Body image outcomes in a replication of the ATLAS program in Australia

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Abstract

The Athletes Training and Learning to Avoid Steroids [ATLAS] program has been evaluated and widely disseminated among American high school Football players. This study is the first independent replication of the program conducted outside of the USA, and in the regular school setting with non-athletes. The research aimed to determine outcomes in real-life settings, thus a quasi-experimental design was used. Participants were *N* = 211 grade 10 males (ATLAS intervention *n* = 119; Waitlist Control *n* = 92) from two successive grade 10 cohorts at one Catholic single-sex high school in Melbourne, Australia. The ten, 45-minute ATLAS sessions were facilitated over 5 weeks by students' usual physical education (PE) teacher (all were male), and student team leaders delivered intervention material to groups of three to four fellow students in intact classroom groups. Linear mixed models analyses found improvements for ATLAS participants relative to control participants for functional and aesthetic body satisfaction, and attitudes towards substance and supplement use. After adjusting for multiple comparisons these changes were no longer significant, but effect sizes were small and consistent with change seen in other body image interventions (f^2 = 0.034 - f^2 = 0.046). Student and teacher feedback about the program also was positive. The small improvements in body image found in this replication support further development of a focus on supplements and steroids as an intervention for adolescent boys.

Keywords

Body image, supplements, steroids, appearance enhancing drugs, muscularity, universal program, intervention

Introduction

Body dissatisfaction is a public health concern, with up to 70% of male and female adolescents wanting to change aspects of their appearance (Smolak, 2012). Unlike girls, who generally want to be thinner, boys and young men who are dissatisfied with their bodies generally desire a larger body that is more muscular, with less body fat (Finne, Bucksch, Lampert, & Kolip, 2011; McCabe & Ricciardelli, 2004; Yager & O'Dea, 2014). Body dissatisfaction and a desire or drive for muscularity may lead some male adolescents to engage in potentially unhealthy behaviors such as consuming supplements, protein powders, creatine, or using anabolic steroids in their quest to achieve the muscular male ideal (McCabe & Ricciardelli, 2003; D. R. McCreary & D. Sasse, 2000; Yager & O'Dea, 2014).

A large range of readily available substances are now available to increase weight and build muscle. Almost 41% of mid-adolescent boys in the US reported the use of protein powders/shakes for muscle-building purposes “sometimes” or “often” (Eisenberg et al., 2012). Evidence indicates that nutritional supplements can have consequences for poor physical and mental health (James, Kristjánsson, & Sigfúsdóttir, 2011) and also act as a gateway to use of more serious drugs and anabolic steroids (Backhouse, Whitaker, & Petroczi, 2013; Ntoumanis, Ng, Barkoukis, & Backhouse, 2014). In adolescent boys, several studies have indicated that body dissatisfaction is related to anabolic steroid use and consumption of supplements (Field et al., 2005; Jampel, Murray, Griffiths, & Blashill, 2016; McCabe & Ricciardelli, 2003; Smolak, Murnen, & Thompson, 2005; Yager & O'Dea, 2014). Furthermore, research indicates that adolescent boys who are more dissatisfied with their body have more lenient attitudes towards the use of doping in sport, doping intentions, and doping use in adolescent boys and in men (Ntoumanis et al., 2014; Yager & O'Dea, 2014).

In light of the negative consequences for adolescents of body both dissatisfaction and consumption of supplements and anabolic steroids, prevention is clearly needed. Schools have been identified as ideal settings for delivering prevention interventions (Levine & Smolak, 2006). However, school-based programs to improve adolescent boys' body image have not been widely successful (Yager, Diedrichs, Ricciardelli, & Halliwell, 2013) with some notable exceptions (Stanford & McCabe, 2005; Wilksch et al., 2014; Wilksch & Wade, 2009). Several doping educational programs exist. However, most focus on knowledge, which does not alter health behaviour (Goldberg, Bents, Bosworth, Trevisan, & Elliot, 1991; Kelly & Barker, 2016). Very few programs have been scientifically evaluated using rigorous randomised controlled trial (RCT) methodologies to determine their impact on doping intentions and behaviors. Despite increasing recognition of the relationship between body image and the use of supplements and doping in sport, no doping prevention programs have incorporated a body image focus, and no body image programs have incorporated efforts to prevent the use of supplements and steroids.

The Athletes Training and Learning to Avoid Steroids [ATLAS] program (Goldberg, MacKinnon, Elliott, et al., 2000) represents current best practice in the prevention of anabolic steroid use among high school athletes in the United States of America (USA). This program has undergone two decades of systematic testing over extensive follow-up periods and has been conducted with over 50,000 high school football players in the USA (Goldberg & Elliot, 2005). The ATLAS program was initially developed in order to respond to risk factors for the use of anabolic steroids, including individual, team, peer, family, school, and community factors, as well as an individual's knowledge, skills, and attitudes in relation to anabolic steroids (Goldberg, Elliott, et al., 1996). The program is based on a number of

health behavior change theories, including Social Learning Theory (Bandura, 1977), the Health Belief Model (Rosenstock, 1974), and the theory of planned behavior (Ajzen & Fishbein, 1980). Importantly, the interactive program is 'facilitated' using a team-based learning environment, where coaches oversee the program implementation by peer leaders who direct teams of 4-6 athletes through the program materials. In the initial pilot and randomized controlled trial, the theory-based sessions were supported by weight-room sessions in the gym. This was not a feature of the program that was implemented in the current replication.

