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Factors related to muscle-building supplement use and non-use in males.

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FACTORS RELATED TO MUSCLE-BUILDING SUPPLEMENT USE AND NON-USE IN MALES

by

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ABSTRACT

Although researchers have begun to study issues related to anabolic steroid use among males, similar studies focusing on legal muscle-building supplements are virtually non-existent. This is despite the likelihood that there are far more users of legal muscle-building supplements than users of anabolic-androgenic steroids. Given that supplements that purport to increase lean muscularity have not been found to be effective and may pose health risks to users, the identification of user characteristics and reasons for use are necessary in order to design education and prevention programs. Variables that have been studied with women in the context of eating pathology have not yet been studied with men, despite the parallels that have been drawn between males' desire for muscularity and females' desire for thinness. These variables include awareness and internalization of sociocultural ideals, frequency of social comparison, and teasing history. The present study sought to expand the existing literature by assessing the relationships between these variables and muscle-building supplement use. Ninety-eight males who met a minimum exercise requirement were administered: a) queries regarding history of muscle-building supplement use; b) the Multidimensional Body-Self Relations Questionnaire; c) the Sociocultural Attitudes Towards Appearance Scale; d) queries regarding frequency of social comparison; e) queries regarding history of being teased for thinness, fatness, and weakness; and f) the Eating Disorder Inventory. Participant groups included 35 non-users, 27 former users, and 36 current users. Current and former users' perceived muscularity was greater than that for non-users. Current users were reportedly more oriented towards fitness and health than non-users and were also reportedly teased for thinness as children more than non-users and former users. Perceived muscularity, reported orientation towards fitness and health and history of being teased for thinness were predictive of supplement use versus non-use. Orientation towards fitness and health was not predictive when former users were

included. Males used muscle-building supplements in order to increase muscularity and strength. Non-users and former users believed they could achieve muscularity through diet and exercise and were concerned about health risks associated with supplement use, though cost was also highly prohibitive. Preliminary recommendations for education and prevention efforts were provided.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I: INTRODUCTION

Overview

The use of anabolic-androgenic steroids (AAS) has become a considerable social problem, with approximately 1 to 3 million users in the United States alone (Kutscher, Lund, & Perry, 2002). Rates of use do not appear to have abated despite the fact that AAS are controlled substances that carry legal penalties for non-medicinal use (Department of Justice - Canada, 1996) and have been associated with numerous adverse health and psychological effects (Yesalis, 2000). The attraction for AAS, particularly among males, lies in their apparent ability to increase lean muscle mass. This is an effect that is also promised through some over-the-counter supplements. Although these supplements are legal, they are not regulated by the FDA and have therefore not been rigorously tested for either beneficial or adverse effects (United States Congress, 1994). Despite the claims of supplement manufacturers, supportive findings have not been consistently reported in the scientific research literature (Juhn, 2003). The overall prevalence of muscle-building supplement use is unknown at this time, but it is likely to be relatively common due to their legality, wide availability without a prescription, and males' interest in muscle-building as evidenced by the high estimates of illegal AAS use. Since relatively little is known about supplement use among males, more research is needed to determine prevalence rates and correlates of use.

Given the negative consequences associated with AAS use, and the lack of evidence supporting the efficacy of muscle-building supplements, why are males using these substances? The answers to this question appear to lie in the domains of athletic improvement and appearance enhancement (Blouin & Goldfield, 1995; Grunewald & Bailey, 1993; Yesalis, 2000). Not surprisingly, exercise and body dissatisfaction are reportedly related to the use of both AAS and muscle-building supplements (Andersen, Barlett, Morgan, & Brownell, 1995; Kanayama, Gruber, Pope, Borowiecki, & Hudson,

2001; Wroblewska, 1997). However, there remains a dearth of research literature concerning muscle-building supplements and their relationships to both exercise and body image.

Other gaps in the research literature exist concerning additional possible psychological and social correlates of AAS and supplement usage. Given the prominence in the eating disorders literature of theories concerning sociocultural norms of beauty, social comparison, and childhood teasing in females (Stormer & Thompson, 1996; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999), as well as the parallels that have been drawn between females' desire to be thinner and males' desire to be larger and more muscular (Pope, Phillips, & Olivardia, 2000), it is surprising that these theories have not been more extensively assessed in relation to males.

Sociocultural norms of attractiveness for males involve a lean and muscular body (Leit, Gray, & Pope, 2002). Despite the intuitive connection between these norms and AAS/muscle-building supplement use, researchers have only recently begun to study AAS use as it relates to societal ideals (Pope, Phillips, & Olivardia, 2000), and have not yet studied muscle-building supplement use in this context. This is despite the proliferation of supplements explicitly designed to help people lose fat and/or gain muscle, and the intuitive connection that is drawn with society's ideals of a lean and very muscular man (Leit, Gray, & Pope, 2002). Furthermore, although the relationships between social comparison and body dissatisfaction have been studied in males (Ricciardelli, McCabe, & Banfield, 2000), no studies have focused on the possible links between social comparisons with others' bodies and AAS or muscle-building supplement use. Lastly, although little studied among men, it has been reported that boys who have been teased about their appearance are more likely to be dissatisfied with their bodies than those who have not been teased (Gardner, Sorter, & Friedman, 1997). Given this finding, as well as the documented links between teasing and eating disturbance in

women (Stormer & Thompson, 1996), a study of the possible relationships between teasing history and AAS and supplement use in males is warranted.

Although it was initially hoped that a group comprised of AAS users would participate in this study, and would serve as a comparison group for those who used legal muscle-building supplements and those who used neither substance, this ultimately was not the case. Despite the exclusion of AAS users as a group, this study's exclusive focus on users and non-users of legal muscle-building supplements serves an important purpose as it fills gaps in the research literature involving body-change methods in males. As previously stated, the use of these supplements is likely to be relatively common among the general population due to their legality, wide availability without a prescription, and males' interest in muscle-building as evidenced by the high estimates of illegal AAS use. Despite this, very little is known about the characteristics of users versus non-users. With this in mind, the present study sought to identify the correlates and predictors of usage and non-usage of muscle-building supplements, and males' reasons for either using or not using such substances. Hypothesized predictors included body dissatisfaction, evaluation of and orientation toward fitness, health, and illness, awareness and internalization of society's muscular-ideal for males, frequency of social comparison, history of teasing, and eating pathology. Based upon the findings, preliminary recommendations for education and prevention efforts were presented.

Anabolic-Androgenic Steroids

Definition and Effects Associated with Use

Anabolic-androgenic steroids (AAS) are synthetic derivatives of the hormone testosterone. Although AAS are commonly used in the treatment of various health problems, their use by both athletes and non-athletes in order to enhance performance and obtain a lean, muscular figure has been well documented (American Academy of Pediatrics, 1997; Yesalis, 2000; Yesalis, Kennedy, Kopstein, & Bahrke, 1993). The

distribution or use of AAS for these non-medical purposes has been illegal in the United States since the late 1980s, when the Anti-Drug Abuse Act came into effect (Hallagan, Hallagan, & Snyder, 1988). In 1990, with the introduction of the Anabolic Steroid Control Act, AAS moved to the level of Schedule III controlled substances, and users and traffickers began to be viewed by the legal system in the same manner as those involved with such substances as cocaine (Yesalis & Cowart, 1998). In 1996, Canada passed similar legislation with its introduction of the Controlled Drugs and Substances Act, which mandated that the use or sale of AAS without a prescription could be punishable by a fine, imprisonment, or both (Department of Justice - Canada, 1996).

Though it has not been consistently supported in the research literature, it is generally acknowledged that AAS are used to increase lean body mass and strength (Kutscher, Lund, & Perry, 2002). These functions have been supported in several controlled studies involving administration of AAS (Bhasin, Storer, Berman, Callegari, Clevenger, Phillips, et al., 1996; Friedl, 2000a; Kutscher et al., 2002).

Despite the reported gains that can be achieved through AAS use, numerous adverse health effects have also been described in the research literature (Friedl, 2000b). Effects range from the relatively benign, such as acne and hair loss, to those that are more serious, including stroke, prostate problems, liver toxicity, tumours, and heart disease related to a decrease in the proportion of HDL versus LDL cholesterol in the bloodstream. Although it has often not been possible to draw direct, causal links between AAS and these serious conditions, they are commonly cited in the AAS literature since users seem to be at a higher risk (Friedl, 2000a; Yesalis & Cowart, 1998). Additional complications associated with AAS use involve physical and psychological dependence (Brower, Blow, Young, & Hill, 1991; Kashkin & Kleber, 1988; Williamson & Young, 1992), and increased aggression (Bahrke, 2000). Links have also been found between AAS use and increases in the full range of affective disorders, and

psychotic symptoms that include paranoia, auditory hallucinations, and delusions (Pope & Katz, 1988; Pope & Katz, 1994; Pope, Kouri, & Hudson, 2000; Su, Pagliaro, Schmidt, Pickar, Wolkowitz, & Rubinow, 1993). Furthermore, in a comparison of AAS-using and non-using bodybuilders, users reportedly had lower self-esteem, as well as a greater number of symptoms that are associated with eating pathology, including interoceptive awareness, maturity fears, bulimic practices, and drive to achieve bulk (Blouin & Goldfield, 1995).

Prevalence Rates in the General Population

Researchers have only relatively recently begun to study and report on the prevalence rates of AAS use amongst different populations. The most widely studied population to date has been adolescents, with Canadian estimates of AAS use among young males ranging from 2.1% to 5.3% (Adalf & Smart, 1992; Boyce, 2004; Canadian Centre for Drug-Free Sport, 1993; Killip & Stennett, 1990; Melia, Pipe, & Greenberg, 1996). Estimates of lifetime use among adolescent males in the United States are higher than Canadian estimates, ranging from 4% to 11% (American Academy of Pediatrics, 1997; Buckley, Yesalis, Friedl, Anderson, Streit, & Wright, 1988; Johnston, O'Malley, & Bachman, 1997; Kann, et al., 1995, 1996). According to Bahrke, Yesalis, Kopstein, and Stephens (2000), these figures translate to approximately 375,000 adolescent male AAS users in the United States alone. In each of the aforementioned studies, the rates of use among males were significantly higher than those reported for females.

According to the Canadian Centre on Substance Abuse, 0.8% of Canadians aged 15 and older had used AAS within the previous month (Canadian Centre on Substance Abuse, 1999). Similarly, rates of lifetime AAS use among American males over the age of 12 has been found to be 0.9%, while 0.3% of males in the same group had used AAS during the previous year (Yesalis, Kennedy, Kopstein, & Bahrke, 1993). The researchers concluded that more than 300,000 people in the United States had

likely used AAS in the past year, with a slight majority being under the age of 26. They also estimated that over 1 million people aged 18 or older had used AAS at some time in their lives, with the slight majority being males aged 26 years and older. This figure was reiterated by Kutscher, Lund, and Perry (2002), who estimated that there are 1 to 3 million current or former AAS users in the United States alone.

Prevalence Rates Among Exercisers

For decades the purported benefits of AAS to increase lean muscle mass and strength have been attractive prospects for athletes hoping to reach and then win at the highest levels of competition (Yesalis, Courson, & Wright, 2000). To date, most studies of AAS use among athletes have been conducted with male competitive bodybuilders and powerlifters (Yesalis, Bahrke, Kopstein, & Barukiewicz, 2000). Estimates of lifetime use within these groups ranged from 19% of a sample of 41 males (McKillop, 1987) to 42% of a sample of 379 males (Delbeke, Desmet, & Debackere, 1995). Earlier estimates are significantly higher, with between 80% and 100% of national and international-level bodybuilders, weight-lifters, and field athletes using AAS in a 1984 report (Lamb, 1984). One study that utilized a Canadian sample reported similar findings (Blouin & Goldfield, 1995). In their comparison of AAS use in three sports they found that no martial artists and only one out of 48 runners had used AAS, while nearly half of the 43 bodybuilders admitted to use. When broken down according to level of bodybuilding, 78% of the competitive bodybuilders and 20% of the recreational bodybuilders had reportedly used AAS. Overall, 42% identified improvement in athletics as their primary reason for AAS use.

Other studies have confirmed the use of AAS among recreational bodybuilders in both the United States (Brower, Blow, & Hill, 1994; Kanayama, Gruber, Pope, Borowiecki, & Hudson, 2001; Kersey, 1993) and in Great Britain (Korkia & Stimson, 1993; Perry, Wright, & Littlepage, 1992). Kanayama et al. found that 5% of their sample

of 344 males working out in commercial gyms had used AAS within the previous three years. They extrapolated this figure to 300,000 gym members in the United States as a whole. Higher U.S. estimates were reported by Kersey and Brower et al., with 18% of 139 and 12% of 404 male weight trainers at health clubs and gyms admitting to AAS use. Brower et al. classified an additional 11% of their sample as "high-risk" non-users, since these males reportedly thought that they would try AAS in the future. Only 24% of the high-risk group and 44% of the AAS users were competitive bodybuilders. A majority of respondents indicated that they lifted weights to improve their performance in other sports, with 66% of the high-risk group and 57% of the AAS-using group participating in other sports activities. Interestingly, rates in Great Britain gyms are even higher than U.S. estimates, with 9% of a sample of 1,310 males (Korkia & Stimson) and 39% of a sample of 160 males (Perry et al.) reporting use of AAS at some time in their lives.

Muscle-building Dietary Supplements

Definition

The Food and Drug Administration (FDA) defines dietary supplements as any edible product that is used to augment one's regular diet, and that is not intended to diagnose, treat, cure, or prevent any disease (Kurtzweil, 1998). Substances that fall under this classification include vitamins, minerals, herbs, plant-derived substances, and amino acids, as well as any product that is created through the natural chemical breakdown of the aforementioned substances. Supplements are available in pill, powder, and liquid forms, and due to their status as food, do not require a prescription for purchase. A variety of functions are purportedly served by different supplements, and include improvements in mental and physical health, appearance and sports performance. The latter two categories include such anabolic effects as increased lean muscle mass and strength. Despite being allowed to make these claims, supplement

manufacturers must inform consumers that the FDA has not evaluated them (Kurtzweil, 1998).

Although the FDA has some control over the manufacture and sale of supplements, as outlined in the Dietary Supplement Health and Education Act (DSHEA; United States Congress, 1994), manufacturers have been given significant leeway in these areas. For example, while the DSHEA requires that manufacturers ensure the safety of their products prior to marketing, there are no regulations concerning the quantity or methodology of studies that are used as proof. Furthermore, manufacturers have no responsibility to either document their efficacy or report any adverse effects on consumers. Once a supplement is marketed, it is the FDA's responsibility to prove that it is unsafe before action can be taken to restrict its use. In this regard, difficulties with quality control have been noted, with some manufacturers failing to test ordered ingredients for contaminants or true composition prior to using them in their supplements (Kurtzweil, 1998).

In 1998 the Standing Committee on Health in the Canadian House of Commons met to discuss new guidelines for dietary health supplements that are manufactured and sold within the country (Canada; Parliament; House of Commons; Standing Committee on Health; Joseph Volpe, 1998). During this meeting it was agreed that the government should be responsible for assessing the safety of products, and that they would establish safety protocols and good manufacturing practices to ensure the purity and quality of supplements. Furthermore, the group agreed with claims that vitamin and mineral supplements, as well as many herbal supplements, likely pose a very low risk to the public. They would therefore be less rigorously regulated, monitored, and tested as compared with supplements providing health claims, including the aiding of health improvement or the reduction in risk of adverse health effects. New labelling rules were enacted in order to better inform consumers about the constituents of supplements, and

therefore labels must provide enough information to allow consumers to make an informed choice concerning use. These rules include the mandatory identification of any possible adverse effects associated with a product's use. Despite the likelihood of consumers experiencing negative side effects, "lower-safety" products would still be available without a prescription, provided that the label informed users of their risks.

It appears as though the leeway afforded supplement companies in the production of their products, at least in the United States, may put the public at an increased risk for harm. One recent example involved a purported sleep and muscle growth aid, Gamma Butyrolactone (GBL; Bove, 2002). In 1999 the FDA banned this supplement from the market after at least 55 reports of adverse effects associated with its use were received. These effects were often potentially serious, involving seizures and comas requiring the support of ventilators. A number of serious adverse effects, including death, have also been associated with non-anabolic supplements, including tryptophan and ephedra (Kurtzweil, 1998).

A related matter that may place consumers at an increased risk for harm related to supplement use is their unwillingness to consult with medical doctors prior to or concurrently with their period of usage (Fillmore, Bartoli, Bach, & Park, 1999). A large proportion of supplement users avoid telling their regular physician what they are taking out of fear that their use will be met with scepticism. While the possibility has not been explored in previous studies, it is also feasible that some users do not to discuss their supplementation because they believe that they have done sufficient research on their own, and do not need further advice from medical personnel. Related to this, users may believe that they know more about supplementation than their practitioners. This has been found to be the case with information concerning AAS and other substances banned in sport (Greenway & Greenway, 1997; Laure, Binsinger, & Lecerf, 2003). Nevertheless, if doctors are unaware of their patients' supplement usage they do not

have the opportunity to warn them of potential drug interactions or side effects that may be idiosyncratic to the patients' health status or prescription drug and dietary intake. Despite the potential dangers associated with supplement use and the failure to consult physicians, it is worth noting that a greater number of serious side effects and deaths that are reported have been associated with the use of prescription drugs (Fillmore et al.).

Since there are no requirements that supplements be proven efficacious in order to be marketed, the FDA has warned of the existence of fraudulent products (Kurtzweil, 1998). These products can often be identified on the basis of their advertised claims, which the FDA monitors for truthfulness. Claims that are likely fraudulent or misleading include those that rely on vague terminology that is difficult to either substantiate or prove false. Also, if a product is purported to cure a number of conditions, have a number of positive effects but no potential negative effects, or does not provide literature citations for their claims, it may also be fraudulent. These warnings echo those of Lightsey and Attaway (1992) in their report on deceptive practices used to market anabolic and exercise-related supplements. The inappropriate use of research was the most common means of deception reported. This included the misrepresentation of findings, taking findings out of context, using outdated research, refusing to allow the public access to research reports, and citing findings from studies that were unpublished, not peer-reviewed, or poorly controlled. The use of testimonials in lieu of reporting scientific research findings is also a potential means of deception.

Specific Types of Muscle-Building Supplements

Although there are hundreds of different anabolic supplements available for purchase, the majority can be grouped according to their key ingredients. The most frequently used supplements are amino acids and their metabolites, protein, and

creatine (Grunewald & Bailey, 1993; Reents, 2000b). All of these supplements are intended to be used in conjunction with exercise.

Amino acids and metabolites. Amino acids are valued for their synthesis of protein in skeletal muscle, and some may stimulate the release of hormones purported to be anabolic, such as growth hormone and insulin (Jacobson, 1990; Wagenmakers, 1999). Despite these natural functions in the body, most research studies have found that the ingestion of amino acid supplements, including branched-chain amino acids, has no significant effect on muscle growth, strength, or endurance among healthy individuals (Jacobson; Wagenmakers; Williams, 1995; Williams, 1999). Furthermore, the concentration of amino acids found in supplements is much lower than could be derived from foods such as chicken (Coleman, 1990). Individuals who consume large amounts of amino acids may experience severe gastrointestinal distress, while users who have liver or kidney problems may worsen their condition with prolonged intake (Wagenmakers; Williams, 1995).

Although research has tended to disconfirm the claims made by amino supplement manufacturers, this does not seem to be the case with β-Hydroxy-β-Methylbutyrate (HMB), a metabolite of the branched-chain amino acid leucine. This supplement is intended to be used in conjunction with exercise in order to decrease body fat while enhancing lean muscle mass and strength (Nissen et al., 1996). Several studies have supported these claims, using 20 to 70 year old males and females, who were weight-trained or untrained at the study's outset (Gallagher, Carrithers, Godard, Schulze, & Trappe, 2000; Nissen et al.; Panton, Rathmacher, Baier, & Nissen, 2000; Vukovich, Stubbs, & Bohlken, 2001). In each of these studies, subjects were involved in a strenuous weight-training program, ranging from three days per week over a three-week period, to six days per week over a seven-week period (Nissen et al.). The optimal

dose of HMB appears to be 3g per day, with no additional gains observed in larger amounts (Gallagher et al.).

Although many studies to date have supported the use of HMB, Juhn (2003) called the conclusions of several of the aforementioned studies into question, citing equivocal findings within each concerning gains in fat-free mass and strength. He concluded that, overall, little empirical research exists to support the use of HMB. Similarly, Kreider (1999) reported on two studies that found no significant gains in strength or fat-free mass in weight-trained males. Panton et al. (2000) raised the possibility that differences may not have been noted because some individuals may not have exercised enough to experience gains, an effect that would not have been noted since exercise was not supervised, and self-report journals may not have been accurate in reporting actual duration and intensity of exercise.

To date, no adverse side effects have been associated with HMB use, while a number of physiological benefits that may reduce the risk of heart attack and stroke have been consistently noted. These effects include decreased systolic blood pressure, and decreased LDL and total cholesterol levels (Nissen et al., 2000). Since the study of HMB is relatively new, research focusing on the effects of long-term use has not been conducted.

Protein. Researchers have documented that, relative to their sedentary counterparts, regular exercisers have an increased need for protein (Lemon & Proctor, 1991; Tarnopolsky, 2000). Despite this, there is little reason to recommend the use of protein supplements to meet this need, since regular exercisers tend to ingest more foods containing protein than they require (Lemon & Proctor). Furthermore, studies have not shown that ingesting large amounts of protein increases body or muscle mass, or strength (Kreider, 1999; Lemon & Proctor; Wolfe, 2000). Furthermore, many athletes may not expend enough energy to utilize all of the extra protein that they ingest, which

leads to increased fat storage (Williams, 1995). One danger associated with supplementation is that foods that contain protein may be avoided or eaten less, resulting in reduced intake of other necessary nutrients that are found in high-protein foods (Short & Marquart, 1993). Furthermore, individuals with impaired kidney function should not consume large amounts of protein since it places an extra burden on the kidneys (Lemon, 1998). As already mentioned, those who take protein supplements are already often consuming enough dietary protein, and would therefore be placing their kidneys at risk if such problems were pre-existing. High-protein diets, which may be related to supplementation, have also been found to increase the risk of osteoporosis by increasing calcium loss from the body (Lemon, 1998). This effect may be prevented through a balanced diet involving eating high-protein foods versus supplements (Lemon, 1998). Despite the lack of findings relating protein supplementation to increased muscle strength and size, Wolfe (2000) stated that there is sufficient reason to expect that protein supplements increase muscle mass in active individuals. He based this statement on a theoretical model that involved more precise outcome measures than have been used in previous studies. To date, his claims have not been empirically validated.

Creatine. Creatine is a popular muscle-building supplement, and is the most extensively studied supplement of its kind (Poortmans & Francaux, 2000). Large numbers of studies are available to support the notion that creatine enhances muscle growth and strength, particularly in those who engage in strenuous exercise concurrently with use (Fillmore et al., 1999; Kreider, 1999; Poortmans & Francaux; Reents, 2000a). Although increased muscle mass has been observed, at least some of these gains may be attributed to water retention. Contradictory findings exist regarding the efficacy of creatine in trained versus untrained individuals, with some reporting that creatine is more efficacious in those who are untrained (Reents, 2000a), and others reporting positive

effects for both (Fillmore et al.). It appears that type of exercise plays a role in the efficacy of creatine supplementation, with bodybuilders and other weight-lifting group members generally experiencing more benefits than those in such endurance activities as swimming and sprinting (Fillmore et al.; Reents). Despite this trend, however, conflicting findings exist, which have been explained by differences in methodology and failure to account for or control such factors as diet (Reents). A dietary factor that has been found to decrease or eliminate the beneficial effects of creatine is caffeine, while vegetarians and those who eat large amounts of carbohydrates concurrently with creatine intake may experience more benefits (Reents).

