



Aggression is associated with increased anabolic-androgenic steroid use contemplation among adolescents

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ABSTRACT

We investigated the relationship between aggression and anabolic-androgenic steroid (AAS) use intent among adolescents. A nationally representative sample of Norwegian 18-year-olds ($N = 1,334$, females = 58.7%) took part in a survey in 2013 (response rate = 64.9%). Participants completed the physical and verbal subscales of the Short-Form Buss-Perry Aggression Questionnaire, the Intent to use AAS Scale, the Alcohol Use Disorders Identification Test-Consumption, and the Hospital Anxiety and Depression Scale. They also provided demographic information and answered questions about AAS use, gambling participation, as well as cigarette and snus use. Descriptive statistics and multinomial logistic regression were used to analyze the data. Lifetime and past year prevalence of AAS use was 0.1%. Between 0.4% and 1.7% of participants disclosed intent to use while between 1.1% and 2.5% expressed neutral intent to initiate AAS use. Compared to persons low on aggression, individuals high on aggression were more likely to report intent and curiosity towards initiating AAS use. Implications of findings are discussed.

Keywords: adolescents; aggression; anabolic-androgenic steroids; contemplation; intention

INTRODUCTION

Anabolic-androgenic steroid(s) (AAS) are a group of hormones including testosterone and its synthetic derivatives used for treating various medical conditions. Some individuals also use them illicitly as a means to facilitate muscle growth and enhance strength. Others use AAS in order to improve their sports and non-sports occupational functioning, and to enhance physical appearance and psychological well-being among others (Evans, 2004; Sagoe et al., 2014a). Although use of AAS has been associated with positive effects as noted above, long-term AAS use has been linked to negative consequences such as increased aggression and violence, suicide, cardiovascular pathology, liver disease, dependence and polypharmacy, hirsutism and menstrual disorders in female users, as well as gynecomastia and sperm motility in male users (Darke, Torok, & Duflou, 2014; Pope & Kanayama, 2012; Pope et al., 2013).

Use of AAS has further been associated with cognitive, emotional, and neurological problems in adolescents (Cunningham, Lumia, & McGinnis, 2013; Hildebrandt et al., 2014; Kicman & Gower, 2003). Apart from the debilitating effects delineated above, experimental evidence indicates that perceived use of AAS harms observers' evaluation of a user's personality or social image (Sagoe et al., 2015a; Yu, Hildebrandt, & Lanzieri, 2015). Nonmedical use of AAS is regarded an issue of public health concern with an overall global lifetime prevalence of 3.3%, and 2.3% for high school students (Sagoe et al., 2014b).

Problem behavior theory (PBT; Jessor & Jessor, 1977) suggests that involvement in one problem behavior such as aggressive and violent behavior is associated with involvement in other problem behaviors (e.g. AAS use) and delinquency. An explanation for adolescent problem behavior is the social ecology of adolescence wherein peer approval and fixation with the attainment of adulthood shape the acquisition and practice of behavior (Jessor, 1992). PBT is one of the most influential theories of deviant behavior (Steinberg & Morris, 2001). In support of PBT, AAS use has been associated with the use of narcotic drugs and alcohol plus