In a number of evaluation trials of the ATLAS program, positive outcomes in relation to anabolic steroids were found. Specifically, knowledge about harms of anabolic steroid use increased, desire and intention to use anabolic steroids decreased, and drug refusal skills and nutrition and exercise behaviors improved (Goldberg, Elliot, Clarke, MacKinnon, Moe, et al., 1996; Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996; Goldberg, MacKinnon, Elliot, et al., 2000). In the original, smaller trial of the ATLAS program (but not the larger RCT), improvements in body image on direct questions about body image were observed (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996; Goldberg, MacKinnon, Elliot, et al., 2000). However, the body image items were not validated or extensive. Thus, further exploration is required to understand the impact of the ATLAS program on body image and the interactions between body image and steroid use.

This research aimed to conduct a controlled pilot trial of this established program, to determine the effectiveness of the program in improving psychological and physical health outcomes in Australia, and among male non-athletes in a school setting. We hypothesized that the ATLAS program would be effective in improving body image and reducing risk factors for body dissatisfaction and unhealthy weight change behaviors; reducing intentions

to use anabolic steroids and other Appearance and Performance Enhancing Drugs [APEDS]; and improving APED knowledge, attitudes and behaviors, compared to a control group, when delivered in the universal school context with Australian adolescent boys.

Method

Design

In this pilot study, we used a quasi-experimental design in which two sequential cohorts of grade 10 classes from one participating school were assigned by convenience to be the intervention and control groups for this study. Randomization was not possible as this was pragmatic research that used successive year groups of adolescent boys for the study population in order to fit with the curriculum demands of the school. The first cohort (2015) of eight classes were assigned to the ATLAS intervention group and program effects were compared with the second cohort (2016) of ten classes which were assigned to the wait-list control group.

Participants

Participants were 244 grade 10 boys from one Catholic single-sex high school in Melbourne, Australia. Students and their parents/guardians provided written informed consent to participate. Participants were included in analyses for the study if they provided baseline data and data for at least one of the immediate post-program or 3-month follow-up assessments (see Figure 1). Attrition was low for both the ATLAS and Control conditions, as shown in Figure 1. Thus, the final sample for analyses was $N = 211$ (ATLAS intervention $n = 119$; Control $n = 92$).

Intervention

The original ATLAS program is described in more detail elsewhere (Goldberg, Elliott, et al., 1996). We used the ATLAS materials that included 10 x 45-minute, classroom-based sessions that focused on drug and supplement education, strength training, and sports nutrition. Program content was modified slightly to include metric measurements and terminology relevant to the Australian context. For example, imperial measurements such as pounds and inches were converted to kilograms and centimetres, respectively, and terms for food items, such as “wheat bread” familiar to North American consumers were substituted with terms such as “wholemeal bread”, which are familiar to Australian consumers. In addition, reference to “athletes” was replaced with reference to “athletes and non-athletes” throughout the program materials to increase applicability of the program to a non-specialist athlete participant group. As the school had lessons that were 90 minutes in length, the 10 x 45 minute sessions were delivered over 5 x 90-minute lessons in this study. An outline of the content of the ATLAS lessons is shown in Table 1.

Lessons were facilitated by students’ usual physical education (PE) teacher (all male), and student “team leaders” delivered intervention material to groups of three to four fellow students in intact class groups. Teachers did not receive specific training, but received the materials and then led a 90-minute training session for the selected student team leaders. The team-leader training was based on the information provided in the ATLAS program materials (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996; Goldberg, MacKinnon, Elliot, et al., 2000). Teachers used a printed, scripted teacher manual to facilitate lesson delivery and student team leaders followed a printed, scripted team leader manual to engage their peers in the ATLAS content. All students were provided with a printed student workbook in which to record their responses to class activities, and a printed student guide with nutritional and weight training information. All students within the class received the

ATLAS lessons regardless of their participation in the research. Approximately 22 students were in each class.

Measures

The outcome measures for this study are presented in Table 2. The measures of body image have been previously used with adolescent samples and scores have been shown to be valid and reliable (e.g., D. R. McCreary & D. K. Sasse, 2000; Mendelson, Mendelson, & White, 2001). The measures of knowledge, attitudes, and intention to use and actual use of substances and supplements had been used in previous evaluation trials of the ATLAS program (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996; Goldberg, MacKinnon, Elliot, et al., 2000). In the present study, internal reliability for all measures ranged from adequate to very good (see Table 2).

Students and teachers in the intervention group were also asked for their thoughts about the program. Participants were asked about how well the program helped them, and their peers to avoid using APEDS, alcohol, and drugs, and how well it helped them to feel better about their appearance. Teachers were asked a series of questions generated by the researchers and asked about the format and delivery mechanisms of the program, curriculum alignment, and suitability of the program resources. Responses were indicated on visual analogue scales [VAS] on a continuum from 0 to 100.Teachers were also provided with the opportunity to explain their responses with open-ended explanations or comments.

Procedure

The study was approved by the Victoria University Human Research Ethics Committee and the Catholic Education Office (Melbourne). Principal consent for school participation was also provided. Students were invited to participate in the study, and following receipt of student and parent/guardian written informed consent, participants completed baseline self-report questionnaires in separate class groups one week prior to the first intervention lesson. Data collection was supervised by the class teacher and a researcher was also present. Student leader training was conducted between baseline data collection and the first intervention lesson. Intervention lessons were delivered twice weekly (2 lessons per 90-minute class period) and were completed during PE theory classes within one school term. Post-program data collection took place one week following the completion of intervention lessons, and follow-up data collection took place three months following the post-program assessment. Data collection for control participants followed the same schedule as for intervention group participants.

Program Fidelity

Program fidelity assessment procedures were developed by the authors. This involved having researchers observe lessons at random and recording the amount of time spent on each activity, whether activities were skipped or not, and rating each activity in terms of the extent of completion and adherence to the manual. Teacher facilitators and peer facilitators were rated out of 10 on a range of criteria (for example 'kept fellow group members on task') for each of the individual activities within the lesson. Additional notes were kept as required to get a sense of the extent to which the program was adhered to by each of the peer groups.

