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Double trouble? A mixed methods study exploring experiences with combined use of anabolic-androgenic steroids and psychoactive substances among women

Ingrid Amalia Havnes [a,*], Marie Lindvik Jørstad [a], Astrid Bjørnebekk [b]

[a] The Anabolic Androgenic Steroid Research Group, National Advisory Unit on Substance Use Disorder Treatment, Division of Mental Health and Addiction, Oslo University Hospital, Pb 4959 Nydalen, 0424 Oslo, Norway

[b] The Anabolic Androgenic Steroid Research Group, Section for Clinical Substance Use and Addiction Research, Oslo University Hospital, Pb 4956 Nydalen, 0424 Oslo, Norway

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ABSTRACT

Concurrent use of anabolic-androgenic steroids (AAS) and psychoactive substances (illicit drugs and alcohol) is found common in studies among men and involves a higher risk of adverse events than AAS use alone. However, women who use AAS represent an understudied group, and little is known about their pattern of psychoactive substance use and possible links to AAS use. The aim of this mixed methods paper is to a) examine lifetime and problem use of psychoactive substances and AAS, *and* b) explore experiences of AAS and psychoactive substance use including understandings of how these substances may be related among women with current or previous AAS use.

Among sixteen women with current or previous AAS use, lifetime psychoactive substance and AAS use, AAS dependence and problem drug and alcohol use were assessed. In-depth semi-structured interviews were conducted, audio-recorded, transcribed verbatim and analyzed thematically within a biopsychosocial framework applying pharmacological agency; the concept of bodily surveillance of effect and the ability to handle substances instrumentally to feel oneselves/ones bodies better.

Twelve participants reported lifetime substance use, where cannabis, cocaine and amphetamines were most commonly used. Substance use problems were found among eight participants; five had lifetime AAS-dependence *and* clinically significant drug and/or alcohol dependence scores, two had lifetime AAS dependence, and one had clinically significant drug dependence scores. Psychoactive substance use was experienced as unrelated to AAS use or it could be used to counteract side effects of AAS. On the contrary, AAS was used to cope with the bodily and emotional change following withdrawal from psychoactive substances and to counteract bodily effects of long-term substance use. Being in substance use disorder (SUD) treatment after detoxification with affected mental health, a passive lifestyle and experiencing a transition from having an emaciated body, gaining weight and becoming unfit, was experienced to motivate AAS initiation during treatment.

The polysubstance nature of AAS use including use of psychoactive substances and risk of developing SUDs poses a significant health risk. Health professionals need to understand motivations for combined use of AAS and psychoactive substances among women to be able to prevent harms and address individual treatment needs.

1. Introduction

Anabolic-androgenic steroids (AAS) are synthetic derivatives of testosterone that, due to their muscle building capacities, are used to enhance image and performance (Kicman, 2008). In view of the masculinizing effects of AAS (Huang & Basaria, 2018), the majority of AAS users are males (Sagoe, Molde, Andreassen, Torsheim, & Pallesen, 2014) and AAS use among women remains an under-researched area. Since they are a minority and due to stigma and secrecy surrounding the use of AAS among women, (Havnes, Jørstad, Innerdal, & Bjørnebekk, 2020; Henning & Andreasson, 2019; McLean, 2020; Sverkersson, Andreasson, & Johansson, 2020), female study participants are

* Corresponding author.
E-mail address: i.a.havnes@medisin.uio.no (I.A. Havnes).

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challenging to recruit (Börjesson, Gårevik, Dahl, Rane, & Ekström, 2016; Börjesson et al., 2020; Ip et al., 2010; Korkia, Lenehan, & McVeigh, 1996).

Most of the existing knowledge about AAS use and health issues has therefore been generated from research mostly on males, where AAS use is found to be associated with physical (Bjørnebekk et al., 2017; Horwitz, Andersen, & Dalhoff, 2019; Pope et al., 2014) and mental health problems (Piacentino et al., 2015), substance use (Abrahin, Félix Souza, de Sousa, Santos, & Bahrke, 2017; Christiansen, Vinther, & Liokaftos, 2017; Garevik & Rane, 2010; Havnes, Bukten, Rognli, & Muller, 2020; Zahnow et al., 2018) and substance use disorders (SUDs) (Havnes, Jørstad, McVeigh, Van Hout, & Bjørnebekk, 2020; Kanayama, Cohane, Weiss, & Pope, 2003; Petersson, Bengtsson, Voltaire-Carlsson, & Thiblin, 2010; Skårberg, Nyberg, & Engstrom, 2009).