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3 involvement in other risky behaviors in adolescence (Barland, & Tangen, 2009; Miller et al.,
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5 2002, 2005; Pallesen et al., 2006).
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8 Similarly, AAS use has been associated with increased aggression and violence in
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10 adolescence. In a study of a nationally representative sample of United States adolescents, it
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12 was found that male lifetime AAS users had greater involvement in violent behavior
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14 compared with nonusers. This difference remained significant even after controlling for
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16 previous violent behavior, polypharmacy, and the interaction of violent behavior and
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18 polypharmacy (Beaver et al., 2008). It is worthy of note that other studies have found no
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20 association between AAS use and aggressive behavior (Bhasin et al., 1996; Pope, Kouri, &
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22 Hudson, 2000). It can be inferred from the above that the association between AAS use and
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24 aggressive behavior currently remains debatable and requires further exploration (Dunn,
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26 2015; Lundholm et al., 2015).
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30 The integrated behavioral model (IBM; Fishbein, 2000, 2008), previously propounded
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32 as the theory of reasoned action (TRA; Fishbein & Ajzen, 1975) and the theory of planned
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34 behavior (TPB; Ajzen, 1985) postulate that intention, moderated by personal skills and
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36 contextual factors, is an important predictor of behaviour. TRA and TPB have been criticized
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38 as having limited applicability to the prediction of behavior (Werner, 2004). Nonetheless,
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40 these theories have received convincing empirical support in the significant prediction of a
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42 diverse range of health behaviors and intentions including blood donation (Bednall et al.,
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44 2013), condom use (Albarracin et al., 2001), smoking (Topa & Moriano, 2010), and the use of
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46 doping substances such as AAS (Ntoumanis et al., 2014).
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50 It is important that preventive interventions take into consideration the correlates of
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52 doping intentions and behavior as doping intentions elucidate doping behavior (Ntoumanis et
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54 al., 2014; Petróczi et al., 2008). Accordingly, monitoring and understanding the correlates of
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56 AAS use and use intent is an important scientific effort. The present study explores the
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3 association between aggression and AAS use intent among a nationally representative sample
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5 of Norwegian 18-year-olds.
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8 **METHODS**

9 **Participants**

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11 A total of 2,055 (females = 52.9%) 18-year-olds were invited to participate in the
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13 study in 2013. Of this sample, 1,334 (females = 58.7%) responded yielding a response rate of
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15 64.9%. The characteristics of the sample are presented in Table 1.
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20 Insert Table 1 about here
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23 **Measures**

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25 A self-report questionnaire containing the following measures were used in the survey.
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27 *Demographics.* Demographic information such as living situation, and grade point
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29 average were assessed in the survey questionnaire.
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32 *Aggression.* The physical and verbal aggression subscales of the Short-Form Buss-
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34 Perry Aggression Questionnaire (BPAQ-SF; Diamond & Magaletta, 2006) were used in the
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36 assessment of aggression. An example item is “I have threatened people I know”. Items are
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38 answered on a 5-point scale ranging from “very unlike me” scored ‘1’ to “very like me”
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40 scored ‘5’. The scale had a Cronbach’s alpha of .79.
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43 *AAS use and intent.* Participants indicated whether they had used AAS in the past 12
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45 months (yes/no). AAS use intent was assessed using the Intent to Use AAS Scale (IUAS;
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47 MacKinnon et al., 2001). The scale has 5 items answered on a 5-point scale ranging from
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49 “strongly disagree” scored ‘1’ to “strongly agree” scored ‘5’. An example item is “I am
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51 curious to try anabolic steroids”. The IUAS yielded a Cronbach’s alpha of .92.
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54 *Tobacco use, and gambling.* Participants disclosed whether they were cigarette
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56 smokers (daily/less than daily/not at all), used snus, i.e. smokeless tobacco (daily/less than
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3 daily/not at all), or had gambled in the last 12 months (yes/no). A dichotomous variable was
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5 computed for cigarette use, snus use, and gambling (no = 0, yes =1).
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7 *Alcohol use.* Use of alcohol was assessed with the 3-item Alcohol Use Disorders
8 Identification Test-Consumption (AUDIT-C; Bush et al., 1998). An example item is “How
9 often do you have a drink containing alcohol?” Responses were given on a 5-point answer
10 scale ranging from “never” scored ‘0’ to “4+ times per week” scored ‘4’. Answers to the three
11 items were added, and an index score was computed with a sum score of 5 or above indicating
12 problematic alcohol use. Cronbach’s alpha was .71.
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20 *Anxiety and depression.* The Hospital Anxiety and Depression Scale (HADS;
21 Zigmond & Snaith, 1983) was used to assess symptoms of anxiety and depression. HADS
22 consists of a 7-item anxiety subscale (e.g., “I get sudden feelings of panic”) and a 7-item
23 depression subscale (e.g., “I can laugh and see the funny side of things”). Items are answered
24 on a 4-point scale scored from 0 to 3. A composite score was computed for each subscale. As
25 in previous studies (Bjelland et al., 2002; Kuijpers et al., 2003; Pallesen et al., 2006), a score
26 higher than 7 on either subscale was deemed to denote the presence of symptoms of anxiety
27 or depression. Cronbach’s alphas were .80 and .73 for the anxiety and depression subscales,
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41 **Procedure**

