feelings* to *I have strong positive feelings*. In men, the underlying factors are 'physical attractiveness', which assesses satisfaction with the face and physique that determine how "good-looking" a man is; 'upper body strength', which measures satisfaction with body parts and functions that can be changed through exercise and that contribute to the ideal, v-shaped figure; and 'physical condition', whicht taps satisfaction with the body's functional aspects related to how "well the body works."

Reliability and validity of subscales can be judged as being sufficient (Franzoi & Shields, 1984), internal consistency is reported to be around $\alpha = .85$ in men (Cash & Pruzinsky, 2002). According to expectations, the subscale 'upper body strength' distinguishes best between weightlifters and non-weightlifting men (Franzoi & Shields, 1984). In bodybuilders, however, we assume especially attractiveness to be an important component and we will therefore use the complete questionnaire.

The Body Esteem Scale for Adolescents and Adults (BESAA),
(Mendelson, et al., 1995)

Body esteem, as referring to self-evaluation of one's body or appearance, according to Mendelson et al. includes three components: (a) feelings about one's general appearance, (b) feelings about one's weight, and (c) the evaluations attributed to others about one's body and appearance. The BESAA tries to assess

these components by use of three independent subscales. It consists of 23 5-point Likert-scored items on which participants rate their degree of agreement with each statement.

Concerning psychometric features, Mendelson et al. (1995) report all three subscales to be significantly correlated to the Rosenberg self-esteem scale in 17-year-old adolescents (Body esteem appearance $r = .28$, $p < .05$; body esteem weight $r = .35$, $p < .01$; body esteem attribution $r = .42$, $p < .01$), however, not in adults (20-25 years). The whole inventory proved to be reliable (retest-reliability lay between $r = .83$ and $r = .92$, $p < .001$, for the respective subscales) over a wide age range. As the subscale 'evaluation attributed to others about one's body and appearance' particularly in bodydysmorphic disorders might be of major significance, even if it does not directly assess body esteem, we will use the complete questionnaire.

The Beck Depression Inventory (BDI)
(Beck et al., 1961, revised by Hautzinger, 1994)

This 21-item questionnaire was developed to measure the degree of clinical depression, each item describing a relevant symptom according to the official criteria for diagnosis (DSM-IV, Wittchen et al., 1997). Each item offers four statements which represent different severity levels of depressivity, and are quantified by at least *0* and at most *4* points. All points are added, with high scores indicating higher levels of depressivity. Hautzinger (1994) proposes to allocate a *mild to moderate* depressivity above score 11, and a *clinically relevant* depressivity above score 18. Those scores, however, must be distinguished from the clinical diagnosis of a depression according to DSM-IV.

Psychometric tests showed a split-half-reliability, corrected by Spearman-Brown, of $r = .93$ (Beck et al., 1961). Values of inner consistency range between $\alpha = .74$ and $\alpha = .92$. Construct validity, calculated by correlation of BDI scores to other self-rating-measures of depression, lies between $r = .71$ and $r = .89$ (Hautzinger, 1994). Therefore, the BDI is widely considered a solid and reliable mean of assessment. We use it in this study to control for clinically relevant depressive syndromes which are known to correlate highly with bodydysmorphic disorder.

The questionnaire ”Soziale Angst vor negativer Bewertung” (SANB)
(Vormbrock & Neuser, 1983)

This questionnaire is an adaptation of the Fear of Negative Evaluation Scale (FNE, Watson and Friend, 1969). It measures cognitive-evaluative aspects of social trait-anxiety, as including fear of negative evaluation by others as well as anticipation of evaluations attributed to others. Twenty items which participants have to rate on four levels from *never applies to me* to *always applies to me* are used for assessment. For further analyses, average testing scores are calculated, with high scores indicating high social anxiety.

For the SANB, Watson and Friends report a good homogenity (Cronbach’s $\alpha = .92$), a sufficient reliability (retest-$r = .87$), and a significant construct validity by correlation with the State-Trait-Anxiety-Inventory, STAI (Spielberger et al., 1970) of $r = .48$, $p < .001$. We include the SANB in our study to check for social anxiety in experimental groups, and, if we happen to find primarily social phobic individuals, to possibly exclude them from final analyses.

3.4 Design

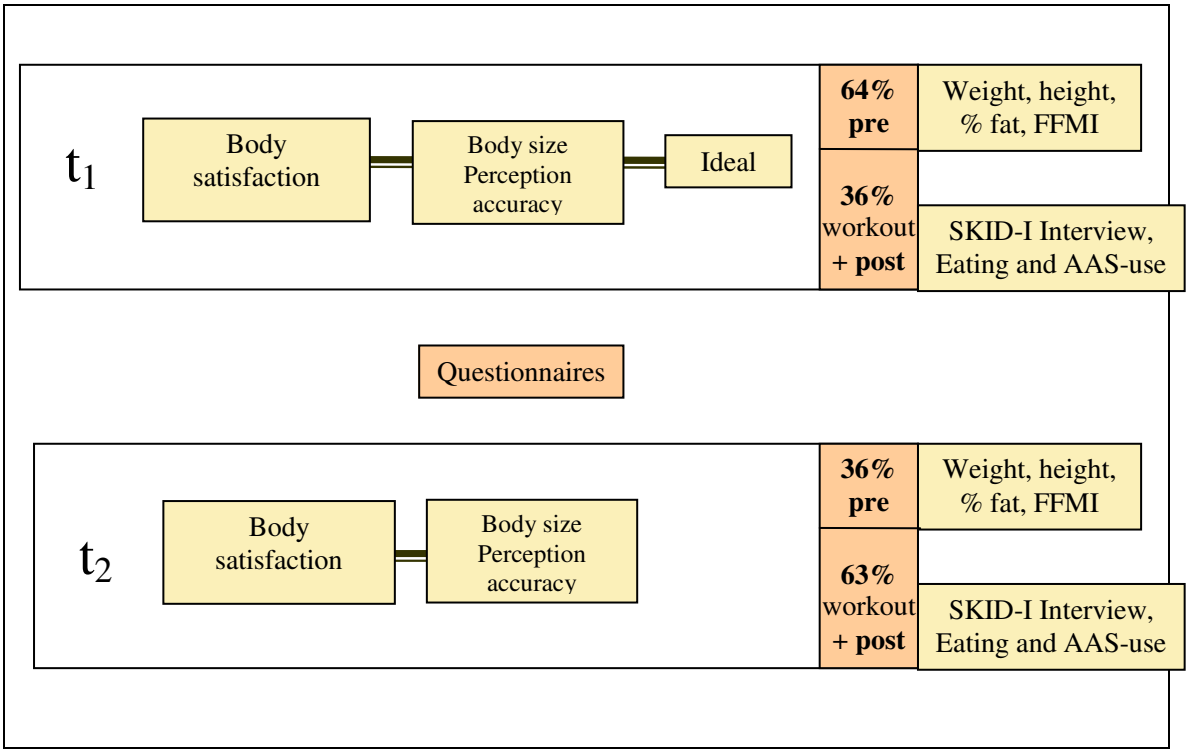

Figure 7. Study design.

We used a balanced pretest-posttest design with a regular workout session of at least 30 minutes taking place after respectively before measurement. Pre- and post-measurement of body satisfaction and body size perception accuracy (computerised) took place on two different days (t_1 and t_2). To balance out learning effects, some participants of each group started with the pre-measurement and the rest with the post-measurement. In the bodybuilding group, n=21 met us for assessment before workout and n=9 after workout. In the triathlon group, n=11 started with the pre-measurement and n=9 with the post-measurement. Computerised measurement of ideal body image was attached to this first session (t_1), so that n=32 participants accordingly chose their ideal before exercising and n=18 after exercising. Between sessions t_1 and t_2, participants filled out a number of questionnaires (see section 3.2.6). All questionnaires were administered at once and collected before second

measurement (t_2) took place. That way we were able to check for missing data and ask participants to complete any missing items. On the second date (t_2) we asked those participants whose data we had assessed before workout on the first date to to meet us following (post) their workout, and whose data we had assessed following their workout on the first date to meet us before (pre) their workout. One bodybuilder did not keep his appointment for the second testing date.

Measurement of height (in metres), weight (in kilograms) and body fat (in percent, to calculate the Fat Free Mass Index, FFMI) took place before training, i.e. on pre-measurement, for reasons of hygiene and to avoid errors in impedance measurement caused by sweaty feet. Therefore, for *n*=32 participants this assessment took place on the first date (t_1) and for *n*=18 on the second date (t_2). Investigation for body dysmorphic disorder and further matters such as eating patterns and AAS-use was attached to post-testing for practical reasons, as athletes usually had more time after they had finished exercising. Therefore, in *n*=18 this investigation took place on the first date (t_1) and in *n*=31 on the second date (t_2). Feedback about each participant's results was offered to be given after the last testing session.

3.5 Statistical analyses

Data were statistically analysed using the software package SPSS for Windows (v11.5; SPSS Inc., USA). As a primary analysis we compared bodybuilders and triathletes by use of an ANOVA. Ten bodybuilders reported bodydysmorphic concerns, so that we were able to conduct a secondary analysis comparing this subgroup to non-bodydysmorphic bodybuilders and triathletes by

performing uni- and multivariate analyses of variance and repeated measures analyses of covariance with a between-subject factor, i.e. group, and a within-subjects factor, i.e. time of assessment. Tukey post hoc tests were always employed to determine significance of between-group differences. Pearson's product-moment-correlation *r* was computed to find interrelations within the parametric data set.

3.6 Power analysis

According to Cohen (1988, pp. 36-37) the sample size needed to statistically detect an effect size of $d > 0.80$ should be $n \geq 20$ per group. According to our search of literature we indeed expect effect sizes to be high. Additionally, we plan to include covariates in the repeated measures analyses: once *satisfaction with today's training* and once *BMI* (reasons are given in later sections). Addition of a covariate to an ANOVA will reduce the error variance and therefore reduce the *N* that is needed to detect a significant effect, to about $n \geq 15$ per group (Cohen, 1988). We included $n = 20$ triathletes and $n = 30$ bodybuilders in our study to be on the safe side. As we were investigating a natural sample and could not foresee how many men with bodydysmorphic concerns we would find, we could not plan for a fixed group size and will therefore analyse this subgroup by a secondary analysis.

3.7 Test of basic assumptions for ANOVA

3.7.1 Dropout and missing data

Overall, we had little drop-out and no missing data in our study. As the investigation took place in the gyms, respectively public sports fields or swimming-pools, and as we arranged times according to training schedules, participation did not cost the athletes much effort. The second date took place after participants had successfully returned all questionnaires. We therefore had the chance to have participants complete any missing data in this second meeting.

One bodybuilder withdrew from participation after pretest, not giving any reason. Another bodybuilder had to be excluded due to an outlying value on ideal body size (exceeding the mean by more than +3 *SD*, Stevens, 1996), which we could only explain by a misunderstanding of the task.

3.7.2 Further assumptions

Normality

In order to calculate univariate ANOVAs, observations on the dependent variable must be normally distributed for each group. We used Kolmogorov-Smirnov-tests to check this and found data on all dependent variables to be normally distributed.

Independence

It is assumed that the data of each case or person must be independent of the data of the other cases or persons. As bodybuilders and triathletes were recruited independently from each other, as measurement in the gyms took place in a separate room or a corner where no other person could comment on a participant's performance, and as we neither had to reject nor had to specifically recruit any participant in order to parallelise groups, this assumption can be regarded as being fulfilled.

Homogeneity of the Covariance Matrices

According to Grimm and Yarnold (2003, p.256) homogeneity of variance and covariance of the dependent variables is usually tested by Box's *M*. The test reveals (see appendix, table A2) that the assumption is tenable. Levene's test for homogeneity of variance further shows that the dependent variables *perceptual discrimination consistency* at pretest and *BDI* fail to meet this criterion (table A3 see appendix). Results of ANOVAs including these variables should therefore be interpreted with care.

4 RESULTS

4.1 Primary analyses

4.1.1 Prevalence of bodydysmorphic disorder and intensity of bodydysmorphic concerns

Within the bodybuilding group, 4 out of 28 (14.3%) participants met the DSM-IV-criteria (APA, 1994) for bodydysmorphic disorder, whereas none of the triathletes did. This difference was significant with $\chi^2(2df)=16.58$, $p< .001$ and matched our original assumption. Bodybuilders further reported higher degrees of bodydysmorphic concerns, measured by the AdCQ, $F(1, 47)=33.98$, $p< .001$, and of muscledysmorphic concerns, measured by the MDQ, $F(1, 47)=13.81$, $p< .01$, than triathletes, as Figure 8 demonstrates.

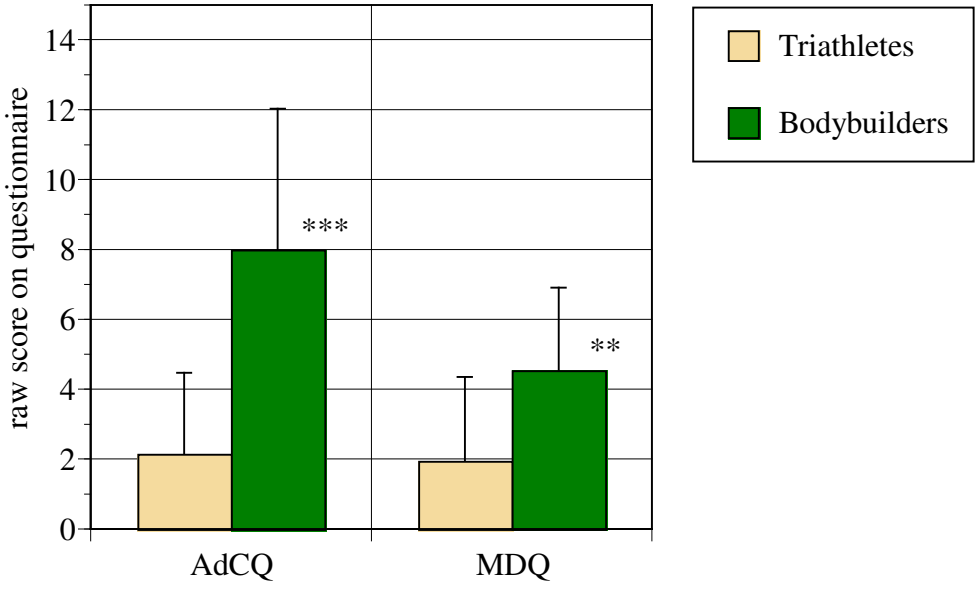

Figure 8. Bar chart of body- (AdCQ) and muscledysmorphic (MDQ) concerns, comparing bodybuilders and triathletes.

** $p< .01$; *** $p< .001$.

Pope et al. (2000) proposed a cut-off score in the Adonis Complex Questionnaire of above 9 to identify individuals who experience bodydysmorphic concerns to a mild to moderate degree at least. We found 10 bodybuilders (35.7% of the bodybuilding sample) to score higher than that. Figure 9 compares the amount of body- (AdCQ) and muscledysmorphic concerns (MDQ) between the two emerging bodybuilding subgroups (bodydysmorphic vs. non-bodydysmorphic bodbuilders) and the triathletes. On the AdCQ, all three groups differ significantly from each other, $F(2, 47)=47.07$, $p< .001$, all Tukey-post-hoc-differences are significant with $p< .001$. On the MDQ, there is a significant group difference as well, $F(2, 47)=10.42$, $p< .001$, with the bodydysmorphic bodybuilders (BDBB) scoring significantly higher than triathletes ($p< .001$) and than non-bodydysmorphic bodybuilders (nBDBB) ($p< .05$).