There is mounting evidence suggesting that polysubstance use often comprise a feature of AAS users' repertoire and is often described as involving a pattern of use where different steroids and other substances are used to maximize muscle building and fat loss, or to counteract the unwanted side effects of AAS (McVeigh, Salinas, & Ralphs, 2020; Sagoe et al., 2015). Such polydrug use is not limited to image- and performance-enhancing drugs but also involves the use of psychoactive substances including illicit drugs, alcohol and addictive medications (Dodge & Hoagland, 2011; McVeigh, Begley, & Policy, 2017; Salinas, Floodgate, & Ralphs, 2019; Skårberg et al., 2009; Van de Ven et al., 2018).

This link also seems to apply to female use, with co-occurring AAS and psychoactive substances having been reported among female adolescents (Elliot, Cheong, Moe, & Goldberg, 2007; Ganson et al., 2021; Gestsdottir, Kristjansdottir, Sigurdsson, & Sigfusdottir, 2020) and weight-training women (Abrahin et al., 2017; Angoorani, Jalali, & Halabchi, 2018; Börjesson et al., 2016; Gruber & Pope Jr, 2000; Skårberg, Nyberg, & Engström, 2008). However, female bodybuilders in an ethnographic study rationalized their AAS use as being controlled and purposeful with long-term targeted efforts to achieve one's physical goals and contrasted it to how recreational drug users sought 'momentary enjoyment' with lack of control. The possible similarities between the types of substances were recognized by some participants who described that AAS could "*possess some addictive and mood changing properties and as such were simply another drug of choice not unlike others*" (McLean, 2020).

Previous findings suggest that strength-trained women who use AAS are more likely to qualify for a substance use disorder (SUD) than male users and women who had never used AAS (Ip et al., 2010). Moreover, in Norway, lifetime AAS use is far more common among female patients in treatment for SUDs than among women in the general population; reported as 8% (Havnes, Jørstad, McVeigh, et al., 2020) and 0.2% (Sagoe, Torsheim, Molde, Andreassen, & Pallesen, 2015), respectively. A common motivation to initiate AAS use among SUD-patients in Norway comprise rebuilding a body that had become thin with psychoactive substance use (Havnes, Jørstad, McVeigh, et al., 2020) and it has been suggested that substance use, cessation, and SUD treatment could be a gateway to AAS use (Nøkleby, 2013; Nøkleby & Skårderud, 2013). Although an understudied thematic, concurrent use of AAS and psychoactive substances among women is of concern as it may lead to co-dependence (Kanayama & Pope, 2013) and comprise a considerable heightened risk of health complications.

The aim of this mixed methods paper is to generate new knowledge and a nuanced understanding of psychoactive substance use in a sample of 16 women with current or previous AAS use where;

1) quantitative data are used to examine AAS dependence and the extent and severity of psychoactive substance use among the participants on a group level, and
2) individual in-depth interviews are used to explore experiences with use of psychoactive substances and AAS and understandings of the potential relation between these substances, (e.g. if use of AAS or psychoactive drugs have influenced the use of the other).

2. Material and methods

This mixed methods study forms part of a larger study exploring brain health, cognition and behavior among men and women with current or previous AAS use and weightlifting controls (Havnes, Jørstad, Innerdal, et al., 2020; Vaskinn, Hauger, & Bjørnebekk, 2020).

2.1. Context

Individuals with SUDs in Norway have treatment rights as patients in publicly funded in- or outpatient SUD treatment. Inpatient treatment is directed toward complex treatment needs, such as SUD and co-occurring somatic and/or mental health and/or socioeconomic problems. One third of SUD-patients are women (Norwegian Directorate of Health, 2018). In 2013, when use and possession of AAS became illegal in Norway, patients with AAS-related health problems got the right to outpatient SUD treatment. However, few women with current or previous AAS use seek information about such treatment (Havnes, Jørstad, & Wisløff, 2019).

2.2. Sample

Women with current or previous AAS use were recruited through social media, user forums, posters, flyers and snowball sampling. The 16 women who participated in the qualitative study comprised ten previous and six current users, mean age at participation was 30.9 (range 19-46), mean age at AAS initiation was 23.1 years (19-32) and mean accumulated use were 4.4 years ranging from one month to 26 years. Seven were students or worked in health and other care services, three worked as coaches or personal trainers, three had creative or service professions and three were students or worked within education. Ten had competed in fitness/bodybuilding disciplines on regional, national or international level.