To date, the main side effect consistently associated with creatine use involves weight gain, although gastrointestinal distress and muscle cramps have also been reported on an anecdotal basis, with a relative absence of research to support claims (Poortmans & Francaux, 2000). In his review of sports supplements and ergogenic aids, however, Juhn (2003) cited increased muscle compartment pressure related to creatine use as a likely reason for muscle cramping. Based on his review, he concluded that numerous reports of muscle dysfunction exist, and therefore clinicians should be wary of its use among athletes with whom they work. Although no formal studies have supported claims of liver and kidney damage associated with short-term use, Juhn (2003) cited two published case-study reports of kidney dysfunction but added the caveats that both individuals had used more than the recommended dose of creatine, and that one had previous renal disease. It was concluded that potential and current users should be counselled regarding the necessity of taking creatine at the recommended doses, if it is to be used at all. Although studies involving creatine supplementation have been conducted for up to a five-year period using small groups of athletes, none have found adverse effects in renal functioning (Poortmans & Francaux, 2000). Despite this, the

researchers advised that caution should be used before creatine is used on a long-term basis, particularly when renal difficulties are present.

Other muscle-building supplements. Numerous other supplements have been purported to increase muscle mass and strength, while few have been empirically validated for these purposes. One supplement that has been studied more extensively is the essential nutrient chromium, which has not been found to increase muscle mass or strength among several groups of trained and untrained males who engaged in exercise (Lukaski, 1999; Reents, 2000b). Adverse health effects associated with large doses of chromium have been reported, including iron depletion and excesses of iron in the liver and spleen. Although rare, cases of liver and kidney toxicity have also been reported (Lukaski).

Androstenedione, a naturally occurring adrenal hormone that is a precursor to testosterone, has been classified as a dietary supplement since the FDA's legislation of the DSHEA in 1994. This is despite the fact that until that time the FDA had banned its sale without a prescription because of its reportedly toxic effects on the liver (Reents, 2000b). The reclassification occurred because conclusive evidence did not exist concerning its anabolic properties, which prevented androstenedione from being labelled as a steroid (Reents). Despite its increased popularity since baseball player Mark McGwire's admission of using androstenedione prior to breaking the home run record in 1998 (Yesalis, 1999), only a few studies have tested its purported benefits. All of these studies used smaller doses than those advertised for supplemental use, and conflicting findings have been reported regarding increases in lean muscle mass (Reents; Yesalis). Health risks associated with short and long-term use are unknown at this time, although liver toxicity (Reents) and rises in estrogen levels may occur in males, leading to breast tissue growth and testicular atrophy (King, Sharp, & Vukovich, 1999). In addition, a preliminary connection has been made between androstenedione use and AAS use,

with 83% of admitted AAS users also using androstenedione or related adrenal hormones (Kanayama et al., 2001).

One of androstenedione's related adrenal hormones is dehydroepiandrosterone (DHEA), which is also sold as a supplement (Reents, 2000b). Similar to androstenedione, the few studies that have involved DHEA supplementation in humans have been conflicting in regards to increased muscle mass (Kreider, 1999; Reents, 2000b). Adverse side effects associated with DHEA use include suppressed testosterone production and liver damage (Reents, 2000b). Long-term studies have yet to be conducted concerning the effects of regular DHEA consumption.

Several researchers have reviewed the literature on muscle-building supplements, and have found no supportive evidence for claims of increased muscle mass among healthy, exercising individuals who used these products (Grunewald & Bailey, 1993; Kreider, 1999; Williams, 1995). Reviewed supplements that have no supportive evidence include vanadyl sulfate, boron, dibencozide, vitamin B-12, and various plants and plant extracts including Smilax, gamma oryzanol, ferulic acid, and yohimbine.

Prevalence Rates in the General Population

The majority of studies that have assessed the prevalence of supplement use in the general population have focused on vitamins and minerals, which are typically not purported to enhance lean muscularity or strength. Overall, these studies have reported that 19 to 40% of Americans take at least one type of supplement daily (Slesinski, Subar, & Kahle, 1995; Stewart, McDonald, Levy, Schucker, & Henderson, 1985), while 68% have used supplements within a six-month period (Wingate, 1998).

According to Kurtzweil (1998), annual revenues from the sale of dietary supplements in general nearly doubled between 1990 and 1996, increasing from $3.3 billion to more than $6.5 billion. According to the FDA (United States FDA - Center for

Food Safety and Applied Nutrition, 1999), of the 15 top-grossing supplement manufacturers in 1997, four created extensive lines of sports supplements which contributed to the companies' $800 million in annual revenues. Furthermore, retail sales of sports supplements such as creatine increased 6% between 1999 and 2000, from $525 million to $555 million, and are projected to reach $656 million by 2005 (Labre, 2002).

Estimates of the number and types of sports supplements available were made through the analysis of advertisements in 9 to 12 issues of health and bodybuilding magazines (Grunewald & Bailey, 1993; Philen, Ortiz, Auerbach, & Falk, 1992). Philen et al. found 89 companies and 311 products, while Grunewald and Bailey reported on 33 companies that marketed 624 supplements. Amino acids and protein powders were present in approximately one-third of all products. Based on the number of muscle-building supplements available, as well as the revenues associated with supplement sales in general, it seems likely that a significant number of males are using such products.

Prevalence Rates Among Exercisers

Although most of the supplements that are purported to increase lean muscle mass term their products "sports supplements" or "ergogenic," which means performance enhancing, there are few prevalence studies concerning their use among athletes and recreational exercisers. A large proportion of studies have focused on vitamin and mineral use, concluding that the average prevalence of supplement use by athletes is similar to that of the general public (Burke & Read, 1993). Differences exist among various sports, with less than 32% of participants in team sports such as baseball, hockey, and soccer, and 100% of bodybuilders and weightlifters reporting supplement use (Burke & Read).

One study of 45 male competitive bodybuilders reported that 50% used amino acids, while 32% used protein powders and 26% used liquid supplements. Only 5% reported use of "weight gain" pills (Andersen, Barlett, Morgan, & Brownell, 1995). Of interest is the finding that only 11% used amino acids and 18% used protein supplements in their off-season. Brill and Keane (1994) reported higher estimates of use among 208 competitive male bodybuilders in the "bulking" phase of their preparation, with 61% using protein powder, 51% using amino acids, 35% using "weight gain" formulas, 20% using "anabolic supplements", and 12% using human growth hormone releasers. During this phase, 60% took three to six different supplements, and 6% consumed seven to eight types.

When recreational bodybuilders were surveyed, it was reported that 18% of 334 males surveyed had used androstenedione and/or other adrenal hormones within the previous three years, which translates into approximately 1.5 million gym members across the United States (Kanayama et al., 2001). This study also found that 61% of males had used protein supplements and 47% had used creatine. Among male adolescent athletes, 8.8% of a sample of 604 used creatine for performance enhancement (74%) and appearance enhancement (61%). Users were identified in every grade from 6 to 12, particularly among football players, wrestlers, hockey players, gymnasts, and lacrosse players (Metzl, Small, Levine, & Gershel, 2001). Furthermore, up to 80% of athletes at the 1996 Olympic Games, up to 75% of the players on two NFL football teams, over 90% of weightlifters and bodybuilders in the United States, and nearly 57% of 360 British elite competitors have used creatine (Poortmans & Francaux, 2000; Williams, Kreider, & Branch, 1999).

Although levels of exercise were not directly assessed, a study of 439 men and 60 women entering military training reported rates of ergogenic supplements use, and behavioural correlates of use (Stephens & Olsen, 2001). Forty-one percent of this

sample had reportedly used ergogenic supplements at some time in their lives, with the majority of users being male. Among the overall sample, creatine was the most commonly used supplement (23%), followed by androstenedione (8%). Compared with those who had never used supplements, a higher prevalence of significant health risk behaviours was found among supplement users, including drinking large quantities of alcohol, driving with someone who had been drinking, drinking and driving, and getting into more physical fights.

Although typically not purported to increase muscle mass or improve sports performance, collegiate and high school athletes have taken vitamin and mineral supplements for these purposes (Krumbach, Ellis, & Driskell, 1999; Sobal & Marquart, 1994b). The rate of use among male college athletes was 55% of 266 respondents, with the two most common reasons for use being improvement in athletic performance (42%) and to build muscle (36%; Krumbach et al.). In this study, the only two supplements assessed that have been purported to increase muscle mass were chromium picolinate (8% use) and vitamin B-12 (10% use). Reasons for non-use of supplements included that the belief that their diet was adequate, that supplement use was against their beliefs, and that they were too costly. In a similar study of 742 high school athletes, Sobal and Marquart (1994b) reported that 39% used supplements that are not purported to be ergogenic or muscle-building, with the possible exception of the undefined "other" category (6% use). Despite this, 65% of male users rated "sports performance" as being "somewhat" or "very" important reasons for use, while 63% rated "muscle development" as having importance.

A more detailed assessment of 509 high school athletes found that protein drinks were used by 22%, amino acids were used by 9%, "weight-gain formulas" were used by 8%, and steroid alternatives were used by 7% (Massad, Shier, Koceja, & Ellis, 1995). Although reasons for use were not identified for amino acids, "weight-gain formulas" or

steroid alternatives, reasons given for use of protein drinks involved increasing muscularity and/or body size. Reasons given for non-use of supplements included the lack of belief in them and/or the need for them, a lack of knowledge concerning supplements, concern over negative health effects, and cost. In general, males had a higher prevalence of use than females, with those in contact sports reporting the highest rates of anabolic supplement use and consuming more supplements overall. Among all respondents, a greater knowledge of supplements was associated with a decreased rate of anabolic supplement use.

Body Image and Related Effects

Body Image in Males

Over the past 30 years, there have been significant changes in the way that males view and feel about their appearance in general, and their bodies in particular (Pope, Phillips, & Olivardia, 2000). Researchers have documented this trend, often utilizing comparisons with females in the process (Cohane & Pope, 2001; Fallon & Rozin, 1985; Phelps et al., 1993). Early studies reported that, contrary to females, young males were satisfied with their bodies and did not desire changes (Fallon & Rozin, 1985; Zellner, Harner, & Adler, 1989; Phelps et al.). In these studies, males as a group tended to identify their current and ideal body figures as being similar, while females consistently wished to have a smaller figure. It was also reported that males did not exhibit eating pathology, and that this was a difficulty more commonly found among females who were dissatisfied with their bodies (Zellner et al.; Phelps et al.).

Since that time, researchers have concluded that body dissatisfaction in males exists, with roughly equal proportions wishing to lose and gain weight. This trend was found among children and adolescents (Cohane & Pope, 2001), university students (Drewnowski & Yee, 1987; Silberstein et al., 1988), and in comparisons between older

and younger adults (Lamb, Jackson, Cassiday, & Priest, 1993). These findings surfaced by calculating body dissatisfaction indices based on the absolute values of males' current figure minus ideal figure preferences on a silhouette rating scale. This was suggested as a reason why previous research failed to report the existence of body dissatisfaction in males; they were taking the average of two opposing yet equally dissatisfied groups.

Although males wish to gain and lose weight in equal proportions, it appears that these desires are dependent upon current weight (Lamb et al., 1993). This trend was observed in comparisons between males over the age of 50, and young males who were in college. The older males in this study tended to be overweight, while the younger males tended to be either underweight or average weight. It was found that although the older males desired to lose weight and the younger males wished to gain, there were no differences in the ideal figures chosen by the two groups. These results were replicated in a university population (Raudenbush & Zellner, 1997), suggesting that males who are of average size wish to gain weight, while those who are overweight wish to lose in order to achieve the same ideal as average-weight males.

Since it appears that males have been appraising their bodies differently over the past few decades, this may be a further rationale for the earlier conclusions of their body satisfaction (Pope, Phillips, & Olivardia, 2000). In their review of three national surveys conducted by Psychology Today magazine in 1972 (Berscheid, Walster, & Bohrnstedt), 1986 (Cash, Winstead, & Janda), and 1997 (Garner), it was concluded that males are becoming more similar to women in terms of their level of dissatisfaction with a variety of features. Although in 1997 women were still more dissatisfied than men on all features surveyed, steady and significant increases in males' discontent were observed over the periods surveyed. For example, although 15% of males were dissatisfied with their overall appearance in 1972, this figure rose to 34% in 1985, and to 43% in 1997. The

level of overall discontent in 1997 was similar for males of various ages, ranging from 13 to 59 year olds. Males' dissatisfaction with weight rose from 35% to 52% over the course of the studies, while discontent with muscle tone rose from 25% to 45% over the same period. Other large increases between 1972 and 1997 were observed for dissatisfaction with the abdomen (36% to 63%), and chest (18% to 38%).

Although not directly assessed in most of the earlier studies of body image, it has been assumed that males' desire to gain weight is indicative of their wish for a more muscular figure (Cohane & Pope, 2001; Drewnowski & Yee, 1987). Tucker (1982), Butler and Ryckman (1993), and Jacobi and Cash (1994) supported this notion by providing muscular options in their assessments of body image in college-aged and adolescent males. In each of these studies, the mesomorphic, or muscular, body figure was chosen as the ideal by a significant majority of participants. In the case of Jacobi and Cash, this desire was nearly unanimous, with 91% wanting a more muscular figure. These findings apply to other countries as well, with males from France and Austria desiring gains similar to males from the United States in their wish to gain 28 pounds of muscle (Pope, Gruber, et al., 2000).

McCreary and Sasse (2000) confirmed the muscular-ideal among adolescent males, and added that those with a high drive for muscularity had lower self-esteem and higher levels of depression. Cohane & Pope (2001), in their review of body image studies with male children and adolescents, affirmed that most have found positive correlations between self-esteem and body image. It appears that the most distressing perception among males involves being or feeling underweight (Page & Allen, 1995). This is particularly true for those who perceive themselves as having a small upper body, with this factor alone explaining a significant proportion of males' body dissatisfaction (Davis, Brewer, & Weinstein, 1993; Tantleff-Dunn & Thompson, 2000). Interestingly,

males' dissatisfaction with chest size is greater than that reported by females, and chest size is important for self-esteem in males but not females (Tantleff-Dunn & Thompson).

From these reports it is evident that body dissatisfaction in males exists, and that there is a preference toward increasing muscularity in the upper body region. In order to achieve their ideals, males may engage in anaerobic exercise such as bodybuilding, and/or use AAS and other muscle-building supplements.

Body Image and AAS Among Exercisers

There is some evidence to indicate that males who engage in strength-related activities such as football and bodybuilding have higher levels of body satisfaction than endurance athletes or non-exercisers (Boroughs & Thompson, 2002; McKay-Parks & Read, 1997). In these studies it was concluded that since the football players and bodybuilders were closer to or had reached their mesomorphic ideal, they were more satisfied than less muscular groups such as runners and sedentary males.

Several other studies have found differences within bodybuilding groups, with many reporting body dissatisfaction, eating pathology, and AAS use (Blouin & Goldfield, 1995; Loosemore, Mable, Galgan, Balance, & Moriarty, 1989; Pope, Katz, & Hudson, 1993). In a comparison of bodybuilders, hockey players, and psychology undergraduates, Loosemore et al. (1989) found that the hockey players and undergraduates accurately perceived their body size, and reported body satisfaction. Conversely, bodybuilders significantly underestimated their body size, and were dissatisfied with their body figures. Blouin & Goldfield reported that, compared with runners and martial artists, bodybuilders reported more bulimic pathology, drive to achieve bulk and lose fat, and AAS use. They also had lower self-esteem and more body dissatisfaction than martial artists, and higher levels of perfectionism and interoceptive awareness than runners. The indices used in this study are highly related to eating pathology in both males and females (Garner, Olmstead, & Polivy, 1983).

Pope et al. (1993) identified an additional link between bodybuilding and eating pathology. In particular, they found a higher prevalence of anorexia nervosa among bodybuilders than rates reported for males in the general population. These researchers also identified a condition similar to anorexia nervosa, which they initially termed "reverse anorexia nervosa." This condition refers to feelings of being very small and weak when in actuality the body is very large and muscular. These feelings led them to such typically anorexic behaviours as avoiding situations where others would see their bodies, and concealing their bodies under layers of clothing to mask their perceived lack of muscularity. This condition was later termed "muscle dysmorphia" (Pope, Gruber, Choi, Olivardia, & Phillips, 1997), and has been proposed as a type of Body Dysmorphic Disorder (BDD). BDD would fall under the category of the Somatoform Disorders in the *Diagnosic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association, 1994; Pope et al., 1997). Muscle dysmorphia has been reported in 8% of a sample of 108 bodybuilders (Pope et al., 1993), and 10% in a sample of 156 bodybuilders (Pope & Katz, 1994). Compared with other weightlifters, males with this condition have reportedly higher rates of current or past major mood disorders (58%), anxiety disorders (29%), and eating disorders (29%; Olivardia, Pope, & Hudson, 2000). The initiation or attenuation of steroid use is also common, with estimates ranging from 46% in a group of 24 (Olivardia et al., 2000) to 100% in a sample of 9 males with this condition (Pope et al., 1993).

When AAS use is studied among bodybuilders, it is clear that body dissatisfaction plays a role in the initiation and continuation of use. In this regard, bodybuilders have identified appearance enhancement as their primary reason for using AAS (Blouin & Goldfield, 1995). Similarly, Brower et al. (1994) reported that over 94% of weightlifters from community gyms cited improvement in appearance as a main reason for training. They also found that weightlifters who were at high-risk for future AAS use

could be identified by their prominent feelings of not being big enough. Furthermore, when compared with high-risk weightlifters, AAS-using weightlifters felt better about their body size, weighed more, and used more non-steroidal substances for the purposes of training. While the low-risk non-users took two of such substances, those in the high-risk group took four, and AAS users took an average of six. These included protein supplements, amino acids, growth hormone, amphetamines, caffeine, and an array of 10 other substances purported to aid in training. These findings indicate that muscle-building supplements and AAS are both likely used to improve appearance among those who lift weights.

To further corroborate the link between AAS and body image, Schwerin et al. (1996) found that AAS-using bodybuilders had less social anxiety concerning their bodies, and felt more positively about their strength-related upper body parts than non-users who were bodybuilders, aerobic exercisers, and non-exercisers. Although non-using bodybuilders were also more satisfied with their upper bodies than the two latter groups, a trend indicating decreased body satisfaction was noted among former AAS users.

Collectively these results suggest that some bodybuilders are at an increased risk for body dissatisfaction that may reach dysfunctional levels, and that AAS use may be initiated or attenuated in an effort to enhance muscularity and feelings of satisfaction. Many additional bodybuilders are also likely using muscle-building supplements for this purpose, although more research in the area is needed given that these connections are not well established.

Sociocultural Theory and Related Effects

It has been well documented that society has created and continues to propagate an unrealistically thin ideal-body figure for females, and that this is done mostly through the mass media (Irving, 2001; Thompson et al., 1999). Researchers have also

established connections between media representations of the ideal female body, body dissatisfaction, and the incidence of eating disorders among women (Andersen & DiDomenico, 1992; Groesz, Levine, & Murnen, 2002; Thompson et al.). Despite the unrealistic nature of society's thin-ideal, women tend to associate thinness with positive qualities, including attractiveness, sexual appeal, and increased frequency of dating (Thompson et al.). This is likely related to the types of social rewards often depicted or implied in the media's portrayal of thin women, as well as observations made in everyday life. For instance, dating likelihood and frequency is reportedly negatively correlated with weight, particularly among Caucasian women (Harris, Walters, & Waschull, 1991; Sheets & Ajmere, 2005).

Although studied to a lesser degree, it appears that society has created and promotes an ideal-body figure for males as well, and that this is characterized by lean muscularity that may be unrealistic for many to achieve without the use of AAS (Pope, Phillips, & Olivardia, 2000). When discussing lean and muscular body types, males ranging in age from eight to twenty-five years made associations with improved health, fitness, and feelings of confidence and power in social situations (Grogan & Richards, 2002). Males in this group were also disparaging of overweight people, attributing their appearance to weakness of will and lack of control. This implies that weight-related appearance is changeable by anyone who decides to do so, a notion that hints at the unrealistic impressions they may hold of becoming as muscular as their ideals. If this is the case, those who are invested in achieving their ideals may turn to muscle-building supplements and/or AAS if exercise and diet alone do not evidence results. Although studies are warranted in order to evaluate these possibilities, none have been conducted to date.

Although the consequences of societal ideals of attractiveness for males are not as established as for females, evidence is mounting that supports the existence of a

muscular ideal for males. There are several means of transmitting the ideal images of both males and females, including television, magazines, videos and video games, computers, CDs, and the radio. These methods combined have daily access to most of its target populations, with young people aged 18 and under spending six and one-half hours utilizing these various forms of entertainment every day (Roberts, Foehr, Rideout, & Brodie, 1999).

Children's toys are an additional means of transmitting societal ideals. Analyses of action figures marketed towards boys indicates that the most popular figures from the past 30 years have increased in lean muscularity to a level that likely could not be attained by real adult males without rigorous bodybuilding, or the aid of AAS (Pope, Olivardia, Gruber, & Borowiecki, 1999).

Many additional studies concerning the media's presentation of ideals for both males and females have focused on the content of magazines. Andersen & DiDomenico (1992) found that popular women's magazines contained significantly more weight loss articles and ads than men's magazines, while men's magazines contained more articles relating to altering body shape. Furthermore, the ratio of diet articles in women's magazines versus men's magazines approximated the incidence of eating disorders for females versus males (10:1). The authors concluded that the media may create and reinforce different ideals for women and men by persuading them to become more concerned with weight and shape, respectively. This trend has continued with the advent of more fitness and health-oriented magazines geared towards males, including *Men's Health* and its recent spin-off for adolescents, *MH-18* (Labre, 2002). Since its creation in 1990, sales of *Men's Health* have made it the most popular magazine of its kind, increasing from a circulation of 250,000 in 1990 to more than 1.5 million in 1997 (Labre).

It appears that the cultural ideal of muscularity for males extends from the bounds of men's magazines and into women's magazines as well. In this regard, over

the past 40 years advertisements featuring male models have shown increasing amounts of bare flesh in an effort to sell various products to women. Similar increases in exposed flesh in advertisements featuring female models were not observed (Pope, Olivardia, Borowiecki, & Cohane, 2001). A further example of this trend is found in *Playgirl*, which is a women's magazine that features attractive, muscular male models. Research has documented *Playgirl*'s trend of presenting progressively leaner, more muscular male models since its inception in 1973 (Leit, Pope, & Gray, 2001; Spitzer, Henderson, & Zivian, 1999). This trend towards increasing muscularity has not been similarly observed among males in the general population (Spitzer et al.). These findings likely lead to or reinforce the beliefs of young males that they should be very muscular in order to attract women. According to reports from women, however, this belief is an erroneous one (Lynch & Zellner, 1999).