Data Analysis

All analyses were conducted using SPSS, version 24. Normality distributions for each continuous outcome variable were examined. Two-step transformation to normality was applied to account for skewness.

Intervention effects for each outcome variable were assessed using random intercepts (generalized) Linear Mixed Models, which are robust with respect to missing follow-up data and groups of varied sizes in repeated measures designs. Linear Mixed Models are the recommended analyses for varying time points, common in repeated measures designs, resulting in a 2 (condition: ATLAS, control) * 3 (time: baseline, post-intervention, follow-up) fixed effects model for each outcome variable. All linear mixed effect models included fixed effects for baseline scores, demographic covariates (age, body mass index [BMI]), condition (ATLAS; control), and time (post-intervention, 3-month follow up), with random effects accounting for individual variation separately. In this context both main effects of condition as well as interactions between condition and time are indicators of intervention effects.

Post-hoc analyses were conducted to assess the differential impact of condition on outcome variables at each post-intervention follow-up, with pairwise comparisons indicating specific group differences. Setting the alpha for the study involved consideration of the fact that multiple analysis were carried out on the same data in this study, which would generally lead to using a more conservative alpha to avoid type 1 errors. Therefore, Bonferroni's adjustment (Portney and Watkins, 2009) was made to the alpha level for statistical significance, noting 13 analyses on outcomes likely to be correlated (0.05/13), setting it at 0.00385 throughout. Given the exploratory focus of the current analysis, analyses that result in *p* values between 0.00385 and 0.05 will also be described, explored,

and discussed. For binary outcomes, such as use of anabolic steroids and supplements, all generalized mixed models were run using all the binary outcomes in those three time points as outcomes.

Analyses of the data relating to student and teacher opinions about the program was analysed using descriptives to obtain the mean and standard deviations for this data.

Results

Participant Characteristics

The baseline characteristics of the control and intervention groups were similar. The groups did not differ in BMI (ATLAS: M_{BMI}: $_{=}$ 21.05 *SD* 2.93; Control: M_{BMI} = 20.67 *SD* 2.93), nor BMI standardised for age and gender (ATLAS: M_{zBMI} = 0.051 *SD* 1.06; Control: $M_{zBMI\ =}$ -0.041 *SD* 1.11), $t_{(200)}$ = -0.60, p = .549, η^2 = 0.002. The mean age of ATLAS intervention group participants (*Mage* = 15.96, SD = 0.40) was however, statistically significantly older than the control group (M_{age} = 15.74, *SD* 0.38) $t_{(209)}$ = -3.99, p < .001, η^2 = 0.07, which can be explained by recruitment and survey completion earlier in the year for the Control group. The cultural profile of participants was similar across the ATLAS and control groups. The majority of participants reported their ethnicity to be Anglo/Caucasian (ATLAS: 64.7%, Control 62.0%) and smaller numbers of participants reported their ethnicity to be Southern European (ATLAS 18.5%; Control 15.2%), South-east Asian (ATLAS 5.9%; Control 10.9%), Middle-eastern (ATLAS 4.2%; Control 0.0%), and a range of other backgrounds (ATLAS 6.6%; Control 11.9%). These proportions broadly reflect the Australian population (Australian Bureau of Statistics, 2017). There were no significant differences in terms of self-reported ethnicity of the groups.

As shown in Table 3, at baseline, few participants from either group reported using anabolic steroids or creatine, whereas a little under half of ATLAS participants and a little over half (55.4%) of controls reported using protein powder at least once. The majority of participants in both groups had consumed alcohol on at least one occasion in their lifetime (ATLAS 74.1%; Control 66.3%), but smaller proportions had consumed alcohol in the past 30 days. Means and standard deviation for continuous outcome variables at baseline, post-program, and 3-month follow-up for the ATLAS and Control conditions are also shown in Table 3.

Intervention Outcomes: Interaction between Condition and Time

Results of Linear mixed models analyses are presented in Tables 4 and 5. A condition by time interaction was found for the Functional Satisfaction subscale of the Embodied Image scale (p = 0.037), however, after adjusting for multiple comparisons, this interaction did not reach significance. The effect size was small (f^2 = 0.034). Post-hoc analyses indicated that ATLAS participants had improved functional body image satisfaction at 3-month follow-up relative to post-program (p = 0.087) but the post-hoc comparison did not achieve statistical significance. A condition by time interaction was also found for the aesthetic satisfaction subscale of Embodied Image Scale (p = 0.018), which did not meet the alpha level required after adjusting for multiple comparisons. The effect size was small (f^2 = 0.046). Post-hoc analyses showed that ATLAS participants also had improvements at 3-month follow-up relative to immediate post-program assessment (p = 0.004), but this was also not statistically significant after adjustments were made.

Condition by time interactions were also found for attitudes towards APEDS and steroids (p = 0.018), but this did not meet the alpha level required after multiple

comparisons. The effect size was small $f^2 = 0.058$. Post-hoc analyses found that ATLAS participants had significantly more negative attitudes towards the use of APEDs (ie., They thought that the use of APEDS by individuals in sport was wrong, a favourable outcome) than the control group at post-program ($p = 0.003$), and ATLAS participants maintained these improvements in attitude scores at 3-month follow-up ($p = 0.046$). Again, this was not significant after adjustments for multiple comparisons.

Main effects of condition

A main effect of condition was found for knowledge about substances and supplements. Participants in the ATLAS group had higher knowledge than participants in the control group ($p < 0.001$), collapsed across time.