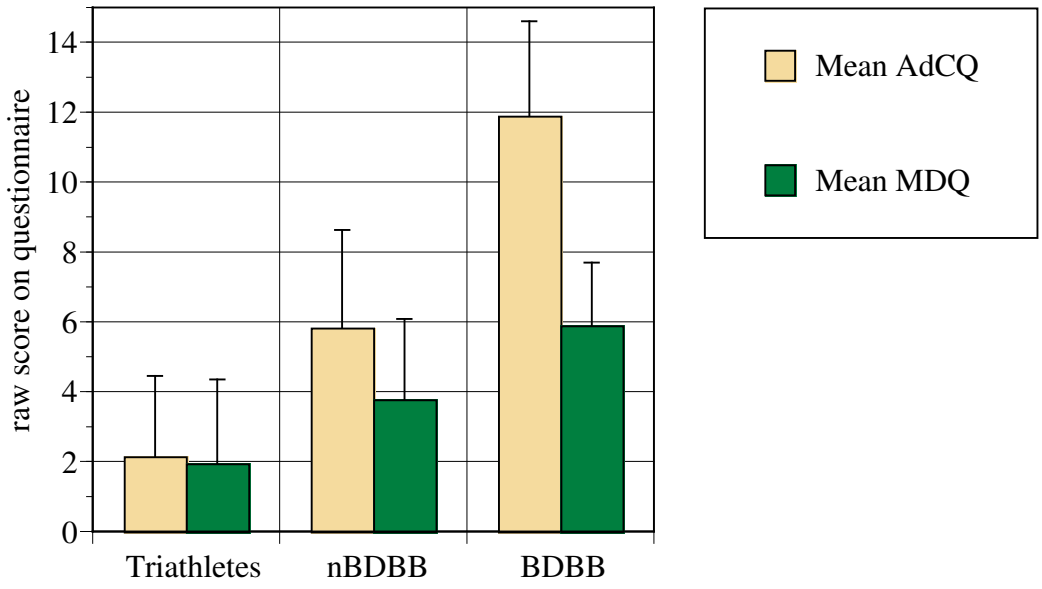

Figure 9. Bar chart of body- (AdCQ) and muscledysmorphic (MDQ) concerns by groups.

The three subgroups' sizes seem sufficient to undertake secondary analyses comparing bodydysmorphic bodybuilders, non-bodydysmorphic bodybuilders and triathletes. All analyses following this section will therefore refer to three groups, formed of

1. athletes without bodydysmorphic concerns, defined as scoring ≤ 9 points, on the Adonis Complex Questionnaire (Pope et al., 2000), i.e.
   (a) $n = 18$ non-bodydysmorphic bodybuilders (nBDBB) and
   (b) $n = 20$ triathletes, and
2. athletes with bodydysmorphic concerns, defined as scoring > 9 points, a cut-off score for mild to moderate body dysmorphia, on the Adonis Complex Questionnaire, i.e.
   (c) $n = 10$ (BDBB).

The muscle dysmorphia questionnaire (MDQ, Pope et al., 2000) was not chosen to split the sample as it is simply a list of common questions the authors usually ask patients in clinical contexts. Until now, neither a final form nor a cut-off criterion nor any data on reliability or validity have been presented. For the AdCQ we undertook a psychometric evaluation on basis of our data; the results are presented in section 4.1.3.

4.1.3 Psychometric evaluation of the Adonis Complex Questionnaire (AdCQ)

As psychometric evaluations have not yet been presented on the AdCQ, we use our own data to evaluate the questionnaire. Positive correlations with muscle dysmorphia (MDQ) and negative correlations with body satisfaction are indicators of the AdCQ's construct validity. We calculated the Pearson's product-moment-correlations with the AdCQ-scores, which were significant for

the MDQ (r= .64, p< .001) and for body satisfaction (r= -.35, p< .05). Assessment of internal consistency of the AdCQ gave a Cronbach's α = .72, which according to the threshold of .7 indicated by Nunnally (1978) is acceptable for such a coefficient. We conclude that the AdCQ is an instrument for assessment of bodydysmorphic concerns in male athletes with sufficient psychometric features, and we can therefore justify to base secondary analyses on a cut-off score in this questionnaire.

4.2 Descriptive statistics

4.2.1 Socio-demographic data

Questions on socio-demographics (questionnaire see appendix) covered age, mother language, family status, school graduation, professional education and work status.

As can be seen in table 1, the three groups were parallel with respect to age, $F(2, 47)=0.766$, n.s.. All athletes reported to have German as their mother language. Concerning family status, none were widowed, divorced or living separated from their spouse. Six triathletes (30%), two non-bodydysmorphic bodybuilders (11%), and one bodydysmorphic bodybuilder (10%) were married, all other participants were unmarried. Differences in family status were not significant ($\chi^2=2.85$, $p= .24$).

As we mentioned in section 3.2, concerning education groups could not be parallelised. The recruitment of triathletes took place with the help of the university's athletic department and exclusively within a university city, and therefore it was difficult to find triathletes without a college degree (table A1, see appendix). In our sample, 80% of triathletes were still in College or had already finished College whereas 60% of bodydysmorphic bodybuilders and 33% of non-bodydysmorphic bodybuilders were. Out of those, who never went to or finished College, the majority were employed. Only one triathlete was unemployed.

Table 1

Means (SD) for age and bodily features by group

	BDBB[a]	nBDBB[b]	Triathletes[c]
Age in years	28.6 (6.1)$_a$	31.1 (9.2)$_a$	32.8 (9.5)$_a$
Height in cm	181.00 (0.1)$_a$	180.4 (0.1)$_a$	183.3 (0.1)$_a$
BMI	31.2 (3.8)$_a$	29.4 (2.8)$_a$	23.3 (1.8)$_b$
FFMI	25.8 (3.0)$_a$	24.8 (1.8)$_a$	21.1 (1.2)$_b$

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .001$ in the Tukey honestly significant difference comparison.

[a] n=10. [b] n=18. [c] n=20

4.2.2 Physical features

As table 1 further shows, there were no differences in body height between the groups $F(2, 45)=0.720$, n.s.. As expected, we found significant differences in the current weight of the groups, $F(2, 45)=18.422$, $p< .001$, and the percentage of body fat, $F(2, 45)=23.653$, $p< .001$, with the triathletes being lighter ($p< .001$) and having less body fat ($p< .001$) than members of both bodybuilding groups. Consequently, the Body Mass Index (BMI), $F(2, 45)=37.438$, $p< .001$, as well as the Fat Free Mass Index (FFMI), $F(2, 45)=27.058$, $p< .001$, differed significantly between groups. Table 1 shows only the latter parametres, as they are calculated by use of height, weight and percent body fat.

For external ratings of athlete's stature by use of the somatomorphic matrix (Gruber et al., 1999), oneway-ANOVAs revealed significant group differences: $F(2, 45)=31.44$, $p< .001$, for ratings of muscularity; and $F(2, 45)=5.62$, $p= .01$, for ratings of body fat, with triathletes being considered by their outward appearance to be the less muscular and leaner group compared with both other groups. Tukey's post-hoc test were significant with $p< .001$ for ratings of muscularity, and with $p< .05$ for ratings of body fat. These ratings support the objective measures of BMI and FFMI, as they correlate significantly ($p< .01$) with both.

4.2.3 Exercise behaviour

Table 2

Exercise behaviour in minutes (SD) by group

	BDBB[a]	nBDBB[b]	Triathletes[c]
Weekly workout-time	407.0 (246.5)$_{a,b}$	313.6 (103.4)$_{a}$	558.8 (258.4)$_{b}$
Range of weekly workout-time	870.0$_{a}$	345.0$_{a}$	900.0$_{a}$

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .01$ in the Tukey honestly significant difference comparison.

[a] n=10. [b] n=18. [c] n=20.

Table 2 gives information on the workout time athletes engage in weekly. There was a significant difference in the weekly amount of training counted in minutes, $F(2, 45)=6.526$, $p < .01$, with the triathletes working out the most and the nBDBB-group the least ($p < .01$). The BDBBs' amount of workout lay in-between without any significant differences compared with both other groups. It is remarkable, however, that a huge range from at minimum 3 hours of weekly exercise to at maximum 16.5 hours in BDBBs respectively 18 hours in triathletes was reported.

4.2.4 Eating and comsumatory behaviour

Table 3

Eating patterns and consumatory behaviour by group

	BDBB[a]	nBDBB[b]	Triathletes[c]
Meals per day (*SD*)	$5.6\ (1.3)_a$	$4.2\ (1.15)_b$	$4.1\ (0.99)_b$
Cigarettes per day (*SD*)	$0.1\ (0.3)_a$	$6.1\ (9.3)_b$	$0.0\ (0.0)_a$
Percentage of athletes who…			
have changed eating patterns for sports	90.0_a	88.9_a	85.0_a
diet	90.0_a	94.4_a	35.0_b
use nutritional supplements	60.0_a	55.5_a	60.0_a
do not drink alcohol	40.0_a	18.7_a	25.0_a

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .01$ in the Tukey honestly significant difference comparison.

[a] $n=10$. [b] $n=17$. [c] $n=20$.

Until today, there do not exist any standardised questionnaires addressing bodybuilders (who usually prefer to gain weight). However, we were interested to discover, if athletes had changed their eating behaviour due to the

requirements of their respective sport (for example by an increased caloric intake), if they had ever dieted before, and if they would use nutritional supplements.

According to table 3, all participants displayed unusual eating patterns. Nearly all of them had changed the ways they eat in the course of engagement in their respective sport. On average, triathletes and non-bodydysmorphic bodybuilders eat equally often, whereas bodydysmorphic bodybuilders have on average one more daily meal. Group differences reach significance, $F(2, 43)=6.2$, $p< .01$), an effect which is uniquely caused by the bodydysmorphic bodybuilders. Moreover, more than half of all participants use nutritional supplements and – which is significantly less common in triathletes ($\chi^2=18.23$, $p< .001$) – commit to undergo a special diet.

Comparing consumatory behaviour, we did not find any differences between groups concerning alcohol ($\chi^2=1.87$, n.s.), but in smoking of cigarettes, $F(2, 45)=6.188$, $p< .01$. The amount of cigarettes smoked within the BDBB-group was caused by only one participant.

Asking participants about general willingness to use anabolic-androgenic steroids (AAS) revealed significant differences between groups, as table 4 displays. One bodybuilder refused to answer any questions. None of the triathletes reported they might at any point in time use AAS whereas nearly half of the bodybuilders without and all of the bodybuilders with bodydysmorphic concerns said they would. Accordingly, none of the triathletes ever or currently used AAS whereas within the nBDBB-group and the BDBB-group significantly more participants reported use in the past ($\chi^2=13.96$, $p< .001$) or the present ($\chi^2=11.85$, $p< .01$).

Table 4

Use of anabolic androgenic steroids (AAS) in percentage by group

	BDBB[a]	nBDBB[b]	Triathletes[c]	χ^2
Willingness to use AAS	100.0	41.2	0.0	29.17***
Recent use of AAS	60.0	35.3	0.0	13.96***
Present use of AAS	40.0	5.9	0.0	11.854**

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders.

[a] n=10. [b] n=18. [c] n=20.

**p< .01; ***p< .001

4.3 Multivariate analyses of variance

For secondary analyses, we plan to compare the three groups with respect to five trait measures: (a) ideal body image, (b) body esteem, (c) exercise dependence, (d) depression and (e) social anxiety. To prevent from capitalization of change, we decided to conduct a multivariate analysis of variance first. Dependent variables, for which an effect can be shown in the MANOVA, will be analysed more closely in the following sections by use of ANOVAs respectively ANCOVAs. The multivariate test for trait variables gave a Wilk's Lambda of $F(12, 66)=2.03$, $p< .05$, and a Pillai-Spur with the same significance. We can therefore conclude that there does exist an effect of group within our data set. Significant effects emerged for the variables ideal body image, $F(2, 38)=3.46$, $p< .05$, and depressivity, $F(2, 38)=3.35$, $p< .05$. A trend emerged for body esteem, $F(2, 38)=2.88$, $p= .07$, and no group differences were found for exercise dependence and social anxiety.

We also plan to compare groups on three state variables: (a) body satisfaction, (b) body size perception accuracy, and (c) perceptual discrimination consistency. These constructs are measured at two points in time: (a) before a regular workout and (b) after a regular workout. As the dependent variables cannot be separately adjusted by a specific covariate, we cannot calculate a MANOVA for these measures and will report only the univariate analyses in the following sections.

We expect *satisfaction with today's training* to have an influence on the change in body satisfaction, because we suppose that the quality of a training session might affect body satisfaction. We did not find a correlation between *satisfaction with today's training* and any of the body satisfaction measures for the full sample. However, within the subgroup of bodybuilders significant

positive correlations emerged with body satisfaction at post-measurement (r= .54, p< .05) and with the difference in body satisfaction between pre- and post-measurement (r= .68, p< .01). In other words, the more satisfied bodybuilders are with their training session, the higher is the increase in body satisfaction after workout. We further compared the two bodybuilding subgroups, with the result that this correlation can only be found for non-bodydysmorphic bodybuilders (correlation with body satisfaction at post-measurement r= .41, p< .05 and with the difference in body satisfaction between pre- and post-measurement r= .55, p< .05). The fact that such an association can only be found for a subgroup and not for the full sample might be the reason why the sum of squares of the error term in the ANCOVA is only slightly smaller than in the ANOVA (ANOVA SS_{error} – ANCOVA SS_{error} = .12). To summarize, we cannot expect *satisfaction with today's training* to represent a strong covariate in our repeated-measurement analysis of variance, but stick to the plan to include it on basis of theoretical considerations.

For measurement of body size perception accuracy and perceptual discrimination consistency *BMI* will be included as a covariate (see section 3.3.2). To support our theoretical idea of why *BMI* should have an influence in measurement of body size perception accuracy, we would have expected to find a significant correlation between *BMI* and measures associated with body size perception accuracy, which is not the case. However, within the bodydysmorphic subgroup *BMI* correlates negatively with the difference in body size perception accuracy between pre- and post-measurement (r= - .79, p< .05). This means that the smaller a bodydysmorphic bodybuilder is by objective standards, the higher is the change in his body size perception after a regular bodybuilding work-out. Accordingly, the sum of squares of the error term drops slightly from SS_{error} = .38 in the ANCOVA to SS_{error} = .37 in the ANOVA. We will include the covariate *BMI* for theoretical reasons although we do not expect a very strong effect.

To control for effects of order, i.e. if any participants would perform differently on the two different dates, not because of having completed a workout or not, but simply because they took part in the study for the second time, we included the variable *order of data collection* (first pretest then posttest vs. first posttest then pretest) as an additional group factor in all the separate ANCOVAs for the above mentioned state variables. *Oder of data collection* had neither a main nor an interaction effect in any of these analyses. Moreover, all other effects stayed the same. We therefore presume that the order in which measurement took place did not have any influence on results and will not report any more information on this question in sections 4.4 and 4.6.

4.4 Body size perception

4.4.1 Body size perception accuracy

As described above, we asked the participants to decide for 30 distorted images of their physique whether they considered their real body size to be wider or smaller than the picture displayed.