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43 In 2013, a total of 2,055 respondents randomly selected from the Norwegian National
44 Population Registry for a previous study (*reference omitted for review*) were sent a
45 questionnaire package by postal mail and invited to participate. An invitation letter explained
46 the purpose of the study and indicated that researchers at the University of [*name omitted for*
47 *review*] were conducting the study. The invitation letter further assured participants
48 anonymity and confidentiality, and promised them a NOK 200 gift card (about € 25 at the
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3 time of data collection) as compensation for their participation. An informed consent form,
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5 the questionnaire, a guide to completing and returning the questionnaire, and a pre-paid
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7 envelope were also included in the package. Participants could complete the questionnaire
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9 online via a provided web link or return the paper version using the prepaid envelope. Up to
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11 two reminders were sent to those who had not replied. The study received ethical approval
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13 from the Regional Committee for Medical and Health Research Ethics in South East Norway
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15 (2012/914).
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18 19 **Statistical Analysis**

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21 Descriptive statistics were used to ascertain characteristics of the sample and
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23 frequencies of responses to items on the IUAS (MacKinnon et al., 2001). Multinomial logistic
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25 regression analysis was used to identify predictors of intent to use AAS using scores on the
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27 IUAS as outcome variable. Responses to the IUAS items were recategorized: “strongly
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29 disagree” and “disagree” were combined into the category “disagree”, “strongly agree” and
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31 “agree” were combined into the category “agree”, while “neither agree or disagree” was
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33 rephrased as “neutral”. “Disagree” was used as the intent or response reference category.
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37 38 **RESULTS**

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40 The estimated lifetime and past year prevalence of AAS use was 0.1%. On the five
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42 AAS use intent items, between 90.3% and 94.7% expressed strong disagreement, 3.2% to
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44 5.4% disagreed, 1.1% to 2.5% were neutral, 0.4% to 1.7% agreed, and 0.5% to 0.8% were in
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46 strong agreement (see Table 2).
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49 Insert Table 2 about here
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52 Table 3 shows the results from the multinomial logistic regression analysis for intent
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54 to use AAS. From Table 3, it is evident that compared to females, males were more likely to
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56 have neutral intent or curiosity towards initiating AAS use. Additionally, males were more
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3 likely to have neutral intent towards initiating use in case AAS use became pervasive among
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5 friends compared to females.
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8 Moreover, lifetime users of snus were less willing to initiate AAS use compared to
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10 lifetime nonusers. Compared to individuals without symptoms of depression, those exhibiting
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12 depressive symptoms were less likely to have a neutral intent towards initiating AAS use in
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14 the event that many friends initiate use.
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17 Importantly, in comparison with persons low on aggression, individuals high on
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19 aggression were more likely to report intent to initiate AAS use and neutrality, as well as
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21 curiosity towards initiating AAS use and neutrality. Furthermore, compared to individuals low
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23 on aggression, persons high on aggression were more likely to have a neutral intent to initiate
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25 AAS use in case AAS use became highly prevalent among either teammates or friends (see
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27 Table 3).
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Insert Table 3 about here

DISCUSSION

We explored the relationship between aggression and AAS use intent in a nationally representative sample of Norwegian adolescents. The estimated past year prevalence of AAS use was 0.1%. Evidence from systematic analyses of the AAS use literature indicate that the majority of AAS users initiate use in their twenties with only about 13% starting use before age 18 (Pope et al., 2014; Sagoe et al., 2014a). The young age of our sample is therefore a plausible explanation for the low AAS use prevalence rate reported in our study. In addition, between 0.4% and 1.7% of participants conveyed their intent to use AAS while between 1.1% and 2.5% were neutral. The estimates from the present study are lower than the 5.1% contemplation prevalence reported in a recent study of Norwegian male high school students (Jenssen & Johannessen, 2015). Although our estimates point to a low prevalence of AAS use

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3 and use intent among Norwegian adolescents, they should be interpreted in view of the low
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5 response rate and the dominance of female participants as a similar study of male adolescents
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7 with a higher response rate produced higher prevalence estimates (Jenssen & Johannessen,
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9 2015).