2.3. Data collection

Both quantitative and qualitative data were collected on the same day. The data on problem use of psychoactive substances were later analyzed and presented on a group level.

2.3.1. Qualitative interviews

All 16 participants underwent a one-hour long qualitative semi-structured interview. The first eight interviews were conducted in 2014-2015 as part of a master's thesis and the last eight interviews were conducted in 2016-2020 to further explore the findings from the first interviews. The topics of particular relevance for this paper included: background information, motivation for AAS use, practices of AAS initiation, experiences of side effects, psychoactive substance use and treatment experiences. The interviews were audio recorded and transcribed verbatim.

2.3.2. Lifetime substance use

All participants were asked to report whether they had ever tried/used the following illicit psychoactive substances and non-prescribed psychoactive medications as listed in SCID (First, 2014): amphetamines, unprescribed methylphenidate, cocaine, heroin, unprescribed opioids, unprescribed benzodiazepines, cannabis, GHB, LSD, Ecstasy and other.

2.3.3. Questionnaire and screening instrument

Demographics and clinical data were assessed using a self-report questionnaire and a semi-structured interview. Current and previous psychoactive substance use was assessed with the drug and alcohol

dependence scales from the Millon Clinical Multiaxial Inventory-III (MCMI-III). Base rate (BR) scores are calculated providing information about the prevalence and severity on a continuum and is representative of the actual prevalence of the particular attribute among patients in mental health services. The BR scores range from 1-115, where a score of 60 is the median score obtained by patients in mental health services. A score >75 on a scale indicates the presence of a trait or syndrome and a score above 85 indicate a persistent, significant clinical concern (Millon, Millon, Davis, & Grossman, 1997). As the BR scores are not normally distributed and small changes in the lower end influence impact on scores more than changes in the upper end, a BR score around 70 is suggested to be of clinical significance (Vanem, Krog, & Hartmann, 2008).

Lifetime AAS dependence included current and previous AAS dependence and was evaluated in a modified and adapted version (Kanayama, Hudson, & Pope, 2009; Pope Jr et al., 2010) of the Structured Clinical Interview for DSM-IV (SCID) (First, Spitzer, Gibbon, & Williams, 1996). Lifetime AAS dependence was present if participants had a maladaptive pattern of AAS use causing clinically significant impairment or distress, manifested by three or more of the DSM-IV criteria reported in the same 12-month period.

2.4. Analyses

2.4.1. Quantitative data

The background and questionnaire data were organized and handled in SPSS 25 and descriptive statistics were used to generate frequencies and mean values regarding AAS use and MCMI-III BR scores.

2.4.2. Qualitative analysis and analytical framework

A two-phase process of data collection and exploratory analysis was applied. The first eight interviews were conducted in 2014-2015 and analyzed using systematic text condensation (Malterud, 2012) as part of a master's thesis. The second phase of the data collection (2016-2020) and analysis engaged a biopsychosocial framework (Borrell-Carrió, Suchman, & Epstein, 2004) with thematic reanalysis of the first eight and ongoing thematic analysis of the last eight interviews (Braun & Clarke, 2006; Braun & Clarke, 2014). The analysis focused on physical, emotional and social aspects related to incorporation of AAS and psychoactive substances, and whether and how the participants experienced that use of these substances were related. The concept pharmacological agency was applied in the analysis and is here related to bodily and emotional needs and the bodily surveillance of effect and ability to handle substances (AAS and/or psychoactive substances) instrumentally to feel themselves/their bodies better and how this is acted upon by the participants (Havnes, Clausen, & Middelthon, 2014). Pharmacological agency is described as a "ceaseless surveillance of the processes associated with the incorporation of drugs" by the individual where the substances, body and emotions are seen as 'forces' and the user as a 'doer' and agent in relation to incorporation of substances.

The biopsychosocial framework and the concept "pharmacological agency" proved useful for exploring biological, psychological and sociocultural factors involved in AAS use, psychoactive substance use and treatment experiences, and subjective experiences of whether and how the AAS and substance use were linked. For example; following detoxification of psychoactive substances in SUD treatment, a participant experienced bodily change (biological) and emotional distress (psychological) and this motivated AAS initiation. Incorporation of AAS led to both desired and undesired bodily (biological), emotional (psychological) and behavioral (social) effects. The continuous surveillance of these effects by the participant was acted upon resulting in cessation of AAS and making AAS use a thematic during sessions with a therapist.