As can be seen in Figure 10, BDBBs (t= –4.88, p< .001) and triathletes (t= –7.5, p< .001) estimated their body size to be smaller than it actually was. The nBDBBs perceived their physique accurately. The figure shows the average body size perception accuracy across pre- and post-measurement, and all means are adjusted by BMI.

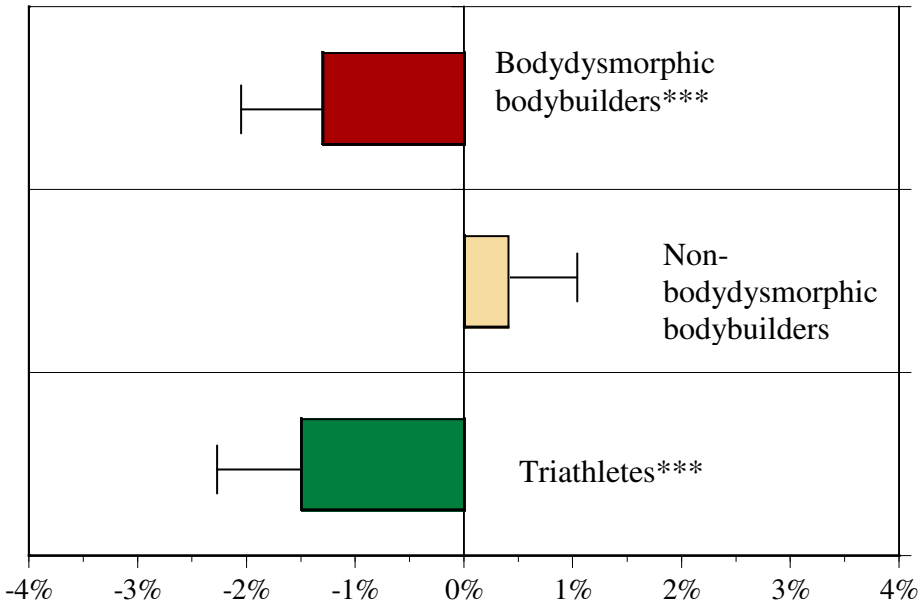

Figure 10. Average accuracy of body size perception (in distortion percentage) by group, across both time points, adjusted by BMI.
*** p< .001, body size perception significantly differs from 0%.

A univariate, repeated measures analysis of variance did not lead to any significant results. The univariate, repeated measures analysis of covariance with *BMI* as a covariate however revealed a trend for the time factor, $F(1, 38)=3.05$, $p= .09$, and a trend for the group factor, $F(2, 38)=2.67$, $p= .08$. Our data therefore suggest that, if athletes were all of the same body mass, the special kind of workout would have a fair effect on body size perception accuracy, and that body size perception accuracy slightly differs between subgroups. A trend also emerged for the interaction between *time* and *BMI*, $F(2, 38)=3.22$, $p= .08$. Taking a closer look at subgroups, this interaction only stayed significant within the bodydysmorphic subgroup, $F(1, 7)=11,59$, $p< .05$, because, as we mentioned before, the covariate was associated with body size perception accuracy in the bodydysmorphic subgroup only. The interaction between time and group was not significant. The Tukey post-hoc-comparisons indicated trends for group differences between triathletes and non-bodydysmorphic bodybuilders ($p= .09$) as well as between bodydysmorphic and non-bodydysmorphic bodybuilders ($p= .08$). In each case, the non-bodydysmorphic bodybuilders had the more accurate body size perception at both points in time. All means can be found in table 5.

Table 5

Means (SD) of body size perception (BSP) in distortion percentage by groups at pretest and posttest, and Analyses of Variance, and means (SD) adjusted by BMI, and corresponding Analyses of Covariance

BSP	BDBB[a]	nBDBB[b]	Triathletes[c]	*ANOVA F(1,38)*	*ANCOVA F(1,37)*	*p*
Pretest	-1.44 (3.3) $_{a}$	0.03 (3.1) $_{a}$	-0.92 (2.7) $_{a}$	0.83	-	0.44.
Pretest, adjusted by BMI	-1.50 (1.2)$_{a}$	0.00 (0.8)$_{a}$	-0.80 (1.1)$_{a}$	-	0.77	0.47
Posttest	-2.03 (2.6) $_{a}$	0.13 (2.4) $_{a}$	-1.03 (2.1) $_{a}$	2.57	-	.09
Posttest, adjusted by BMI	-1.10 (0.8)$_{a,b}$	0.08 (0.6)$_{a}$	-2.20 (0.8)$_{b}$	-	3.94	.03

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .05$ in the Tukey honestly significant difference comparison. [a] n=9. [b] n=17. [c] n=16.

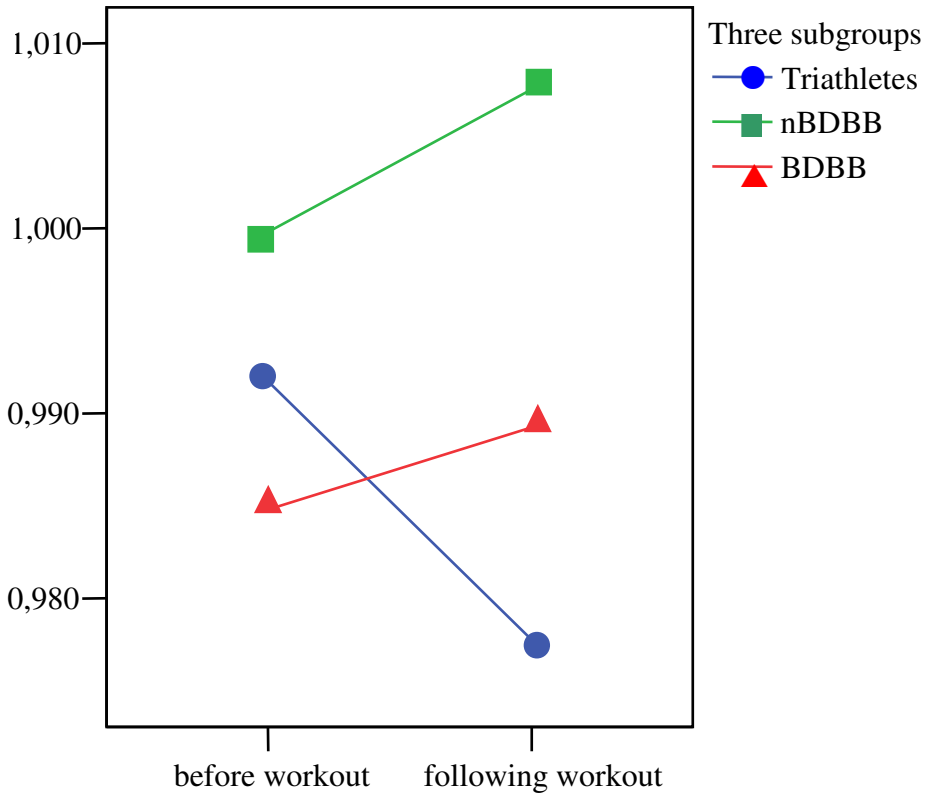

Figure 11. Body size perception accuracy in distortion percentage adjusted by body mass index, before and after workout, by group.

As Figure 11 illustrates, non-bodydysmorphic bodybuilders seem to estimate their body size to be bigger after workout compared to their body size perception before workout. This effect also applies to bodydysmorphic bodybuilders, who tend to have a less accurate body size perception than non-bodydysmorphic bodybuilders, with a significant distortion to be smaller than they really are (see Figure 10.). In contrast to the bodybuilders, a triathlete of same body mass, whose exercising does not aim at an increase in body size, seems to estimate his body size to be smaller after workout compared to his body size perception

before workout. However, these within-group differences after adjustment for BMI across the full sample do not reach significance.

4.4.2 Perceptual discrimination consistency (PDC)

PDC on average was *M*=3.92% (*SD*=2.53) on pre-testing and *M*=3.79% (*SD*=2.53) on post-testing, also see table A4, appendix. This measure differed neither between groups nor between the two testing sessions and using BMI as a covariate did not have any effect.

4.4.3 Test-retest reliability

To test the reliability of our measurement of body size perception accuracy and perceptual discrimination consistency by use of the software programme 'nesnap', we calculated the test-retest-reliability-coefficient, using the data from the testing date before workout and the testing date after workout. The correlation for body size perception accuracy was $r = .40$, $p < .01$, and for perceptual discrimination consistency $r = .20$, n.s..

4.5 Ideal body image

For ideal body size, the difference between the ideal and the real body size and the difference between between the ideal and the perceived body size, we computed separate ANOVAs. Corresponding data can be found in table 6. Using *BMI* as a covariate did not give any better results.

Table 6

Means (SD) for ideal body image in percentage by group, and Analyses of Variance

	BDBB[a]	nBDBB[b]	Triathletes[c]	*F*
Ideal body	124.10 (25.82)$_a$	119.30 (19.10)$_{a,b}$	105.30 (11.9)$_b$	4.56 *
Absolute difference between				
Ideal and real body	24.60 (25.30)$_a$	22.00 (15.60)$_a$	9.20 (9.00)$_b$	4.39 *
Ideal and perceived body	27.50 (26.88)$_a$	21.88 (16.83)$_{a,b}$	9.29 (8.55)$_b$	3.89*

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .05$ in the Tukey honestly significant difference comparison.

[a] $n=10$. [b] $n=18$. [c] $n=20$.

*$p < .05$.

As displayed in Figure 12, within the nBDBB-group ($p< .01$) and within the BDBB-group ($p< .05$), athletes chose an ideal image that was significantly wider than the original picture (100%). Triathletes chose an average ideal picture that tended to be wider than the original ($p< .10$). Differences between groups were significant, $F(2, 45)=4{,}56$, $p< .05$; triathletes chose a significantly smaller ideal physique compared with the BDBB-group ($p< .05$), and by a trend a smaller ideal than the nBDBB-group ($p< .10$).

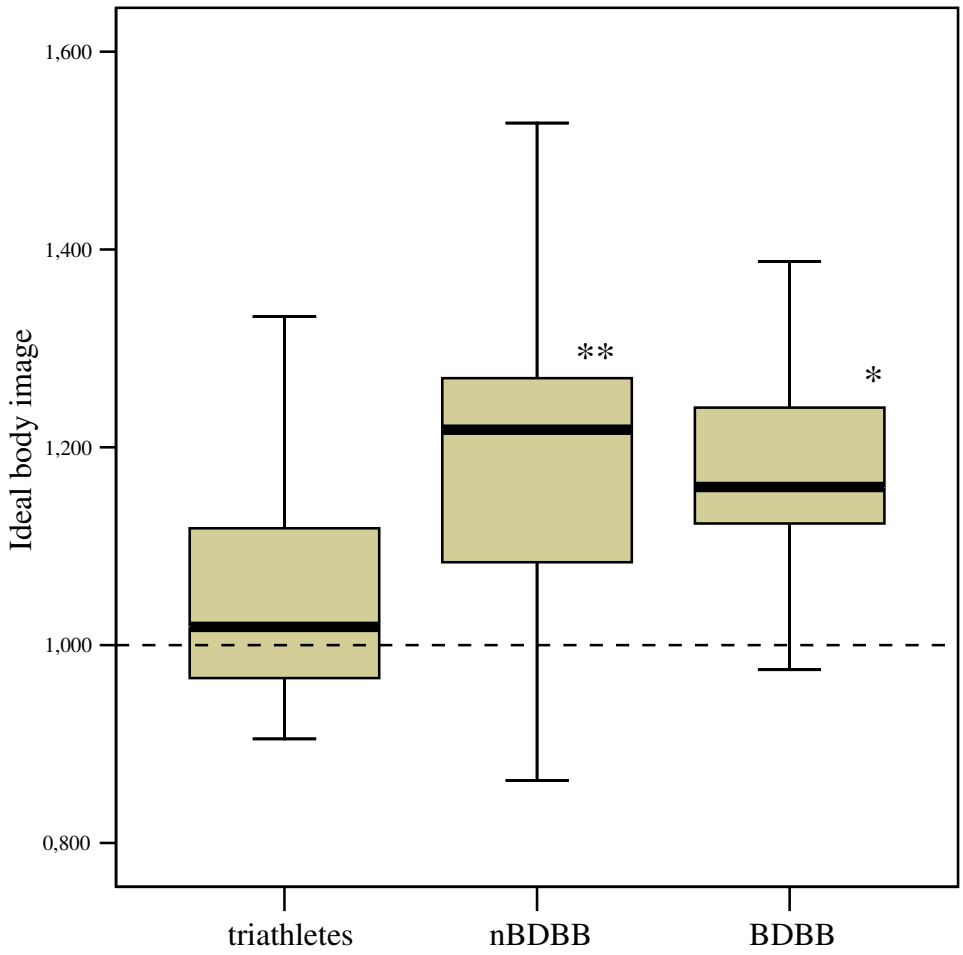

Figure 12. Box Plot of ideal body, by multiplication factor of real body size.
*$p< .05$; **$p< .01$; indicating a significant difference from real body size (factor 1.0).

Concerning the question of how different from (in contrast to how much bigger than) their real body size athletes would like to be, we used the absolute difference between the chosen image and 100%. By this procedure we tried to take into account the fact that nine triathletes and three bodybuilders wished to be thinner and therefore picked an ideal body smaller than 100%. For example, two participants' ideal images of 115% and 85% in average would erroneously give a group ideal that exactly matches the real body size if relative differences were used. Results show, that this difference is significantly greater than zero for triathletes ($p< .001$), the nBDBB-group ($p< .001$) and the BDBB-group ($p< .05$). Comparing this variable between groups, a significant effect of group was found, $F(2, 45)==4.39$, $p< .05$, with the triathletes showing smaller differences ($p< .05$) than the other two groups.

However, it is questionable if the parametre of real body size is of any meaning in the context of body image, as it will always be subject to cognitive-evaluative processes. Perceived body size is the result of these psychological processes, and the more appropriate question would therefore be, how different from their perceived body size athletes would like to be. To answer this, we used the absolute difference between the chosen image and the average body size perception accuracy values in percentage. Results show, alike the ones on ideal-real-body-difference, that all groups wish to have a body that is significantly different from the one that they perceive to have, as differences are significantly different from zero (for triathletes $p< .01$; for the nBDBB-group $p< .001$; for the BDBB-group $p< .05$). Again, the group effect that we found was significant, $F(2, 45)=3.89$, $p< .05$, with the BDBB-group showing a larger ideal-perceived-body size difference than the triathletes ($p< .05$), and the nBDBB-group showing an ideal-perceived-body size difference that lies in-between.

Pearson's product-moment correlation coefficient r was used to check for relevant interrelations among the discrepancy between ideal and perceived body

size and other variables. As expected, a negative correlation could be found with body satisfaction ratings (r = - .39, p< .01) across all groups, and within the BDBB-group alone (r= -.87, p< .01). Furthermore, a significant positive correlation was shown for FFMI-values with ideal-perceived body size differences (r= .33, p< .05), and a significant negative correlation for FFMI and satisfaction (r= .44, p< .05), meaning that the more muscular an athlete is, the bigger is his ideal body size relative to his actual body size and the lower is his satisfaction. However, the differences between group means seem to account for these results, as within-group correlations were not significant.