Student Feedback on the Program

To assess program feasibility, participant's post-program ratings of their perceptions of the helpfulness of the ATLAS program were compared with repeated measures ANOVAs. Participants were asked about how well the program helped them and their peers to avoid using APEDS, alcohol, and drugs, and to help them to feel better about their appearance. A significant difference between ratings of topic areas was found, F (3, 53.14) = 37.44, $p <$ .001, $\eta_p^2 = .281$. The highest reported ratings for helpfulness were for avoiding use of APEDs and avoiding use of drugs. In pairwise comparisons these ratings were not significantly different from one another ($p = .213$) but both were rated significantly higher than ratings of helpfulness for avoiding alcohol ($p < .001$, $p < .001$, respectively) and for improving feelings about appearance ($p < .001$, $p < .01$, respectively). Pairwise comparisons also revealed that

the program was rated more highly for helping to improve feelings about appearance than for helping to avoid alcohol ($p < .01$). See Figure 2 for mean ratings.

Teacher Feedback on the Program

Four of the six teachers involved in program delivery completed the online feedback survey. All questions used Visual Analog Scales [VAS] and asked the teachers to mark a point on a continuum from 0 to 100 in response to the question, and follow this with open-ended explanations. The minimum, maximum, and mean scores for each of these items are presented in Table 6, and high scores are indicative of more positive feedback about the program. Feedback in relation to the peer-led aspect of the program was mixed. Teachers indicated that they selected peer leaders on the basis of their perceived maturity, and leadership potential, but that they thought it would be helpful to have more time to work with the team leaders prior to program implementation to allow them to practice their role. The teachers identified the benefits of the peer facilitation as allowing the students to work at their own pace, and "listening to a different voice in a new setting". However, problems with this approach emerged when team leaders were absent, or when some were less committed than others. The teachers indicated that the team leaders experienced additional benefits from this role, such as confidence, responsibility, empowerment, and greater insight into the program. However, they experienced difficulties in trying to keep their groups on track, and to get their fellow students to take the program seriously.

In relation to the ATLAS program, teachers indicated that there were minor issues related to the 'translation' to the Australian context, and the difficulties fitting the 10-session program into five timetabled classes, despite the requirements for program duration matching the time available in the 5 x 90-minute class periods. Teachers also noted

concerns about the combination of sessions and resulting repetition, heavy emphasis on steroid use, as opposed to a broader spectrum of supplements, and the lesson asking for feedback from girls which was difficult in an all-boys' school. Suggested improvements to the program included reducing the repetition and condensing the program to 5 or 6 sessions, the addition of audio visual materials, greater use of information technology, and improvements to the manual involving conversion to the Australian context and improved clarity of the layout.

Program Fidelity

Six teachers were responsible for facilitation of the ATLAS program in physical education for eight year ten classes in the intervention year. Researchers attended and observed the ATLAS lessons at random and recorded data for 27 sessions out of a possible 80 sessions. These were: session 2 (*n* = 3), 3(*n* = 3), 4 (*n* = 4), 5(*n* = 3), 6(*n* = 3), 7(*n* = 1), 8(*n* = 3), 9(*n* = 3), and 10 (*n* = 4). In total, 23 individual activities were skipped out of a total of 368 activities in the program (46 activities in the program multiplied by 8 classes), meaning that 6.25% of the content was not delivered overall. The activities that were omitted were predominantly the introductory or wrap up activities within the lessons, and this most commonly occurred within the lessons that were combined. For example, given that session three and four were delivered within the one lesson period, sometimes teachers skipped the wrap up from session 3, and the introduction that followed for session 4. Goal setting check-ins were also completed intermittently by the groups and it was rare for them to consistently engage in this program component.

Researchers also rated the teacher and peer facilitators from a scale of 1 to 10, with 10 being a more favourable rating, on a range of criteria during the observations. Teacher

adherence to the manual was rated as a mean of 8.04 (*SD*= 2.20) out of 10. Teacher facilitators were rated as appearing confident when delivering the content (*M*=8.75, *SD* 1.94), listening to students and reflecting understanding (*M*=8.57, *SD*=1.93), demonstrating enthusiasm for the material (*M*=8.25, *SD*=2.58), and transitioning well to student-led activities (*M*=8.25, *SD*=2.67). Lower ratings were recorded for keeping groups on topic and on time (*M*=7.61, *SD*=3.28), and being prepared and organised (*M*=7.45, *SD*=2.93). Peer leaders were rated highly for adhering to the manual (*M*=8.04, *SD*= 2.20), but less highly for attempting to include all team members (*M*=6.97, *SD*=3.26), keeping team members on task (*M*=6.78, *SD*=3.06), and expressing ideas clearly (*M*=6.56, *SD*=2.80).

Analysis of the notes recorded by the research officers indicated that there were high levels of variability in teacher facilitation and peer leadership of the sessions. While some of the teachers asked the students stop and wait at the end of each activity, others allowed groups to proceed at their own pace. Classes were more likely to get through all of the activities and groups were more likely to stay on track when the activities were timed and teachers progressed the class through activities at the same times. The groups varied in terms of their depth of engagement with the materials between the peer groups in the class. In some cases, peer leaders just read out the answers to quizzes (as they had them in their peer leader book), instead of facilitating the activity as instructed, where group members would come up with the responses. Engagement of each group seemed to be highly dependent on the team leader and their enthusiasm for the program, and was supported by the teacher walking around to keep everyone on track. International students at the school were observed to have difficulty completing the program for language and cultural reasons.

Discussion

This study was the first independent evaluation of the ATLAS program outside of the USA, and for a classroom-based, non-athlete audience. We found that the ATLAS program group had small improvements on the functional and aesthetic body image scale and their attitudes towards APEDS and anabolic steroids compared to the control group, over time. These trends of change were all in the expected direction, but after adjustments for multiple comparisons, the differences were nonsignificant. Changes were not observed for body esteem, drive for muscularity, or use of APEDS or anabolic steroids.