Overall, these findings suggest that males continually face pressure to adhere to the notion of "hegemonic masculinity" (Connell, 1987, 1995). This can best be understood as society's consensus of what constitutes "manliness", and subsequently exerts pressure on males to attain. According to the theory, ideals have little to do with the actual characteristics of the average male. Consistent with previous findings (Leit et al., 2001; Pope et al., 1999), ideals that represent the pinnacle of masculinity are constantly changing, and serve to help males achieve or maintain power within society (Connell, 19987, 1995).

Researchers have not only documented the media's presentation of unrealistic body-ideals for both males and females, but have also found negative effects associated with exposure to such ideals. For example, men and women who viewed photographs of same-gender models reported a drop in their body esteem immediately following their exposure (Grogan, Williams, & Conner, 1996; Leit et al., 2002). In addition, women who read beauty magazines and men who read fitness magazines tended to internalize the

societal ideals portrayed in the magazines (Morry & Staska, 2001). Among males, reading fitness magazines predicted eating problems, while their level of internalization was related to self-objectification. This is a preoccupation with one's outward appearance as opposed to valuing other aspects of oneself. Women who read beauty magazines had similar negative outcomes, which is a finding that has been consistently reported among women following their exposure to thin models (Morry & Staska, 2001; Groesz et al., 2002).

A number of factors appear to play a role in increasing susceptibility to the negative effects associated with exposure to body-ideals. Among adolescent males, self-esteem and negative affect moderate the effects of exposure to male models, with those low in self-esteem and high in negative affect being more susceptible to pressures to lose weight and increase muscle (Ricciardelli & McCabe, 2001). Levels of awareness and internalization of the sociocultural ideal also appear to play important roles in predicting negative outcomes related to exposure to body-ideals in both males and females (Smolak, Levine, & Thompson, 2001; Stormer & Thompson, 1996). Furthermore, it appears that young adolescent boys may not give the media per se much credence in their beliefs or practices concerning weight loss or gain (Ricciardelli, McCabe, & Banfield, 2000). Instead, parents and friends appear to exert more influence, although they may espouse similar beliefs concerning weight as is found in the media despite being less extreme. For nearly one-third of the boys, the media and significant others such as parents and male friends exerted a positive effect on their intent to change their bodies in the form of exercise and alterations in diet.

Although it is clear that the media has increasingly portrayed the male body as being very lean and muscular, and that this can have negative effects on males' body image and eating patterns, it is less clear whether the media influences males' decisions to use AAS or muscle-building supplements. It is also unknown what role such factors as

awareness and internalization of the muscular-ideal, or self-esteem play in the initiation or maintenance of AAS or supplement use. Given the unrealistic nature of this ideal for many males, it seems likely that use would be increased among some who cannot achieve their goals with exercise and diet alone.

Social Comparison Theory and Related Effects

Although sociocultural theory has been the most widely studied and supported theory of body image disturbance, use of this theory alone would be insufficient to explain the differing levels of body dissatisfaction that are found in the general population (Thompson et al., 1999). In this regard, it appears that there are other cognitive processes that affect one's level of internalization of societal ideals, as well as their level of body dissatisfaction. These include the levels of social comparison in which one engages, and their selected targets of comparison (Thompson et al.). These notions are based on the original social psychological models of Festinger (1954) and Wood (1989).

Social comparison theory states that people are driven to compare themselves against others in order to gain a more accurate representation of their own attributes. Furthermore, people engage in comparisons because they ultimately want to improve themselves. Although Festinger (1954) believed that individuals retained control over those to whom they compared themselves, and that comparisons were made in order to benefit the comparer, these notions have since been revised and expanded (Wood, 1989).

Newer postulates of social comparison theory include that individuals likely face forced comparisons over which they have little control, and that these comparisons may still exert an influence on the observer. The most common example of forced comparisons come in the form of advertisements on television, buses, billboards, signs, and magazines, which are encountered on a daily basis. It has been estimated that the

average person encounters 3,000 such advertisements per day (Kilbourne, 1999). When confronted with various attractive, same-sex images from the media, a common effect is for the observer to make an "upward comparison". This means that they are confronted with someone who is considered to be more attractive than themselves. Although upward comparisons can aid in self-enhancement by providing a source of inspiration, most often upward comparisons concerning attractiveness result in negative affect and body dissatisfaction in women (Stormer & Thompson, 1996). Conversely, downward social comparisons, which involve comparing oneself to others who are inferior on an attribute such as attractiveness, improve one's affect and self-regard (Stormer & Thompson).

Although the media does not offer many targets for downward social comparisons in terms of attractiveness, family members and peers may be used as both upward and downward comparison targets (Powell, Matacin, & Stuart, 2001; Ricciardelli et al., 2000). These targets would be classified as "particularistic", since they share a particular bond or identity with the comparer. Comparisons with media figures or the average student or citizen, who are more global and less familiar to the comparer, are considered to be "universalistic" in nature.

Through various studies concerning body image and social comparisons, individuals have been found to vary in terms of their frequency of comparisons, to whom they compare themselves most often, and the importance placed on various targets (Stormer & Thompson, 1996; Thompson & Heinberg, 1992). These studies have typically focused on women, and have concluded that those who place importance on particularistic and universalistic targets combined have more problems with body dissatisfaction, negative affect, and eating pathology (Stormer & Thompson; Thompson & Heinberg). Similar relationships were also observed when tendency to engage in social comparisons was considered (Mautner, Owen, & Furnham, 2000; Stormer &

Thompson). Type of comparison target has also been varied in studies, with researchers reporting increased body dissatisfaction related to comparisons between sisters (Rieves & Cash, 1996) and with models from the media (Cattarin, Thompson, Thomas, & Williams, 2000). A related study using males and females found similar results among both groups, with body dissatisfaction being related to a higher tendency towards social comparisons (Faith, Leone, & Allison, 1997).

Of further interest are the findings that, in addition to social comparison variables, studies have variously reported that levels of awareness and internalization of sociocultural ideals, teasing history, and body mass index uniquely contributed to eating pathology and negative affect (Faith et al., 1997; Cattarin et al., 2000; Mautner et al., 2000; Rieves & Cash, 1996; Stormer & Thompson, 1996). From these findings it appears that social comparison theory alone cannot adequately account for differences in body image and eating pathology, at least among women, and that other factors need to be taken into account. These possibilities need to be explored with males in conjunction with AAS and muscle-building supplement use, in order to gain a more multidimensional idea of correlates and reasons for use.

Although little is currently known about males' social comparisons, and their related effects, two studies with adolescent boys have been conducted (Jones, 2002; Ricciardelli et al., 2000). In Jones' study of boys in grades seven and ten it was found that this group tended to compare their height and weight with their same-sex peers from school, as opposed to models or celebrities. However, when the comparisons were based on the boys' face and body build/shape, they tended to compare themselves to peers and models/celebrities at the same rate. Boys who engaged in more frequent comparisons concerning their height, weight, shape/build, and face tended to feel more dissatisfied with their bodies, regardless of the comparison target chosen. The variables that significantly predicted body dissatisfaction in this sample included the frequency of

body mass index, weight, and facial comparisons made. Interestingly, boys who were physically larger experienced greater body dissatisfaction, which is a finding that may be explained by an increase in fat as opposed to muscle. Despite the relationships observed in this study, the researchers noted that these were significant but only modest in accounting for the variance in body dissatisfaction. This implies that other factors, such as teasing history and sociocultural factors, may play additional roles in males' body dissatisfaction, and need to be included in future studies in this area.

In their study of adolescent boys' body image and body change methods used in relation to comparisons with various others, Ricciardelli et al. (2000) found that over half (53%) of boys engaged in social comparisons, and that these comparisons were considered to negatively impact body image in 24% of respondents. Conversely, 38% of respondents reported that comparisons had a positive impact on their feelings about their bodies and 38% believed that their comparisons had a neutral impact. The most frequent targets of comparison were peers (38%), followed by same-sex family members (10%) and media personalities (5%). These social comparisons affected males' decisions to eat less (19%) and more (10%), and also influenced their decision to exercise more often (52%). Of those who exercised, 55% used exercise to increase the size of their muscles, 43% used exercise to change their body shape, and 40% exercised in order to change their body size. From these results, it appears that muscularity is important to young males, and that this desire may increase the likelihood of using AAS and/or muscle-building supplements in an effort to reach these goals if exercise and diet are not found to be effective. Furthermore, almost one-quarter of males stated that social comparisons had a negative impact on their body esteem, which may be an additional reason to initiate AAS or muscle-building supplement use.

One exception to these assumptions lies in the realm of self-enhancement. In particular, it has been found that when undergraduate males perceived deficits in their

levels of a physical trait, they tended to rate that attribute as being less important to have (Powell, Matacin, & Stuart, 2001). This trend occurred for attributes relating to physical attractiveness, physical condition, and upper-body strength. Furthermore, males tended to rate the "average male student" lower on all physical attributes, yet rated their closest male friend as being equal to themselves in all respects except for being less physically attractive. These results indicate that males may engage in self-serving evaluations of their physical attributes in order to preserve or inflate their self- or body-esteem, although this is less likely to occur when close peers are concerned. This is consistent with social comparison theory, which states that individuals tend to view their own social group as being better than other groups, and that this tendency is self-enhancing (Powell et al., 2001). Overall, self-enhancing evaluations may serve to reduce the risk for use of AAS or other muscle-building supplements, since males who are not muscular may subsequently place less importance on achieving muscularity and would not engage in muscle-building activities.

Based on the aforementioned reports, it was difficult to predict if, or how, social comparisons would affect males' decision to use AAS or muscle-building supplements. Despite this, the research to date has sufficiently documented the relationships between social comparison and dysfunctional eating practices in women, and the possibility exists that social comparison may serve a similar function in males.

Teasing History and Related Effects

Over the past decade, researchers have established connections between childhood teasing, body dissatisfaction, and eating disturbances in females (Thompson et al., 1999). A review on the defining features of teasing suggests that the messages conveyed may serve to promote group conformity, and reinforce dominance over people who vary on some attribute important to the group (Shapiro, Baumeister, & Kessler, 1991). The most frequent target of teasing is physical appearance, including weight

(39%), followed by level of intellectual abilities, and physical behaviours such as clumsiness. While only one percent of children believed that teasing is an entirely positive thing, 18% of third graders, 31% of fifth graders, and 82% of eighth graders believed that teasing could be either good or bad. Although teasing has a humorous as well as an aggressive component, the intent can often be misinterpreted by the person being teased, resulting in emotional distress. Among all of the elementary school children surveyed, 97% reported that they had negative reactions to being teased, including anger, embarrassment, hurt, and sadness (Shapiro et al.).

These findings were corroborated using female college students, of whom 72% reported having been teased as a child (Cash, 1995). In particular, facial features (41%) and weight (39%) were the most frequent targets of childhood teasing, and the most common perpetrators of teasing were peers (60%) and family members (34% of parents, 54% of siblings, and 23% of other relatives). Of interest is the finding that the reported presence or absence of teasing related to appearance was not predictive of current body image. Instead, the perceived severity of teasing, in terms of frequency, longevity, and emotional impact at the time, predicted body dissatisfaction.

Numerous other studies have established and reinforced the relationships between childhood teasing, body dissatisfaction, and eating pathology among females (Stormer & Thompson, 1996; Thompson & Heinberg, 1992; Thompson & Psaltis, 1988). These relationships have also been reported among cross-cultural samples of females (Lunner et al., 2000; Mautner et al., 2000). Some of these studies also provided support for the importance of sociocultural awareness and internalization, social comparisons, and BMI, indicating that teasing history alone is likely insufficient to account for all of the variance associated with body image and eating disturbances (Mautner et al.; Thompson & Heinberg; Stormer & Thompson).

Research that includes or focuses on males has also documented associations between levels of childhood teasing and body dissatisfaction, and has supported the notion that the resultant negative effects can be long-lasting (Gleason, Alexander, & Somers, 2000). Peer teasing about weight has been found to be the strongest predictor of body dissatisfaction among adolescent males (Jones, 2002), and is related to negative affect and binge eating in obese men (Womble et al., 2001). In addition, 35% of adult males reported that being teased by peers as a child contributed to their body image (Garner, 1997). Although women felt guilty when they recalled teasing others, men reported guilty feelings when recalling instances of alternatively being the perpetrator and the victim of teasing. This emotional reaction may help to explain the fact that almost half of males who are teased keep it a secret from others – they may feel they deserve to be teased (Thompson et al., 1999). This secrecy may have served to lower the estimates of childhood teasing found among males, and thus more than 35% of Garner's sample may have experienced shifts in body image related to teasing. Furthermore, the belief that one deserves to be teased is likely related to self-esteem, which has been found to decrease in males in relation to childhood teasing about competence (Gleason et al., 2000).

Findings are mixed with regards to the effect of parental concern over appearance, with one study reporting that such parental feedback was related to psychological functioning in both males and females, but related to body dissatisfaction for women only (Schwartz, Phares, Tantleff-Dunn, & Thompson, 1999). A second study reported that level of parental concern was positively related to the presence of eating disorders among children and adolescents, while teasing was positively related to eating disorders in adolescent males but not females (Gardner, Stark, Friedman, & Jackson, 2000). The type of feedback discussed in these reports appears to be different from teasing per se, and is more subtle. This area of research is just beginning to be

documented, and much work needs to be done with both females and males before firm conclusions can be made regarding the influence of parental concern on eating pathology and body dissatisfaction (Schwartz et al.; Tantleff-Dunn, Thompson, & Dunn, 1995).

Rationale for Present Study

Although research has established that AAS use is related to various negative physical and psychological side effects, young males are using these substances now more than ever in their efforts to increase muscle mass. Although less-often studied, it appears likely that even more young males are using over-the-counter muscle-building supplements in conjunction with exercise in order to increase their muscularity. This is despite the fact that most muscle-building supplements have been found to be unnecessary and ineffective, and long-term side effects and risks are unknown. Furthermore, many of the substances found in supplements could be easily obtained from food, which is a healthier and more cost-effective alternative.

The distinction that is made in this study between AAS and over-the-counter supplements is two-fold. Firstly, AAS are illegal to use for non-medical purposes, thus the use of AAS carries severe legal consequences and an associated social stigma (Pope, Phillips, & Olivardia, 2000; Yesalis, Bahrke, Kopstein, & Barsukiewicz, 2000; Yesalis & Cowart, 1998). In contrast, over-the-counter muscle-building supplements are legally sold, are openly advertised, are often endorsed by celebrities and sports figures, are widely available in conspicuous places such as shopping malls and pharmacies, and provide lucrative sales opportunities for many companies. Thus, the social stigma that is associated with AAS use is not likely as much of a factor for those who use legal supplements. The fact that more is known about AAS than any other type of muscle-building supplement provides further support for a distinction in the present study.

Similarities or differences between users of legal and illegal supplements cannot be assumed in the absence of research studies involving one of the groups.

Despite the prevalence of AAS and muscle-building supplement use among males, few research studies have focused on correlates of use and non-use in order to generate their respective profiles, and to establish the degree of similarity that exists among users of AAS and users of legal supplements. Such research could help to identify risk factors for use of muscle-building supplements, and open avenues for related education and prevention efforts. Education is a salient long-term goal, given that it has been found to be particularly useful in deterring young athletes from using various types of muscle-building supplements (Massad et al., 1995).

Areas that are worthy of exploration in conjunction with use of muscle-building supplements, and which may provide insights into reasons for use or non-use, include body image and type and amount of exercise. These variables are important since many males use supplements in order to enhance appearance and improve sports performance (Blouin & Goldfield, 1995; Metzl et al., 2001). Additional factors that have been previously identified in the literature on AAS (Blouin & Goldfield; Pope et al., 2000), but not muscle-building supplements, include psychological and behavioural manifestations of eating pathology. Other factors that have not been studied in regards to supplementation in males include awareness and internalization of sociocultural ideals of attractiveness, frequency and targets of social comparisons concerning appearance, and childhood teasing history. These variables were included with the goals of shedding light on the relatively unexplored area of muscle-building supplement use, and creating a foundation of knowledge that could be used to understand reasons for use and non-use, as well as risk and protective factors related to supplementation. As previously mentioned, since these types of supplements have not been found to be necessary or effective at increasing muscularity and may also be associated with negative health

effects, there is little reason to recommend or support their use. Therefore, research was needed that would aid in generating possible targets for education and prevention efforts.

Research Questions

When the present study was originally envisioned, the overall purpose was to examine variables that might relate to the use and non-use of AAS and muscle-building supplements by males. The plan was to explore similarities and differences between those who use only legal muscle-building supplements, AAS, or neither substance, with the goal of identifying significant predictors that could serve as targets for prevention, education, and intervention in the future. Unfortunately, very few AAS users volunteered to participate in this study, and the study had to be modified. An important goal of the modified study was to identify variables that predict muscle-building supplement use versus non-use. There are many more males using muscle-building supplements relative to those who are using AAS (Poortmans & Francaux, 2000; Williams, Kreider, & Branch, 1999; Yesalis, et al., 1993), and there is a clear need for knowledge and understanding of this population that has not been explored within the research literature to date. Given the lack of research involving this population, the present study was considered to be exploratory in nature and no a-priori hypotheses were made concerning which variables would best predict supplement use versus non-use. The main research questions that guided this study were as follows.

Research Question #1: What variables, if any, differentiate current users of muscle-building supplements from those who do not use such substances?

Research Question #2: Which combination of variables best predicts use and non-use of muscle-building supplements?

Research Question #3: What reasons do males report for using or not using muscle-building supplements?

Given that previous studies involving the use of various types of ergogenic and non-ergogenic supplements have identified the desire for increased muscularity and improvement in athletic performance as main reasons for use (Krumbach et al., 1999; Massad et al., 1995; Shier et al., 2001; Sobal & Marquart, 1994b), these were hypothesized to be main reasons for muscle-building supplement use in the present study. Furthermore, given that males in previous studies involving ergogenic and non-ergogenic supplements have indicated that supplementation is not necessary to achieve desired goals, goes against their personal beliefs, is unhealthy, and is too costly (Massad et al; Krumbach et al.), these were hypothesized to be main reasons for non-use of muscle-building supplements in the present study.

CHAPTER II: METHOD

Participant Recruitment

To be eligible for the present study, participants had to identify themselves as males who strenuously exercised at least three times weekly for at least 20-30 minutes per session. These requirements were based on the amount of exercise necessary to improve cardiovascular functioning (Engel, 1993). Two main targets for recruitment purposes included the University of Windsor in Windsor, Ontario and various fitness facilities located throughout the city of Windsor, Ontario. A detailed breakdown of response rates according to recruitment source can be found in Appendix A, and a detailed summary of the number of participants recruited within each group, by recruitment source, can be found in Appendix B.

Recruitment from the University of Windsor

Participants from the University of Windsor were recruited via the Psychology department's research participant pool, as well as through posters that were placed around the university campus (see Appendix C). They were chosen based on their response to a screening question included on the participant pool questionnaire that asked if they had ever used any type of muscle-building supplements. Those who answered yes to the screening question were contacted by the researcher and were given a brief description of the research study and its requirements. They were offered their choice of either one bonus point to be credited to their psychology course grade or a free movie ticket. Those who indicated an interest in participating arranged a meeting time with the researcher and completed the questionnaire in a private room in the Psychology department with the researcher nearby. The purposes of the study were re-explained at that time both verbally and via a written informed consent sheet that the student was asked to sign and return to the researcher prior to completing the

questionnaire (see Appendices D1 and D2). The confidential nature of the study and their right to refuse to answer any questions or to withdraw from the study at any time without penalty were reiterated. The researcher was available before, during, and after completion of the questionnaire to respond to questions. Participants were also given the opportunity to provide either a home or e-mail address where a synopsis of the results of the study could be sent.

With the university's prior approval, recruitment posters were placed throughout the main campus, including various locations within the Student Centre and on bulletin boards within specific departments. Individuals who were interested in participating contacted the researcher by telephone or e-mail, and subsequently underwent the same procedure as participants from the Psychology participant pool. Males who were recruited via posters were given one free movie ticket for their participation.

Recruitment from Fitness Centres in Windsor, Ontario

The researcher contacted managers of fitness centres across the city of Windsor, Ontario by telephone and/or in-person to request access to their facilities for the purpose of recruiting participants. Managers of three of the six facilities that were approached agreed to allow the researcher to place recruitment posters on their communal bulletin boards and recruit participants in-person during regular business hours. The researcher subsequently classified the participating facilities with "training facility", "community facility", and "university" designations.

Participants at the training facility were involved in organized classes designed to prepare them for physical competitions. Males at this facility were presented with a verbal description of the study by the researcher. If they were interested in participating they were given a questionnaire packet and offered the choice of completing the questionnaire at the end of their workout, or taking it home and returning it at their next

class for collection by the researcher. They were provided with an informed consent sheet to read and sign at the outset of their involvement, and were notified of their rights as a research participant. They were given the opportunity to ask questions before, during, and after their involvement with the study. Participants who had questions while at home completing the questionnaire were invited to contact the researcher by e-mail or telephone. The researcher personally collected each questionnaire and asked each participant if they had encountered questions or problems while answering the items. On return of their questionnaire in a sealed envelope, participants were given a free movie ticket and were invited to provide a home or e-mail address where a synopsis of the results of this study could be mailed.

Participants from both the community and university facilities were obtained through posters or in-person recruitment. Males who responded to the poster advertisements were met by the researcher at the fitness facility, and given the opportunity to complete the questionnaire either after their workout or at home. In-person recruitment involved the researcher sitting at a table in a busy common area of the facility, and posting signs around the table and throughout the facility briefly indicating the purposes of the study, eligibility criteria, and renumeration for participation. Interested members were directed to the researcher's table, and participants subsequently followed the same procedure as those in the training facility. Participants were given the opportunity to return the questionnaire directly to the researcher, or to leave their questionnaire in a sealed drop-off box at the fitness facility. In the event that participants chose to use the drop-off box, they were given a small slip of paper to include an address where their movie ticket could be mailed.

In an additional effort to recruit subjects, the researcher employed the method of "snowball recruiting". In particular, all males who participated in this study were asked if

they knew of any other males who may be interested in participating. They were encouraged to provide the researcher's contact information to those males, or to have them meet with the researcher during the times that she would be at the fitness facility collecting data.

Participants

In total, 102 males agreed to participate in the study and returned questionnaires that were at least partially complete. Of these, one questionnaire had to be omitted from analyses due to the participant's failure to complete several entire measures. The remaining questionnaires were categorized according to their self-identified use or non-use of muscle-building supplements, including AAS. Of these, 35 males were categorized as "non-users" of all types of muscle-building supplements, 36 males were identified as "current users" of legal muscle-building supplements, and 3 males were identified as "AAS users". Given the small number of AAS users that were obtained, this group had to be excluded from all subsequent analyses. A final, unexpected group that emerged during data collection included males who identified themselves as "former users" of various muscle-building supplements. A significant proportion of the total sample (n= 27) fell into this new group. It was decided that although these males technically represent current "non-users" of muscle-building supplements, their responses might differ from those in the "never-used" group. Although this group was not anticipated at the outset of this study, their responses were compared with those males who reported never using muscle-building supplements and those who reported current use of muscle-building supplements.