4.6 Body satisfaction

Repeated measures analyses of variance and of covariance were undertaken to account for changes in body satisfaction due to physical workout. The ANOVA revealed significant main effects for group, F(2, 45)=5,25, p< .01, and time, F(1, 45)=4.07, p= .05, but no interaction effect, F(2, 45)=0.27, p= .77. The variable *satisfaction with today's training* was used as a covariate, as we suppose that the quality of a training session might influence state-body-satisfaction and because a significant correlation was found with *body satisfaction after workout* and with the difference in body satisfaction between pre- and post-measurement within the bodybuilding group and more specifically within the non-bodydysmorphic bodybuilders. Inclusion of the variable *weekly amount of training* did not have any effect on the results. The ANCOVA revealed the same significant main effects for group, F(1, 44)=5.22, p< .01, and time, F(2, 44)=5.34, p< .05, as the ANOVA, but no interaction effect, F(2, 44)=0.07, p= .94. All groups report a comparable increase in body satisfaction due to physical training, as Figure 13 demonstrates. The data are displayed in table 7.

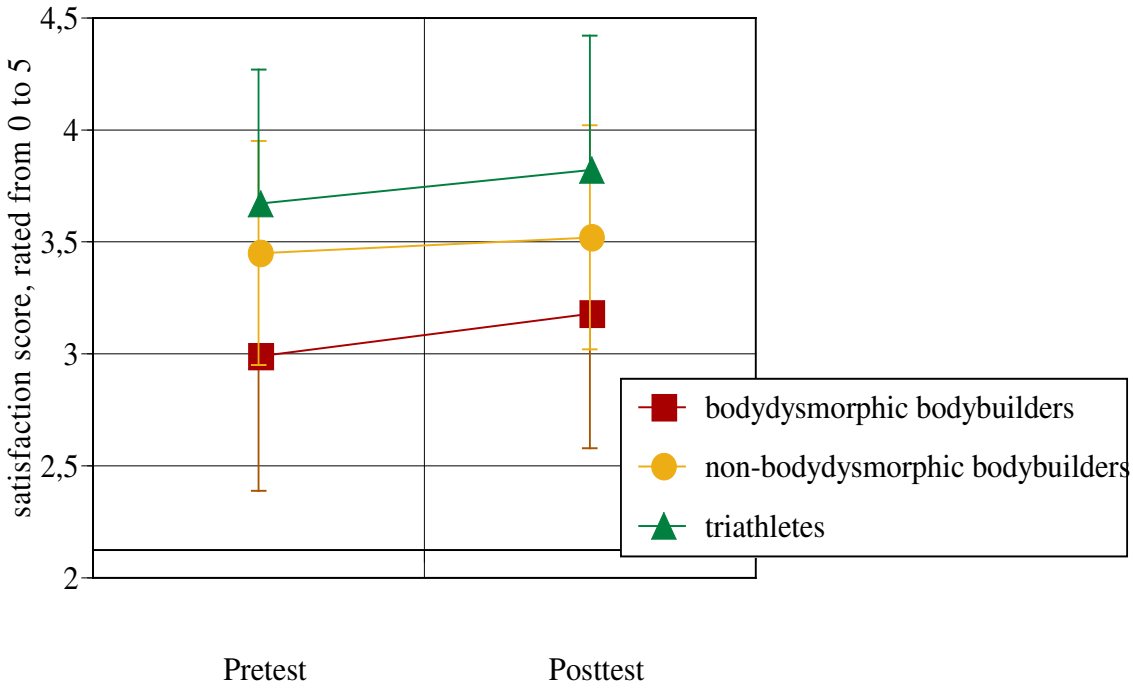

Figure 13. Satisfaction on pretest and posttest by groups.

Table 7

Mean (SD) satisfaction at pre- and posttest by groups, ANOVA and ANCOVA.

Body satisfaction				ANOVA	ANCOVA
	BDBB[a]	nBDBB[b]	Triathletes[c]	F(2,45)	*F*(2,44)
Pretest	2.99 $(0.6)_a$	3.45 $(0.5)_{a,b}$	3.67 $(0.6)_b$	4.7*	4.51*
Posttest	3.18 $(0.6)_a$	3.52 $(0.5)_{a,b}$	3.82 $(0.6)_b$	4.3*	4.61*

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .05$ in the Tukey honestly significant difference comparison.

[a] $n=10$. [b] $n=18$. [c] $n=20$. *$p < .05$.

Tukey post hoc tests were used to determine the significance of between-group differences. The nBDBB-group showed similar satisfaction as the triathletes, whereas the BDBB-group scored significantly lower ($p < .01$) than the triathletes. Differences in satisfaction between the BDBBs and the nBDBBs did not reach significance ($p = .14$).

The subscales reveal significant differences between groups for lower body parts, fitness and attractiveness. Concerning buttocks, hips and legs, triathletes were significantly more satisfied ($p < .01$) on pretest than both bodybuilding groups, whose scores were about the same. On posttest, the BDBB-group had gained satisfaction with buttocks, hips and legs whereas both other groups stayed equally satisfied. The difference between triathletes and the nBDBB-group showed a trend towards significance ($p < .10$) on posttest. The ratings of satisfaction with fitness and attractiveness did not show any differences between triathletes and the nBDBB-group on neither pre- nor posttest. The BDBB-group in contrast reported significantly less satisfaction than both other groups concerning attractiveness ($p < .01$) and as a trend concerning fitness ($p < .10$) before as well as after physical workout. No differences can be reported for stomach and upper torso, i.e. chest and arms. The corresponding data are displayed in table A5 in the appendix.

4.7 Questionnaire scores

Table 8

Mean scores (SD) on BDI and BESAA by groups, One-Way Analyses of Variance

	BDBB[a]	nBDBB[b]	Triathletes[c]	*F*
BDI	$6.30\ (5.25)_{a}$	$2.67\ (2.61)_{b}$	$3.74\ (3.36)_{a,b}$	3.31**
BESAA	$3.29\ (0.58)_{a}$	$3.65\ (0.49)_{a,b}$	$3.78\ (0.52)_{b}$	2.98*

Note. BDI = Beck Depression Inventory. BESAA = Body Esteem Scale for Adolescents and Adults. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .05$ in the Tukey honestly significant difference comparison.

[a] $n=10$. [b] $n=18$. [c] $n=20$.

*$p < .1$. **$p < .05$.

A multivariate analysis of variance across questionnaire variables revealed a significant group effect for only the Beck Depression Inventory, $F(2, 44)=3.31$, $p < .05$, and a trend for the Body Esteem Scale for Adolescents and Adults, $F(2, 44)=2.98$, $p < .10$. Table 8 displays the full data. Symptoms of depression are more present in the BDBB-group compared to the nBDBB-group ($p < .05$) with triathletes' scores lying in-between (n.s. in comparison to both other groups). However, the means of groups stay below the criterion for mild depression (cut-off score = 12); one triathlete scored higher (score 13), none of the nBDBBs, and two of the BDBBs (scores 12 and 15).

Concerning body esteem, there is a trend that the BDBB-group scores lower than the triathletes ($p < .10$). Differences between the BDBB- and the nBDBB-group fail to reach significance ($p = .19$).

Scores of the Muscle Dysmorphia Questionnaire are correlated with the Adonis Complex Questionnaire (r= .66, p< .001), i.e. the criterion variable for allocation of bodybuilders to subgroups, and thus have to reach high significance for differences between groups, $F(2, 44)=10.33$, p< .001. Correlation analyses across all participants show that the AdCQ-scores indicating body-dysmorphic concerns are not only strongly related to the MDQ (see above), but also to

1. size of ideal body image (r= .29, p< .05),
2. body satisfaction ratings (r= - .34, p< .05),
3. body esteem (BESAA, r= - .40, p< .01),
4. exercise dependence (ExDS, r= .38, p< .01),
5. and the body indices such as BMI (r= .70, p< .001) and FFMI (r= .71, p< .001).

Our results indicate that men who are very concerned of their appearance favour a bigger physical ideal, are less satisfied with their body, have lower body esteem, exercise more up to the degree of showing signs of addiction, and therefore are bigger in size and musculature. Furthermore, regarding body esteem (BES, BESAA), positive correlations are found with body satisfaction scores (r= .50, p< .001), and negative correlations with ratings of social anxiety (SANB, r= - .45, p< .001).

As differences between group-means might have generated the correlations reported above, we checked for significant correlations within groups. We found:

1. bodydysmorphic concerns to correlate significantly with exercise dependence (r= .87, p< .01), and body esteem measured by the BES to correlate significantly with body satisfaction (r= .81, p< .001) in triathletes,

2. bodydysmorphic concerns to correlate significantly with body esteem measured by the BESAA (r= -.61, p< .01), and the BESAA scores to correlate significantly with body satisfaction (r= .66, p< .01) in nBDBBs, and
3. muscledysmorphic concerns measured by the MDQ to correlate significantly with exercise dependence (r= .70, p< .05) in BDBBs.

5 DISCUSSION

The primary purpose of this study was to compare bodybuilders and non-bodybuilding athletes with respect to bodydysmorphic concerns and bodydysmorphic disorder. Ten bodybuilders reported to have bodydysmorphic concerns to at least a mild to moderate degree. This subgroup was separately analysed and compared to non-bodydysmorphic bodybuilders and the non-bodybuilding athletes in a secondary analysis. We examined differences of body satisfaction, body size perception accuracy and perceptual discrimination consistency between the three subgroups. In addition, the influence of an ordinary workout session on these three variables was studied. Furthermore, we checked for differences in trait-measures such as ideal body image, body esteem, exercise dependence, depression and social anxiety between the three groups.

In the following sections, we will summarise the results from our analyses, starting with differences between groups (first primary analysis, then secondary analyses), and continuing with effects due to the workout. Then, we will evaluate our study's internal and external validity. This chapter will finish with a discussion of the results with respect to the current theoretical understanding of muscle dysmorphia.

5.1 Primary analysis: bodydysmorphic concerns in bodybuilders

To begin with, we analysed body image concerns in bodybuilders, a population which sets high emphasis on outward appearance, which pursues an extreme physical ideal and which we therefore expect to be vulnerable to body dysmorphic disorder. Through daily and competitive comparison with other, possibly even more muscular men who follow a specific lifestyle with extensive workout, critical self-evaluation, restrictive eating or even substance use, a bodybuilder is highly likely to develop a heightened level of self- and body-consciousness.

The research group led by H. J. Pope (2000) undertook various investigations on body image in bodybuilders and concluded that about 10% of them display signs of a specific type of body dysmorphic disorder: the muscle dysmorphic disorder. Individuals that have muscle dysmorphic disorder typically fear that they might be not sufficiently muscular.

In the primary analysis, we compared a sample of competitive bodybuilders and of non-bodybuilding triathletes regarding the degree of bodydysmorphic concerns respectively the occurrence of bodydysmorphic disorder. Our findings support the notion that bodybuilders display higher degrees of body- and muscledysmorphic concerns than triathletes. They meet the clinical criteria for a DSM-IV diagnosis of bodydysmorphic disorder (APA, 1994) more often than non-bodybuilding athletes, who in our study did not show any signs of bodydysmorphic disorder. The prevalence of body dysmorphic disorder that we found (14,3%) matches the 10%-prevalence reported by Pope et al. (1997). Further, anabolic androgenic steroids were exclusively used by the bodybuilders, a behaviour which seems to be linked to body image concerns.

5.2 Secondary analysis: Body image in bodydysmorphic bodybuilders, non-bodydysmorphic bodybuilders and non-bodybuilding athletes

With regard to the publication by Pope et al. (2000), we could expect 10% of all bodybuilders to have bodydysmorphic disorder (DSM-IV, APA, 1994), and accordingly even more bodybuilders to display milder forms. However, we could not a priori recruit groups of fixed sizes to compare bodybuilders with or without bodydysmorphic concerns and therefore used a questionnare cut-off score proposed by Pope et al. (2000) to form subgroups for secondary analyses. Ten of the 28 bodybuilders (35.7%) and none of the 20 triathletes reported to experience bodydysmorphic concerns to a mild to moderate degree at least. Despite the fact that group sizes are small for a secondary analysis aiming at a comparison of bodydysmorphic bodybuilders, non-bodydysmorphic bodybuilders and triathletes, we found significant effects. Yet, the results have to be interpreted with care due to a possible lack of statistical power.

We expected that bodydysmorphic participants would display a body image disturbance, whereas non-bodydysmorphic bodybuilders and triathletes would not. With reference to Cash (2002), we assume that body image consists of an attitudinal and a perceptual component, both of which we tried to address in our study by investigating body satisfaction and body size perception accuracy.

Criteria for bodydysmorphia (APA, 1994) imply that a person with bodydysmorphic concerns will feel dissatisfied with his or her body, which let us expect lower degrees of body satisfaction in bodydysmorphic bodybuilders on any testing occasion compared with non-bodydysmorphic bodybuilders or triathletes.

Knowledge of the second component, body size perception, is still rare, especially regarding men. We do not know the distinct steps of how a bias in body size perception develops, and can only theoretically explain its function, and how it helps to maintain a body image disorder. In eating-disordered women, a perceptual distortion to view one's body as bigger than it actually is was found to be common (Smeets, 1996). Pope et al. (1996) concluded that there might exist a similar, but opposite phenomenon in muscledysmorphia, which they accordingly termed 'bigorexia'. Gray (1977) reported that the average man tends to perceive himself as weighing less than he actually does, whereas Pope et al. (2000) found men to estimate body fat accurately and overestimate musculature. Loosemore et al. (1989) found bodybuilders to underestimate their body size. However, in none of these analyses made a distinction between groups with different levels of bodydysmorphic concerns. In our study, we expected to find a bias to perceive the body as smaller than it really is in bodydysmorphic bodybuilders, in contrast to a rather accurate body size perception in non-bodydysmorphic bodybuilders and triathletes.

Body satisfaction and body size perception are said to be influenced by ideal body image in bodydysmorphic disorders (Pope et al., 1999). Pursuit of an unattainable physical ideal may additionally lead to affective, cognitive or behavioural problems. For example, eating-disordered women respond with an immediate negative affect when watching ideal physiques (Hausenblas et al., 2003; Irving, 1990). Waller et al. (1993) further reported that visual exposition to the physical ideal influences cognitive-evaluative processes. In the bodybuilding population, ideal body image has rarely been investigated. In our study, we not only assumed that bodybuilders favour more bulky and muscular physiques than non-bodybuilding athletes, but also that bodydysmorphic bodybuilders pursue a bigger ideal than non-bodydysmorphic bodybuilders.

With reference to findings of a lowered level of self-esteem in bodybuilders by Blouin and Goldfield (1995), we further assumed that bodydysmorphic bodybuilders might exhibit more affective problems such as lower body esteem, meaning the extent to which someone trusts in and socially relies on his or her attractiveness, and higher degrees of depressivity than non-bodydysmorphic or non-bodybuilding study-participants.

To summarise our results, we found bodybuilders with bodydysmorphic concerns to show distinctive features of body image, compared to non-bodydysmorphic bodybuilders and athletic participants who engage in a sport with competitive goals other than shaping one's body.

1. Bodybuilders with bodydysmorphic concerns report less satisfaction with their bodies than triathletes. Bodybuilders without bodydysmorphic concerns score in-between, but tend to be comparable to the triathletes rather than to bodydysmorphic bodybuilders. This supports the questionnaire for bodydysmorphic concerns and the cut-off score we used in terms of internal validity.