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11 Notably, we found aggression to be a risk factor for AAS use contemplation as
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13 individuals high on aggression were more likely to report intent and curiosity towards
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15 initiating AAS use in comparison with persons low on aggression. These findings corroborate
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17 evidence showing that adolescents considering future AAS use are significantly higher on
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19 aggression compared to a control group of non-contemplators (Jenssen & Johannessen, 2015).
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21 The present findings are also consistent with evidence linking aggression to exposure to AAS
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23 milieu (Sagoe et al., 2015b) as well as the actual use of AAS (Wichstrøm & Pedersen, 2001).
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25 As pointed out previously, causality between aggression and AAS use currently remains
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27 blurred (Dunn, 2015; Lundholm et al., 2015). Nonetheless, given the relationship between
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29 intention and behavior presented in theoretical frameworks (Ajzen, 1985; Fishbein, 2000,
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31 2008; Fishbein & Ajzen, 1975) and empirical work on AAS use (Allahverdipour, Jalilian, &
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33 Shaghghi, 2012), the present findings suggest the need for attention towards the sublimation
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35 or management of aggression in the development of adolescent-targeted preventive
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37 interventions.
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43 In this regard, it is recommended that AAS-targeted interventions combine education
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45 on anti-doping and healthy nutritional practices with practical strength training. This type of
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47 intervention has proven effective in convincing adolescents that the potentially derivable
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49 physical and psychosocial benefits of AAS use can be achieved without resorting to the use of
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51 AAS and other performance and image enhancing drugs (Goldberg et al., 2000; Sagoe et al.,
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53 2016). In addition, males were more likely to have neutral intent or curiosity towards
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55 initiating AAS use if AAS use became highly characteristic of one's peer cluster. This is in
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3 line with epidemiological evidence indicating that there is a significantly higher prevalence of
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5 AAS use among males compared to females (Sagoe et al., 2014b) probably because the
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7 androgenic effects of AAS use such as hirsutism and deepening of the voice dissuade females
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9 from initiating or continuing use.
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12 Moreover, persons with depressive symptoms were less likely to have a neutral intent
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14 towards initiating AAS use in the event that many friends initiate use compared to individuals
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16 without symptoms of depression. The present result is inconsistent with evidence connecting
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18 depressive symptoms in adolescents to exposure to AAS milieu (Pallesen et al., 2006; Sagoe
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20 et al., 2015b) and with studies suggesting that depression is a risk factor for relapse following
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22 AAS use cessation (Kanayama et al., 2009). This finding is also in contrast to qualitative
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24 studies showing that depressive symptoms are related to the initiation of AAS use (Sagoe et
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26 al., 2014a). Furthermore, compared to lifetime nonusers, lifetime users of snus or smokeless
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28 tobacco were less willing to initiate AAS use. It is not clear why there is a negative
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30 relationship between snus use and AAS use. However, previous studies have shown that snus
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32 use is less strongly associated with indicators of poor general adjustment compared to
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34 smoking (Pedersen & von Soest, 2014). As far as we are aware, the present study is the first to
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36 investigate the relationship between snus use and AAS use intent. Thus, further studies are
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38 needed in order to validate the present findings regarding the relationship between snus use
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40 and AAS use intent.
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46 Lifetime cigarette use, past year gambling, as well as alcohol use had no association
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48 with AAS use intent in the present study. In this respect, the present findings are in contrast to
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50 evidence (Miller et al., 2002, 2005; Pallesen et al., 2006) delineating ‘problem behavior
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52 syndrome’ (Jessor & Jessor, 1977) as an explanation for adolescent exposure to AAS milieu
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54 and actual use of AAS. Some merits of the present study such as the use of a nationally
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56 representative sample and several well-validated instruments deserve mention. It must
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3 however be noted that data were derived from self-reports which may have limited validity.
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5 Future studies should consider validating self-reports with data from other sources such as
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7 objective tests. Additionally, the cross-sectional nature of the present study did not allow for
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9 causal inferences. Longitudinal investigations are warranted in future studies to further clarify
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11 the phenomenon of AAS use intent and actual use, as well as the link between aggression and
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13 AAS use contemplation. Finally, similar studies in other cultural and geographic settings are
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15 warranted to further elucidate our findings.
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18 19 **DECLARATION OF INTEREST**