The ongoing analysis enabled the findings from the previous interviews to be engaged in the later interviews, for purposes of both member-validation and comparison of inter-subjective experiences. The authors are all involved in clinically focused research related to AAS use and have background from biomedicine, psychiatry and addiction medicine (IAH), psychology (MLJ) and neuroscience (AB). All authors took part in the data collection and read the interview transcripts several times and discussed preliminary findings. IAH conducted the initial coding of data related to psychoactive substance use, and the development of subthemes and main themes were jointly discussed among the authors (Braun & Clarke, 2006; Clarke, Braun, & Hayfield, 2015). For main themes and sub-themes, see table 1.

2.4.3. Ethics

Ethical approval and research permission for the qualitative/mixed methods study were obtained from the Norwegian Regional Committee for Medical Research Ethics (2013/601) and the Norwegian Centre for Research Data (39668). All participants received oral and written information about the study, and written formal consent were collected from all participants. Emphasis was placed on voluntary participation, confidentiality and that refrainment from participation was possible at any stage of the study prior to publication of data. Emphasis has been placed on ensuring anonymity in the publication process. The participants in the qualitative study were compensated with 1000 NOK (approx. 90 Euro) for their contribution in the mixed methods study that also involved time consuming testing of cognitive function and health variables.

3. Results

The first part of the results section describes lifetime illicit drug use, clinically significant alcohol and/or drug use and AAS dependence in combination with clinically significant psychoactive substance use problems. The in-depth interviews generated empirical material on the relation between AAS and psychoactive substance use and in the last part of the results section, we focus on understandings and experiences of *substance use as unrelated to AAS use, psychoactive substance use at AAS initiation,* and *AAS use to cope with bodily and emotional change during SUD treatment.*

3.1. Lifetime illicit substance use

Among the 16 participants, 12 reported lifetime experience with illicit psychoactive substances. The most commonly reported substances were cannabis, cocaine, and amphetamines, see Figure 1.

Table 1
Subthemes and main themes developed during the thematic analysis

Main themes	Sub-themes
AAS and no drug use	Fear of interaction of AAS and drugs resulting in suboptimal effect of AAS
	Contrasting personal identity with the identity of illicit drug users
AAS and drug use	Disparate motivation: drug use to induce euphoria/ wellbeing vs AAS to build muscles
AAS initiation during SUD treatment	Weight increase following withdrawal of illicit drugs as motivation for AAS initiation
	Emotional change following illicit drug withdrawal as motivation for AAS initiation
	Previous bodily surveillance of clenbuterol effect as motivation for AAS use
	Experience of AAS use to increase self-esteem
	Experience of AAS use to counteract reduced initiative and low energy level
	Incorporation of AAS as unsafe injection practice
	Experienced negative behavioral change during AAS use
AAS use during SUD treatment	Development of SUD unrelated to AAS use and AAS not included as treatment goal
	AAS use during SUD treatment as a public moral concern
	Addressing motivation for AAS use in SUD treatment

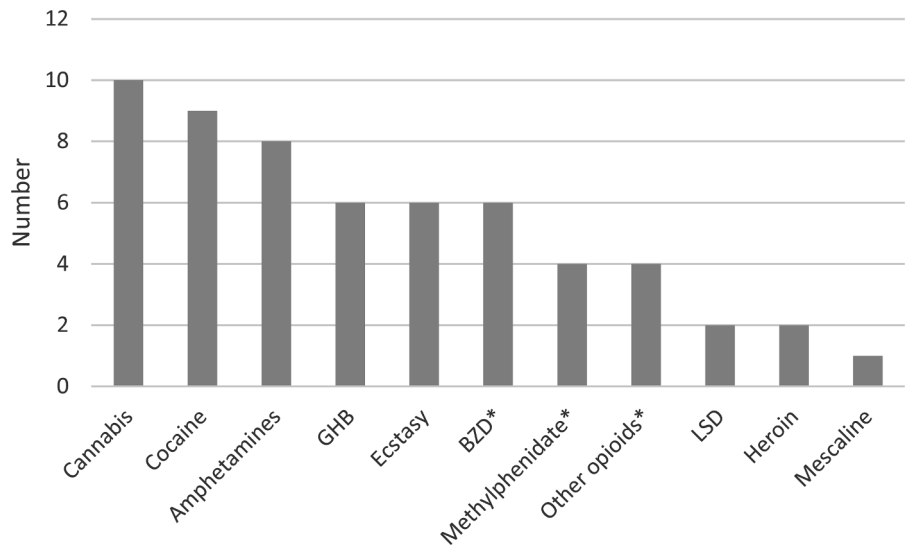

Fig. 1. Lifetime substance use reported by 12 of the 16 females with previous or current AAS use
*Non-prescribed use. BZD: benzodiazepine. LSD: lysergic acid diethylamide. GHB: gamma hydroxybutyric acid.