Measures

1. *Background Questionnaire* (See Appendix E)

This questionnaire was created by the researcher and was intended to gather information concerning the demographic characteristics of the sample, as well as their lifetime and current use of legal and illegal supplements and possible reasons for use and non-use of such substances. Reasons for use and non-use that have been previously identified in the research literature were randomly listed, and participants were asked to rate their top three reasons for use or non-use. Participants were also presented with a list of various types of supplements and were asked to indicate which they had ever used, and those that they were using at present. They were also asked to provide details regarding the length and frequency of use of each supplement. Questions concerning the type and amount of weekly exercise that they engaged in, as well as their current height and weight, were also included.

2. *Somatomorphic Matrix (Abbreviated paper version; Pope, Phillips, & Olivardia, 2000)*

The paper version of the Somatomorphic Matrix presents an array of 12 male body figures that vary across three rows and four columns in terms of the body fat and muscularity levels depicted. For scoring purposes, the specific levels of body fat and fat-free mass are listed by the authors in a separate scoring key. The three rows of body figures are arranged according to percentage of body fat that is depicted, with the top row being representative of a small amount of total body fat (8%). The second row is representative of body figures with 20% total body fat, while the bottom row includes figures that have a relatively high amount of body fat (32%). The four columns that are presented across these rows also vary according to level of fat-free mass, which can also be referred to as muscularity. The first column depicts males very little muscularity (16.5%) but that also vary in terms of their percentage of body fat, while the second and

third columns represent increasing muscularity levels (19.5% and 22.5%, respectively) while also simultaneously depicting varying levels of body fat. The fourth column presents figures that have a very high level of muscularity (25.5%) but that also vary in terms of their level of body fat. Respondents were asked to choose their current and ideal body figures, and were free to make choices that are between any of the provided figures. The difference between males' current and ideal figure choices, in terms of percentage of fat-free mass (muscularity) and body fat, was used as an index of body dissatisfaction.

This measure was adapted from the computerized Somatomorphic Matrix, which provides 100 male figures from which participants can choose (Gruber, Pope, Borowiecki, & Cohane, 2000). All 12 figures that are presented in the paper version are included in the computerized version. The paper version differs from its computerized counterpart by presenting all figures at once, in three rows and four columns, while the computerized version presents figures one at a time based on the respondent's identified preferences. Although the 100-figure version may provide a more precise measure of body dissatisfaction, the paper version is likely comparable due to its use of a similar range of body figures, and the participant's ability to choose a figure that is between any of those that are presented. Benefits of the paper version include decreased administration time and the ability to be given to several people simultaneously.

Although the paper version of the Somatomorphic Matrix has not been utilized in any published studies to date, the computerized version has been used in several studies of body image among male university and weightlifting populations (Leit et al., 2002; Pope, Gruber, et al., 2000; Gruber et al., 2000; Pope, Phillips, & Olivardia, 2000). These studies consistently reported that males desire a leaner and significantly more

muscular body figure than they currently have. The findings converge well with those of studies in which Fallon and Rozin's (1985) Figure Rating Scale (FRS; McKay-Parks & Read, 1997; Raudenbush & Zellner, 1997; Silberstein et al., 1988) was employed, and with studies that directly ask participants to state their current and desired levels of muscularity (Jacobi & Cash, 1994; Kelly, 2000). Discrepancy scores on the Somatomorphic Matrix are positively correlated with measures of depression and eating pathology in males, and negatively correlated with a measure of self-esteem in males (Pope, Phillips, & Olivardia).

3. The Multidimensional Body-Self Relations Questionnaire (MBSRQ; Cash 2000)

The MBSRQ contains 69 items that measure attitudes and feelings about body image and other weight-related variables. It is a revision of the Body-Self Relations Questionnaire (BSRQ; Brown, Cash, & Mikulka, 1990), which contained 294 items that were factor analyzed and subsequently removed, altered, or retained in the MBSRQ. The older measure assessed three different psychological dimensions concerning one's body (Evaluation, Attention/Importance, and Action/Activity), as well as the three bodily domains of Appearance, Fitness, and Health. These combined to form a 3x3 conceptual matrix yielding nine subscales. The MBSRQ altered this structure by retaining the Evaluation subscale and collapsing the Attention/Importance and Action/Activity dimensions to form an Orientation subscale. Since the original three bodily domains were retained, the MBSRQ contains a 3x2 matrix that serves as the basis for 6 subscales. Items within the Evaluation subscale concern the extent of liking, attainment, and satisfaction of one's body in terms of the Appearance, Fitness, and Health domains. The resulting subscales are Appearance Evaluation (7 items), Fitness Evaluation (3 items), and Health Evaluation (6 items). Items within the Orientation subscale concern

the degree of cognitive importance of and attention paid to the aforementioned bodily domains. Corresponding subscales include Appearance Orientation (12 items), Fitness Orientation (13 items), and Health Orientation (8 items). Factor analysis also identified an Illness Orientation factor, which is included as a separate subscale with five items. All items are rated on a 5-point Likert scale, ranging from "definitely disagree" to "definitely agree." Subscale scores are derived by summing their component item scores. In order to reduce the number of scores that are derived, the authors recommend averaging the responses from the Fitness Evaluation and Health Evaluation scales in order to calculate a Fitness/Health Evaluation measure. They further recommend averaging the responses from the Fitness and Health Orientation scales in order to calculate a Fitness/Health Orientation measure.

The MBSRQ also includes the Body Areas Satisfaction Scale (BASS; nine items), which assesses satisfaction with various body parts on a 5-point scale, and also includes measures of Subjective Weight (SW; average of two items) and Weight Preoccupation (WP; average of four items). However, these subscales are not being used in the current study since their targeted areas, namely body dissatisfaction and dysfunctional behaviours related to eating and weight, overlap with other measures that are being administered, including the Somatomorphic Matrix (abbreviated, paper version; Pope et al., 2000) and the Eating Disorder Inventory (EDI; Garner, Olmstead, & Polivy, 1983).

The MBSRQ is a psychometrically sound measure for use with both males and females (Cash, 2000). In particular, its factor structure has been found to be similar and stable among a large standardization sample comprised of 988 males and 1064 females (Brown et al., 1990). Using the same sample of males, the reported internal consistency of the subscales ranged from an alpha level of .73 to .91, while the one-month test-retest

correlations among college-aged males ranged from .71 to .89 (Cash, 2000). Concurrent validity has also been demonstrated in studies that found the MBSRQ subscales to be related to other health, exercise, and body image measures that were administered to males (Huddy & Cash, 1997; Jacobi & Cash, 1994; Waaler- Loland, 1998; Williams & Cash, 2001).

4. *Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ; Male version; Smolak, Levine, & Thompson, 2001)*

The SATAQ-male version is a measure that assesses levels of Awareness (4 items) and Internalization (7 items) of the lean and muscular ideal body for males that is portrayed in society, as well as the Importance of a Muscular Look (2 items). It is a revision of the SATAQ for women, which is a widely-used, well-validated measure of women's awareness of, and attitudes about, sociocultural images of thinness (Heinberg, Thompson, & Stormer, 1995). Fourteen statements concerning sociocultural ideals, and the levels of internalization and importance placed on them, are presented. An example of an Awareness item is "In our society, fat people are regarded as unattractive," while a sample Internalization question is: "Men who appear in TV shows and movies have the type of appearance that I see as my goal." The Importance of a Muscular Look is tapped using questions such as "Most people believe that the more muscular you are, the better you look." Results are coded on a 5-point Likert-type scale, ranging from "completely disagree" to "completely agree." Scores for each subscale, as well as a total score, are obtained by summing all of the composite items.

The psychometric characteristics of the male version of the SATAQ were established using pre-adolescent boys (Smolak et al., 2001). The internal consistencies of the subscales and the measure as a whole were adequate, ranging from .75 to .87. Concurrent validity was established using several measures of body image, including

those related to muscle building, weight control, and concerns about being physically small (Smolak et al.). Although no studies have been conducted using this version of the SATAQ with older males, it is applicable to adult males given its emphasis on muscularity and the related literature positing that societal ideals concerning muscularity relate to numerous psychological and behavioural implications in adult males (Pope et al., 2000). In a recent study, Morry and Staska (2001) utilized a similarly modified version of the SATAQ to assess sociocultural theory and its relationship to body image and eating pathology in undergraduate males. The coefficient alpha for the Internalization subscale closely approximated the figure reported by Heinberg et al. (1995) in their original study with women, as well as what was reported by Smolak et al. in their study with boys. However, the alphas for the Awareness subscale that were reported by Smolak et al. and Heinberg et al. were considerably higher than what was reported by Morry and Staska, which provides additional justification for the use of Smolak et al.'s measure in the present study.

5. *Frequency of Social Comparison to Various Targets* (See Appendix F)

This measure was created by the researcher in order to establish the comparison targets that are most often utilized by males. Respondents were presented with a list of 7 possible comparison targets and were asked how often they compare their body build/physique with each. Ratings were made on a scale from 1 ("never") to 5 ("a lot"). Comparison targets included male family members, closest male friends, other males at the gym or on the same sports team, average male gym member or male in their sport, male actors/models, male sports figures, and average male citizen. Although this type of measure has been utilized in a previous study of body image in adolescent males (Jones, 2002), only two targets were used and the focus needed to be broadened for the purposes of the present study. In particular, the provision of several possible comparison

targets allowed for more precise conclusions regarding the nature and effects of appearance-related social comparison among males.

6. *Teasing History* (See Appendix G)

Three questions related to being teased in childhood were included. Males were asked to indicate how often they had been teased for being too thin, too fat, and too weak, respectively. Participants also responded to an additional question regarding the level of upset over being teased for the aforementioned reasons. In each case, ratings were made on a 5-point Likert type scale, ranging from "1" (often) to "5" (never). The Perception of Teasing Scale (POTS; Thompson, Cattarin, Fowler, & Fisher, 1995) has been used in previous body image studies (Gleason et al., 2000; Schwartz et al., 1999), but it focuses on both weight-related and competence-related teasing. Given that teasing history for weight is the only variable of interest in the present study, and that the POTS only includes questions related to fatness, the POTS was not used in the present study. It is likely that males' history of being teased for thinness has an effect on their body image and may relate to supplement use (Davis, et al., 1993; Page & Allen, 1995; Tantleff-Dunn & Thompson, 2000). Being teased for weakness is a related concept that has not been previously explored in the research literature but which may conceptually relate to being teased for thinness. Therefore being teased both for thinness and weakness were included.

7. The Eating Disorder Inventory (EDI; Garner, Olmstead, & Polivy, 1983)

The EDI is a 64-item, self-report inventory of various cognitions and behaviours that are purportedly common among eating disordered individuals. It consists of eight subscales, including three that assess specific types of body image and eating-related pathology (Drive for Thinness, Bulimia, and Body Dissatisfaction). The remaining five subscales assess attitudes and cognitions that are related to eating pathology

(Ineffectiveness, Perfectionism, Interpersonal Distrust, Interoceptive Awareness, and Maturity Fears). Items are presented as self-referent statements, and responses are given on a 6-point Likert scale ranging from "always" to "never." To score the EDI, the most extreme "anorexic" response is given a score of 3, while the immediately adjacent response is scored as 2, and the next adjacent response is coded as 1. All three choices that are least representative of an "anorexic" response are coded as zero, and thus are not counted in the overall score at all. Subscale scores are derived by summing all relevant items, with higher scores indicate greater eating-related pathology.

The EDI is the one of the most commonly used self-report measures of eating disordered thoughts and behaviours in both women and men (Hausenblas & Carron, 1999; Olivardia, Pope, Mangweth, & Hudson, 1995; Thompson et al., 1999). Although the original standardization sample included mostly women with various types and levels of eating pathology, a comparison group of 166 undergraduate males was also utilized (Garner et al., 1983). Findings from this study demonstrated criterion-related validity for women with anorexia, who had higher scores than both the female and male control groups. The female control group scored higher than the males only on the Bulimia, Body Dissatisfaction, and Drive for Thinness subscales, while the males scored higher on the Interpersonal Distrust subscale. Garner et al. provided additional indices of criterion-related validity, as well as construct, convergent, and discriminant validity using their sample of female anorexics. Similar information was not provided for their male sample. Olivardia et al. (1995) reported similar response styles between college-aged males and females with eating disorders, which were significantly different from the comparison group of males on all EDI subscales except for Maturity Fears. In terms of concurrent validity, males' scores on the EDI were significantly related to other measures of eating pathology, questions concerning body image, and psychopathology

in general (Olivardia et al.). Individual subscales of the EDI have also been used in other studies involving body image and exercise in males (Boroughs & Thompson, 2002; Hausenblas & Carron, 1999; Loosemoore et al., 1989), and steroid use in males (Blouin & Goldfield, 1995; Olivardia et al., 2000; Schwerin et al., 1997). The EDI was used in the present study to maintain consonance with previous studies in the area. Since other measures of body satisfaction were already included (i.e., the Somatomorphic Matrix, and the MBSRQ), the Appearance Evaluation subscale of the EDI was not included in analyses. The Drive for Thinness subscale was also excluded a-priori due to the already large number of variables under consideration, and the conceptual differences that Drive for Thinness represents relative to drive for muscularity, which was the main focus of the study.

CHAPTER III: RESULTS

Background Information According to Group

Demographic information [i.e., age, height, weight, body mass index (BMI), perceived muscularity, exercise level, ethnicity, and education] for each of the three groups and for the entire sample is presented in Table 1. Males within each group reportedly engaged in various types of exercise on a regular basis, both at the competitive and recreational levels. Group-specific accounts of the types of exercise, as well as the number of males who reportedly engaged in each activity, can be found in Appendix H

Males in the former user group reported that they had used an average of 2.2 (SD = 1.3) different muscle-building supplements in the past, whereas those in the current-user group reported using an average of 3.7 (*SD* = 1.3) different supplements over the course of their lives. This figure takes into account their purported current use of 1.9 (*SD* = 2.3) different supplements. A detailed breakdown of the number of supplements reportedly used by each group in the past and present can be found in Appendices I1 and I2. The most popular muscle-building supplements reportedly taken in the past by former users were protein powder or drinks (n= 22; 81.5%), creatine (n= 18; 66.7%), and amino acids (n= 6; 22.2%). Current users reported similar patterns of use, with 91.7 % reporting use of protein powder or drinks (n= 33), 72.2 % reporting use of creatine (n= 26), and 55.6 % reporting use of amino acids (n= 20). Detailed group-based accounts of the specific muscle-building supplements used in the past and present can be found in Tables 2 and 3. The length of time that each supplement was used, as reported by former and current users, can be found in Appendices J1 and J2.

Participants within each group reported altering their diet during the previous month in order to change their weight. Specifically, 51.4% of non-users (n= 18), 18.5% of former users (n= 5), and 33.3% of current users (n= 12) acknowledged that they

Table 1

Background Information for Each Group and Total Sample

		Non-Users n = 35	Former Users n = 27	Current Users n = 36	Total Sample n = 98
Age	*M*	28.83	26.74	29.92	28.65
	SD	9.12	6.89	8.33	8.28
	Median	25.00	24.00	27.00	26.00
	Range	18-49	19-45	20-53	18-53
Height (Inches)	*M*	71.40	69.89	70.86	70.79
	SD	2.34	2.42	3.49	2.87
Weight (Pounds)	*M*	182.34	175.67	189.17	183.01
	SD	24.27	23.65	31.60	27.31
Body Mass Index	*M*	25.19	25.27	26.26	25.66
	SD	3.45	3.14	3.01	3.38
Fat-Free Mass Index	*M*	19.46	21.33	21.63	20.77
	SD	3.98	2.05	2.39	3.12
Desired Fat-Free Mass Index	*M*	21.47	23.11	23.83	22.79
	SD	4.54	1.63	2.08	3.25
Exercise Level (Minutes/Week)	*M*	350.03	256.96	308.92	309.29
	SD	271.66	153.05	209.95	222.29
Ethnicity (%)					
Caucasian		77.1	77.8	77.8	77.6
African Amer.		14.3	7.4	2.8	8.2
Hispanic		0.0	3.7	2.8	2.0
Asian		2.9	3.7	0.0	2.0
Other		5.7	7.4	16.7	10.2
Education (%)					
Some High School		0.0	0.0	2.8	1.0
High School		28.6	25.9	11.1	21.4
Some Coll./Univ.		20.0	18.5	25.0	21.4
College		17.1	7.4	27.8	18.4
University		28.6	37.0	25.0	29.6
Post-Graduate		5.7	11.1	8.3	8.2

Table 2

Specific Muscle-Building Supplements Used by Former Users During Lifetime (n= 27)

Supplement	*N**	*Percent*
Protein Powder/Drinks	22	81.5
Creatine	18	66.7
Amino Acids	6	22.2
Weight Gain/Anabolic Formulas	5	18.5
Anabolic Steroids	4	14.8
Chromium	1	3.7
Tribulus Terrestris	1	3.7
Yohimbine	1	3.7
Other: Ripped Fuel	1	3.7

* "Lifetime" frequencies include former and current supplement use combined, and total more than number of group members due to multiple responding by some participants

Table 3

Specific Muscle-Building Supplements Used by Current Users During Lifetime and Currently

(n= 36)

Supplement	*Lifetime Use**	*Percent*	*Currently Use**	*Percent*
Protein Powder/Drinks	33	91.7	32	88.9
Creatine	26	72.2	14	38.9
Amino Acids	20	55.6	10	27.8
Weight Gain/Anabolic Formulas	11	30.6	2	5.6
HMB	6	16.7	2	5.6
Chromium	5	13.9	3	8.3
Androstenedione/Norandrostenedione	4	11.1	0	0
Anabolic Steroids	3	8.3	0	0
Smilax	3	8.3	0	0
Tribulus Terrestris	3	8.3	0	0
Vanadyl Sulfate	2	5.6	1	2.8
CLA	2	5.6	2	5.6
Growth Hormone Releasers	2	5.6	1	2.8
Yohimbine	2	5.6	0	0
Other: Endurox R4	2	5.6	2	5.6
DHEA	1	2.8	0	0
Other: Alphalipoic Acid	1	2.8	1	2.8
Cell-Tech	1	2.8	1	2.8
Charge	1	2.8	1	2.8
GNC MegaMan	1	2.8	1	2.8
GNC Power Orange	1	2.8	0	0
Prolab N-Large 20	1	2.8	1	2.8
Ripped Fuel	1	2.8	1	2.8

* "Lifetime" frequencies include former and current supplement use combined, and total more than number of group members due to multiple responding by some participants

restricted their food intake in order to lose weight, whereas 8.6% of non-users (n= 3), 33.3% of former users (n= 9), and 22.2% of current users (n= 8) had reportedly been eating more food or calories in order to gain weight.

Examination of discrepancy scores on the Somatomorphic Matrix revealed that the majority of males indicated dissatisfaction with their perceived muscularity. In this regard, 60.0% of non-users (n= 21), 70.4% of former users (n= 19) and 69.4% of current users (n= 25) chose an ideal body figure with a level of muscularity that was larger than their current figure. Discrepancy scores concerning levels of body fat indicated a high percentage of males within each group were dissatisfied with their current levels of body fat. In particular, 45.8% of non-users (n= 16), 40.7% of former users (n= 11) and 39% of current users (n= 14) wished to lose body fat, while 2.9% of non-users (n= 1) and 7.4% of former users (n= 2) indicated a desire to gain body fat.

The majority of males within each group reportedly engaged in social comparisons with a variety of targets, with "other males at (their) gym or on (their) sports team" ranking as the top target of bodily comparisons among all males. Non-users reported that they frequently compared their bodies with male sports figures, but this target did not rank as highly among former and current users. A detailed group-based summary of the frequency with which bodily comparisons reportedly occurred with various targets can be found in Tables 4A and 4B.

Data Screening

All variables were subjected to a screening process in order to evaluate the assumptions required for multivariate analyses. Though missing data were found within each group, this was a rare and random occurrence. Therefore, missing values were simply replaced with the group mean for the variable (Tabachnick & Fidell, 1996).

Table 4A

Percentage of Males Who Reportedly Engaged in Social Comparison

Target Group

	Non-Users (n = 35)	Former Users (n = 27)	Current Users (n = 36)
Male Family Members	62.9	48.1	44.4
Closest Male Friends	85.7	66.7	83.3
Other Males at Your Gym/ On Your Sports Team	82.9	77.8	83.3
Ave. Male Gym Member/ Male in Your Sport	80.0	74.1	88.9
Male Actors/Models	74.3	63.0	80.6
Male Sports Figures	77.1	55.6	83.3
Ave. Male Citizen	77.1	63.0	77.8

Table 4B

Percentage of Males Who Reportedly Engaged in Social Comparison More than "Sometimes"

Target Group

	Non-Users (n = 35)	Former Users (n = 27)	Current Users (n = 36)
Male Family Members	22.9	14.8	11.2
Closest Male Friends	37.1	29.6	25.0
Other Males at Your Gym/ On Your Sports Team	40.0	44.4	38.9
Ave. Male Gym Member/ Male in Your Sport	20.0	29.6	30.6
Male Actors/Models	22.9	18.5	16.7
Male Sports Figures	40.0	22.2	27.7
Ave. Male Citizen	22.8	29.6	19.5

Internal consistencies for the standardized measures were calculated for each group and for the total sample (see Appendix K). Variables with Cronbach Alphas below .70 for the total sample were excluded from all analyses, since values at that level are indicative of poor internal consistency (Tabachnick & Fidell, 1996). Based on this criterion the Fitness and Health Evaluation subscales of the MBSRQ (α=.69 and .68, respectively) and the Interoceptive Awareness, Bulimia, and Perfectionism subscales of the EDI (α=.65, .52, and .66, respectively) were excluded. Univariate outliers were assessed within each group by analyzing Z-score equivalents of each variable. Within the non-user group one outlier was found on the measured weekly exercise variable, one outlier was found on the Awareness subscale of the SATAQ, and one outlier was found on the Ineffectiveness subscale of the EDI. The former user group also had one outlier on the exercise measure and one outlier on the muscularity discrepancy score of the Somatomorphic Matrix. The current user group evidenced one outlier on the exercise measure and two outliers on the Ineffectiveness subscale of the EDI. In order to reduce their influence on subsequent analyses each outlier was adjusted to one unit larger than the next most extreme score within each group. Mahalanobis Distances were calculated for all variables within each group, and no multivariate outliers were identified.

The normality of each variable was assessed according to group, and the Ineffectiveness subscale of the EDI was found to be severely positively skewed within each group. Since square root transformations failed to resolve the problem and other types of transformation were not possible due to the high frequency of "0" values within each group, this variable was excluded from further analyses. The Maturity Fears subscale of the EDI was found to be normally distributed among the non-user group, but it was substantially positively skewed among the former users and moderately positively skewed among the current users, and was therefore excluded from further analyses.

Furthermore, a square root transformation was inadequate at normalizing the distribution among the former users, and as discussed above no other transformations were applicable for this variable. Similar difficulties arose with the Interpersonal Distrust subscale of the EDI, with the non-users exhibiting a normal distribution and both the former and current users exhibiting a moderately positively skewed distribution. This variable was also excluded from further analyses. In order to check for multicollinearity and singularity, bivariate correlations between each variable were inspected (see Table 5). Using Box M tests, the homogeneity of variance-covariance matrices was found to be satisfactory.

Exploration of Potential Covariates

Prior to conducting the main analyses for this study, several one-way between-subjects analyses of variance (ANOVAs) were computed in order to determine if any of the main background variables should be considered as covariates in subsequent analyses. Separate ANOVAs were calculated for age, body mass index (BMI), perceived muscularity, exercise level, and education. In order to control for Type I error, the alpha level for each analysis was set at the .01 level.