2. Body size perception is accurate in non-bodydysmorphic bodybuilders, whereas bodydysmorphic bodybuilders, but also triathletes, display a perceptual bias to view their bodies as smaller than they really are. According to Gray (1977) who states that a bias to view the body as smaller than it is seems to be normal in men, the finding of an underestimation of body size in bodydysmorphic bodybuilders does not seem to be pathological. Contrary to our original assumptions, in our study the non-bodydysmorphic bodybuilders tend to be the deviating group by having a more accurate body size perception than other participants, although our analysis of variance revealed only a trend for this group difference. Bodybuilders might be trained to perceive and judge

themselves as accurately as possible for competitive reasons, supported by working-out in front of mirrors and by getting honest feedback from coaches. The findings of this study raise the question of why those bodybuilders who experience bodydysmorphic concerns show the same bias as any non-bodybuilding participant or, in other words, seem unable to profit from the specific training in objective self-judgment. One possible explanation is that the specific training is countered by the bodydysmorphic concerns. Either these participants might have started from an even worse point of distorted body size perception which through constant coaching was raised to a normal level, or bodydysmorphic men simply are not as susceptible to objective feed-back as non-bodydysmorphic bodybuilders.

3. Bodybuilders have a hypermesomorphic ideal body image compared to athletic participants. Bodydysmorphic bodybuilders choose a physical ideal which is not significantly different from the ideal chosen by non-bodydysmorphic bodybuilders. This contradicts our original assumptions. However, this finding might be have been caused by a ceiling-effect, meaning that highly distorted digital images might have looked too unrealistic for participants to choose them as their ideal.

   Further, the difference between ideal and perceived body correlates negatively with body satisfaction. Therefore we can draw the conclusion that the more the bodily ideal differs from what athletes perceive to be their body size, the less satisfied they are. This finding applies not only to the full sample, which would imply group mean differences, but to the subgroup of bodybuilders as well, and - even more specifically – to the bodydysmorphic bodybuilders.

4. Bodydysmorphic bodybuilders reach lower scores on a questionnaire for body esteem than triathletes. Bodybuilders without bodydysmorphic concerns score in-between, but tend to be comparable to the triathletes rather than to the bodydysmorphic bodybuilders. Therefore, the assumption that bodydysmorphic bodybuilders would have less body esteem than non-bodydysmorphic bodybuilders and triathletes is partly supported by our findings. These findings further show that studies which do not differenciate different degrees of bodydysmorphic concerns in bodybuilders, like the one by Blouin and Goldfield (1995), give too general results on self-esteem in bodybuilding, which should be considered in future research.

5. Lastly, bodydysmorphic bodybuilders on average achieve higher scores on the Beck Depression Inventory than non-bodydysmorphic bodybuilders, although not exceeding a clinically significant cut-off score. Triathletes score in-between, without any significant differences to both other groups. We have to consider that the assumption for homogeneity of variance was not met by this variable and that we therefore need to be careful when interpreting this result.

5.3 Workout effects

Our original assumption was that body satisfaction and accuracy of body size perception should increase due to physical workout. We could refer to only one research study by Williams et al. (2001) who found an improvement in body image, both body satisfaction and body size perception, through participation in a circuit weight training programme. The authors report an improved evaluation of appearance, greater body satisfaction, reduced social physique anxiety and enhanced physical self-efficacy after 6 weeks of weight training. This time period, however, is rather broad. As pumping iron can be considered an aversive, even painful activity, it is plausible that there must be some immediate positive reinforcement to it, for example a positive effect on body image.

When asking bodybuilders, they will in unison confirm that they instantly feel more satisfied after workout. Our study gives the matching result that physical workout leads to an immediate gain in body satisfaction. However, this effect is neither unique in bodybuilding nor in bodydysmorphia. Considering the fact that, on average, body satisfaction remains lower in bodydysmorphic bodybuilders than in all other groups at every point in time, we can conclude that, through a single workout session, low body satisfaction caused by bodydysmorphic concerns cannot be raised to a “normal” level.

Body size perception accuracy does not change significantly between pre- and posttesting, but our analysis revealed several trends. As mentioned in the previous section, non-bodydysmorphic bodybuilders tend to have a more accurate body size perception than bodydysmorphic bodybuilders. As well bodydysmorphic as non-bodydysmorphic bodybuilders seem to perceive their bodies as bigger after workout compared to before workout, however, these

changes do not reach significance. In contrast to these two subgroups, triathletes show an opposite trend and tend to perceive their bodies as smaller after compared to before workout. Probably due to a lack of power or due to methodological problems (see section 5.4.1) we cannot report any significant results on this question. Although our original assumption, that bodydysmorphic bodybuilders would have a stronger bias in body size perception before workout than both other groups and that body size perception would approach objective body size afterwards, was not supported, our results stress that body size perception does seem to change, and furthermore in a specific direction depending on the kind of workout. In combination with the general gain in body satisfaction, different athletic disciplines seem to have a specific influence on body image.

Several different explanations might apply to this finding:

1. Different outcome expectancies, i.e. the beliefs that individuals hold about the effects of a specific workout on their physique, behaviour, mood, and emotions, might be responsible for training-specific changes in body size perception. Bodybuilders will expect to gain body mass whereas triathletes probably expect to burn plenty of calories, dehydrate and therefore lose weight.

2. Additionally, bodybuilders and triathletes might perceive different interoceptive cues after a workout session. Musculature probably feels different, i.e. more stretched and flexible, after doing endurance sports compared to the heightened muscle tone and blood circulation after bodybuilding. This might influence evaluations of body size. Ekkekakis (2003) introduced a theoretical model in which he assumes that only at low intensity training cognitive factors, such as physical self-efficacy, will have a dominant influence on affective responses to exercise, and that interoceptive

cues, e.g. muscular or respiratory, will gain salience and influence as training intensity approaches the individual's functional limits. If body size perception is modified by similar factors and in a similar way and if workout in bodybuilding and in triathlon is not equally intensive, both athletic disciplines might not only differ by the interoceptive cues they produce, but also by these cues' salience.

3. Lastly, absolute muscle size changes temporarily after a physical workout. Most scientific studies, however, focus on lasting size changes after several weeks of regular exercising instead of short-term pretest-posttest-comparisons. For example, Takashi et al. (2000) report that muscle thickness, measured by ultrasound, does not change significantly until the sixth week of regular resistance training. Steady muscle size differences due to a single workout would in comparison be marginal. Regarding transient muscle-size changes, Ploutz-Snyder et al. (1995) found thigh musculature to significantly gain size by 5% to 9% immediately following barbell squat exercises, because of immediate fluid movement form the vascular space into the active muscle, whereas 45 minutes after exercise it had essentially returned to baseline size. As in our study the posttest assessment took place earlier than 45 minutes after workout, and as workout for bodybuilding and triathlon might lead to different fluid movements in the tissue, we have to take into account the possibility that group-specific changes in body size perception might have been caused by group-specific absolute size changes of musculature.

5.4 Internal validity

5.4.1 Evaluation of measurement of body size perception (BSP)

The computer programme which we used to assess body size perception was only recently developed, and has not yet been tested for validity and reliability. We did not include any other, separate assessment of body size perception so that we cannot decide if our mean of measurement was valid. Further, participants' scores on body size perception accuracy did not correlate significantly with any of the other measures, a result which was not surprising considering our instrument's low test-retest-reliability, $r = .4$ ($p < .01$). Concerning this matter, Tovée et al. (2003) criticized that methods using digital photographs might lack the precision to measure subtle differences in BSP.

Tovée et al. (2003) further points out that shape changes produced by a technique which stretches or compresses the body horizontally do not accurately mimic the pattern of shape change produced by changing body mass through working-out. Indeed, participants of our study complained that they were not able to choose a broader chest and shoulders, and at the same time leave waist and hips narrow. Moreover, unrealistic body proportions might provide cues to observers about the degree of distortion in body size in the pictures presented. It is therefore desirable to develop a computer software programme that offers a more flexible tuning of the picture.

To pursue this way of thinking, in a bodybuilding context, it might be advisable to adapt measurement of perceived or ideal body to a few more conditions: to give athletes the opportunity to change not only their body size, but also the shape of singular muscles, the fat content on pictures, the visibility of

veins and the skin tone. This was, by the way, one of the most common feedbacks that our participants gave us concerning our measurement.

Farrell et al. (2002) presented an interesting new development of a whole body method in a recent research study. They used a similar instrument as we did to measure body size perception accuracy, but instead of presenting a regular digital photograph to participants they used the mirror-inverted view and presented the picture in half life-size. That way the authors tried to establish conditions that resembled the real-life situation of viewing oneself in a mirror because they assumed that participants would be less used to seeing their photograph than to seeing their reflection, which might affect evaluation of body size. In order to assess the perception of body size instead of the memory of body size, they additionally provided participants with the opportunity to view themselves in a mirror while they had to adjust their projected image. Although Farrell et al. (2002) do not give the exact coefficient, they report that “the new method showed high test-retest reliability”. They conclude that their method is not only ecologically valid, but also “the most clinically relevant of the methods developed to date”. However, this procedure differs from our measurement and aims at a different aspect. Referring to Smeets (1997), see section 2.5.2, we expect the mental body image to be distorted in muscle dysmorphia, rather than to find a perceptual deficiency on a neurological background, and therefore we assessed a different construct than Farrell et al. (2002).

5.4.2 Ideal body image

Ideal body image was assessed using a computer software which let the participant tune the digital picture of the own body to ideal size. The same point of criticism applies here as for measurement of body size perception: tuning was possible for the whole body only at once and only in horizontal direction. To achieve a more realistic assessment of ideal body image, it might be advisable for future research to develop software programmes that offer the possibility of a separate tuning of specific body parts. For example, in a sample of bodybuilders a V-shaped body with broad shoulders and narrow waist is said to be preferred (Mishkind et al., 1986). Such specifics of the physical ideal could not be depicted by our software due to technical limitations.

Secondly, we assessed ideal body image only at one of the two dates of measurement, not taking into account the possibility that ideal body image might not be a trait measure but also change in the course of time. For the same reason, we were not able to calculate a coefficient of retest-reliability, which would have been desirable.

To evaluate validity of our instrument, we could not correlate scores on ideal body image with any other measure that explicitly assessed an aspect of ideal body image. For example, we could have asked participants to pick their ideal figure from the somatomorph matrix. For future studies on ideal body image, we will have to consider these adjustments in our design.

5.5 Further methodological remarks

A few circumstances might have affected our measurement in a negative way.

Several participants first seemed to have problems understanding the task given in the computer programme 'nesnap'. Despite an unambiguous instruction they reported to feel uncertain whether by clicking *smaller* or *wider* they were supposed to judge the size of the picture displayed or the size of their body. We were able to correct for errors of that kind by assisting in evaluation of the first few pictures displayed. We deem environmental influences in the gyms responsible for this phenomenon. Usually, we could find only a corner aside instead of a separate room to ask participants questions and to have them look at the pictures on the laptop. Concentration was therefore impaired by a constant noise level in the background and by the feeling of being watched by others. This was possibly the price we paid for undertaking the study in a real-life setting.

A further point of criticism is that answering patterns of all men might have been influenced by the fact that the investigation was undertaken by female researchers. As questions about attractiveness and body image satisfaction present a sensitive topic for men they might have felt ashamed to honestly evaluate their appearance and have tried to come across as being less concerned than they really are.

Third, we were not successful in finding a questionnaire which adequately addresses impaired eating behaviour in men. For example, the restrained eating scale (Hermann & Polivy, 1980) measures eating and dieting behaviour in the sense of losing weight, which does not apply to bodybuilders. In future research it might be interesting to develop and evaluate a better-fitting questionnaire for

men who do not have typically anorexic syndromes, but nevertheless report to have unusual eating patterns.

5.6 External validity

As our sample might possibly have been selected in a non-random way due to the voluntary participation of athletes, generalisability of our results might be limited. For example, it is possible that athletes with higher degrees of body image concerns than those that were reported in our sample were afraid to participate. The prevalence of bodydysmorphic disorder in our sample might therefore be rather specific and a generalisation to the bodybuilding population erroneous. The criterion 'bodydysmorphic concerns to a mild to moderate degree' was, although revealing significant between-group differences, easy to meet. We would like to stress that only 4 of those 10 participants fulfilled the full criteria for a bodydysmorphic disorder according to DSM-IV.

Further it is debatable whether or not triathletes represent a fitting control group. When planning the study, we had considered to include soccer or basketball-players, non-athletic fellow-students or leisure sportsmen. We finally chose triathletes because we expected these athletes to pursue a physically balanced workout and therefore to contrast with bodybuilders who focus on muscles and specific body parts. At the same time, triathletes are at least to a low degree used to doing some resistance training, so that the respective questions and questionnaires applied to them as well. We decided not to include leisure sportsmen or non-athletic persons because they might not have been able to individually define a 'regular workout', or, even worse, might not have been able to participate in one without feeling exhausted and dissatisfied afterwards. Retrospectively, we can however evaluate triathletes as being quite particular as

well. We found athletes to follow extreme workout schedules, be very concerned about their nutrition, however different from the bodybuilders, and display high degrees of exercise dependence. The generalisation that body image difference between bodybuilders and triathletes depict body image differences between bodybuilders and non-bodybuilding athletes is questionable, although we do not know how this issue could have been solved otherwise.

Coming back to our experimental group, we can further question whether the bodybuilders that we chose to address with our investigation are typical at all? We selected them following the criteria that they should consider themselves to be seriously involved in bodybuilding and that they should participate in official competitions, respectively have done so in the past or plan to do so in the near future. But are these athletes *the* typical bodybuilders? On the one hand, those athletes might experience much higher pressure to meet a certain body ideal than non-competitive bodybuilders. On the other hand, competitive bodybuilders might profit from official acknowledgment. To win an award which is appreciated by the socio-cultural environment is very likely to enhance self-esteem. For example, a few participants reported to profit in their job qualification as a police officer or a security door man. The fact that many of them admitted that they did not know how they would feel if, all of a sudden, they were forced to stop working out, for example due to some injury, may stem as well from the feared loss of body size as from the feared loss of positive feedback.

5.7 Conclusions on male body image, muscle-dysmorphia, and its development

For male athletes in general, our study gives the result that across groups a higher Fat Free Mass Index correlates with a more extreme ideal body image and a greater actual- and perceived-ideal body image discrepancy. Moreover, the greater these discrepancies, the lower is body satisfaction. Concerning body size perception accuracy, we found that across groups and points in time, men tend to perceive themselves as smaller than they really are.

Figure 14 displays the various constructs (see also section 2) that we regarded to be important in the understanding of body image and body- respectively muscledysmorphic disorders in men, and that we tried to cover in our study by different means of measurement. As can be seen, most of them correlate significantly. This supports our current understanding of muscledysmorphia.

After splitting the sample according to scores on the Adonis Complex Questionnaire (Pope et al., 2000), which measures body- and muscledysmorphic concerns in men, significant between-group-effects, as enumerated above, emerged for nearly all of the related variables. This supports the preliminary diagnostic criteria for muscle dysmorphia presented by the same authors.