3.2. Clinically significant alcohol and drug use

All 16 women completed the MCMI III form, however one was later excluded due to a low raw score on the x (Disclosure) scale <34, that could indicate that the individual is secretive (Millon et al., 1997). The mean BR score for Drug Dependence was 54.2 (range 15-92) and 52.1 (0-79) for Alcohol Dependence. Five women scored above the cutoff for clinical significance (M ≥ BR 70) on Drug Dependence and two women scored above the cutoff for clinical significance on Alcohol Dependence, see Figure 2.

3.3. AAS dependence and substance use problems

Eight participants (50%) fulfilled the criteria for lifetime AAS dependence (7) and/or lifetime drug and/or alcohol dependence scores above clinically significant threshold level and the remaining eight (50%) participants did not fulfill criteria for problem use of any substance, see Figure 3.

3.4. Qualitative findings: possible links between AAS and psychoactive substance use

3.4.1. Experiences of psychoactive substance use as unrelated to AAS use

Regular, infrequent alcohol use was reported by most of the participants, however among those who competed in fitness, alcohol was rarely used when they were on a strict diet preparing for a competition. One participant provides an example. She competed and fulfilled the criteria for AAS dependence and explained that she used rather large amounts of alcohol once a month, but that she surveilled the effect to avoid getting sorely drunk:

> *… the few times I drink it's just like I do not get drunk, I can easily drink two regular bottles of prosecco and such, and also rum and coke. So it becomes quite a lot at once.*

She was also one of four participants who had deliberately never tried or used illicit drugs, and reported that she did not intend to try such substances as she was uncertain whether it could interact with her cycles of AAS-associated polypharmacy (Primobolan, Masteron, Winstrol, Anavar, Clenbuterol, Nolvadex, and sometimes also Trenbolone, Decadurabolin and growth hormones):

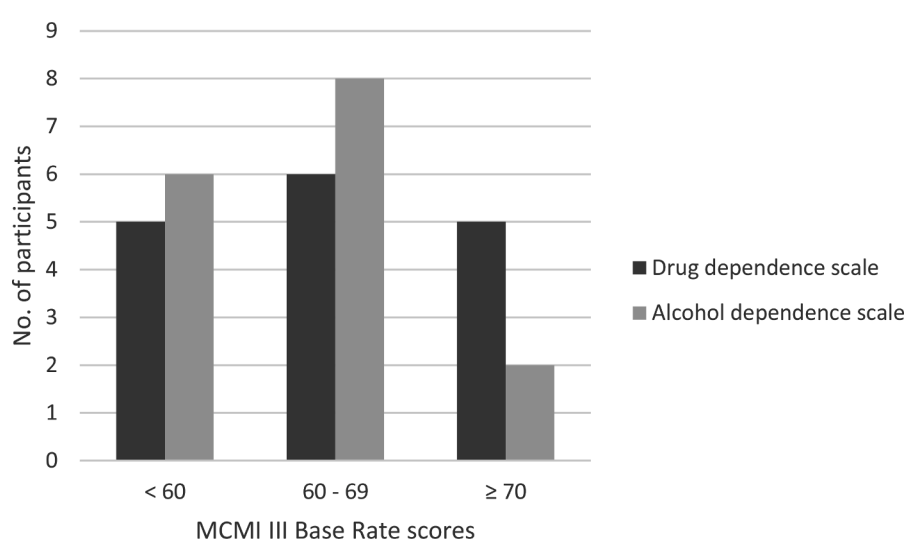

Fig. 2. MCMI III base rate (BR) scores on Drug and Alcohol Dependence scales, N=16.