The findings in the current study demonstrate a trend towards replication of the body image findings of the small original pilot of the ATLAS program conducted with athletes (Goldberg, et al., 1996), but do not meet statistical significance after adjustments for multiple comparisons. Taken together, these add weight to the need to further examine the body image outcomes of the program, given that in the larger ATLAS trial with high school football players in the US, no improvements in body image were reported (Goldberg, MacKinnon, Elliot, et al., 2000).

We tentatively suggest that the improvements in body satisfaction could occur due to the focus on reasons not to use anabolic steroids, which may act as cognitive dissonance against the hyper-muscular male ideal. The Body Project, which takes a cognitive dissonance approach to reduce internalisation of the thin ideal, has been the most successful eating disorder prevention program and has demonstrated consistent improvements in body image with female participants aged 16 years and older (Stice, Marti, Spoor, Presnell, & Shaw, 2008) and both gay (Brown & Keel, 2015) and heterosexual young men (Brown, Forney, Pinner, & Keel, 2017). It might be possible that the approach in the ATLAS program also invokes cognitive dissonance and provides an avenue for reducing internalisation of the

muscular ideal. This approach could be strengthened by incorporating specific activities that use a cognitive dissonance approach.

Although there were no significant changes in use of or intentions to use APEDs, steroids, and drugs over time, this could be due to a floor effect, as use was very low at baseline. Thus, differences or reductions between groups were unlikely to emerge in the short follow-up time period for this pilot evaluation. In support of this notion, in the original ATLAS program, illicit drug use with or without alcohol were reduced in the longer term (Goldberg, et al. 2000). In the current evaluation, students gave some of the highest helpfulness ratings for program content about APED use, indicating that it was useful, and could potentially inform their future avoidance of these substances. Student helpfulness scores for avoiding alcohol were significantly lower than for avoiding drugs and APEDs. Although there is a focus in ATLAS on alcohol and athletic performance, this section may not have relevance for all male adolescents.

Strengths of the study included the diversity of the sample, with 37% of participants reporting that they were non-Caucasian, which is representative of the Australian population according to the 2016 census (Australian Bureau of Statistics, 2017). Some limitations of this work also need to be considered in the context of interpreting the results. First, the study design was quasi-experimental and pragmatic by necessity in order to fit in with the practicalities of the school environment. We did not have random assignment to control and intervention conditions in the allocation of two successive cohorts of year levels of students to intervention and control conditions. We argue that this protects from contamination that might occur when randomising by class, within year level, to condition. The peer facilitation model used in this program means that there may have been a large amount of variability in the delivery of the program, and although we made attempts to

measure fidelity, each adolescents' experience of the program would have depended heavily on the enthusiasm of their peer leader, and the teacher facilitating the class. Finally, the measures that we used were limited by the need to include measures from the original study so that we could compare the performance of the program in different settings.

Despite these limitations, in our trial, we found small improvements in aesthetic and functional body image, and attitudes towards and knowledge about APEDS and steroids. We suggest future development of theoretical frameworks and body image programs for adolescent boys that explore the potential of combining prevention of supplement and steroid use and body dissatisfaction, with a focus on cognitive dissonance against the hyper-muscular ideal.