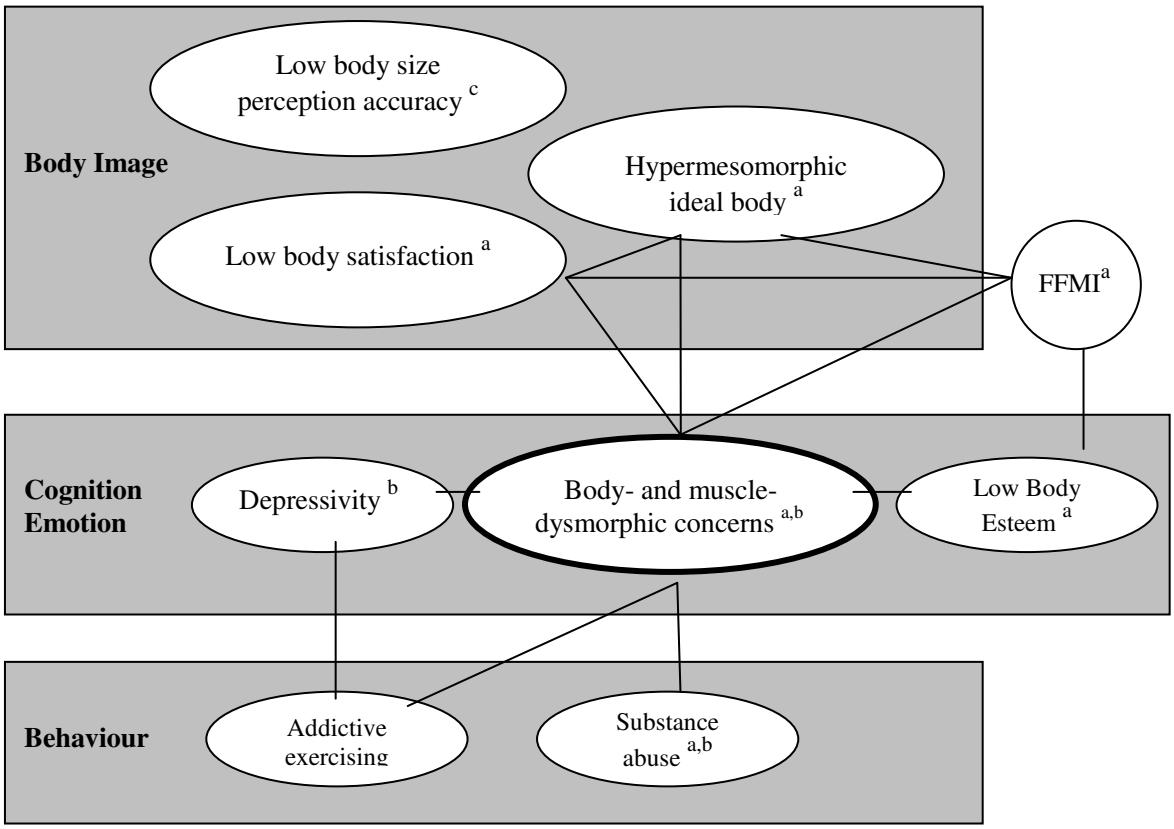

Figure 14. Constructs in the context of body- and muscledysmorphic concerns

—— significant positive correlation of at least $p < .05$.

[a] BDBBs significantly differ from triathletes ($p < .05$).

[b] BDBBs significantly differ from nBDBBs ($p < .05$).

[c] BDBBs differ from nBDBBs by a trend ($p < .10$).

According to prevalence estimates of bodydysmorphic disorder in bodybuilders of around 10% (Pope et al., 1997), respectively 14.3% in our study, it is likely that bodybuilding does not cause bodydysmorphic disorders. Concerning the question of why some bodybuilders develop muscle dysmorphia whereas others do not, we do not have any scientifically supported answer yet. We do not know whether before getting involved in bodybuilding those athletes had issues with body image or not. Longitudinal studies concerning this matter have not yet been undertaken. Many men who have low self- and body-esteem might try to compensate for that by trying to look as muscular and masculine as possible, and in order to achieve this start to develop muscle mass through

bodybuilding. Although some of them might already have favoured extremely bulky physiques before that, it is likely that the extreme ideal body image develops in the course of a bodybuilder's career. Environmental influences in gyms where specific role models are propagandised may serve as a partial explanation. Bodybuilders not only compare themselves to other gym members or coaches, but also actively search competition by applying for official championships. Focus on body and attractiveness as well as social comparison processes may be intensified by the constant confrontation with one's own physique while working out in front of mirrors. In other contexts there is evidence that performance of tasks in the presence of a mirror enhances public self-consciousness (Heinrichs et al., 2002). In the long run, these factors might diminish body satisfaction especially in men with low self- and body-esteem, in spite of the short-term gain that we found. Additionally, the gain of body mass, may be accompanied by a gradual shift in ideal body image, so that the impression to be insufficient in comparison to the ideal stays unchanged.

5.8 Final and controversial statements…

'Sometimes I don't get along with myself, the way I look, and with what used to be and might come...' (bodybuilder, age 21, BMI 27.6, FFMI 22.1, meeting criteria for BDD and depression).

'I have never had thoughts about trying to look bigger. On the contrary, I usually place emphasis on clothing and behaviour that would rather conceal the fact that I'm very big and muscular.' (bodybuilder, age 40, BMI 31.86, FFMI 25.58, not meeting any DSM-IV-criteria).

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APPENDIX

ADVERTISEMENT

Wie beeinflusst Bodybuilding Ihre Körperwahrnehmung?

Ich suche:

Athleten, die regelmäßig und ernsthaft trainieren, für meine Doktorarbeit

Finden Sie heraus:

- wie Ihre eigene Körperwahrnehmung ist!
- welchen Einfluss das Training hierauf nimmt!
- Wie Sie aussehen, wenn Sie Ihre Figur auf einer Digitalfotografie zum Ideal verändern können!

Für die Untersuchung komme ich natürlich ins Studio. Darüber hinaus bietet die Uni eine kleine Entschädigung von EUR 15,00.

Für genauere Infos erreichen Sie mich:

Telefon: 02 51 – 4 18 34 -3 oder -45
email: CDS@uni-muenster.de

Ansprechpartner: Dipl.-Psych. Inga Petersen

DESCRIPTION OF THE CONTROL GROUP

The triathlon is a 3-event endurance sport in which athletes compete sequentially in swimming, cycling and running. Today's official distances are 1.5 kilometres of swimming, 40 kilometres of cycling and 10 kilometres of running. Athletes therefore have to train and master all three sports at the same time, which implicates a high training frequency. Success – in contrast to succeeding in bodybuilding through perfecting one's outlooks – is defined by completing the distances as fast as possible.

Concerning body image, one cannot say that there exists a typical bodily ideal for a triathlete. All three sports require a different physical stature, as in swimming the athlete will profit from at least some bodyfat to be held up better in the water, in running a lean and light figure will be of advantage, and cycling will need strength and musculature. Therefore, a rather balanced build of body seems to be best. When investigating body satisfaction in triathletes, DiGioacchino et al. (2002) let participants pick their expected actual and ideal body out of a row of drawn silhouettes. In order to compare those two pictures and thus obtain a measure for satisfaction, the authors found 53.3% of triathletes to have a matching perceived and ideal body, whereas 34.9% of triathletes wished to be smaller and only 11.8% wished to be more muscular.

INFORMED CONSENT AND INFORMATION SHEET

Einverständniserklärung
Veränderung der eigenen Körperwahrnehmung durch (Kraft-) Sport

1. Ich bin durch Herrn/Frau _____am _____schriftlich über Zweck und Ablauf der Studie unterrichtet worden.

2. Ich wurde darüber informiert, dass die erhobenen Daten unter Einhaltung der Vorschriften des Datenschutzes nach Entfernung von Namen, Geburt*SD*atum und Anschrift ausschließlich zu wissenschaftlichen Zwecken auf elektronischen Datenträgern gespeichert und mittels statistischer Verfahren zusammengefasst und ausgewertet werden. In wissenschaftlichen Berichten werden nur Sammelstatistiken veröffentlicht, d. h. persönliche Daten jedweder Art bleiben anonym.

3. Die vorliegende Einverständniserklärung bezieht sich lediglich auf die Daten, die im Rahmen der Untersuchung an der Westfälischen Wilhelms-Universität Münster durchgeführt wurde (Ergebnisse testpsychologischer und experimenteller Untersuchungen) und kann jederzeit widerrufen werden.

4. Ich gebe diese Einverständniserklärung unter der Bedingung ab, dass alle Personen der Schweigepflicht unterliegen, die im Verlauf der Untersuchung Befunde, die meine Person betreffen, zur Kenntnis bekommen.

Name: _____

_____ _____

Münster, den Unterschrift

Veränderung der eigenen Körperwahrnehmung durch Kraftsport

Guten Tag!

Sie sind eingeladen, an einer Studie zum Einfluss des Krafttrainings auf das Körperselbstbild teilzunehmen. Es handelt sich hierbei um eine computerunterstützte Untersuchung. Wir hoffen durch unsere Studie ein besseres Verständnis der Wirkung von Krafttraining auf das eigene Körpergefühl und demzufolge auch auf das Bild, das der Trainierende von seinem eigenen Körper hat, zu erlangen. Wissen um solche Zusammenhänge ist notwendig, um zu erklären, wie sich Männer zum Kraftsport motivieren.

Was werden Sie tun?
Wir bitten Sie, zweimal an einem Computerexperiment teilzunehmen und eine Reihe von Fragebögen auszufüllen. Die Computerexperimente sollen an möglichst aufeinander folgenden Tagen jeweils einmal direkt vor und einmal direkt nach einer Trainingseinheit in Ihrem Fitnessstudio / bei Ihrem Training stattfinden. Die Fragebögen können Sie zwischen den Terminen zuhause ausfüllen.

Das Computerexperiment:
Für das Computerexperiment möchten wir von Ihnen eine digitale Fotografie erstellen. Dieses Bild kann von unserem Computer breiter und schmaler verzerrt werden. Wir bitten Sie dann, die jeweilige Verzerrrichtung einzuschätzen. So lässt sich feststellen, wie genau Sie die Breite Ihres eigenen Körpers einschätzen, und ob das Training hierauf einen Einfluss nimmt. Selbstverständlich erhalten Sie auch eine Rückmeldung zu Ihrem Ergebnis. Darüber hinaus werden wir Sie bei den Messungen befragen, wie zufrieden Sie aktuell mit bestimmten Körperbereichen bzw. mit dem Ergebnis des soeben stattgefundenen Trainings sind.
Da viele Medikamente die Stimmung und somit das Körpergefühl beeinflussen können, ist es unbedingt notwendig, dass Sie uns über die Art der Präparate, die Sie zum Zeitpunkt der Studie einnehmen, informieren. Derartige Informationen unterliegen selbstverständlich ebenfalls der Schweigepflicht.

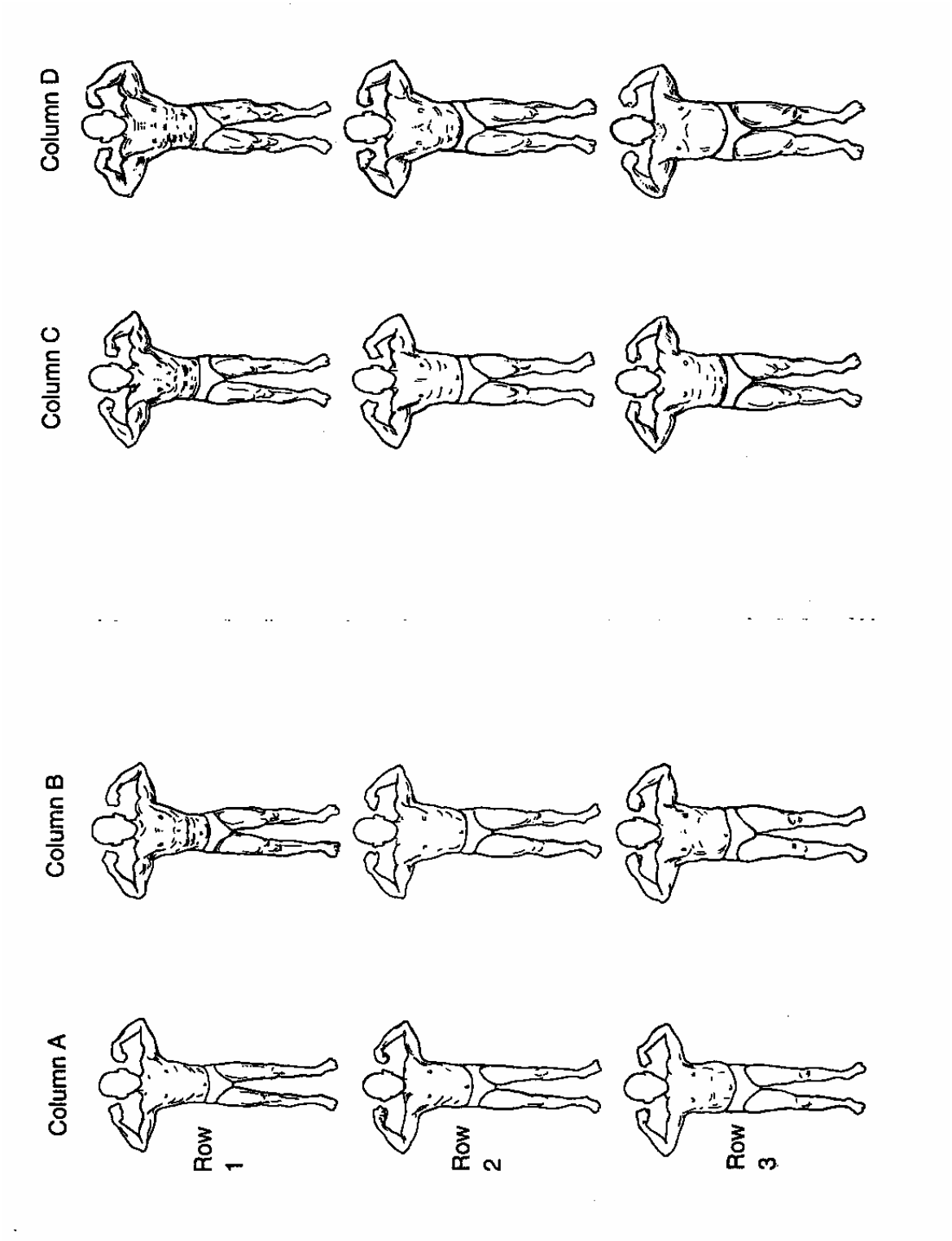
Was sind mögliche Vorteile?
Sie werden möglicherweise keine persönliche Vorteile aus der Teilnahme an der Untersuchung ziehen können, sie helfen uns jedoch bei der Erforschung der Motivation von sportlicher Aktivität.

In jedem Falle können wir Ihnen eine Entschädigung von Euro 15,00 für Ihre Teilnahme an der Untersuchung anbieten. Falls Sie sich bezüglich Ihres Körpers sehr unsicher fühlen und exzessiv trainieren, um dieses Gefühl auszugleichen, können wir Ihnen eine 30-minütige psychologische Beratung anbieten. In der Beratung werden Sie Informationen über Störungen des Körperbildes speziell im Kraftsport und Empfehlungen über mögliche Behandlungsmethoden erhalten, von denen Sie profitieren könnten.

Wir würden uns freuen, wenn Sie an der Studie teilnehmen würden. Es ist selbstverständlich, dass Ihre Angaben anonym bleiben, vor allem auch gegenüber Ihres Fitnessstudios oder Ihres Vereins, und dass von Ihnen erstellte Fotografie nach Abschluss der Studie nicht gespeichert werden. Ihre Teilnahme ist selbstverständlich vollkommen freiwillig. Es steht Ihnen frei, sich gegen eine Teilnahme zu entscheiden oder Ihre Teilnahme zu jedem Zeitpunkt der Studie aus jedem beliebigen Grund abzubrechen, ohne irgendwelche negativen Konsequenzen befürchten zu müssen.