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21 The authors report no conflicts of interest. The authors alone are responsible for the content
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23 and writing of the article.
24
25

26 27 **GLOSSARY**

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29 *Aggression*: Behavior carried out with the immediate intention to harm.
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33 *Anabolic–androgenic steroids*: Testosterone and its synthetic derivatives misused by some
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35 healthy persons for enhanced physical appearance, strength, wellbeing and
36
37 sports/occupational performance.
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Table 1. Characteristics of the study sample ($N = 1,334$).

Characteristic	<i>n</i>	%
Gender		
Female	783	58.7
Male	550	41.3
Living situation		
Both parents	826	62.6
Single parent	242	18.3
Shuttling between parents	81	6.1
Alone	67	5.1
Household/dormitory	20	1.5
Other	84	6.4
Past year AAS use		
No	1277	99.9
Yes	1	0.1
Alcohol		
AUDIT-C < 5	121	10.2
AUDIT-C \geq 5	1060	89.8
Past year gambling		
No	812	61.1
Yes	516	38.9
Lifetime cigarette use		
No	1113	84.3
Yes	207	15.7
Lifetime snus use		
No	1001	75.8
Yes	319	24.2
Anxiety		
HADS A \leq 7	914	70.0
HADS A > 7	391	30.0
Depression		
HADS D \leq 7	1144	87.5
HADS D > 7	164	12.5

AUDIT-C: Alcohol Use Disorders Identification Test-Consumption

HADS: Hospital Anxiety and Depression Scale

Percentages may not add up to 100% due to missing data on the respective items.

Table 2. Responses to items on the Intent to Use AAS Scale.

Item	Strongly disagree <i>n</i> (%)	Disagree <i>n</i> (%)	Neither agree nor disagree <i>n</i> (%)	Agree <i>n</i> (%)	Strongly agree <i>n</i> (%)
Intend ^a	1253 (94.7)	42 (3.2)	15 (1.1)	5 (0.4)	8 (0.6)
Willing ^b	1234 (93.1)	51 (3.8)	25 (1.9)	7 (0.5)	8 (0.6)
Curious ^c	1195 (90.3)	62 (4.7)	33 (2.5)	23 (1.7)	10 (0.8)
Teammates ^d	1217 (91.8)	70 (5.3)	25 (1.9)	6 (0.5)	7 (0.5)
Friends ^e	1205 (91.4)	71 (5.4)	31 (2.4)	5 (0.4)	6 (0.5)

^a I intend to try to use anabolic steroids.

^b I would be willing to use steroids to know how it feels.

^c I am curious to try anabolic steroids.

^d I would use anabolic steroids, if more of my teammates would start using them.

^e I would use anabolic steroids, if more of my friends would start using them.

Percentages may not add up to 100% due to missing data on the respective items.

Table 3. Multinomial logistic regression analyses of predictors of AAS use intent.