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Figure 1

Flow of Participants

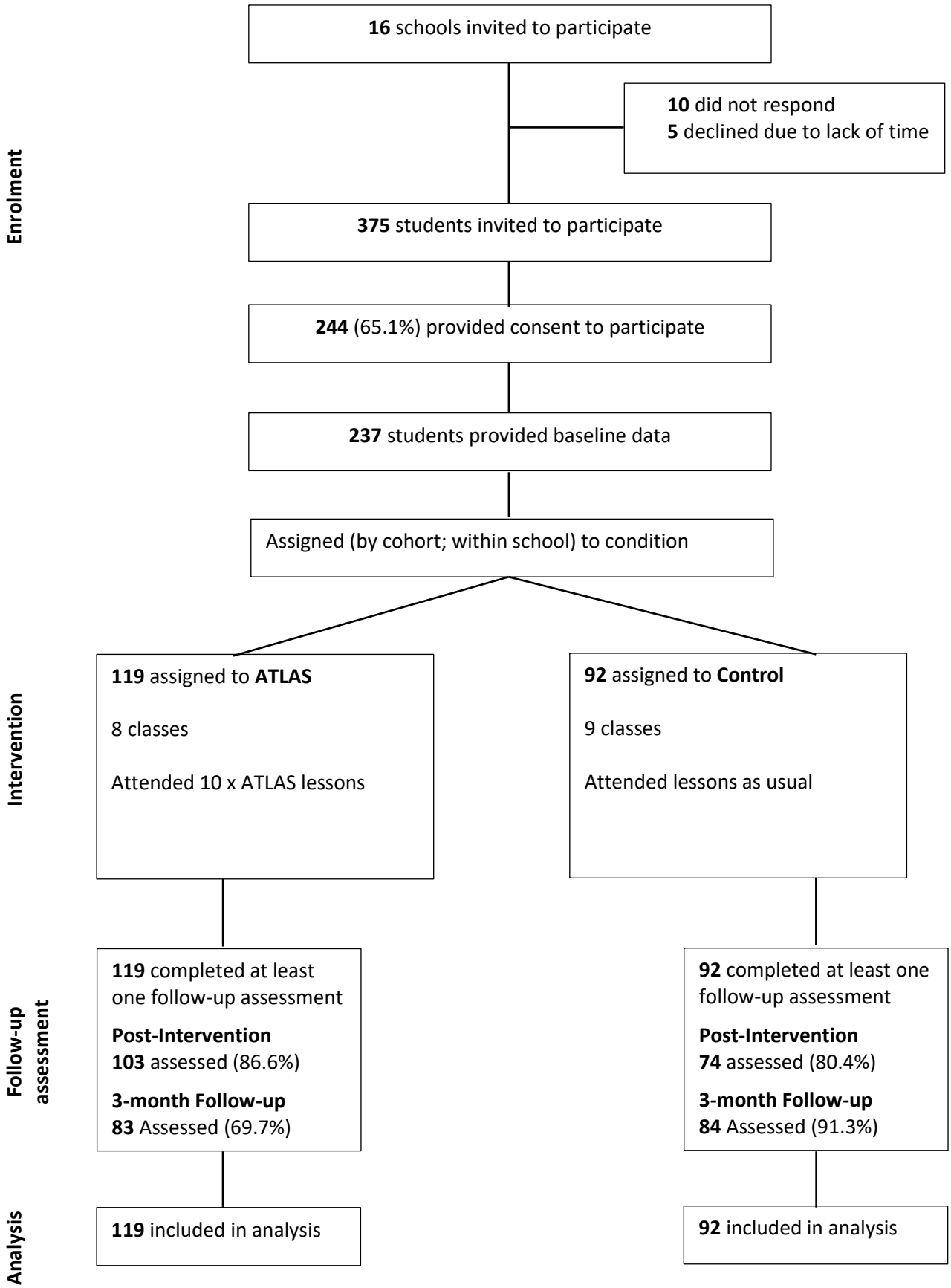

Table 1: ATLAS Intervention Lesson Outline

Lesson	ATLAS Content
1	Introduction to ATLAS; adolescent testosterone production; side effects of anabolic steroid use; macronutrient function for exercise, muscle repair and growth
2	Overview of three types of strength training; safety principles of weight training
3	Appropriate fluid intake during exercise; sports nutrition; protein and calorie requirements; set dietary goals
4	Importance of breakfast; recognition and recall of side-effects of anabolic steroid use; critical analysis of advertised “muscle building” supplement claims;
5	Nutrition requirements for exercise; role play refusing anabolic steroid use offers; effects of drugs and alcohol on athletic performance
6	Development of an advertising campaign to promote sports nutrition or training, or prevent adolescents from using anabolic steroids
7	Overview of problems associated with high-fat diets; presentation of advertising campaigns
8	How to be a better athlete; review of drug and anabolic steroid information
9	Creation and presentation of media article discussing drugs in sport, use of supplements, exercise or nutrition; review different types of strength training; poll females about preferred male body types
10	Review key facts relating to anabolic steroids, nutrition, and exercise with “Steroid Man” game

Table 2

Description of Self-report Assessment Measures.

Variable	Measure, range, internal consistencies (Cronbach's alphas for the current study) and sample item
Body image	
Body esteem [b]	Body Esteem Scale for adults and adolescents (Mendelson et al., 2001). Weight subscale, 7 items, range 0 – 28[b], α = .82 e.g., "I am satisfied with my weight" Appearance subscale, 10 items, range 0 – 40[b], α = .90 e.g., "I like what I look like in pictures"
Drive for muscularity [a]	Drive for Muscularity Scale (D. R. McCreary & D. K. Sasse, 2000), 15 items, range 1 – 6[a], α = .89 e.g., "I wish that I were more muscular"
Appearance rating [b]	Body Appearance Rating (Van Hoorn, Keffor, & O'Dea, 1999), 6 items, range 0-10[b], α = .83 e.g., "How do other people think you look?"
Body satisfaction [b]	Embodied Image Scale (Abbott & Barber, 2010). Functional satisfaction, 3 items, range 5-15[b], α = .92 e.g., "I am very happy with my performance in physical activities". Aesthetic satisfaction, 3 items, range 5-15[b], α = .92 e.g., "Overall I am very satisfied with my appearance"
Substances and supplements	
Knowledge [b]	Knowledge about supplements (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996), 6 items, range 1 – 7[b], α = .76 e.g., "I know about the physical side effects of using anabolic steroids"
Attitudes [b]	Attitudes towards supplement use (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996), 3 items, range 1 – 7[b], α = .85 e.g., "I believe that using anabolic steroids and other performance enhancing drugs is wrong"

Intentions [a]	Intentions to use substances (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996), 6 items, range 1 – 7[a], α = .70 e.g., "I intend to try or use protein powder"
Use of alcohol [a]	Number of occasions of consuming alcoholic drinks in the past 30 days (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996), 1 item, range 0 (zero occasions) – 7 (40+ occasions)
Use of steroids; use of protein powder; use of creatine	Number of occasions using steroids, protein powder, and creatine (lifetime) (Goldberg, Elliot, Clarke, MacKinnon, Zoref, et al., 1996), 3 items, range 1 (never) – 3 (more than three times)
Program feasibility[c]	Student feedback on the usefulness of the program (developed by the authors), 4 items, range 1 – 7[b] e.g., "This program has helped me and my team to feel better about our appearance"

[a]Lower scores more desirable; [b]Higher scores more desirable; [c]Assessed at post-program for ATLAS participants only

Table 3

Means and standard deviations or sample numbers and percentages for outcome variables at baseline, post-program, and 3-month follow-up for the ATLAS and Control conditions