SOMATOMORPHIC MATRIX

(Gruber et al., 1999, shortened version by Pope et al., 2000)



SOCIO-DEMOGRAPHIC VARIABLES

Alter: _____ (Bitte eintragen)

Familienstand:
1 □ ledig
2 □ verheiratet, zusammenlebend
3 □ verheiratet, getrennt lebend
4 □ geschieden
5 □ verwitwet

Muttersprache:
1 □ deutsch
2 □ andere: _____ (Bitte eintragen)

höchster erreichter Schulabschluss:
1 □ kein Abschluss
2 □ Sonderschulabschluss
3 □ Hauptschul-/Volksschulabschluss
4 □ Realschulabschluss/Polytechnische Oberschule
5 □ (Fach-)Abitur
6 □ Hochschulabschluss
7 □ anderer Schulabschluss

Berufsausbildung:
1 □ keine/abgebrochen
2 □ Berufsausbildung/Lehre
3 □ Sonstige: .....

Die folgende Frage bezieht sich auf die Tätigkeit, die Sie überwiegend ausüben. Wählen Sie bitte nur eine Antwortkategorie aus.

Erwerbstätigkeit:
1 □ Auszubildende(r)
2 □ Angestellte(r), Beamte(r)
3 □ ArbeiterIn/FacharbeiterIn
4 □ Selbständige(r)/FreiberuflerIn
5 □ mithelfende(r) Familienangehörige(r)
6 □ Arbeitslose(r)
7 □ SchülerIn/StudentIn
8 □ Hausmann/Hausfrau
9 □ RentnerIn
10 □ berufl. Rehabilitation
11 □ Sonstige(r) Erwerbslose(r)
12 □ Sonstige

Trinken Sie Alkohol? 0 □ nein 1 □ ja

Rauchen Sie? 0 □ nein 1 □ ja

Wenn ja, wie viele Zigaretten rauchen Sie am Tag? _____

Sport:
An durchschnittlich wie vielen Tagen pro Woche treiben Sie Sport? _____

Wie viele Minuten dauert eine für Sie typische Trainingseinheit? _____

QUESTIONNAIRES

ADONIS COMPLEX QUESTIONNAIRE (Pope et al., 2000)

1. Wieviel Zeit verbringen Sie damit, sich über irgendeinen Aspekt Ihrer äußerlichen Erscheinung Sorgen zu machen (nicht nur darüber nachzudenken, sondern sich tatsächlich darum zu sorgen)?

    a. Unter 30 Minuten
    b. 30 – 60 Minuten
    c. mehr als 60 Minuten

2. Wie oft sind Sie unglücklich wegen Ihrer Sorgen um Ihr Aussehen (das heißt auch: erregt, ängstlich oder deprimiert)?

    a. Nie oder selten
    b. Manchmal
    c. Häufig

3. Wie oft vermeiden Sie, dass andere Ihren ganzen Körper oder Teile davon zu sehen bekommen? Zum Beispiel: wie oft vermeiden Sie Umkleidekabinen, Schwimmbäder oder Situationen, in denen Sie sich ausziehen müssten? Alternativ, wie oft tragen Sie spezielle Kleidungsstücke, um Ihre körperliche Erscheinung zu verändern oder zu kaschieren – so wie zum Beispiel einen Hut, um das Haar zu verstecken oder weite Kleidung, um den Körper zu verdecken?

    a. Nie oder selten
    b. Manchmal
    c. Häufig

4. Wieviel Zeit verbringen Sie insgesamt jeden Tag mit Körperpflege, um Ihr Aussehen zu verbessern?

    a. Unter 30 Minuten
    b. 30 – 60 Minuten
    c. mehr als 60 Minuten

5. Wieviel Zeit investieren Sie insgesamt täglich für körperliche Aktivitäten, um Ihr Aussehen zu verbessern, z.B. Gewichtheben, Sit-ups oder Joggen auf dem Laufband? (Bitte zählen Sie hierzu nur die sportlichen Aktivitäten, die Sie hauptsächlich zur Verbesserung Ihres Aussehens betreiben).

    a. Unter 30 Minuten
    b. 30 – 120 Minuten
    c. mehr als 120 Minuten

6. Wie oft machen Sie Diäten oder essen spezielle Nahrungsmittel (z.B. hoch proteinhaltige oder low-fat Nahrungsmittel), oder nehmen Nahrungsmittelzusätze, speziell um Ihr Aussehen zu verbessern?

    a. Nie oder selten
    b. Manchmal
    c. Häufig

7. Wieviel Ihres Einkommens geben Sie für Dinge aus, die Ihr Aussehen verbessern sollen (z.B. Diätnahrungsmittel, Zusätze, Haarprodukte, Kosmetik und kosmetische Behandlungen, Trainingszubehör oder Fitnessstudiomitgliedschaft)?

    a. Einen nicht nennenswerten Betrag.
    b. Eine beträchtliche Summe, jedoch nie bis zu dem Punkt, wo finanzielle Probleme entstehen würden.
    c. Genug, um in irgendeiner Weise finanzielle Probleme zu verursachen.

8. Wie stark haben Ihre auf das Aussehen bezogenen Verhaltensweisen Ihre sozialen Kontakte untergraben? Haben beispielsweise Ihr Training, Ihre Diäten oder anderes Ihre Beziehung zu anderen Menschen beeinträchtigt?

    a. Gar nicht
    b. Ein wenig
    c. Sehr stark

9. Wie oft ist Ihr Sexualleben durch Unsicherheit bezüglich Ihres Aussehens beeinträchtig worden?

    a. Nie oder selten
    b. Manchmal
    c. Häufig

10. Wie oft haben Sorgen um Ihr Aussehen bzw. hiermit verbundene Aktivitäten Ihren Job oder Karriere (oder, falls Sie Schüler oder Student sind, Ihre Lernleistungen) beeinträchtigt? Kamen Sie beispielsweise zu spät, verpassten die Arbeit oder Schule, arbeiteten unter Ihrem Potential oder verpassten Aufstiegschancen wegen Bedürfnissen oder Selbstunsicherheiten, die mit Ihrem Aussehen zusammenhängen?

    a. Nie oder selten
    b. Manchmal
    c. Häufig

11. Wie oft haben Sie aufgrund von Sorgen um Ihr Äußeres vermieden, von anderen Leuten gesehen zu werden (z. B. indem Sie nicht zur Schule, Arbeit, sozialen Anlässen oder in die Öffentlichkeit gingen)?

    a. Nie oder selten
    b. Manchmal
    c. Häufig

12. Haben Sie jemals irgendeine Sorte Drogen oder Medikamente – legal oder illegal – genommen, um muskulöser zu werden, Gewicht zu verlieren oder auf irgendeine andere Art und Weise Ihr Aussehen zu verbessern?

    a. Nie
    b. Nur legale Substanzen, frei käuflich oder über Verschreibungen
    c. Legale und Illegale Substanzen, Steroide, Diätpillen

13. Wie oft haben Sie extreme Maßnahmen (mit Ausnahme von Substanzmissbrauch) ergriffen, um Ihr Aussehen zu verändern? (Gemeint ist zum Beispiel exzessives Training, Training selbst bei Verletzung, Fastenkuren oder andere ungesunde Diätmethoden, Erbrechen, Gebrauch von Abführmitteln, ungewöhnliche Techniken für Muskelzuwachs, Haarwuchs, Penisvergrößerung, etc.)

    a. Nie oder selten
    b. Manchmal
    c. Häufig

MUSCLE DYSMORPHIA QUESTIONNAIRE (Pope et al., 2000)

1. Machen Sie sich häufig Sorgen, dass Ihr Körper nicht ausreichend schlank und muskulös ist?
2. Haben Sie Sozialkontakte, die Sie normalerweise genossen hätten, aufgegeben, weil Sie die Zeit brauchten, speziell um im Fitnessstudio zu trainieren?
3. Stört sich Ihr Bedürfnis zu trainieren mit Ihrem Job – zum Beispiel, so dass Sie Arbeitszeiten verpassen, sich zu häufig frei nehmen oder Karrieremöglichkeiten nicht in Anspruch nehmen?
4. Haben Sie häufig spezielle Diäten gemacht, zum Beispiel Hoch-Protein- oder Niedrig-Fett-Diäten, oder haben Sie große Mengen von Protein- oder anderen Nahrungszusätzen benutzt, um Ihre Muskulatur zu verbessern?
5. Haben Sie viel Geld für besondere Nahrungsmittel oder –zusätze, z. B. Eiweißpulver, Aminosäuren, Creatin oder andere Substanzen, die angeboten werden, um die Muskulatur zu verbessern, ausgegeben?
6. Haben Sie jemals Einladungen zu Restaurants, Parties oder Abendessen aufgrund besonderer Diätvorschriften abgesagt?
7. Vermeiden Sie Situationen, wo andere Leute Ihren Körper sehen könnten, wie zum Beispiel Strände, Schwimmbäder, Umkleidekabinen oder öffentliche Duschen, weil Sie sich Sorgen machen, nicht muskulös genug auszusehen?
8. Tragen Sie manchmal schwere, weite Kleidungsstücke, wie baggy Trainingshosen oder Sweatshirts, um Ihren Körper zu verstecken, weil Sie sich Sorgen machen, dass sie nicht muskulös genug aussehen?
9. Tragen Sie manchmal Kleidungsstücke in mehreren Schichten übereinander, z. B. drei T-Shirts übereinander, weil Sie hoffen, dass Sie so breiter aussehen?
10. Suchen Sie gezielt Kleidungsstücke aus, von denen Sie denken, dass sie Sie muskulöser machen?
11. Nehmen Sie häufig die Maße Ihres Körpers, z. B. indem Sie mit einem Maßband Ihre Taille, Brust oder den Bizeps überprüfen?
12. Haben Sie jemals weitertrainiert, obwohl Sie verletzt waren, weil Sie befürchteten, an Muskelmasse zu verlieren, falls Sie das Training unterbrechen würden?
13. Haben Sie jemals Medikamente oder bestimmte Substanzen (sowohl legale als auch illegale wie Anabolika) genommen, um muskulöser zu werden?
14. Vergleichen Sie häufig Ihre Muskularität mit derer anderer Männer in Ihrem Umfeld, weil Sie befürchten, dass diese stärker als Sie sein könnten?
15. Wenn Sie einen Mann sehen, der deutlich muskulöser ist als Sie, denken Sie einige Zeit später noch darüber nach oder fühlen Sie neidisch?

EXERCISE DEPENDENCE SCALE (Smith et al., 1998)

Bitte geben Sie an, wie oft sie mit den folgenden Aussagen übereinstimmen: Auf einer Skala von Nie (1) bis Immer (5) kreuzen Sie bitte neben jeder Aussage bzw. Frage die passende Zahl an. Bitte verstehen Sie unter dem allgemeinen Begriff „Training“ das spezifische Training, welches Sie selber vorrangig betreiben, das heißt Krafttraining, Au*SD*auertraining, Technik, Jogging etc.

		Nie	Selten	Manchmal	Oft	Immer
1.	Trainieren Sie jemals, wenn Sie eine Erkältung oder eine Grippe haben?	1	2	3	4	5
2.	Trainieren Sie jemals weiter , wenn Sie verletzt sind?	1	2	3	4	5
3.	Ich würde kein planmäßiges Training versäumen, selbst wenn mir gar nicht nach trainieren zumute ist.	1	2	3	4	5
4.	Ich habe Schuldgefühle, wenn ich eine Trainingseinheit verpasse.	1	2	3	4	5
5.	Falls ich eine Trainingseinheit verpasst habe, fühle ich mich, als ob meine Kraft / Muskulatur / Au*SD*auer / Fitness o.ä. abnehmen würde.	1	2	3	4	5
6.	Meine Familie und/oder Freunde haben sich bereits über die Menge an Zeit, die ich in mein Training investiere, beschwert.	1	2	3	4	5
7.	Das Training hat meinen Lebensstil total verändert.	1	2	3	4	5
8.	Ich plane meine anderen täglichen Aktivitäten um meine Trainingszeiten herum.	1	2	3	4	5
9.	Im Fall eines Interessenkonflikts zwischen meinem Training und meinem Job, würde mein Training an erster Stelle stehen.	1	2	3	4	5

BODY ESTEEM SCALE (Franzoi & Shields, 1984)

Instruktionen: Auf dieser Seite sind eine Reihe von Körperteilen und Funktionen aufgelistet. Bitte lesen Sie jedes Item und geben Sie, unter Gebrauch der folgenden Skala, an wie Sie sich in Bezug auf diesen Körperteil oder diese Funktion ihres eigenen Körpers fühlen:

1 = Ich habe starke negative Gefühle
2 = Ich habe mittelmäßige negative Gefühle
3 = Ich habe weder ein gutes noch ein schlechtes Gefühl
4 = Ich habe mittelmäßige positive Gefühle
5 = Ich habe starke positive Gefühle

1. Körpergeruch _____
2. Appetit _____
3. Nase _____
4. Physische Ausdauer _____
5. Reflexe _____
6. Lippen _____
7. Muskelkraft _____
8. Taille _____
9. Energie _____
10. Oberschenkel _____
11. Ohren _____
12. Bizeps _____
13. Kinn _____
14. Statur _____
15. Physische Koordination _____
16. Gesäß _____
17. Beweglichkeit _____
18. Breite der Schultern _____
19. Arme _____
20. Brust _____
21. Aussehen der Augen _____
22. Wangen/Wangenknochen _____
23. Hüften _____
24. Beine _____
25. Figur _____
26. Sexualtrieb _____
27. Füße _____
28. Geschlechtsorgane _____
29. Aussehen des Bauches _____
30. Gesundheit _____
31. Sexuelle Aktivität _____
32. Körperbehaarung _____
33. Gesundheitlicher Zustand _____
34. Gesicht _____
35. Gewicht _____

BODY-ESTEEM SCALE FOR ADOLESCENTS AND ADULTS

(Mendelsohn et al., 1995)

Bitte geben Sie an, wie oft sie mit den folgenden Aussagen übereinstimmen*:* Auf einer Skala von Nie (1) bis Immer (5) kreuzen Sie bitte neben jeder Aussage die passende Zahl an.