No significant group differences were found for age ($F(2, 95) = 1.15$, $p = .32$), BMI ($F(2, 95) = 1.45$, $p = .24$), or exercise level ($F(2, 95) = 1.35$, $p = .27$). In order to compute an ANOVA for education level the variable was converted from an ordinal scale to an interval approximation of years of education. The conversions were as follows: some high school = 10; completed high school = 12; some college or university = 14; completed college = 15; completed university = 16; post-graduate = 18. The subsequent ANOVA did not reveal any group differences in education level ($F(2, 95) = .44$, $p = .65$).

Significant differences in perceived muscularity were noted between the groups ($F(2, 95) = 5.34$, $p < .01$). Post-hoc analyses using a Bonferroni correction revealed that

Table 5

Pearson Product-Moment Correlations Among Variables Included in Analyses

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. App.Eval.	—	.09	.44**	-.00	-.07	-.17	.32**	.11	.18	-.13	.23*	-.50**	.06
2. App.Orient.		—	.32**	.17	.60**	-.01	-.08	.00	-.12	.39**	.01	.00	.04
3. F/H Orient.			—	.45**	.20*	.01	.14	.16	.10	.17	.08	-.30**	.27**
4. Ill. Orient.				—	.10	.11	.03	.07	-.01	.18	.05	-.21*	.05
5. SATAQ-Total					—	.21*	-.14	.02	-.09	.61**	.01	.05	.26*
6. Teased- Thin						—	-.04	.34**	.32**	.21*	.17	.17	.28**
7. Teased- Fat							—	.24*	.51**	-.12	.07	-.38**	.10
8. Teased- Weak								—	.59**	-.22*	.27**	.08	.15
9. Teased- Upset									—	-.17	.18	-.06	.10
10. Soc. Comp.										—	-.18	.12	.13
11. FFMI Disc.											—	-.07	.22*
12. Fat Disc.												—	.02
13. Cur. FFMI													—

* $p = .05$ ** $p = .01$

the current users rated their perceived muscularity as being significantly higher (M = 21.63, SD = 2.39) than non-users (M = 19.46, SD = 3.98). Former users also rated their perceived muscularity as being significantly higher (M = 21.33, SD = 2.05) than non-users. No significant differences in perceived muscularity were found between former and current users.

In order to determine whether perceived muscularity was significantly related to the dependent variables that were used in subsequent analyses, a correlation matrix involving the total sample was analyzed. As noted in Table 5, perceived muscularity was positively correlated with participants' reported orientation to fitness and health (MBSRQ; r = .27, p = .01), awareness and internalization of society's muscular body-ideal (SATAQ; r = .26, p = .01), teasing history for thinness (r = .28, p = .006), and the discrepancy between current and ideal perceived muscularity (r = .22, p = .03). Findings were similar when correlation matrices for each group were calculated, as can be seen in Appendix L. Scores on the SATAQ and endorsement of being teased for fatness were significantly correlated with perceived muscularity only among the non-users, and endorsement of a history of being teased for thinness was correlated with perceived muscularity only for the non-users and current users. In addition, the muscularity discrepancy score was significantly correlated with perceived muscularity only among the former and current user groups. Participants' reported orientation to fitness and health, and their appearance evaluation, were significantly related to perceived muscularity only among the current users. Given these correlations, it was deemed necessary to include perceived muscularity as a covariate in subsequent analyses.

Analysis of Research Questions

Research Question #1: What variables, if any, differentiate current users of muscle-building supplements from those who do not use such supplements?

Given the aim of the present study (i.e., to explore variables that may or may not be related to supplement use and non-use), and the relative absence of previous research studies to definitively guide predictions, no specific hypotheses were made regarding group differences on each variable. Although the "former user" group was unplanned for at the outset of this study, this group was included after the planned analyses, for exploratory and comparison purposes. Group-based descriptive statistics for all variables used in the analyses are presented in Table 6.

In order to determine whether any of the variables differentiated supplement users and non-users after the effects of perceived muscularity were accounted for, two one-way multivariate analyses of covariance (MANCOVAs) were conducted. The dependent variables that were included in the first MANCOVA represented the body image variables, and included the fat discrepancy and muscularity discrepancy scores from the Somatomorphic Matrix, and the Appearance Evaluation, Appearance Orientation, Fitness/Health Orientation and Illness Orientation subscales of the MBSRQ. Analyses using Wilks' Lambda indicated that perceived muscularity did not explain a significant amount of the variance associated with the combination of dependent variables (Λ= .87, $F(6, 63) = 1.57$, $p = .17$). After the effects of perceived muscularity were accounted for, analyses using Wilks' Lambda indicated that level of supplement use explained 17.8% of the variance associated with the combination of the dependent variables, which was significant (Λ= .82, $F(6, 63) = 2.28$, $p < .05$). Closer analysis of the data revealed significant group differences on the Fitness/Health Orientation scale ($F(1, 68) = 6.11$, $p < .05$), which explained 8.2% of the variance. Pairwise comparisons using a Bonferroni correction indicated that current users rated themselves as being more oriented towards fitness and health ($M = 4.03$, $SD = .44$) than non-users ($M = 3.68$, $SD = .46$). Given that perceived muscularity was not significantly related to the body image

Table 6

Means and Standard Deviations of All Variables

		Non-Users n = 35	Former Users n = 27	Current Users n = 36
Somatomorphic Matrix				
Perceived Musc.	*M*	19.46	21.33	21.63
	SD	3.98	2.05	2.39
Disc.- Fat	*M*	5.83	5.56	5.17
	SD	8.42	10.11	7.19
Disc.- Musc.	*M*	-2.01	-1.94	-2.21
	SD	2.02	1.71	1.80
MBSRQ				
Appear. Eval.	*M*	3.54	3.94	3.82
	SD	.68	.58	.65
Appear. Orient.	*M*	3.51	3.30	3.52
	SD	.68	.71	.54
Fit/Health Orient.	*M*	3.68	3.85	4.03
	SD	.46	.64	.44
Ill. Orient.	*M*	3.20	3.23	3.14
	SD	.86	.89	.84
SATAQ- Total	*M*	42.63	42.00	42.94
	SD	8.84	10.45	9.42
Soc. Comparison	*M*	2.75	2.47	2.63
	SD	.94	1.06	.87
Teasing History				
Thinness	*M*	4.34	4.30	3.47
	SD	1.08	1.14	1.61
Fatness	*M*	3.97	4.48	4.00
	SD	1.38	.94	1.31
Weakness	*M*	4.00	4.07	4.11
	SD	1.28	1.04	.95
Level of Upset	*M*	3.74	4.04	3.67
	SD	1.27	1.09	1.12

variables, the analysis was repeated without perceived muscularity. Findings were similar to the original MANCOVA, with level of supplement use explaining a significant amount of the variance associated with the combination of the dependent variables (23.3%; Λ= .77, F(6, 64) = 3.25, p < .01). The main effect involving Fitness/Health Orientation was strengthened, and explained 13.5% of the variance (F(1, 69) = 10.75, p < .01).

A second MANCOVA was conducted between the non-users and current users, using the dependent variables derived from specific theories thought to relate to supplement use in men. These included the total SATAQ score, the total frequency of social comparison engaged in, teasing history involving thinness, fatness, and weakness, and the level of upset associated with being teased. Perceived muscularity was entered into the analysis as a covariate. Perceived muscularity was found to explain 23.3% of the variance associated with the combination of dependent variables, which was significant (Λ= .77, F(6, 63) = 3.20, p < .01). Significant findings were also obtained for group, with level of supplement use explaining 20.7% of the variance (Λ= .79, F(6, 63) = 2.74, p < .05). Analysis of main effects indicated that a history of teasing for thinness explained 17.5% of the variance, which was significant (F(1, 68) = 14.45, p < .001). Pairwise comparisons using a Bonferroni correction revealed that current users were teased for thinness more often (M = 3.47, SD = 1.61) than non-users (M = 4.34, SD = 1.08). The importance of the covariate is illustrated by the fact that if only group effects were considered in the analysis, a significant group effect was not obtained (Λ= .85, F(6, 64) = 1.84, p = .10).

In order to determine whether any of the variables differentiated supplement users and non-users from former users after the effects of perceived muscularity were accounted for, the two original MANCOVAs were repeated, this time using the former

user group along with the non-user and current user groups. The dependent variables that were included in the first analysis were the fat discrepancy and muscularity discrepancy scores from the Somatomorphic Matrix, and the Appearance Evaluation, Appearance Orientation, Fitness/Health Orientation and Illness Orientation subscales of the MBSRQ. After the effects of perceived muscularity were accounted for, analyses using Wilks' Lambda indicated no significant group differences on the combination of the dependent variables (Λ= .81, F(12, 178) = 1.66, p = .08). Perceived muscularity was found to explain 12.8% of the variance associated with the combination of dependent variables, which was significant (Λ= .87, F(6, 89) = 2.17, p < .05). The importance of the covariate is illustrated by the fact that when it is not considered in the analysis, significant group effects emerge (Λ= .79, F(12, 180) = 1.83, p < .05), with only 10.9% of the variance explained. Findings indicate trends in the data that include a significant main effect for orientation to health and fitness where current users rate themselves more highly than non-users, and a significant main effect for appearance evaluation that is no longer significant once Bonferroni corrections are made for the pairwise comparisons (p = .054). In the latter case, there is a trend for former users to rate their appearance more highly than non-users. These findings do not represent firm conclusions however, given that significant group effects did not emerge when perceived muscularity was considered.

The final MANCOVA that was conducted compared non-users, current users, and former users on the dependent variables derived from specific theories that are thought to relate to supplement use. These included the total SATAQ score, the frequency of social comparison engaged in, being teased for thinness, fatness, and weakness, and the level of upset associated with being teased. Perceived muscularity was entered into the analysis as a covariate. Findings were similar to those obtained

when current users and non-users were compared. Specifically, perceived muscularity was found to explain 20.5% of the variance associated with the combination of dependent variables, which was significant (Λ= .80, $F(6, 89) = 3.83$, $p < .01$). Significant findings were also obtained for group, with level of supplement use explaining 12.8% of the variance (Λ= .76, $F(12, 178) = 2.19$, $p < .05$). Analysis of main effects indicated that history of teasing for thinness explained 15.8% of the variance, which was significant ($F(2, 94) = 8.80$, $p < .001$). Pairwise comparisons including Bonferroni corrections revealed that current users were teased for thinness more often ($M = 3.47$, $SD = 1.61$) than both non-users ($M = 4.34$, $SD = 1.08$; $p < .001$) and former users ($M = 4.30$, $SD = 1.14$; $p < .05$). The importance of perceived muscularity as a covariate was illustrated by the fact that if it was not considered in the analysis (i.e., one-way MANOVA), a significant group effect was not obtained (Λ= .82, $F(12, 180) = 1.60$, $p = .10$).

Research Question #2: Which combination of variables best predicts use and non-use of muscle-building supplements?

In order to assess which combination of dependent variables might best predict supplement use versus non-use, while also accounting for perceived muscularity, a stepwise discriminant function analysis (DFA) was conducted. The dependent variables that were included in the DFA were those that had been found to significantly differentiate users and non-users through MANCOVA analyses. These included the Fitness/Health Orientation subscale of the MBSRQ and teasing history for thinness. The resulting discriminant function produced a Λ= .69, $\chi 2(3) = 25.17$, $p < .001$. The canonical correlation was .56. Therefore, 31.4% of the variance in the discriminant function scores was shared between level of supplement use (use versus non-use), the covariate (perceived muscularity), and the two entered dependent variables. A summary

of this DFA is presented in Table 7. Examination of the predictor loadings on the discriminant function indicates that each of the variables were good representations of the discriminant function (Comrey & Lee, 1992). With a Bonferroni corrected alpha of .017, perceived muscularity, orientation to fitness and health, and teasing history for thinness each significantly contributed to the discrimination between supplement users versus non-users. Overall, the discriminant function was able to correctly classify 69.0% of the participants. Analysis of classification rates within each group revealed a slightly higher rate of accurate classification for users (72.2%) than for non-users (65.7%).

In order to determine the degree to which the same combination of dependent variables could predict level of supplement use when former users were included, an additional stepwise discriminant function analysis (DFA) was conducted. The dependent variables that were included in the analysis were the Fitness/Health Orientation subscale of the MBSRQ and teasing history for thinness. The resulting discriminant function produced a $\Lambda = .76$, $\chi 2\,(4) = 26.29$, $p < .001$. The canonical correlation was .47. Therefore, 22.1% of the variance in the discriminant function scores was shared between level of supplement use (use versus former use versus non-use), perceived muscularity, and teasing history for thinness. A summary of this DFA is presented in Table 8. Examination of the predictor loadings on the discriminant function indicates that perceived muscularity and teasing history for thinness were good representations of the discriminant function, whereas orientation to fitness and health was a poor representation (Comrey & Lee, 1992); this variable was therefore excluded from the DFA. With a Bonferroni corrected alpha of .017, perceived muscularity and teasing history for thinness each significantly contributed to the discrimination of the three groups. Fitness/Health Orientation was not found to be significant after the Bonferroni correction was applied. Overall, the discriminant function was able to

Table 7 Discriminant Function Analysis of Prediction of Supplement Use and Non-Use (n = 71)

Predictor Variable	Correlations of predictors with discriminant function	Univariate F (1, 69)	Pooled within group correlations among predictors	
			Fit/Health Orient.	Teased
Perceived Muscularity	.59	7.80*	.27	.38
Fitness/Health Orientation	.50	10.75*		.11
Teased for Thinness	-.48	7.09*		
Canonical Correlation	.56			
Eigenvalue	.45			

* $p < .017$ (Bonferroni corrected Alpha)

Table 8

Discriminant Function Analysis of Prediction of Supplement Use, Former Use, and Non-Use (n = 98)

Predictor Variable	Correlations of predictors with discriminant function	Univariate F (1, 69)	Pooled within group correlations among predictors	
			Fit/Health Orient.	Teased
Perceived Muscularity	.58	5.34*	.20	.38
Fitness/Health Orientation	.10	4.21		.10
Teased for Thinness	-.54	4.77*		
Canonical Correlation	.47			
Eigenvalue	.29			

* $p < .017$ (Bonferroni corrected Alpha)

correctly classify 53.1% of the participants. Analysis of classification rates group revealed that whereas the supplement users and non-users were correctly classified more than half of the time (52.8% and 60.0%, respectively), the classification rate for former users was slightly lower (44.4%).

Research Question #3: What are males' reasons for using or not using muscle-building supplements?

At the outset of this study it was hypothesized that the main reasons for muscle-building supplement use would be to build muscle and to improve athletic performance. The hypothesized main reasons for non-use of muscle-building supplements included the idea that results could be achieved through diet and exercise alone, that use is against personal beliefs and could impair health, and that supplements are too costly.

Reasons given for current muscle-building supplement use varied according to the specific supplement taken. The top supplements currently taken by participants included protein powder and shakes, creatine, and amino acids, and the main reasons for use of each were to build muscle and improve strength. Improvement of an inadequate diet was an additional main reason for use of protein powder and shakes, while creatine was used to improve endurance. Amino acids were also used to improve athletic or competitive performance, improve health, and because of recommendations by a coach or personal trainer. Overall, these findings support initial hypotheses. See Table 9 for a detailed breakdown of participants' reasons for current use of specific muscle-building supplements.

Of the 35 participants who had never used muscle-building supplements, 4 (11.4%) did not provide a reason for their non-use. Most of the remaining 31 participants believed that they could achieve desired results through diet and exercise alone (n = 19; 54.3%); that muscle-building supplement use could pose a risk to their health (n = 19;

Table 9

Reasons Given for Currently Using Specific Muscle-Building Supplements (n = 36)

Supplement	Reason	Frequency n*	Percent
Protein Powder/Drink	1. Build muscle	25	69.4
	2. Improve strength	12	33.3
	3. Inadequate diet	9	25.0
	4. Lose fat	7	19.4
	5. Improve health	6	16.7
	6a. Improve athletic/competitive performance	4	11.1
	6b. Makes me feel better about myself	4	11.1
	6c. Other reason (as specified by participant)**	4	11.1
	7a. Recommended by family member or friend	2	5.6
	7b. Recommended by nutritionist or dietician	2	5.6
	8a. Improve energy	1	2.8
	8b. Prevent disease or illness	1	2.8
	8c. Recommended by coach or trainer	1	2.8
Creatine	1. Build muscle	10	27.8
	2. Improve strength	8	22.2
	3. Improve endurance	4	11.1
	4. Lose fat	3	8.3
	5a. Improve athletic/competitive performance	2	5.6
	5b. Improve energy	2	5.6
	5c. Improve health	2	5.6
	5d. Makes me feel better about myself	2	5.6
	6. Makes me more aggressive	1	2.8
Amino Acids	1. Build muscle	5	13.9
	2a. Improve athletic/competitive performance	3	8.3
	2b. Improve strength	3	8.3
	3a. Improve health	2	5.6
	3b. Recommended by coach or trainer	2	5.6
	4a. Lose fat	1	2.8
	4b. Improve endurance	1	2.8
	4c. Improve energy	1	2.8
	4d. Recommended by family member or friend	1	2.8
	4e. Other reason (as specified by participant)**	1	2.8

Table 9 (Continued)

Reasons Given for Currently Using Specific Muscle-Building Supplements (n = 36)

Supplement	Reason	Frequency n*	Percent
HMB	1. Lose fat	1	2.8
	No answer	1	2.8
Chromium	1a. Lose fat	1	2.8
	1b. Improve health	1	2.8
	1c. Recommended by family member or friend	1	2.8
	No answer	2	5.6
Other: Endurox R4	1a. Other reason (as specified by participant)**	1	2.8
	1b. Improve endurance	1	2.8
	1c. Build muscle	1	2.8
	No answer	1	2.8
Other: Ripped Fuel	1a. Lose fat	1	2.8
	1b. Improve health	1	2.8
	1c. Improve endurance	1	2.8
Other: Charge	1a. Improve athletic/ competitive performance	1	2.8
	1b. Improve endurance	1	2.8
	1c. Improve energy	1	2.8
Other: ProLab N-Large	1a. Build muscle	1	2.8
	1b. Improve athletic/ competitive performance	1	2.8
	1c. Improve strength	1	2.8

* Frequencies total more than number of group members because participants were asked to rank up to three reasons for their use of supplements, and these responses were combined to create overall conclusions

** See Appendix M for list of reasons given

54.3%); and that muscle-building supplement use was against their beliefs (*n* = 17; 48.6%).

Among the 27 former users, 2 (7.4%) did not provide a reason for their current non-use. The top three reasons given for current non-use included the belief that they could achieve desired results through diet and exercise alone (*n* = 20; 74.1%); that supplements cost too much (*n* = 14; 51.2%); and that using supplements would pose a risk to their health (*n* = 13; 48.1%).

A majority of participants who were current users had tried various muscle-building supplements in the past that they were no longer taking (*n* = 23). Of those participants, 8 (34.8%) did not provide a reason for their current non-use, while 11 participants (47.8%) cited cost as a reason for non-use, 9 participants (39.1%) were concerned that using specific supplements would pose a risk to their health, and 8 participants (34.8%) believed that they could achieve desired results without those specific supplements, through diet and exercise. In summary, hypotheses regarding reasons for non-use of muscle-building supplements were supported, though the prominence of each reason varied according to supplement use history. Complete lists of participants' reasons for current non-use of muscle-building supplements, according to group, can be found in Tables 10, 11, and 12.

Table 10

Reasons Given for Never Using Muscle-Building Supplements (n = 35)

Reason	Frequency n*	Percent
1a. I can get results without them (through diet/exercise)	19	54.3
1b. I am concerned about negative effects on my health	19	54.3
2. It is against my beliefs	17	48.6
3. They cost too much	12	34.3
4. Other reason (as specified by participant)**	6	17.1
5a. I don't believe they work	5	14.3
5b. My friends/family members told me I shouldn't use them	5	14.3
6a. They will hurt my athletic performance	1	2.9
6b. They are banned by my sport/athletic association	1	2.9
6c. My coach/personal trainer told me I shouldn't use them	1	2.9
6d. They are hard to get	1	2.9
No Answer Given	4	11.4

* Frequencies total more than number of group members because participants were asked to rank up to three reasons for their non-use of supplements, and these responses were combined to create overall conclusions

** See Appendix N for list of reasons given

Table 11

Former Users' Reasons Given for Not Currently Using Muscle-Building Supplements (n = 27)

Reason	Frequency n*	Percent
1. I can get results without them (through diet/exercise)	20	74.1
2. They cost too much	14	51.2
3. I am concerned about negative effects on my health	13	48.1
4. Other reason (as specified by participant)**	10	37.0
5. I don't believe they work/they haven't worked for me	4	14.8
6a. It is against my beliefs	2	7.4
6b. My doctor/nutritionist/dietician told me I shouldn't use them	2	7.4
7a. They are banned by my sport/athletic association	1	3.7
7b. My coach/personal trainer told me I shouldn't use them	1	3.7
No Answer Given	2	7.4

* Frequencies total more than number of group members because participants were asked to rank up to three reasons for their non-use of supplements, and these responses were combined to create overall conclusions

** See Appendix N for list of reasons given

Table 12

Current Users' Reasons Given for Not Currently Using Specific Muscle-Building Supplements (n = 23)

Reason	Frequency n*	Percent
1. They cost too much	11	47.8
2. I am concerned about negative effects on my health	9	39.1
3. I can get results without them (through diet/exercise)	8	34.8
4. Other reason (as specified by participant)**	5	21.7
5. I don't believe they work/they haven't worked for me	3	13.0
6. It is against my beliefs	2	8.7
7. They will hurt my athletic performance	1	4.3
8. My friends/family members told me I shouldn't use them	1	4.3
No Answer Given	8	34.8

* Frequencies total more than number of group members because participants were asked to rank up to three reasons for their non-use of supplements, and these responses were combined to create overall conclusions

** See Appendix N for list of reasons given

Summary of Major Findings, by Research Question

- ***Research Question #1:*** What variables, if any, differentiate current users of muscle-building supplements from those who do not use such substances?
  - ***Current Users vs. Non-users:*** MANCOVA used
    - Fitness/Health Orientation (Current Users > Non-users)
    - Teased for Thinness (Current Users > Non-users)
  - ***Current Users vs. Non-users vs. Former Users:*** MANCOVA used
    - Perceived Muscularity (Current Users and Former Users > Non-users)
    - Teased for Thinness (Current Users > Former Users and Non-users)
- ***Research Question #2:*** Which combination of variables best predicts use and non-use of muscle-building supplements?
  - ***Current Users vs. Non-users:*** Stepwise DFA used
    - Perceived Muscularity
    - Fitness/Health Orientation
    - Teased for Thinness
  - ***Current Users vs. Non-users vs. Former Users:*** Stepwise DFA used
    - Perceived Muscularity
    - Teased for Thinness
- ***Research Question #3:*** What reasons do males report for using or not using muscle-building supplements?
  - ***Reasons for Use (Overall)***
  - Build Muscle - Improve Strength - Improve Athletic/Competitive Performance
  - ***Reasons For Non-Use (In order of rated importance):***
  - *Non-users*: Can get results without them; Concerned about health effects; Against my beliefs; Too costly
  - *Former Users:* Can get results without them; Too costly; Concerned about health effects
  - *Current Users (who no longer use a supplement):* Too costly; Concerned about health effects; Can get results without them

CHAPTER IV: DISCUSSION

The present study aimed to explore the incidence of muscle-building supplement use and non-use in males, and to describe the characteristics of males who use muscle-building supplements and identify variables that predict use and non-use. The variables that were considered to be potentially important have been extensively studied in female populations in the context of eating disorders and body image research, but have been utilized with male populations to a much lesser extent. An additional purpose of this study was to identify males' reasons for their use and non-use of muscle-building supplements. At the outset of this study it was hoped that a group of anabolic steroid users would be included in analyses. However, insufficient numbers in this group made that goal impossible. An unanticipated comparison group of males who formerly used muscle-building supplements was added to the study. Overall, it was hoped that findings would help to fill a void in the literature involving body image in males, and would help to identify potential targets for education and prevention efforts involving muscle-building supplement use.