	Baseline		Post-program		3-month follow-up	
	ATLAS	Control	ATLAS	Control	ATLAS	Control
Measures (baseline covariate value)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Body image[3]						
Body esteem - weight[a]	18.25 (5.01)	16.99 (5.34)	18.09 (4.98)	17.99 (5.42)	18.08 (4.69)	16.98 (5.52)
Body esteem - appearance[a]	26.37 (7.16)	26.03 (7.66)	26.8 (6.87)	25.78 (7.92)	26.63 (6.62)	25.12 (7.93)
Drive for muscularity[b]	2.51 (0.81)	2.63 (0.93)	2.55 (0.93)	2.53 (0.95)	2.43 (0.95)	2.63 (1.01)
Appearance rating[a]	7.88 (1.42)	7.73 (1.44)	7.86 (1.5)	7.81 (1.51)	7.79 (1.6)	7.45 (1.85)
Body satisfaction – functional[a]	11.99 (2.48)	11.84 (2.37)	11.75 (2.66)	11.91 (2.42)	12.08 (2.65)	11.61 (2.47)
Body satisfaction - aesthetic[a]	11.62 (2.46)	11.12 (2.7)	11.32 (2.46)	11.35 (2.88)	11.76 (2.64)	11.07 (3.03)
Substances and supplements						
Knowledge	4.62 (1.24)	4.88 (1.27)	5.37 (1.09)	4.91 (1.36)	5.13 (1.29)	4.97 (1.39)
Attitudes	5.00 (1.74)	4.98 (1.81)	5.58 (1.55)	5.01 (1.56)	5.29 (1.68)	5.19 (1.77)
Intentions	2.26 (1.01)	2.41 (1.08)	2.29 (0.99)	2.28 (0.96)	2.40 (1.21)	2.46 (1.17)
Use of steroids, N (%)						
No	95 (79.8)	78 (84.8)	99 (96.1)	63 (85.1)	73 88.0)	68 (81.0)
Yes-once or twice	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (3.6)
Yes, >three times	1 (0.8)	2 (2.2)	1 (1.0)	2 (2.7)	3 (3.6)	2 (2.4)
Do not know substance	20 (16.8)	12 (13.0)	1 (1.0)	7 (9.5)	7 8.4)	10 (11.9)
Did not respond	3 (2.5)	0 (0.0)	2 (1.9)	2 (2.7)	0 (0.0)	1 (1.2)

Body image outcomes 2

Use of protein powder, N (%)						
No	60 (50.4)	35 (38.0)	61 (59.2)	33 (35.9)	47 (56.6)	34 (40.5)
Yes-once or twice	32 (26.9)	21 (22.8)	22 (21.4)	13 (14.1)	16 (19.3)	21 (25.0)
Yes, >three times	21 (17.6)	30 (32.6)	18 (17.5)	25 (27.2)	16 (19.3)	24 (28.6)
Do not know substance	3 (2.5)	6 (6.5)	1 (1.0)	3 (3.3)	4 (4.8)	4 (4.8)
Did not respond	3 (2.5)	0 (0.0)	1 (1.0)	0 (0.0)	0 (0.0)	1 (1.2)
Use of creatine, N (%)						
No	61 (51.3)	43 (46.7)	81 (78.6)	47 (63.5)	63 (75.9)	49 (53.3)
Yes-once or twice	3 (2.5)	1 (1.1)	2 (1.9)	0 (0.0)	1 (1.2)	4 (4.8)
Yes, >three times	5 (4.2)	2 (2.2)	3 (2.9)	2 (2.7)	4 (4.8)	5 (6.0)
Do not know substance	44 (37.0)	45 (48.9)	15 (14.6)	23 (31.1)	15 (18.1)	25 (29.8)
Did not respond	6 (5.0)	1 (1.1)	2 (1.9)	2 (2.7)	0 (0.0)	1 (1.2)
Alcohol use (occasions) last 30 days N (%)-						
None	69 (580%)	65 (70.7%)	44 (42.7)	52 (70.3)	41 (49.4)	58 (69.0)
1 - 2	29 (24.4%)	13 (14.1%)	29 (28.2)	9 (12.2)	11 (13.3)	13 15.5)
3 - 5	10 (8.4%)	6 (6.5%)	15 (14.6)	5 (6.8)	14 (16.9)	4 (4.8)
6 - 9	4 (3.4%)	5 (5.4%)	5 (4.9)	3 (4.1)	5 (6.0)	3 (3.6)
10 - 19	2 (1.7%)	0 (0.0)	2 (1.9)	1 (1.4)	2 (2.4)	3 (3.6)
≥20	2 (1.7%)	3 (3.3%)	5 (4.9)	4 (5.4)	9 (10.8)	3 (3.6)
Did not respond	3 (2.5)	0 (0.0)	3 (2.9)	0 (0.0)	1 (1.2)	0 (0.0)

[a] High scores are indicative of more positive body image

[b] High scores are indicative of more negative body image, i.e., greater drive for muscularity

Table 4

Main and Interaction Effects from Linear Mixed Models Analyses for Body Image Variables

Measures	*Denominator df*	*F*	*p*	*Adjusted alpha*
Body esteem - weight				
Time	157.385	0.374	0.542	> 0.0038
Condition	194.241	0.316	0.575	> 0.0038
Time x Condition	157.423	0.333	0.565	> 0.0038
Body esteem - appearance				
Time	163.178	0.661	0.417	> 0.0038
Condition	191.759	1.470	0.227	> 0.0038
Time x Condition	163.215	0.181	0.671	> 0.0038
Appearance rating				
Time	154.721	0.992	0.375	> 0.0038
Condition	195.430	1.323	0.238	> 0.0038
Time x Condition	154.595	3.131	0.079	> 0.0038
Body satisfaction – functional				
Time	160.509	0.063	0.802	> 0.0038
Condition	201.222	0.149	0.700	> 0.0038
Time x Condition	160.498	4.421	**0.037**	> 0.0038, <.05
Body satisfaction - aesthetic				
Time	159.096	2.411	0.122	> 0.0038
Condition	195.101	0.042	0.838	> 0.0038
Time x Condition	159.134	5.691	**0.018**	> 0.0038, <.05
Drive for Muscularity[a]				
Time	150.900	0.193	0.661	> 0.0038
Condition	175.252	0.716	0.399	> 0.0038
Time x Condition	150.808	0.00	0.992	> 0.0038

Note. Results have sequential Bonferroni adjustments applied. Bolded p-values indicate significant results before ("*p*" column) and after ("Adjusted alpha" column) application of Bonferroni adjustment.