Variable	Intend ^a		Willing ^b		Curious ^c		Teammates ^d		Friends ^e	
	Neutral	Agree	Neutral	Agree	Neutral	Agree	Neutral	Agree	Neutral	Agree
	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI	95% CI
Gender										
Female ^f										
Male	5.75*	1.94	1.81	1.64	2.96*	1.80	1.20	1.76	2.63*	1.44
	1.15–28.67	.40–9.32	.63–5.16	.48–5.61	1.16–7.56	.76–4.31	.73–5.45	.43–7.24	1.01–6.89	.33–6.27
Living situation										
Both parents ^f										
Single parent	1.21	.40	1.69	1.40	1.78	2.23	.63	.61	.64	.73
	.28–5.21	.04–3.8	.54–5.29	.34–5.82	.68–4.67	.94–5.3	.17–2.28	.06–5.71	.20–2.05	.08–6.76
Shuttling between parents	2.32	2.77	1.39	1.59	1.72	.79	1.87	5.41	.45	2.89
	.23–23.17	.27–28.15	.17–11.68	.17–14.84	.35–8.39	.10–6.47	.39–9.00	.85–34.61	.05–4.05	.31–27.16
Other ^g	.62	.77	1.00	1.17	.31	.26	.32	1.82	.44	2.22
	.07–5.53	.08–7.23	.21–4.80	.22–6.35	.04–2.45	.03–2.07	.04–2.51	.30–10.99	.09–2.09	.39–12.66
Cigarette [†]										
No ^f										
Yes	.57	.55	.81	.49	1.57	.95	.90	.42	.89	.71
	.14–2.30	.09–3.22	.24–2.71	.12–1.98	.49–5.03	.34–2.68	.28–2.92	.09–2.06	.31–2.60	.11–4.45
Snus [†]										
No ^f										
Yes	.27	.29	.62	.23*	.50	1.02	.78	.26	.67	.51
	.06–1.28	.05–1.82	.19–1.99	.06–.94	.18–1.39	.38–2.73	.26–2.40	.05–1.35	.23–1.90	.09–2.81
Gambling ^{††}										
No ^f										
Yes	.60	1.19	.67	.82	.98	.65	.63	.72	.94	.72
	.17–2.12	.26–5.54	.25–1.85	.24–2.74	.41–2.38	.28–1.48	.25–1.62	.18–2.88	.38–2.33	.17–3.04
Anxiety										
HADS A ≤ 7 ^f										

HADS A > 7	.81	2.71	1.40	.37	.54	.84	2.72	.93	.55	1.50
	.20–3.33	.41–17.98	.42–4.69	.10–1.37	.21–1.43	.33–2.17	.76–9.71	.20–4.39	.20–1.47	.25–8.91
Depression										
HADS D ≤ 7 ^f										
HADS D > 7	1.18	.56	.44	.50	.75	.60	.32	.44	.27**	.92
	.20–6.85	.08–3.71	.12–1.58	.12–2.01	.24–2.35	.21–1.74	.10–1.03	.08–2.28	.10–.70	.09–8.93
Grade point average	.73	1.03	1.08	.94	.83	.82	.99	.82	.67	1.08
	.34–1.58	.38–2.79	.56–2.09	.46–1.92	.48–1.45	.48–1.39	.53–1.87	.37–1.80	.37–1.20	.43–2.68
Alcohol (AUDIT-C)	.92	.74	.99	.81	1.04	1.07	.97	.77	.99	.87
	.66–1.27	.51–1.06	.77–1.28	.60–1.09	.83–1.30	.87–1.33	.77–1.22	.54–1.09	.80–1.23	.61–1.25
Aggression	1.13*	1.19*	1.09	1.03	1.10*	1.12**	1.11*	1.07	1.10*	1.07
	1.01–1.28	1.04–1.37	.99–1.21	.91–1.16	1.01–1.19	1.03–1.21	1.01–1.22	.93–1.22	1.01–1.20	.92–1.24

^a I intend to try to use anabolic steroids.

^b I would be willing to use steroids to know how it feels.

^c I am curious to try anabolic steroids.

^d I would use anabolic steroids, if more of my teammates would start using them.

^e I would use anabolic steroids, if more of my friends would start using them.

AAS use intent reference category: Disagree.

†Lifetime. ††Past year.

AUDIT-C: Alcohol Use Disorders Identification Test-Consumption

HADS: Hospital Anxiety and Depression Scale

^f Variable's reference category (OR = 1.00).

^g Household/dormitory, alone etc.

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