Participant Characteristics

Demographic Characteristics. Analyses of demographic characteristics revealed several important differences and similarities in relation to previous studies in the area. The majority of males in the present study were Caucasian (77.6%), which is consonant with the majority of previous research on male body image (McCabe & Ricciardelli, 2004). Though most studies involving supplement use have not mentioned the ethnicity of participants, those that have report ethnic frequencies that are consistent with those in the present sample (Brower et al., 1994; Krumbach et al., 1999). The conclusions from this study can thus be related to much of the previous research in the area, although the generalizability to groups other than Caucasians is limited.

Males in the present study were similar in age to those included in previous studies of muscle-building supplement use (Andersen et al., 1995; Kanayama, et al., 2001), but

were older and encompassed a wider age range than those typically included in past research that focused on body image and related variables (McCabe & Ricciardelli, 2004). Furthermore, it appears as though males' decision to use, never use, or give up muscle-building supplements is unrelated to their age, since no age differences were found between the three respective comparison groups. This finding has not been reported in previous studies involving muscle-building supplements, and provides impetus for education and prevention efforts that target all age groups.

Males in the present study were more educated than those included in previous body image studies, with 56.2% of the total sample having completed their college or university studies; an additional 21.4% were involved in a college or university program at the time of the study. This is likely related to the fact that many past studies have focused on high school and college students rather than samples from the general population (McCabe & Ricciardelli, 2004). This is also true of previous studies involving supplement use (Sobal & Marquart, 1994a; Sobal & Marquart, 1994b), though there is a trend in the literature to include fitness club and sports team members without mention of education levels (Burke & Read, 1993; Kanayama et al., 2001). The exception comes from one reviewer who contended that the typical creatine user had attended or graduated from college (Poortmans & Francaux, 2000), which is consistent with present findings. Given that there were no significant educational differences between groups in this study, however, it appears that supplement use may be independent of formal education. It may not be education per se that influences males' decision to use or not use supplements, but rather education that specifically focuses on issues related to supplement use. Several studies have supported this notion, with adolescents who have greater knowledge about supplements reporting less use (Massad et al., 1995; Sobal & Marquart, 1994b).

Exercise Levels. Participants in groups reported being much more physically active than the minimal requirement for participation in this study (i.e., at least 20-30 minutes of

strenuous activity, three times weekly). Overall, participants spent more than five hours per week involved in aerobic and anaerobic activities. Most engaged in exercise recreationally, but competitive athletes from various sports were represented as well. There were no competitive weightlifters involved in this study, but the majority in each group engaged in weightlifting on a recreational basis. On the whole, these characteristics contrast with those reported in previous studies involving adult males, which have tended to focus solely on competitive athletes, including bodybuilders (Burke & Read, 1993; Krumbach et al., 1999; Andersen et al., 1995). Thus, it appears that findings from the present study are more generalizable to males in the general population than has typically been the case, although the high levels of exercise engaged in by participants may limit this generalizability. Only 30% of adult American males reportedly exercise at the recommended level of 20 minutes daily, three times per week (Pratt, Macera, & Blanton, 1999), whereas 53% of Canadian males over the age of 20 are considered to be to be inactive (Statistics Canada, 2003). The findings from this study may therefore be more applicable to regularly exercising males than to males in the general population.

Amount of weekly exercise did not differentiate muscle-building supplement users from non-users or former users in this study, which is a finding that contradicts a recent report that protein and creatine users exercised more often than non-users (Bell, Dorsch, McCreary, & Hovey, 2004). However, Bell et al. studied adolescent participants, and their respective user characteristics may differ from those of the adults in the current study. Possible differences that could exist between the groups include amount and type of exercise engaged in, reasons for use, level of knowledge concerning supplement use, and amount of importance placed on achieving muscularity. These possibilities could be examined in future research, as cohort differences may emerge.

Another possible explanation for the lack of differences between users, non-users, and former users in terms of exercise level is that supplement users are more heavily

involved in exercises that emphasize size and strength, a notion that is consonant with previous studies (Massad et al., 1995; Sobal & Marquart, 1994a). In the present study this was true for weightlifting, which was done by nearly all of the current users (88.9%) versus most of the former users (70.4%) and slightly more than half of the non-users (54.3%). Moreover, current users spent more time weightlifting (259.1 minutes per week) than both former users (203.4 minutes) and non-users (225.5 minutes). Although the amount of time spent doing each activity was assessed in this study, the level of commitment and interest that participants had in each activity is unknown. It is plausible that users spent more time and also put more effort into weightlifting, and that their high level of commitment relates to their supplement use. These possibilities should be evaluated in future studies in order to clarify the relationship between supplement use and exercise.

Evaluation of Physical Appearance. The majority of males were dissatisfied with their current body figures and wanted to be more muscular. Participants' perceived muscularity was similar to figures previously reported for adult males (Pope, Gruber, et al., 2000). Moreover, former and current users' perceived muscularity can be described as "distinctly muscular" (Cafri & Thompson, 2004). While non-users chose an average level of ideal muscularity when compared with previous reports (Pope et al.), former and current users chose an ideal level of muscularity that approximates the upper limits that can be attained without using AAS (Pope, Phillips, & Olivardia, 2000). The majority of males reportedly wished to gain muscularity, though only 8.6% of non-users (3 of 35), 33.3% of former users (9 of 27) and 22.2% of users (8 of 36) had reportedly eaten more food or calories over the previous month in order to gain weight.

A large proportion of non-users (45.8%; 16 of 35), former users (40.7%; 11 of 27), and supplement users (39.0%; 14 of 36) reported a desire to lose body fat. Moreover, 51.4% of non-users (18 of 35), 18.5% of former users (5 of 27) and 33.3% of users (12 of 36) reportedly dieted to lose weight during the previous month. Contrary to previous research

that relates older age with higher fat levels and a corresponding desire to lose weight (Lynch & Zellner, 1999; McCabe & Ricciardelli, 2004), no age differences were found between those who desired fat loss (M= 29.15) and those who were satisfied with their level of body fat (M= 27.93).

Overall, participants' self-reported desire to gain muscularity and lose body fat is consistent with the sociocultural standard of bodily attractiveness for males, which is a mesomorphic body build (Leit et al., 2002; Leit et al., 2001). The fact that over 50% of males within each group dieted in order to either lose or gain weight is further indicative of this desire. Although participants uniformly reported an interest in attaining this body figure, those who took supplements desired a more muscular body figure with less fat than those who were non-users. Former users appeared to have similar ideals to current users, which may help to explain their initial use of supplements. Since they are often believed to enhance muscularity and achieve the mesomorphic body build, supplements may have been taken initially in order to achieve their weight and shape goals.

It is notable that even though current users rated their bodies as being more muscular than those of non-users, they still desired significant changes in terms of increased muscularity. Though their self-rated ideal body figure appears to be achievable without the use of anabolic steroids (Pope, Phillips, & Olivardia, 2000), at the time of their participation that ideal had not been reached through high levels of exercise, alterations in diet, and muscle-building supplement use. It appears reasonable to assume, based on their practice of the aforementioned behaviours, that attainment of a muscular body is important to them. Future research should continue to explore variables that relate to continued supplement use in terms of adding or switching supplements, as well as those that relate to the decision to use anabolic steroids (AAS) in an effort to achieve weight and shape goals. The identification of supplement users who are at high-risk for AAS use would enable future education and prevention efforts.

Social Comparisons. One additional variable that was explored in the present study was the frequency of social comparisons that were made with various targets. Overall this behaviour was reported by a majority of participants, with the most frequent target of bodily comparisons being other males at the participants' gym or on their sports team. This finding is consistent with the notion that social comparisons are often made with others who are perceived to be representative of the "zone of possibility" in terms of an attribute (Richins, 1995).

Though the subsequent cognitive and affective consequences of comparisons were not directly assessed in the present study, it is reasonable to assume that reactions would relate to whether the targets represented upward or downward comparisons (Stormer & Thompson, 1996), since both of these types of targets would likely be available in the gyms surveyed. If males with less muscularity and/or more body fat were targets, then the likely effect would be body satisfaction, while the opposite is true for targets that have greater muscularity and/or less fat than the comparer (Lorenzen, Grieve, & Thomas, 2004). An obvious but extreme example of the latter comparison target would be an AAS user. Although very few self-identified AAS users participated in this study, it is possible that at least some of the members of the gyms surveyed used AAS and thus served as unrealistic comparison targets for the males who do not use AAS (Pope, Phillips, & Olivardia, 2000). While it is possible that males may have used these targets of upward social comparison as aspirational goals that engender positive feelings, literature conducted with females indicates that this is often not the case (Stormer & Thompson, 1996).

Interestingly, non-users compared their bodies with sports figures as frequently as they compared themselves with males at their gym or on their sports team. Given that sports figures have a higher likelihood of being more lean and muscular than males in the general population (Norton & Olds, 2001), they likely serve as targets for upward social comparison. As already mentioned, this type of comparison often leads to negative affect and body

dissatisfaction, but it is also possible that they serve as aspirational figures that the male strives to approximate (Stormer & Thompson, 1996). Given that the bivariate correlations indicated that non-users engaged in social comparison more often when their perceived muscularity was furthest away from their ideal, it appears to be more likely that comparisons with sports figures resulted in negative affect. This may also be the case among supplement users, given that they mainly compared themselves against other males involved in sports or exercise in some way. These targets specifically included other males at their gym or on their sports team, the average male gym member or team member, and male sports figures. Bivariate correlations indicated that users compared their bodies more often with others when they were more oriented towards their appearance. Comparisons with other males involved in sports or exercise makes sense in this case, given that comparison targets may be more likely to represent society's mesomorphic ideal (Norton & Olds, 2001). Further examination of the bivariate correlation matrices indicated that males within each group compared their bodies more when their level of awareness and internalization of sociocultural ideals of muscularity, as measured by the SATAQ, increased. It is possible that as males identify with and place importance on sociocultural norms of attractiveness, they increasingly turn to others in order to judge changes in their own physique, and also may want to assess for changes in society's ideals over time. These interpretations are consistent with the findings of Morry & Staska (2001), who concluded that internalization of muscular ideals, as portrayed in fitness magazines, significantly predicted body dissatisfaction in college-aged males.

Comparisons that involved friends, family members, and actors generally occurred to a lesser extent among males within each group. This contrasts with the comparisons of adolescent boys, which mainly involved peers, family members, and media personalities (Ricciardelli et al., 2000). These comparisons tended to engender either positive or neutral feelings in the adolescents surveyed. Although the emotional consequences of comparisons

were not directly assessed in the present study, evidence of body dissatisfaction did exist among the males surveyed, and may relate to their frequency of social comparisons. This would be consistent with previous research in the area (Jones, 2002).

Characteristics of Muscle-Building Supplement Use

As a group, former users reported lifetime use of nine different muscle-building supplements, while current users had tried 23 different supplements. Of those, 14 were still being used at the time of this study. The average former user had reportedly tried two different supplements over the course of their lifetime, while the corresponding figure among users was nearly four. Furthermore, the average user reportedly consumed two different supplements at the time of this study, which is consistent with those reported among competitive bodybuilders (Brill & Keane, 1994) and weight-lifting males classified as "low-risk" for AAS use (M= 2.3; Brower, Blow, & Hill, 1994). Supplement users in the present study may not represent a "high-risk" group for AAS use, given that a significantly higher rate of muscle-building supplement use than was found has been associated with intentions to use anabolic steroids (M= 3.9) and actual anabolic steroid use (M= 5.7; Brower et al.).

The most popular types of muscle-building supplements that were reportedly used either in the past or currently were similar to those identified in previous studies (Bell et al., 2004; Grunewald & Bailey, 1993; Reents, 2000b), and mainly included protein powders and drinks, creatine, and amino acids. In terms of lifetime use, protein powders and drinks were found to be most popular both among former (81.5%; n= 22) and current users (91.7%; n= 33). Use of this supplement was so popular among users, in fact, that only one male had reportedly stopped taking it since initiating its use. Once males began taking protein supplements, many stated that they used it for a lengthy period. This appeared to be the case even among former users, with 22.2% (n= 6) having used for less than one year, and a third of the overall group (n= 7) reporting use of protein for a one to four year period. At the time of this study, 27.8% of users (n= 10) had reportedly been taking protein for less than

one year, while the usage histories of the remaining 44.4% of respondents (n= 15) varied widely and included 16.7% (n= 6) who had reportedly used for five to ten years, and 11.1% (n= 4) who had reportedly used for more than a decade. Though no serious adverse effects have been directly associated with protein supplementation (Lemon & Proctor, 1991; Phillips, 2004; Tarnopolsky, 1999), no studies have been undertaken that have investigated the possible adverse effects of long-term supplementation at the level that was reported in this study. Furthermore, the studies to date have generally agreed that protein supplementation is not necessary even among frequent exercisers (Lemon & Proctor, 1991; Phillips, 2004; Tarnopolsky, 2000).

The long-term use of protein supplements identified by many participants raises the question of why use would be continued if no effects on body composition were observed. It is possible that any changes in body composition were misattributed to protein supplementation rather than the relatively healthy diet and exercise regimen that were likely concurrently utilized. Similarly, it is also possible that males exercised harder and/or more efficiently while taking protein supplements, and subsequently misattributed any gains to their supplementation rather than their own efforts. Lastly, supplement users could have exhibited a positively skewed cognitive distortion, whereby they viewed their bodies as being more muscular than it actually was because of their belief in the efficacy of the supplements. A similar phenomenon has been described that involves negatively skewed misperceptions of bodily features in males, whereby they perceive larger amounts of hair loss and body fat than are the case (Pope, Phillips, & Olivardia, 2000), but it is plausible that positive distortions could occur as well. Furthermore, the notion that supplement users are more likely to believe in its efficacy than non-users has been supported by previous research (Stephens & Olsen, 2001).

When participants were asked why they took protein supplements, most respondents indicated that they wanted to build muscle, while one-third of users indicated that they

wanted to improve strength. These findings are consistent with previous studies involving adult bodybuilders and high school and college athletes that queried reasons for supplement use (Brill & Keane, 1994; Froiland, Koszewski, Hingst, & Kopecky, 2004; Krumbach et al., 1999; Massad et al., 1995; Metzl et al., 2001). Furthermore, these reasons are logical ones, given that increasing muscle mass and strength are the purported benefits of protein supplementation (Grunewald & Bailey, 1993; Juhn, 2003). More than one-quarter of protein users stated that their use was related to an inadequate diet. If in fact these males are not consuming enough protein in order to fuel their activity levels, it may be a valid reason for supplementation (Lemon & Proctor, 1991; Tarnopolsky, 1999). This possibility is unlikely, however, since protein requirements to sustain even high activity levels are often easily met through diet alone (Lemon, 1998; Lemon & Proctor). Given that this is the case, it is possible that some of the current users are deliberately not eating whole foods that contain protein as well as other nutrients, and are opting instead for protein supplements (Short & Marquart, 1993). Another explanation could be that these males are not informed about protein requirements in relation to exercise levels, and overestimate the amount of protein needed in their diet. Nonetheless, based on the high percentage of protein users who indicated they supplemented due to an inadequate diet, education efforts need to focus on proper nutrition in order to help males make more informed choices about their health. This is a particularly salient goal given that improved health was rated as an important reason for protein supplementation by 16.7% of users (n= 6). Though supplement use was found to relate to body image variables in this study, only 11.1% (n= 4) stated that protein supplementation made them feel better about themselves. Overall, it appears that the most salient reasons for protein use are related to the form and function of the body, while reasons related to self and body-esteem are less important. This does not mean that these latter variables should not be given credence in future studies, however, since self-esteem has been found to relate to several body image variables, including perceived muscularity scores on the

Somatomorphic Matrix (Olivardia, Pope, Borowiecki, & Cohane, 2004). Future studies involving supplement use among recreational exercisers should therefore include a separate measure of self-esteem in order to clarify the relationship. Recommendations from friends, family members, nutritionists, dieticians, coaches and trainers were reported as being important reasons for protein use for only 11.1% of users (n= 5). One rationale for this may be that these males have not perceived these influences as being overt, particularly in the case of friends, family members, and trainers who may model supplementation through their own use. Given that most males in previous studies involving adolescents and adult body builders have identified several types of people who have influenced their decision to use supplements (Andersen et al., 1995; Kleiner, Bazzarre, & Litchford, 1990; O'Dea & Rawstorne, 2001), future studies involving recreational exercisers should consider including a separate query concerning these influences in order to clarify their most salient sources of information regarding supplements. If it were found that nutritionists, doctors, and/or gym personnel were consulted regarding supplement use by a significant number of males, for example, then these types of professionals could be targeted for greater education regarding supplements in the future.

Similar profiles were observed for the use of creatine and amino acids, though fewer users were identified relative to those who used protein. The majority of past and current users had reportedly taken these respective supplements for more than three years. The true extent of their use cannot be known, however, since a relatively large percentage of participants did not provide estimates of how long they had used creatine and/or amino acids. Although creatine has had some positive support for its use, conclusions have been mixed (Poortmans & Francaux, 2000; Reents, 2000a; Juhn, 2003). Similar findings have been reported for amino acids, with the majority concluding that they are not effective (Jacobson, 1990; Wagenmakers, 1999; Williams, 1995; Williams, 1999; Juhn, 2003). To date, very few studies have explored the possible negative effects associated with multiple

years of continuous creatine use, though muscle cramping and renal dysfunction have been anecdotally reported among males who took higher doses than recommended (Juhn, 2003; Poortmans & Francaux, 2000). Conclusions cannot be made in this regard, since the present study did not query participants' dosage histories. Despite this, sufficient concern in the research literature has been raised concerning taking creatine on a long-term basis (Juhn; Poortmans & Francaux), and therefore participants may be taking unnecessary chances with their health. Furthermore, it has been found that individuals who consume large amounts of amino acids may experience severe gastrointestinal distress, while users who have liver or kidney problems may worsen their condition with prolonged intake (Wagenmakers; Williams, 1995). Although it is unlikely that either creatine or amino acid use would have continued for such a long time if severe muscle cramping and/or gastrointestinal distress were experienced, other side-effects that may be associated with long-term use may exist and have not been highlighted due to a lack of long-term research. Taken together, these findings mean that even if the average creatine or amino acid consumer in this study was aware of the scientific evidence in favour of their respective use, they were nonetheless engaging in potentially damaging behaviour by taking it for such a long period.

When asked to identify their main reasons for use, both creatine and amino acid users listed similar reasons as those who used protein supplements. In particular, most were using creatine and amino acids in order to build muscle and improve strength, which are the purported benefits of these supplements (Kreider, 1999; Jacobson, 1990; Reents, 2000a; Wagenmakers, 1999). Although the third and fourth most common reasons for creatine use were improved endurance and fat loss, respectively, neither of these functions have been supported in the research literature (Branch & Williams, 2002). Those who used amino acids rated improvements in athletic and competitive performance as being very important, which may be related to the fact that a higher proportion of users were acting on the recommendations of a coach or trainer than was the case for either protein or creatine use.

It appears as though coachers and personal trainers are considered to be valid sources of information regarding supplementation, at least for some males, and therefore these may serve as important targets for education regarding the efficacy of various supplements.

One notable finding concerns the relatively low incidence of androstenedione use in the present sample. Although researchers have expressed concern of an increase in the use of this supplement subsequent to its notoriety in the media (Yesalis, 1999; Kanayama et al., 2001), only 4.1% of this study's sample (n= 4) had reportedly ever tried androstenedione, and none acknowledged current use. These findings are in contrast to previous estimates, with 18% of a sample of 334 males (Kanayama et al., 2001) and 8% of a sample of 439 males (Stephens & Olsen, 2001) reporting use during their lifetime. Given that participants used many other supplements that researchers have concluded are largely ineffective, it is unlikely that their decision not to use androstenedione was based on education regarding its effects and lack of efficacy. One possible explanation for the present findings is that males in the present study were less influenced by the media in general and therefore were less swayed by intimations that androstenedione increases strength and/or muscularity. Although this notion could not be directly tested in the present study, it remains a possibility given the low frequency of social comparisons with various media figures that were reported by the majority of participants. It is interesting to note in this context that non-users chose sports figures as one of their most frequent social comparison targets, yet the use of androstenedione by Mark McGwire obviously did not have an effect on them in terms of increasing the likelihood that they would take supplements in order to achieve the body of a sports figure. Perhaps in this case the type of sport engaged in plays a role, with baseball players being chosen as comparison targets less often than males who play other types of sports. A related explanation concerning males' targets of social comparison involves the finding that, overall, participants chose other males at their gym and/or on their sports team as their most frequent social comparison targets. In addition to serving as comparison

targets, these males may be important sources of information regarding supplements. Therefore, if androstenedione was not popular among the gyms and/or teams surveyed it is possible that it deterred increases in use amongst its members. This hypothesis is consonant with reports that male bodybuilders most often use friends, health club staff, former competitors, coaches, books, and magazines for nutrition information, and rely less on radio and television reports (Andersen et al., 1995; Kleiner, et al., 1990).

The reported lifetime incidence of AAS use in this study was comparable to one estimate taken from a gym-based sample (Kanayama et al., 2001). Though three males in the present study identified themselves as current AAS users (3.0%), their data was excluded from further study due to the low response rate of AAS users overall. Of the remaining sample (n= 98), 7.1% (n= 7) identified themselves as former AAS users. The corresponding estimate of use in Kanayama et al.'s (2001) study was 5% of a sample of 334 (n= 18) within the previous three years. Slightly higher estimates were reported by Brower et al. (1994) and Kersey (1993), with 12% of 404 and 18% of 139 male recreational weight lifters admitting to AAS use. It appears, then, that estimates of lifetime use of AAS in the present study are comparable to those obtained in other studies using gym-based populations, but are lower than those obtained using sports teams and competitive, strength-based athletes. For instance, estimates of lifetime use among competitive bodybuilders ranged from 44% of a sample of 43 males (Blouin & Goldfield, 1995) to 42% of a sample of 379 males (Delbeke, et al., 1995). The fact that competitive, strength-based athletes were not recruited for this study could be considered an asset, however, since findings are more likely to be considered a reasonable estimate of AAS use within a Canadian gym-based population.