		Nie	Selten	Manchmal	Oft	Immer
1.	Ich mag, wie ich auf Fotos aussehe	1	2	3	4	5
2.	Andere Leute halten mich für gutaussehend	1	2	3	4	5
3.	Ich bin stolz auf meinen Körper	1	2	3	4	5
4.	Ich bin sehr mit dem Versuch beschäftigt, mein Körpergewicht zu verändern	1	2	3	4	5
5.	Ich glaube, dass mein Aussehen mir helfen könnte, einen Job zu bekommen.	1	2	3	4	5
6.	Ich mag, was ich sehe, wenn ich in den Spiegel sehe.	1	2	3	4	5
7.	Es gibt viele Dinge, die ich an meinem Aussehen ändern würde, wenn ich könnte.	1	2	3	4	5
8.	Ich bin zufrieden mit meinem Gewicht.	1	2	3	4	5
9.	Ich wünschte, ich sähe besser aus.	1	2	3	4	5
10.	Ich mag wirklich, wie viel ich wiege.	1	2	3	4	5
11.	Ich wünschte, ich sähe wie jemand anders aus.	1	2	3	4	5
12.	Leute meines Alters finden mein Aussehen gut.	1	2	3	4	5
13.	Mein Aussehen regt mich auf.	1	2	3	4	5
14.	Ich sehe so gut aus wie die meisten Leute.	1	2	3	4	5
15.	Ich bin ziemlich glücklich über mein Aussehen.	1	2	3	4	5
16.	Ich habe das Gefühl, mein Gewicht ist für meine Größe genau richtig.	1	2	3	4	5
17.	Ich schäme mich dafür, wie ich aussehe.	1	2	3	4	5
18.	Mich zu wiegen, deprimiert mich.	1	2	3	4	5
19.	Mein Gewicht macht mich unglücklich.	1	2	3	4	5
20.	Mein Aussehen hilft mir, Verabredungen mit Frauen (Männern) einzugehen.	1	2	3	4	5
21.	Ich mache mir Sorgen darüber, wie ich aussehe.	1	2	3	4	5
22.	Ich denke, ich habe einen guten Körper.	1	2	3	4	5
23.	Ich sehe so gut aus, wie ich es mir wünsche.	1	2	3	4	5

SOZIALE ANGST VOR NEGATIVER BEWERTUNG

(Vormbrock & Neuser, 1983)

Anleitung: Im Folgenden finden Sie eine Anzahl von Feststellungen. Lesen Sie bitte jede Feststellung durch und wählen Sie aus den vier Antworten diejenige aus, die angibt, was *im Allgemeinen* für Sie zutrifft. Kreuzen Sie bitte bei jeder Feststellung die Zahl unter der von Ihnen gewählten Antwort an. Es gibt keine richtigen und falschen Antworten.

trifft fast nie zu 1	trifft manch-mal zu 2	trifft oft zu 3	trifft fast immer zu 4

1.	Es macht mich unruhig, wenn andere mich für albern halten.....	1	2	3	4
2.	Was andere von mir denken, macht mich unruhig, auch wenn ich weiß, dass ihre Meinung keine Folgen hat.....	1	2	3	4
3.	Ich werde gespannt und zappelig, wenn ich weiß, dass mich jemand mustert.....	1	2	3	4
4.	Es macht mir kein Kopfzerbrechen, wenn ich weiß, dass Leute sich ein schlechtes Bild von mir machen.....	1	2	3	4
5.	Ich werde sehr nervös, wenn ich im Umgang mit anderen einen Fehler mache.....	1	2	3	4
6.	Die Meinungen, die wichtige Personen von mir haben, machen mir Kopfzerbrechen.....	1	2	3	4
7.	Ich habe keine Angst, dass ich lächerlich aussehe oder mich zum Narren machen könnte.....	1	2	3	4
8.	Ich habe Angst vor Leuten, die meine Schwächen bemerken.....	1	2	3	4
9.	Ich bin beunruhigt darüber, welchen Eindruck ich auf jemanden mache.....	1	2	3	4
10	Ich fürchte, dass andere mich nicht anerkennen.....	1	2	3	4
11.	Ich befürchte nicht, dass andere etwas an mir auszusetzen haben.....	1	2	3	4
12.	Die Meinung anderer über mich, bringt mich nicht aus der Ruhe.....	1	2	3	4
13.	Ich werde immer gleich nervös, wenn ich jemandem nicht gefalle.....	1	2	3	4
14.	Wenn ich mich mit jemandem unterhalte, habe ich Angst davor, was der andere von mir denkt.....	1	2	3	4
15.	Ich mache mir keine Sorgen darüber, welchen Eindruck ich auf andere mache.....	1	2	3	4
16.	Ich mache mir Sorgen darüber, was meine Vorgesetzten von mir denken.....	1	2	3	4
17.	Es beunruhigt mich nicht, wenn andere mich für wertlos halten.....	1	2	3	4
18.	Ich glaube, zu sehr mit dem beschäftigt zu sein, was andere von mir denken.....	1	2	3	4
19.	Ich fürchte, Falsches zu tun oder zu sagen.....	1	2	3	4
20.	Ich werde gespannt und zappelig, wenn ich weiß, dass ich von meinen Vorgesetzten beurteilt werde.....	1	2	3	4

BECK DEPRESSIONS INVENTAR (Beck, 1961)

Die folgenden beiden Seiten enthalten Gruppen von Aussagen. Bitte lesen Sie jede Gruppe sorgfältig durch. Kreuzen Sie die eine Aussage jeder Gruppe an, die am besten beschreibt, wie Sie sich in dieser Woche einschließlich heute gefühlt haben! Falls mehrere Aussagen in einer Gruppe gleichermaßen zuzutreffen scheinen, können Sie auch mehrere Ziffern ankreuzen. Lesen Sie auf jeden Fall alle Aussagen in jeder Gruppe, bevor Sie Ihre Wahl treffen.

A		G	
0	Ich fühle mich nicht traurig.	0	Ich bin nicht von mir enttäuscht.
1	Ich fühle mich traurig.	1	Ich bin von mir enttäuscht.
2	Ich bin die ganze Zeit traurig und komme nicht davon los.	2	Ich finde mich fürchterlich.
3	Ich bin so traurig oder unglücklich, daß ich es kaum noch ertrage.	3	Ich hasse mich.
B		H	
0	Ich sehe nicht besonders mutlos in die Zukunft.	0	Ich habe nicht das Gefühl, schlechter zu sein als alle anderen.
1	Ich sehe mutlos in die Zukunft.	1	Ich kritisiere mich wegen meiner Fehler oder Schwächen.
2	Ich habe nichts, worauf ich mich freuen kann.	2	Ich mache mir die ganze Zeit Vorwürfe wegen meiner Mängel.
3	Ich habe das Gefühl, daß die Zukunft hoffnungslos ist, und daß die Situation nicht besser werden kann.	3	Ich gebe mir für alles die Schuld was schiefgeht.
C		I	
0	Ich fühle mich nicht als Versager.	0	Ich denke nicht daran, mir etwas anzutun.
1	Ich habe das Gefühl, öfter versagt zu haben als der Durchschnitt.	1	Ich denke manchmal an Selbstmord, ich würde es aber nicht tun.
2	Wenn ich auf mein Leben zurückblicke, sehe ich bloß eine Menge Fehlschläge.	2	Ich möchte mich am liebsten umbringen.
3	Ich habe das Gefühl, als Mensch ein völliger Versager zu sein.	3	Ich würde mich umbringen, wenn ich es könnte.
D		J	
0	Ich kann die Dinge genauso genießen wie früher.	0	Ich weine nicht öfter als früher.
1	Ich kann die Dinge nicht mehr so genießen wie früher.	1	Ich weine jetzt mehr als früher.
2	Ich kann aus nichts mehr eine echte Befriedigung mehr ziehen.	2	Ich weine jetzt die ganze Zeit.
3	Ich bin mit allem unzufrieden oder gelangweilt.	3	Früher konnte ich weinen, aber jetzt kann ich es nicht mehr, obwohl ich es möchte.
E		K	
0	Ich habe keine Schuldgefühle.	0	Ich bin nicht reizbarer als sonst.
1	Ich habe häufig Schuldgefühle.	1	Ich bin jetzt leichter verärgert oder gereizt als früher.
2	Ich habe fast immer Schuldgefühle.	2	Ich fühle mich dauernd gereizt.
3	Ich habe immer Schuldgefühle.	3	Die Dinge, die mich früher geärgert haben, berühren mich nicht mehr.
F		L	
0	Ich habe nicht das Gefühl, gestraft zu sein.	0	Ich habe nicht das Interesse an anderen Menschen verloren.
1	Ich habe das Gefühl, vielleicht bestraft zu sein.	1	Ich interessiere mich jetzt weniger für andere Menschen als früher.
2	Ich erwarte, bestraft zu werden.	2	Ich habe mein Interesse an anderen Menschen zum größten Teil verloren.
3	Ich habe das Gefühl, bestraft zu gehören.	3	Ich habe mein ganzes Interesse an anderen Menschen verloren.

M

0 Ich bin so entschlussfreudig wie immer.
1 Ich schiebe jetzt Entscheidungen öfter als früher auf.
2 Es fällt mir jetzt schwerer als früher, Entscheidungen zu treffen.
3 Ich kann überhaupt keine Entscheidungen mehr treffen.

N

0 Ich habe nicht das Gefühl, schlechter auszusehen als früher zusehen als früher.
1 Ich mache mir Sorgen, daß ich alt oder unattraktiv aussehe.
2 Ich habe das Gefühl, daß in meinem Aussehen Veränderungen eingetreten sind, die mich unattraktiv machen.
3 Ich finde mich häßlich.

O

0 Ich kann genauso gut arbeiten wie früher.
1 Ich muß mir einen Ruck geben, bevor ich eine Tätigkeit in Angriff nehme.
2 Ich muß mich zu jeder Tätigkeit zwingen.
3 Ich bin unfähig zu arbeiten.

P

0 Ich schlafe so gut wie sonst.
1 Ich schlafe nicht mehr so gut wie früher.
2 Ich wache 1 bis 2 Stunden früher auf als sonst und es fällt mir schwer wieder einzuschlafen.
3 Ich wache mehrere Stunden früher auf als sonst und kann nicht mehr einschlafen.

Q

0 Ich ermüde nicht stärker als sonst.
1 Ich ermüde schneller als früher.
2 Fast alles ermüdet mich.
3 Ich bin zu müde, um etwas zu tun.

R

0 Mein Appetit ist nicht schlechter als sonst.
1 Mein Appetit ist nicht mehr so gut wie früher.
2 Mein Appetit hat sehr stark nachgelassen.
3 Ich habe überhaupt keinen Appetit mehr.

S

0 Ich habe in letzter Zeit kaum abgenommen.
1 Ich habe mehr als zwei Kilo abgenommen.
2 Ich habe mehr als fünf Kilo abgenommen.
3 Ich habe mehr als acht Kilo abgenommen.

Ich esse absichtlich weniger, um abzunehmen:

ja O nein O

T

0 Ich mache mir keine größeren Sorgen um meine Gesundheit als sonst.
1 Ich mache mir Sorgen über körperliche Probleme, wie Schmerzen, Magenbeschwerden oder Verstopfung.
2 Ich mache mir so große Sorgen über gesundheitliche Probleme, daß es mir schwerfällt, an etwas anderes zu denken.
3 Ich mache mir so große Sorgen über meine gesundheitlichen Probleme, daß ich an nichts anderes denken kann.

U

0 Ich habe in letzter Zeit keine Veränderung meines Interesses an Sexualität bemerkt.
1 Ich interessiere mich jetzt weniger für Sexualität als früher.
2 Ich interessiere mich jetzt viel weniger für Sexualität.
3 Ich habe das Interesse für Sexualität völlig verloren.

TABLES

Table A 1

Education level and professional status by groups

	BDBB[a]	nBDBB[b]	Triathletes[c]
10th grade	4	8	2
13th grade	3	7	9
College degree	3	3	9
Employee	6	13	9
Freelancer	1	2	3
Student	3	3	7
Unemployed	0	0	1

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders.

[a] n=10. [b] n=18. [c] n=20.

Table A 2

Box-M Test for homogeneity of covariance matrices, for all variables included in MANOVAs, ANOVAs or ANCOVAs

Box M-Test	*F*	*df1*	*df2*	*p*
159.53	1.14	78	1743	.20

Table A 3

Levene-Tests for homogeneity of residual variance, for variables included in MANOVAs, ANOVAs or ANCOVAs

	F (2, 38)	*p*
Body size perception at pretest	0.05	.95
Body size perception at posttest	0.39	.68
Perceptual discrimination consistency at pretest	3.74	.03
Perceptual discrimination consistency at posttest	0.01	.99
Body satisfaction at pretest	1.07	.35
Body satisfaction at posttest	0.55	.58
Ideal body	1.43	.25
BDI	4.20	.02
BESAA	0.26	.77
BES	1.70	.20
ExDS	0.28	.76
SANB	0.13	.88

Table A 4

Means (SD) of perceptual discrimination consistency (PDC) in percentage at pretest and posttest by groups, and One-Way Analyses of Variance

PDC	BDBB[a]	nBDBB[b]	Triathletes[c]	*F*
Pretest	5.8 (6.8)	7.9 (5.5)	8.6 (6.8)	0.64, n.s.
Posttest	8.6 (7.8)	8.4 (5.2)	9.0 (8.0)	0.04, n.s.

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders.

[a] n=10. [b] n=18. [c] n=20.

n.s. = not significant.

Table A 5

Means (SD) of satisfaction ratings of single body parts at pretest and posttest by groups, One -Way Analyses of Variance

Satisfaction	BDBB[a]	nBDBB[b]	Triathletes[c]	*F*
Chest, pretest	3.10 (1.0)	3.50 (1.0)	3.85 (0.9)	2.18
Chest, posttest	$3.50\ (0.9)_{a}$	$3.44\ (1.2)_{a}$	$3.90\ (1.0)_{a}$	1.03
Arms, pretest	$3.30\ (0.8)_{a}$	$3.61\ (0.7)_{a}$	$3.65\ (1.0)_{a}$	0.64
Arms, posttest	$3.40\ (1.1)_{a}$	$3.44\ (1.0)_{a}$	$3.80\ (0.9)_{a}$	0.83
Lower body, pretest	$2.90\ (0.6)_{a}$	$3.06\ (0.9)_{a}$	$3.80\ (0.7)_{b}$	7.32 **
Lower body, posttest	$3.30\ (0.7)_{a,b}$	$3.11\ (0.6)_{a}$	$3.80\ (0.9)_{b}$	4.25 *
Stomach, pretest	$2.50\ (2.1)_{a}$	$2.61\ (0.9)_{a}$	$3.15\ (1.2)_{a}$	1.82
Stomach, posttest	$2.60\ (1.2)_{a}$	$2.90\ (0.8)_{a}$	$3.40\ (1.3)_{a}$	2.02
Musculature, pretest	$3.30\ (0.8)_{a}$	$3.56\ (0.8)_{a}$	$3.87\ (0.9)_{a}$	1.02
Musculature, posttest	$3.40\ (0.7)_{a}$	$3.67\ (0.6)_{a}$	$3.90\ (0.9)_{a}$	1.47
Fitness, pretest	$2.80\ (1.7)_{a}$	$3.89\ (0.8)_{b}$	$3.80\ (1.0)_{a,b}$	3.45 *
Fitness, posttest	$2.90\ (1.4)_{a}$	$3.83\ (1.1)_{a,b}$	$4.15\ (0.9)_{b}$	4.56 *
Attractiveness, pretest	$2.50\ (1.2)_{a}$	$3.72\ (0.9)_{b}$	$3.45\ (0.7)_{b}$	6.37 **
Attractiveness, posttest	$2.7\ (0.8)_{a}$	$3.72\ (0.8)_{b}$	$3.60\ (0.7)_{b}$	6.80 **

Note. BDBB = bodydysmorphic bodybuilders. nBDBB = non-bodydysmorphic bodybuilders. Means in the same row that do not share subscripts differ at $p < .05$ or less in the Tukey honestly significant difference comparison. Satisfaction is rated from 0 (*not satisfied at all*) to 5 (*extremely satisfied*).

[a] $n=10$. [b] $n=18$. [c] $n=20$.

*$p < .05$. **$p < .01$.

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Hiermit versichere ich, dass ich die Arbeit selbständig verfasst, keine unerlaubte fremde Hilfe in Anspruch genommen, sie noch in keinem anderen Prüfungsverfahren vorgelegt und keine anderen als die in der Dissertation aufgeführten Quellen benutzt habe und dass es sich bei dem eingereichten Exemplar um ein Original handelt.

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