Table 5 *Main and Interaction Effects from Linear Mixed Models Analyses for Substance Use*

Measures	*Denominator df*	*F*	*p*	*Adjusted alpha*
Substances and Supplement Knowledge				
Time	165.426	0.533	0.466	> 0.0038
Condition	199.298	14.112	**<0.001**	> 0.0038
Time x Condition	165.421	3.24	0.074	> 0.0038
Substances and Supplement Attitudes				
Time	153.983	0.058	0.811	> 0.0038
Condition	182.675	3.195	0.073	> 0.0038
Time x Condition	153.931	5.736	**0.018**	> 0.0038, <.05
Intentions to use substance and supplements				
Time	149.078	1.649	0.201	> 0.0038
Condition	191.896	0.845	0.359	> 0.0038
Time x Condition	149.064	0.011	0.917	> 0.0038
Use of alcohol				
Time	161.814	0.804	0.371	> 0.0038
Condition	189.792	8.836	**0.003**	**< 0.0038**
Time x Condition	161.839	0.901	0.344	> 0.0038
Use of steroids (binary)				
Time			0.775	> 0.0038
Condition			0.973	> 0.0038
Time x Condition			0.972	> 0.0038
Use of protein powder (binary)				
Time			0.831	> 0.0038
Condition			0.721	> 0.0038
Time x Condition			0.900	> 0.0038
Use of creatine (binary)				
Time			0.612	> 0.0038
Condition			0.776	> 0.0038
Time x Condition			0.699	> 0.0038

Note. Results have sequential Bonferroni adjustments applied. Bolded p-values indicate significant results before ("*p*" column) and after ("Adjusted alpha") application of Bonferroni adjustment.

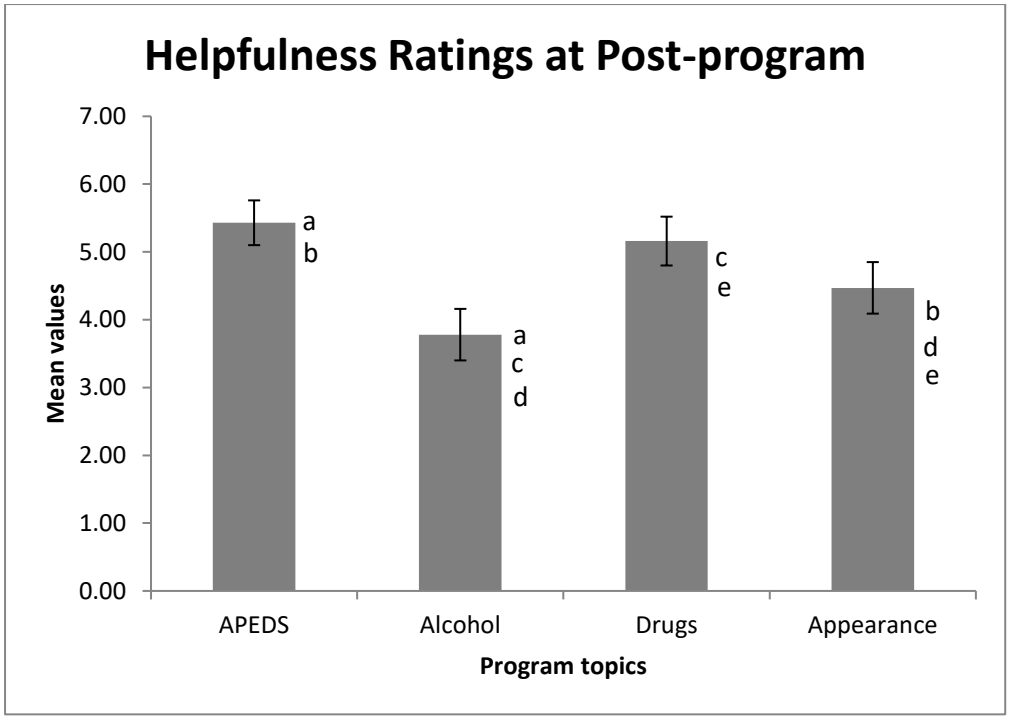

Figure 2. Mean ratings and 95% confidence intervals of post-program ratings of program helpfulness by student participants

Note. Topic areas with the same superscripts are significantly different from one another

Table 6

Teacher Feedback (n=4) on the ATLAS program

Item	Min	Max	Mean [SD]
• Initial support for delivery of the ATLAS program	78	98	86.67 [10.26]
• Effectiveness of the training session for student leaders	73	96	84.25 [9.94]
• Effectiveness of the student leader model of delivery for this type of content	67	98	78.75 [13.40]
• Effectiveness of the student leader model of delivery for this age group	64	97	76.75 [14.17]
• Appropriateness of ATLAS activities for all students	17	92	63.25 [32.34]
• Appropriateness of timing of the lessons	39	82	63.00 [19.41]
• Appropriateness of curriculum alignment	70	78	72.50 [3.78]
• Degree to which teacher manual supported lesson delivery	67	97	84.50 [13.50]
• Support for future facilitation of the ATLAS program	59	87	72.75 [15.32]

* Note, high scores are indicative of higher levels of support for the program