Reasons for Supplement Non-Use

The hypotheses made regarding males' reasons for non-use of supplements were mostly supported. Non-users and former users' top reasons for non-use included that results

could be achieved through diet and exercise alone, and that supplementation could harm their health. These findings are reassuring, given that these are in fact the main reasons why people should not use these substances. Although it was not directly queried in this study, previous researchers have found that the main sources of information regarding supplements are friends, fellow athletes, coaches, personal trainers, and nutritionists, with media sources less frequently utilized (Andersen et al., 1995; Froiland et al., 2004; Kleiner, at al., 1990; O'Dea & Rawstorne, 2001). These studies have been vague regarding what type of information is obtained from these sources, and it would therefore be interesting to query recreational exercisers not only about to whom they turn for information regarding supplements, but also the tone of the information that was obtained in terms of encouraging versus discouraging use. Preliminary findings from this study indicate that while at least 25% of users (n= 9) were encouraged to use various supplements by family and/or friends, doctors and/or nutritionists and/or dieticians, and coaches and/or trainers, at least 10.2% of the overall sample (n= 10) were discouraged from supplement use by these same sources. Given that increased knowledge regarding supplements has related to decreased use in previous research (Massad et al., 1995) as well as in the present study, a complete understanding of where recreational exercisers obtained their supplement-related information is necessary.

It was initially hypothesized that males would rate the cost of supplements as an important reason for their non-use, and this was the case among non-users, former users, and current users alike. The finding that costliness was more of a deterrent against use than was the belief that supplements are ineffective is worrisome given the changeability of the cost of supplements and/or males' financial situations, and the fact that these changes may result in the initiation of supplement use. Educators and health professionals need to be aware of this possibility and work to increase males' knowledge about supplements, thereby strengthening their belief that they are ineffective. Over half of the former users mentioned

the cost of supplements as a deterrent to use, which was ranked second only to their belief that they can get results through diet and exercise alone. Similarly, current users rated costliness as the most important reason for giving up certain supplements, while both groups mentioned costliness slightly more often than worry over negative effects on health. Again, these findings point out the need for education regarding the nature and effects of supplementation.

One additional finding of interest relates to the "other" reasons provided by former users relative to those provided by the other groups. Specifically, 25.9% of the former users spontaneously stated that their non-use is related to the cessation of competitive sports and/or weightlifting. This notion has not been mentioned in the previous research literature regarding reasons for non-use, but nonetheless makes sense given that many supplement users are also athletes. This finding adds further support for the need for education among athletes at all levels, given that they have been found to use in order to maximize performance in athletics in various ways, and should make informed decisions regarding their use.

Other reasons that were spontaneously provided by participants may also warrant further study. In particular, approximately one-third of males who provided an "other" reason for their non-use implied that they were either not interested in or did not place a high level of importance on achieving a high level of muscularity. Examples include the non-user who said (I) "don't want to get in "that" shape that badly"; the former user who said that he was "not concerned about building muscles - at a different point in life"; and the current user who simply stated "not as important to me".

Taken together, males' reasons for non-use highlight the complex issues surrounding males' decision to use or not use muscle-building supplements. These issues often appear to involve specific belief systems, which may include the acceptability of using supplements for athletic purposes versus aesthetic reasons, perceived societal pressures

concerning muscularity and how those perceptions may change with age, and how and why males combat or avoid the pressure to achieve muscularity. These areas would likely best be understood in the context of qualitative research, where the meanings underlying individual responses could be explored. In the process, protective and risk factors associated with muscle-building supplement use could be delineated and clarified, which may aid in theory building and subsequent education efforts.

Predictors of Supplement Use versus Non-Use

One of the main purposes of the present study was to explore variables that differentiate and can be used to predict supplement use in males. Of the variables that were predicted to differentiate between supplement users and non-users, only participants' perceived muscularity, orientation to health and fitness, and identified teasing history for thinness were found to be different between users and non-users. Together they were found to predict supplement use versus non-use at a rate that was greater than chance.

Males' perception of their current level of muscularity was found to differentiate the groups whereby users rated their muscularity as being larger than non-users. Although their ratings may or may not be based in reality, users rated their muscularity at a level where it would be very obvious to the casual viewer (Pope et al., 2000). As previously mentioned, their ratings may be indicative of a positive cognitive distortion (Pope et al., 2000), or be based in reality but due to a healthy diet and exercise rather than their supplementation. Both groups of males indicated a desire to be more muscular than they already are, to the point where current users desired the upper limits of muscularity that is achievable without anabolic steroids (Pope et al., 2000). Males who express a desire to achieve this level of muscularity, whether at a gym or on a sports team, could benefit from counselling regarding supplementation, as well as the proper diet and exercises that can be used to achieve muscularity. This type of counselling could also help to validate and reinforce the healthy

behaviours of males who are muscular, yet who have been mistakenly giving at least some of the credit for their gains to various supplements rather than their own efforts.

Current users also rated their orientation to health and fitness as being greater than that of non-users. In terms of definitions, one's orientation to fitness involves the extent of investment in physical fitness, and is often related to level of exercise (Cash, 2000). As previously mentioned, there were no differences in the overall level of exercise between users and non-users, so it is somewhat surprising that users would see themselves as more involved in exercise-related activities. Perhaps they engaged in different types of exercise, or put more effort or intensity into the workouts in which they engaged when compared with non-users. Furthermore, given that orientation to health is synonymous to a health conscious lifestyle (Cash, 2000), and that supplement use has not been deemed necessary or recommended in order to maintain health because of their potentially harmful and/or unknown effects on the body (Juhn, 2003), it is interesting that users see themselves as being more health conscious than non-users. One researcher recently noted that, among other variables, fitness orientation predicted males' drive for muscularity (Davis, Karvinen, & McCreary, 2005). Similar to the findings from the present study, males with a greater fitness orientation had a higher drive for muscularity. It appears as though this drive for muscularity leads not only to changes in exercise, higher investment in health and fitness and changes in diet, but to supplement use as well.

Current users were reportedly teased for thinness more often as children than were non-users. Furthermore, recall of being teased for thinness was positively correlated with a reported history of being teased for weakness, recalled level of upset over being teased, and frequency of social comparisons among current users only. Both users' and non-users' recalled teasing history for thinness correlated with perceived muscularity and the discrepancy between perceived and ideal muscularity. This suggests that supplement users have an increased likelihood to recall having been teased for thinness, which is also related

to reportedly being teased for weakness, and feeling upset over being teased. These findings are supportive of previous research indicating that the most distressing perception among young males is to be too thin (Davis et al., 1993; Page & Allen, 1995). Futhermore, these findings build upon previous literature that indicates long-lasting body image difficulties among males who were teased about their weight (Garner, 1997; Gleason et al., 2000; Jones, 2002). Though previous studies did not ask about teasing for thinness, and instead focused solely on teasing for fatness, it is possible that males who were teased for different weight reasons have different long-term consequences. Specifically, males who were teased for thinness appear to have a drive for muscularity and are at-risk for using muscle-building supplements, while those who were teased for fatness appear to have poor body image (Garner, 1997; Gleason et al., 2000; Jones, 2002) and may have a drive for weight loss and more difficulties with obesity and/or eating pathology (Womble et al., 2001). These possibilities should be evaluated in future research studies since this is a relatively new but seemingly salient area of inquiry in the body image and supplement use literature, and replication of present findings are therefore necessary.

An additional area worthy of further study concerns the relationship between being teased for thinness and frequency of social comparisons, whereby those who recall being teased more compared their bodies more with others. Perhaps these males are sensitive to the possibility of being teased or judged again for their weight, and are therefore more watchful and vigilant of others' bodies in an effort to measure up to the standards of others, and ultimately avoid being teased or judged again. It is also possible that these males were physically bullied in relation to their small size, and their efforts to increase muscularity are related to a desire to be capable of physically defending themselves should the need arise. This is a possibility that has not been explored in the research literature but which may prove to be fruitful.

Non-Predictors of Supplement Use versus Non-Use

Several variables were not found to differentiate between users and non-users, or predict supplement use versus non-use. In particular, neither of the discrepancy scores between current and ideal levels of muscularity or fat as measured by the Somatomorphic Matrix; males' appearance evaluation and orientation, as well as their illness orientation as measured by the MBSRQ; awareness and internalization of a muscular ideal as measured by the SATAQ; frequency of social comparisons; and history of being teased for fatness and weakness, as well as level of upset over being teased were each found to be similar among users and non-users alike. One trend in the data was observed, however, whereby users evaluated their appearance more highly than did non-users. This trend has been noted among males who use anabolic-androgenic steroids (AAS) as well (Brower et al., 1994; Schwerin et al., 1996). While this finding did not attain significance (p = .054), it indicates a need to include a measure of appearance evaluation in future studies involving body image and supplement use. It is possible that the low number of participants in this study decreased the chances of achieving significant findings, and that a study with more participants would evidence a stronger relationship between appearance satisfaction and supplement use. Possible reasons for users' reported satisfaction with their appearance despite the lack of efficacy of muscle-building supplements have already been discussed in the context of protein supplement use, and include that they are exercising harder and/or more efficiently than others; that they are generally eating healthy diets; or that they are exhibiting a positive cognitive distortion regarding their bodily appearance.

Predictors and Non-Predictors of Level of Supplement Use - Analyses of Current, Former, and Non-Users

When the aforementioned analyses were re-run including the former user group in order to explore their characteristics in relation to users and non-users, several differences from the previous analyses emerged. In particular, after the effects of current muscularity

were accounted for in the analysis involving the body image variables, the effects associated with level of supplement use were no longer significant. The reverse was true when the theoretical measures involving social comparison, sociocultural theory, and teasing were included. In this case, if the effects of current muscularity were not accounted for in the analysis then the effects associated with level of supplement use were no longer significant. Overall, then, it appears as though both current muscularity and teasing history for thinness play important roles in the discrimination and prediction of level of supplement use, and that these variables somehow interact in order to produce stronger effects. Moreover, current users experienced teasing for thinness more often than both non-users and former users. Although comparisons involving only users and non-users exhibited a strong relationship between fitness and health orientation and supplement use, this relationship was no longer significant when former users were added into the analysis. Furthermore, the predictive value of perceived muscularity and teasing history for thinness was reduced by including the former user group, since less variability in the scores was accounted for. Lastly, fewer users and non-users were correctly identified relative to the success rate identified in the initial analysis, while fewer than half of the former users were correctly identified in the second analysis.

A possible explanation for these findings lies in the nature of the former user group. In particular, they were not consistently found to be significantly different from either group, even when differences between users and non-users were identified. Based on these findings, it is possible that the former user group includes two or more relatively distinct groups of males who were somewhat arbitrarily grouped together based on their history of supplement use. For the purposes of the present study this was a logical choice, given its focus on supplement use versus non-use and the lack of clarity regarding which group former users would most closely resemble. The former user group may instead have included males who represented a "high-risk" for re-use of supplements, and who may have

more closely resembled current users in several respects. Possible support for this hypothesis can be found among the former users' reasons for non-use of supplements, which included costliness as one of the most important reasons for non-use. Arguably, the male who chooses not to use supplements because of financial issues is likely different from one who does not use based on their belief that they are ineffective or are against their belief system overall. Related to this, the former user group may have also included males who will never use supplements again and who pose a "low risk" for re-use. These males may more closely resemble non-users on several variables, including reasons for non-use. Specific examples listed by this possible group include that they are no longer involved in competitive sports or weightlifting, and are worried about negative health effects associated with use. The concept and designation of "high-risk" and "low-risk" has been used in the context of research involving anabolic steroid use (Brower et al., 1994) and nutritional supplements (Bell et al., 2004), and these studies have found differences between those who have intentions or risk to use versus those who do not. These possibilities warrant further study, since they implicate a continuum of supplement use that may warrant different types and targets for education and prevention efforts. Focusing on the characteristics of former users who are likely to never use again may provide insight into ways to get other current users to cease their supplementation, as well as ways to prevent non-users from trying supplements altogether.

Overall, aside from the finding that males' orientation to health and fitness failed to significantly discriminate the three groups and subsequently failed to be predictive of level of supplement use, the analyses that included the former user group were found to be similar in terms of predictive and non-predictive variables. As these findings have already been discussed in the context of users versus non-users, they will not be reiterated here.

Limitations to the Present Study

A number of limitations to the present study should be noted. One limitation was the size of the samples that were utilized. Because a small number of participants comprised each group within this study, statistical power was lowered. This means that the chances of finding group differences when they actually existed was reduced, and may have lead to false negative conclusions. This may have been the case with the Appearance Evaluation subscale of the MBSRQ, which evidenced nearly-significant group differences whereby users evaluated their appearance more favourably than did non-users. Though no other comparisons yielded findings that approached significance, it is possible that additional group differences would emerge if larger samples were utilized. There may be a general difficulty in obtaining large community-based samples, which would partially explain the large percentage of both body-image and supplement-use studies that utilize samples of university and high school students (Bell et al., 2004; McCabe & Ricciardelli, 2004; Sobal & Marquart, 1994b). Previous studies that have sampled from the community have tended to have relatively small sample sizes as well (Blouin & Goldfield, 1995; Brower et al., 1994), or have asked only a few questions thereby enabling them to obtain more participants (Kanayama et al., 2001). Despite the fact that the present study utilized a small sample size, significant group differences were nonetheless obtained. We can therefore be assured that these differences are true rather than spurious and related to a large sample size.

Further limitations to this study exist regarding the level of education of the participants surveyed. In this regard, participants were reportedly more educated than those utilized in previous studies (McCabe & Ricciardelli, 2004; Sobal & Marquart, 1994a; Sobal & Marquart, 1994b). While findings may not be generalizable to males who have no advanced education, this is a common difficulty with much of the research in the area (McCabe & Ricciardelli, 2004; Sobal & Marquart, 1994a).

The design of the present study also poses a limitation. In particular, its cross-sectional nature meant that males were not randomly assigned to groups and were only assessed once rather than on two or more occasions to assess for changes over time. This design precludes conclusions about causality or direction of effects noted. It should be noted, however, that random assignment to groups was not feasible since this study involved psychological variables that may naturally be associated with supplement use and non-use, and these would likely not emerge if males were randomly assigned to ingest supplements for a specified amount of time. Furthermore, only one previous study has utilized a longitudinal design to study body change strategies in males (McCabe & Ricciardelli, 2004). Although rarely utilized, this design would enable the study of males who have recently begun to use muscle-building supplements and would allow for comparisons over time with males who have never used supplements. This would allow for a greater determination of causality than is possible with the present study's design.

This study's reliance on self-report data also poses a limitation. Although it is impossible to verify the accuracy of participants' responses to most of the queries used in this study, including retrospective reports of the frequency of teasing, their orientation to health and fitness, and their level of social comparison, this is a common difficulty within social science research. While it would be possible to have close friends and/or family members provide additional data in an attempt to verify responses, this is a very timely process that was not feasible for the present study. Although males have been found to provide fairly accurate self-reports of their weight (Shapiro & Anderson, 2003) and level body fat on the Somatomorphic Matrix (Pope, Gruber, Mangweth et al., 2002), there have been conflicting findings regarding the accuracy of muscularity self-ratings. While Pope et al. reported that males modestly overestimated their muscularity, the males in Gruber et al.'s (2000) study were accurate in their perceptions. Given that the males in Pope et al's study were from the general population while those in Gruber et al.'s study were athletic and only

slightly more muscular than the males in the present study, it is possible that present findings concerning perceived muscularity are accurate as well.

One further possible limitation concerns the use of an abbreviated version of the Somatomorphic Matrix rather than the entire measure. While the abbreviated version has been published (Pope, Phillips, & Olivardia, 2000), it has not been used in previous research studies. The original Somatomorphic Matrix is a computer-based instrument, which precluded its use in the present study since the main recruiting strategy involved allowing participants to take the questionnaire home and complete it at their leisure. Although the Somatomorphic Matrix has been widely used in previous studies of body image (Cafri & Thompson, 2004), since data was collected for the present study it has been found to lack reliability (Cafri, Roehrig, & Thompson, 2004). While the test-retest reliability for current muscularity and ideal body-fat were adequate, test-retest reliability for ideal muscularity, current body-fat, and the discrepancy scores (current - ideal) for muscularity and body-fat, respectively, were inadequate. Despite the scale's low reliability overall, however, it should be noted that one of the important findings of the present study involved males' current muscularity, which was found to exhibit adequate reliability in Cafri, Roehrig, et al.'s study. Cafri & Thompson (2004) have created a modification of the measure that consists of an abbreviated number of figures presented on a poster board. Compared with the original Somatomorphic Matrix, this measure may more closely approximate the version that was utilized in the present study. Use of this new measure in future studies may ensure the reliability of measurements, though this prospect still needs to be tested.

A final possible limitation of this study involves the low incidence of AAS users within the overall sample. This limits the generalizability of findings somewhat, given that the bulk of research studies involving muscle-building supplement use have focused on AAS use rather than over-the-counter supplement use. Although AAS users were not included in the present study, however, findings are still important given the paucity of research

involving legal supplement use and the related characteristics of users. Given that more males are using legal supplements than AAS (Kanayama et al., 2001) there appears to be a need for increased knowledge among researchers and health professionals alike regarding the characteristics of supplement users. This could aid in education and prevention efforts targeted at reducing the incidence of legal supplement use. Future researchers should continue to attempt to obtain comparison samples of AAS users in order to fill the gaps in the literature regarding the characteristics of users and non-users of AAS and legal muscle-building supplements, respectively. A larger sample of AAS users may be obtained by sampling from competitive sports such as bodybuilding, football, and professional wrestling. These types of samples were not utilized in the present study in order to preserve the generalizability of the sample.

Future Directions

The present study aimed to explore variables that predict muscle-building supplement use and non-use in males, and was intended to be mainly exploratory in nature. In the process a preliminary foundation of research was created, and several potential areas for further inquiry were raised. Given that many prospects for future research have been raised throughout the discussion of findings from this study, only the major points will be reiterated and elaborated upon in this section.

Several variables were found to have important relationships with level of supplement use, and should be included in future studies in order to replicate findings. In particular, having a history of being teased for thinness was significantly related to muscle-building supplement use, and warrants that a measure of being teased for thinness be included in future studies. Given that this variable was measured using only one item, researchers should consider adopting a format similar to that used by Thompson et al. (1995) for the Perception of Teasing Scale (POTS). These researchers used several weight-based questions to determine if respondents experienced teasing for fatness as a child.

Furthermore, although the weakness-related item did not evidence a significant relationship with muscle-building supplement use in the present study, future researchers may want to utilize it in conjunction with questions regarding being teased for thinness. It appears as though these two concepts are quite similar and may be found to be statistically related in future research. Finally, in future studies the weight-related target of teasing should be considered in conjunction with body image issues and possible eating pathology. As previously mentioned, it appears that while being teased for thinness relates to a later desire for bulk and an increased likelihood of using muscle-building supplements, males who are teased for fatness may later have difficulties with poor body image, binge eating, and obesity (Garner, 1997; Gleason et al., 2000; Jones, 2002; Womble et al., 2001). These are distinctions that have not been addressed in previous studies, yet present findings highlight the need to do so. Education and prevention programs that target teasing in general and weight-related teasing in particular, as well as ways to cope with specific types of weight-based teasing, could be implemented within schools in order to combat the apparent long-term consequences.

Questions regarding attitudes toward muscle-building supplement use and the perceived likelihood of use among non-users and former users would be important to study further in order to generate and refine respective profiles for risk. These efforts could aid in providing at-risk males with specific education that is geared toward their risk for use as well as their usage history. The present study's findings suggested that non-users may respond best to education regarding ways to alter their diet and exercise routines in order to achieve desired results, as well as to information regarding the negative health effects associated with muscle-building supplement use. Similarly, former users may respond well to education regarding proper diet and exercise, but may also need more information concerning the inefficacy of muscle-building supplements at achieving desired results. Information regarding possible negative health effects may also be helpful with this group. Given that

users rated themselves as being more oriented towards health and fitness than non-users, while some also appeared to have some misconceptions regarding the necessity of protein supplements, the recommended interventions concerning proper exercise, nutrition, and possible negative health effects would appear to be applicable for this group as well.

The aforementioned types of targeted interventions have been found to be helpful in altering attitudes and intentions to use AAS among young athletes (Goldberg, MacKinnon, Elliot, Moe, Clarke, & Cheong, 2000; Trenhaile, Choi, Proctor, & Work, 1998), and may help to guard against the initiation or resumption of use by exercising males, particularly those who indicated that their non-use was primarily related to the costliness of supplements and who therefore may serve as a high-risk group. While these interventions could be undertaken in an efficient manner by a wide variety of professionals, including doctors, nurses, coaches, personal trainers, dieticians, and nutritionists, the most informed and effective scenario may involve a combination of these types of professionals. An additional possibility that may reach a broader audience who may not have access to health professionals involves the placement of various types of targeted informational posters, pamphlets, or references to relevant books or articles on display in gyms, locker rooms, and in doctor's and nutritionist's offices. This intervention has been used to broadly disseminate information regarding the dangers of sharing needles to inject AAS, which is a topic this is often not discussed directly with health professionals (Rich, Foisie, Towe, Dickinson, McKenzie, & Salas, 1999). Overall, it is hoped that with increased knowledge regarding the lack of necessity and efficacy of muscle-building supplements, as well as the lack of research on the possible risks associated with long-term use, that males will forego use of muscle-building supplements and will instead focus on more efficacious and healthier means of achieving their desired figures.

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Appendix A

Response Rates Broken Down by Recruitment Source

Source	*N Handed Out*	*N Completed*	*Percent*
Training Facility	29	19	65.5
Community Facility	66	26	39.4
University Gym	24	16	66.7
Snowball Sampling	31	28	90.3
Posters	10	6	60.0
Undergraduate Participant Pool	6	6	100.0
TOTAL	**166**	**101**	**60.8**

** Note: 1additional questionnaire was returned but was excluded from analyses due to lack of responding to multiple measures*

Appendix B

Participant Groups Broken Down by Recruitment Source

Non-Users

Source	*Number Recruited*	*Percent*
Training Facility	6	17.1
Community Facility	9	25.7
University Gym	9	25.7
Snowball Sampling	10	28.6
Posters	1	2.9
TOTAL	**35**	

** Note: 88.6% of participants from this group were recruited in Windsor, Ontario.*

Former Users

Source	*Number Recruited*	*Percent*
Training Facility	7	25.9
Community Facility	3	11.1
University Gym	4	14.8
Snowball Sampling	10	37.0
Posters	1	3.7
Undergraduate Participant Pool	2	7.4
TOTAL	**27**	

** Note: 88.9% of participants from this group were recruited in Windsor, Ontario.*

Appendix B

Participant Groups Broken Down by Recruitment Source (continued)

Current Users

Source	*Number Recruited*	*Percent*
Training Facility	4	11.1
Community Facility	14	38.9
University Gym	3	8.3
Snowball Sampling	8	22.2
Posters	4	11.1
Undergraduate Participant Pool	3	8.3
TOTAL	**36**	

** Note: 86.1 % of participants from this group were recruited in Windsor, Ontario.*

AAS Users

Source	*Number Recruited*	*Percent*
Training Facility	2	66.7
Undergraduate Participant Pool	1	33.3
TOTAL	**3**	

** Note: 100% of participants from this group were recruited in Windsor, Ontario.*

Appendix C
Recruitment Poster

University of Windsor Graduate Student Looking for Athletic Males to Participate in a Study

*** I am Melanie Kelly, and I am a doctoral student in Psychology at the University of Windsor. I am interested in studying the rates of muscle-building supplement use among males, and the factors that may relate to such use.**

*** I am looking for males who are least 18 years old, and who exercise at least 3X/week, for 20-30 minutes per session. You do not need to have ever taken muscle-building supplements to participate. I would ask you to fill out some questionnaires, which would be kept confidential. These questionnaires should take 30-40 minutes to complete.**

*** To compensate you for your help with my study, you will receive one free movie pass.**

*** If you are interested in this study, please e-mail me at "astle@uwindsor.ca", or call me at 977-1543. This research project has been reviewed and has received ethics clearance through the University of Windsor Research Ethics Board.**

Appendix D1

Letter of Information
Factors Related to Muscle-Building Supplement Use and Non-Use in Males

Researcher: Melanie Kelly, M.A.
Department of Psychology, University of Windsor
Supervisor: Dr. Cheryl Thomas, Ph.D.

You are asked to participate in a research study conducted by Melanie Kelly and Cheryl Thomas, from the Department of Psychology at the University of Windsor. Results from this study will contribute to Melanie Kelly's doctoral dissertation. If you have any questions about this research, please feel free to ask me at any time. If you have any comments or concerns at a later date, please feel free to contact Melanie Kelly (e-mail: astle@uwindsor.ca) or her dissertation supervisor, Dr. Cheryl Thomas (phone: (519) 253-3000, ext. 2252; e-mail: cdthomas@uwindsor.ca).

PURPOSE AND PROCEDURES OF THE STUDY: The present study will investigate rates of muscle-building supplement use among males, and will also explore factors that may be related to such use. If you volunteer to participate in this study, we would ask you to complete a questionnaire package that asks background questions about yourself, including your current and past level of supplement use. You will also be asked questions related to your attitudes and beliefs concerning your appearance, and things that you may have done in order to evaluate or change your appearance. This will take approximately 30-40 minutes of your time. If you are interested in receiving a summary of the findings from this study, please indicate this at the bottom of this form, by providing an e-mail or home address where the results can be mailed to you. It is expected that these results will be available in approximately one year. If you are interested in knowing about this study's findings, but do not wish to provide your contact information, feel free to contact Melanie Kelly via e-mail in approximately one year. Results will then be forwarded to you.

POTENTIAL RISKS, DISCOMFORTS, AND BENEFITS: Although the questions that you will be asked are not designed to make you uncomfortable or upset, in some unforeseen cases, participants with personal problems related to the questions being asked may become upset by their involvement. In order to deal with this possibility, all participants will be given a list of appropriate counselling services in the Windsor area. For your participation in this study, you will receive one free movie pass.

CONFIDENTIALITY: Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. I would like you to know that none of your answers can be traced back to you, since you will not write your name on any questionnaires. Also, your signed consent form is always kept separate from your answer sheets, and Melanie Kelly is the only person who will ever have access to your information. All forms will be stored in a locked cabinet for 5 years, and then will be shredded.

PARTICIPATION AND WITHDRAWAL: You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may exercise the option of removing your data from the study. You may also refuse to answer any questions you don't want to answer and still remain in the study.

RIGHTS OF RESEARCH SUBJECTS: You may withdraw your consent at any time and discontinue participation without penalty. This study has been reviewed and received ethics clearance through the University of Windsor Research Ethics Board. If you have questions regarding your rights as a research subject, contact:

Research Ethics Co-ordinator
University of Windsor
Windsor, Ontario
N9B 3P4

Telephone: (519) 253-3000, ext. 3916
E-mail: ethics@uwindsor.ca

Appendix D2

Consent Form

I have been given a copy of the Information Sheet involving Melanie Kelly's study entitled "Factors Related to Muscle-Building Supplement Use and Non-Use in Males." I know that I can keep this Information Sheet for my records. I have read this sheet, and understand the information provided. I understand that my answers will be kept confidential, and that I may withdraw from the study at any time without penalty. My questions have been answered to my satisfaction, and I agree to participate in this study.

Printed Name: _____ Signature: _____

Date: _____

If you wish to receive a summary of the final results of this study, please provide either an e-mail or mailing address where these results can be mailed to you in approximately one year's time. If you are not interested in receiving these results, please leave the following section blank.

E-mail address: _____

OR

Mailing address: _____

Appendix E

Background Questionnaire

1. How old are you? _____

2. What is your cultural or ethnic background? (Please circle any that apply)

   Caucasian
   African American
   Hispanic
   Asian
   Native American
   Other (please specify) _____

3. What is the highest level of education that you have completed? (Please circle your response)

   Elementary
   Some high school, but did not graduate
   High School
   College
   University
   Some college/university, but did not graduate
   Post-graduate

4. What is your height? (In either feet and inches, or centimeters, please specify): _____

5. What is your current weight? (In either pounds or kilograms, please specify): _____

6. What is your ideal weight? (In either pounds or kilograms, please specify): _____

7. Do you consider yourself to be a regular exerciser? Yes No

8. Over the past three months, about how often have you engaged in exercise that increased your breathing rate and made you sweat? _____ days per week, for _____ minutes per day

9. Are you currently on a varsity athletic team, or involved in any other organized and/or competitive sports activities? Yes No

   9a. If you answered yes, what sport(s) are you involved in?_____

   9b. How often do you participate in organized/competitive sports? (If you listed more than one sport, please identify the amount of time you spend playing each sport separately).

   (Name of sport): _____: _____ days per week, for _____ minutes per day

   (Name of sport): _____: _____ days per week, for _____ minutes per day

   (Name of sport): _____: _____ days per week, for _____ minutes per day

10. Do you engage in any other types of exercise (such as weightlifting, running, swimming, etc.)? Yes No

    10a. If you answered yes, what type(s) of exercise do you engage in? _____

    10b. How often do you engage in these activities? (If you listed more than one activity, please identify the amount of time you spend on each activity separately).

    (Name of activity): _____: _____ days per week, for _____ minutes per day

    (Name of activity): _____: _____ days per week, for _____ minutes per day

    (Name of activity): _____: _____ days per week, for _____ minutes per day

11. For each of the following over-the-counter muscle-building supplements, please identify:

a. Those that you have ***used at least once in your life*** (Put a check mark (√) if you have ever used that supplement)
b. Those that you are ***currently using*** (Put a check mark (√) if you are currently using that supplement)
c. If ***currently*** using a particular supplement, ***how often you take it every week*** (Provide number of times per week you use each)
d. When you ***first used*** each supplement, and the ***most recent time you used them*** (Provide month and year. If unsure, just give your best guess)

* If you have used or are using a supplement, but only know the brand name, please write the name under "Other".

	Ever Used?	Currently Using?	Current Weekly Use (# of Times Per Week)	First Use (Month/Year)	Most Recent Use (Month/Year)
1. Amino Acids (Ex.- L-Carnitine, L-Glutamine, BCAA powder, amino fuel products, etc.)					
2. HMB (beta-hydroxy-beta-methyl butyrate)					
3. Protein Powder/Drinks (Ex.- whey products, soy protein products, etc.)					
4. Weight-gain/Anabolic formulas (Ex.- Cytodyne, Muscletech, or Weight Gainer products, etc.)					
5. Growth-hormone Releasers (Ex.- HGH Plus products, Pro-hGH products)					
6. Creatine					
7. Androstenedione (Andro)/Norandrostenedione					
8. Chromium					
9. DHEA (Dehydroepiandrosterone)					
10. Vanadyl sulfate					
11. Boron					
12. CLA (Conjugated Linoleic Acid)					
13. Smilax (Sarsaparilla)					
14. Gamma Oryzanol					
15. Ferulic Acid					
16. Tribulus terrestris (Ex.- Tribulus Fuel, etc.)					

17. Yohimbine					
18. Anabolic Steroids					
19. Other: **a.** (Supplement Name: _____)					
b. (Supplement Name: _____)					

12. If you have ever used anabolic steroids, how many specific steroids have you taken at one time ("stacked")? _____

13. If you ***are currently*** taking any of the muscle-building supplements mentioned above, please use the provided list to rank your top 3 reasons for taking them. You can identify each reason according to its accompanying letter on the list. If you take many different types of supplements, please provide answers for the 3 supplements you use most often.

A.	Improve athletic/competitive performance	K.	Recommended by coach or trainer
B.	Build muscle	L.	Recommended by physician or pharmacist
C.	Lose fat	M.	Recommended by nutritionist or dietician
D.	Improve endurance	N.	Makes me feel better about myself
E.	Improve strength	O.	Makes me more sexually attractive
F.	Improve energy	P.	Makes me more aggressive
G.	Improve health	Q.	Improves my sex-drive
H.	Prevent disease or illness	R.	Other (please specify) _____
I.	Inadequate diet	S.	Other (please specify) _____.
J.	Recommended by family member or friend	T.	Other (please specify) _____

1. Supplement Name: _____

   1st Reason: _____ 2nd Reason: _____ 3rd Reason: _____

2. Supplement Name: _____

   1st Reason: _____ 2nd Reason: _____ 3rd Reason: _____

3. Supplement Name: _____

   1st Reason: _____ 2nd Reason: _____ 3rd Reason: _____

14. If you ***do not use or have stopped*** taking any of the muscle-building supplements mentioned above, what are your reasons for not taking these types of supplements? Provide as many reasons as you feel necessary.

1. Reason for not using supplements:

_____

2. Reason for not using supplements:

_____

3. Reason for not using supplements:

_____

Appendix F

Frequency of Social Comparison to Various Targets

Please rate how often you compare your body build/physique to each of the following groups, using the scale provided.

Never		Sometimes		A Lot
1	2	3	4	5

1 2 3 4 5	Male family members
1 2 3 4 5	Closest male friends
1 2 3 4 5	Other males at your gym or on your sports team
1 2 3 4 5	Average male gym member or male in your sport
1 2 3 4 5	Male actors/models
1 2 3 4 5	Male sports figures
1 2 3 4 5	Average male citizen

Appendix G

Teasing History

In the past, how often were you teased for being too thin or underweight? (please circle a number)

Often		**Sometimes**		**Never**
1	2	3	4	5

In the past, how often were you teased for being too fat or overweight? (please circle a number)

Often		**Sometimes**		**Never**
1	2	3	4	5

In the past, how often were you teased for being too weak? (please circle a number)

Often		**Sometimes**		**Never**
1	2	3	4	5

If you were teased about your weight, size, or strength in the past, how did this affect you? (please circle a number)

Really upset me		**Somewhat upset me**		**Did not upset me**
1	2	3	4	5

Appendix H
Type of Exercise Engaged In, By Group

Type of Exercise Engaged In by Non-Users (N = 35)

Competitive/Organized Sports	Frequency	Recreational Exercise	Frequency*
Kickboxing	4	Weightlifting	19
Hockey	4	Running	16
Karate	3	Biking	5
Soccer	3	Rollerblading	5
Baseball	1	Swimming	5
Basketball	1	Cardiovascular Exercise	2
Cycling	1	Walking	2
Floor Hockey	1	Basketball	1
Tennis	1	Floor Hockey	1
		Golf	1
No Answer	3	No Answer	3

Type of Exercise Engaged In by Former Users (N= 27)

Competitive/Organized Sports	Frequency*	Recreational Exercise	Frequency*
Karate	6	Weightlifting	19
Basketball	5	Running	8
Hockey	5	Biking	5
Kickboxing	3	Swimming	3
Baseball	2	Cardiovascular Exercise	2
Running	2	Squash	2
Soccer	2	Rollerblading	1
Field Hockey	1	Yoga	1
Floor Hockey	1		
Golf	1		
Judo	1		
Motorcycle Racing	1		
Paintball	1		
Ultimate Frisbee	1		
Wrestling	1		
No Answer	1	No Answer	1

* Frequencies total more than number of group members due to multiple responding by some participants

Appendix H
(Continued)

Type of Exercise Engaged In by Current Users (N = 36)

Competitive/Organized Sports	Frequency	Recreational Exercise	Frequency*
Hockey	4	Weightlifting	32
Volleyball	4	Running	10
Baseball	3	Cardiovascular Exercise	4
Karate	3	Rollerblading	4
Kickboxing	3	Biking	3
Basketball	2	Swimming	2
Bodybuilding	1	Golf	1
Golf	1	Yoga	1
Judo	1		
Running	1		
Soccer	1		
Tennis	1		

* Frequencies total more than number of group members due to multiple responding by some participants

Appendix I1

Number of Different Muscle-Building Supplements Used Over Lifetime*, by Group

Former Users (n= 27)

Number	*Frequency*	*Percent*
1	10	37.0
2	8	29.6
3	5	18.5
4	2	7.4
5	1	3.7
6	1	3.7

M = 2.2 SD = 1.3

Current Users (n= 36)

Number	*Frequency*	*Percent*
1	4	11.1
2	10	27.8
3	5	13.9
4	8	22.2
5	3	8.3
6	2	5.6
7	1	2.8
8	2	5.6
9	0	0.0
10	0	0.0
11	1	2.8

M = 3.7 SD = 2.3

* Among current users, frequencies include former and current supplement use combined

Appendix I2

Number of Different Muscle-Building Supplements Currently Used

Current Users (n= 36)

Number	*Frequency*	*Percent*
1	17	47.2
2	10	27.8
3	5	13.9
4	3	8.3
5	0	0.0
6	1	2.8

M = 1.9 SD = 1.2

Appendix J1

Length of Lifetime Use of Specific Muscle-Building Supplements by Former Users

(n= 27)

Supplement	*Months of Use*	*N**	*Percent*
Protein Powder/Drinks	≤ 12	6	22.2
	13-24	3	11.1
	25-36	4	14.8
	37-48	2	7.4
	49-60	1	3.7
	85-96	1	3.7
	No Answer	5	18.5
Creatine	≤ 12	5	18.5
	13-24	2	7.4
	25-36	3	11.1
	37-48	1	3.7
	49-60	1	3.7
	61-72	1	3.7
	85-96	1	3.7
	No Answer	4	14.8
Amino Acids	≤ 12	1	3.7
	25-36	2	7.4
	No Answer	3	11.1
Weight Gain/Anabolic Formulas	≤ 12	1	3.7
	13-24	0	0.0
	25-36	1	3.7
	61-72	1	3.7
	No Answer	1	3.7
Anabolic Steroids	No Answer	4	14.8
Chromium	≤ 12	1	3.7
Tribulus Terrestris	≤ 12	1	3.7
Yohimbine	73-84	1	3.7
Other: Ripped Fuel	No Answer	1	3.7

* Frequencies total more than number of group members due to multiple responding by some participants

Appendix J2

Length of Past and Current Use of Specific Muscle-Building Supplements by Current Users

(n= 36)

Supplement	*Months of Use*	*Past N**	*Percent*	*Current N**	*Percent*
Protein Powder/Drinks	≤ 12	0	0.0	10	27.8
	13-24	0	0.0	2	5.6
	25-36	1	2.8	0	0.0
	37-48	0	0.0	3	8.3
	61-72	0	0.0	1	2.8
	85-96	0	0.0	4	11.1
	97-108	0	0.0	1	2.8
	121-132	0	0.0	1	2.8
	145-156	0	0.0	1	2.8
	157-168	0	0.0	2	5.6
	No Answer	1	2.8	5	13.9
Creatine	< 12	2	5.6	5	13.9
	37-48	2	5.6	3	8.3
	61-72	1	2.8	1	2.8
	85-96	1	2.8	1	2.8
	No Answer	6	16.7	3	8.3
Amino Acids	< 12	2	5.6	5	13.9
	37-48	0	0.0	2	5.6
	109-120	2	5.6	0	0.0
	No Answer	7	19.4	4	11.1
Weight Gain/Anabolic Formulas	25-36	1	2.8	0	0.0
	37-48	0	0.0	1	2.8
	49-60	1	2.8	0	0.0
	No Answer	7	19.4	1	2.8
HMB	≤12	0	0.0	1	2.8
	No Answer	4	11.1	1	2.8
Chromium	≤12	1	2.8	1	2.8
	37-48	0	0.0	1	2.8
	No Answer	1	2.8	1	2.8
Androstenedione/ Norandrostenedione	≤12	1	2.8	0	0.0
	49-60	1	2.8	0	0.0
	No Answer	2	5.6	0	0.0

Appendix J2
(Continued)

Length of Past and Current Use of Specific Muscle-Building Supplements by Current Users

(n= 36)

Supplement	Months of Use	Past N*	Percent	Current N*	Percent
Anabolic Steroids	No Answer	3	8.3	0	0.0
Smilax	121-132	1	2.8	0	0.0
	No Answer	2	5.6	0	0.0
Tribulus Terrestris	No Answer	3	8.3	0	0.0
Vanadyl Sulfate	13-24	0	0.0	1	2.8
	No Answer	2	5.6	0	0.0
CLA	49-60	0	0.0	1	2.8
	No Answer	1	2.8	0	0.0
Other: Endurox R4	No Answer	0	0.0	2	5.6
Growth Hormone Releasers	No Answer	1	2.8	0	0.0
Yohimbine	No Answer	2	5.6	0	0.0
DHEA	No Answer	1	2.8	0	0.0
Other: Alphalipoic Acid	25-36	0	0.0	1	2.8
Cell-Tech	≤12	0	0.0	1	2.8
Charge	37-48	0	0.0	1	2.8
GNC MegaMan	No Answer	0	0.0	1	2.8
GNC Power Orange	No Answer	1	2.8	0	0.0
Prolab N-Large 20	No Answer	0	0.0	1	2.8
Ripped Fuel	≤12	0	0.0	1	2.8

* "Past" frequencies include supplements no longer used by participants, and total more than number of group members due to multiple responding by some participants

Appendix K

Internal Reliability Coefficients for Standardized Dependent Variables for Each Group and Total Sample

Measure	Alpha Coefficient			
	Non-Users n = 35	Former Users n = 27	Current Users n = 36	Total Sample n = 98
_MBSRQ				
Appearance Evaluation	.82	.65	.81	.73
Appearance Orientation	.88	.89	.78	.86
Fitness Evaluation	.84	.50	.69	.69
Fitness Orientation	.73	.86	.68	.77
Health Evaluation	.78	.53	.68	.68
Health Orientation	.70	.80	.66	.74
Illness Orientation	.78	.73	.75	.75
SATAQ				
Internalization	.88	.90	.88	.88
Awareness	.71	.79	.73	.75
Muscular Look	.91	.94	.76	.87
EDI				
Interoceptive Awareness	.56	.73	.66	.65
Bulimia	.57	.59	.13	.52
Ineffectiveness	.85	.56	.87	.84
Maturity Fears	.71	.91	.66	.79
Perfectionism	.75	.69	.49	.66
Interpersonal Distrust	.74	.59	.64	.71

Appendix L

Correlations Between Variables Included in Analyses, by Group

Non-Users

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. App.Eval.	—	.14	.31	-.02	-.09	-.37*	.37	.13	.19	-.18	.37*	-.63**	-.25
2. App.Orient.		—	.64**	.44**	.51**	-.02	-.10	.09	-.17	.32	-.09	-.02	-.00
3. F/H Orient.			—	.63**	.40*	-.19	.20	.11	.01	.26	.05	-.31	.09
4. Ill. Orient.				—	.24	-.06	-.14	-.04	-.15	.16	-.13	-.20	-.14
5. SATAQ-Total					—	.28	-.18	.04	-.07	.68**	-.25	.00	.39*
6. Teased- Thin						—	.07	.32	.22	.26	-.17	.37*	.44**
7. Teased- Fat							—	.27	.60**	-.18	.38*	-.29	.35*
8. Teased- Weak								—	.58**	-.39*	.45**	.16	.20
9. Teased- Upset									—	-.31	.34*	-.02	.23
10. Soc. Comp.										—	-.38*	.13	.18
11. Musc. Disc.											—	-.19	.10
12. Fat Disc.												—	-.02
13. Perceived Musc.													—

* $p = .05$ ** $p = .01$

Former Users

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. App.Eval.	—	.24	.72**	.09	.16	-.15	.37	.10	.24	.00	.11	-.58**	.06
2. App.Orient.		—	.19	.12	.57**	-.39*	.30	-.09	-.10	.37	-.14	-.15	-.06
3. F/H Orient.			—	.38**	.25	.09	.27	.22	.30	.16	-.05	-.45	.06
4. Ill. Orient.				—	.29	.22	-.19	-.01	-.10	.09	.07	-.24	.16
5. SATAQ-Total					—	.07	.19	.01	-.13	.69**	.13	-.04	.22
6. Teased- Thin						—	-.14	.18	.30	-.04	.46*	-.01	.38
7. Teased- Fat							—	.32	.36	.19	-.07	-.37	-.21
8. Teased- Weak								—	.58**	-.17	-.01	.03	-.18
9. Teased- Upset									—	-.13	.10	-.12	-.14
10. Soc. Comp.										—	-.16	.10	.06
11. Musc. Disc.											—	-.23	.71**
12. Fat Disc.												—	-.08
13. Perceived Musc.													—

* $p = .05$ ** $p = .01$

Appendix L
(Continued)

Correlations Between Variables Included in Analyses, by Group

Current Users

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. App.Eval.	—	.00	.30	-.04	-.22	-.02	.21	.07	.11	-.10	.11	-.35*	.33*
2. App.Orient.		—	.14	-.08	.74**	.32	-.23	-.05	-.02	.48**	.29	.26	.30
3. F/H Orient.			—	.44**	-.01	.31	.03	.15	.06	.18	.33	-.07	.58**
4. Ill. Orient.				—	-.21	.15	.33*	.28	.21	.29	.20	-.22	.32
5. SATAQ-Total					—	.29	-.29	-.01	-.06	.48**	.26	.20	.18
6. Teased- Thin						—	-.14	.56**	.41*	.38*	.34*	.17	.40*
7. Teased- Fat							—	.18	.47**	-.20	-.18	-.57**	-.23
8. Teased- Weak								—	.65**	-.04*	.27**	.04	.27
9. Teased- Upset									—	-.00	.08	-.10	.03
10. Soc. Comp.										—	.11	.17	.26
11. Musc. Disc.											—	.29	.52**
12. Fat Disc.												—	.24
13. Perceived Musc.													—

* $p = .05$ ** $p = .01$

Appendix M

"Other" Reasons Given for Currently Using Specific Muscle-Building Supplements

Protein Powder/Shake

1. Heal muscle faster (n =3).
2. Gain weight.

Amino Acids

1. Repair tissue after surgery.

Endurox R4

1. Speeds muscle recovery.

Appendix N

"Other" Reasons Given for Not Currently Using Muscle-Building Supplements

Non-Users (n = 6)

1. Need to order them online and I am waiting on a credit card.
2. Don't want to get in "that" shape that badly.
3. I have too much pride.
4. Not interested.
5. Trying to lose weight, not gain weight.
6. It's cheating.

Former Users (n = 10)

1. For continued effects you must keep taking them.
2. More rewarding to make gains without "cheating".
3. Stopped weight training.
4. Not disciplined enough.
5. Not as sport-focused now, exercise for stress relief and general health.
6. Stopped weightlifting.
7. Not concerned about building muscles - at a different point in life.
8. No longer competing.
9. I don't need to take them because I'm not involved in competitive sport.
10. My competitive sport days are over!

Current Users (n = 5)

1. Need to lose weight first.
2. Not as important to me.
3. Worked too good.
4. Scheduled dose/time.
5. No reason provided

VITA AUCTORIS

NAME	Melanie Kelly
PLACE OF BIRTH	Newcastle, New Brunswick
YEAR OF BIRTH	1974
EDUCATION	Marathon High School, Marathon, Ontario (1988 - 1993)
	Carleton University, Ottawa, Ontario (1993 -1998) - B.A. (Hons.)
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