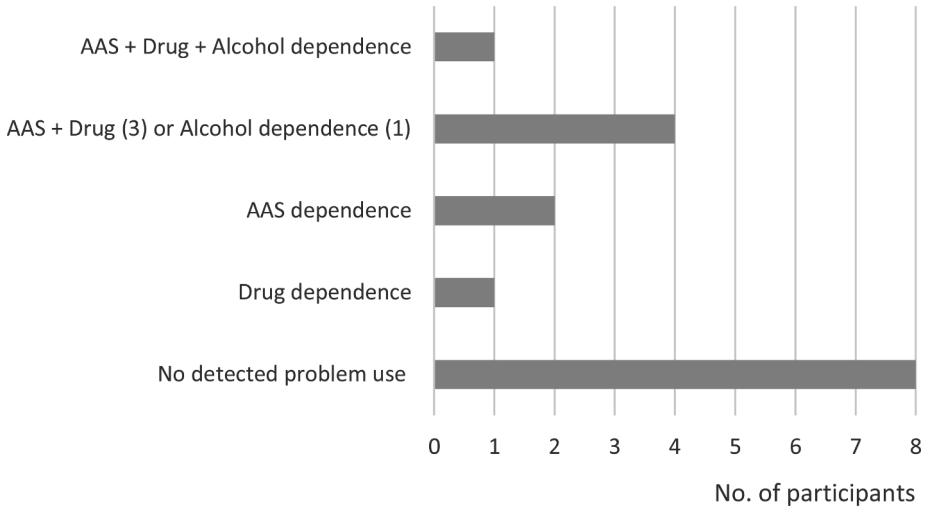

Fig. 3. AAS dependence and clinically significant psychoactive substance use (drugs and/or alcohol) problems (N=16)

I don't feel like mixing it with cycles. I don't know what the outcome might be.

Some reported regular or sporadic recreational drug use for limited time periods. One participant exemplifies this as she belonged to a social environment where recreational drug use was common in her mid-20s. Then she tested some and used other psychoactive substances regularly for a few years:

Let me see, I have [used] amphetamine. That was to get high or to feel better. [..] I have tried to smoke heroin once, so… I could include that. Let me see, what have I been into? LSD, ecstasy, marijuana, cannabis, cocaine, steroids of course.

After those few years, she preferred LSD and amphetamines although she used them very rarely, and her recreational substance use never progressed into problem use or a SUD. When she initiated AAS use in her early thirties, she administrated it as cycles once or twice yearly for some years together with her partner to get stronger and more muscular. She emphasized that AAS and amphetamines were not used concurrently as the substances were used with different motives; to experience the immediate euphoric effect and the muscle building effect, respectively.

3.4.2. Psychoactive substance use at AAS initiation

Some participants reported experiences of previous SUDs including inpatient SUD treatment. There were examples of SUDs that appeared to be linked to AAS use, and those that were unrelated both in time and motivation for use. One participant provides an example of development of SUD not related to AAS use. She initiated AAS to build muscles and later prepare for a fitness competition when use of AAS was legal in Norway. A male acquaintance, an active bodybuilder, who worked in the gym provided her with AAS and GHB at the same time and instructed her to use the latter after working out to be able to relax when she was on cycle, she explains the process of initiation of both:

He knew that I wanted to exercise to get big and such, but I don't remember if it was he who asked me, or if I asked him to get me something [steroids]. But at least he got me [the steroids]. I don't remember what it was, but it was injections. And then it was the substance [GHB] you can mix with water and drink. [..]…he gave me the powder, and when I took it after working out, I completely relaxed…[..] I still remember being in the tiny bathroom where I lived and injecting here [points at the gluteal region], it was terribly disgusting.

She explained that she injected the steroids herself by using a book with instructions. Although she was advised to use it, incorporation of GHB made her feel sedated and the bodily and emotional effect was undesirable. She therefore stopped using GHB shortly thereafter. When asked whether she used other illicit substances, such as central stimulants to be able to work out more during AAS use, she clearly stated that she rejected illicit drugs and did not identify herself as drug user:

I am not like that [a user of illicit drugs], I don't like it. I rather used alcohol, sometimes pills, but mostly alcohol.

Some years prior to the interview, she had developed alcohol dependence and was admitted as inpatient in SUD treatment while still using AAS. When asked whether she used alcohol to counteract effects of AAS, she clearly related her excess use of alcohol to cope with an emotionally difficult life situation:

There is no connection between those two [AAS use and alcohol]. Nothing. I started drinking after a break-up with my partner.

During treatment, she did not experience AAS use as problematic, and to cease AAS use was therefore not a treatment goal:

We [the therapist and I] talked about everything [including AAS use], it [AAS use] wasn't really a subject [in treatment], not for me or for anyone else.

3.4.3. AAS use to cope with bodily and emotional change during SUD treatment

One of the participants initiated AAS during SUD treatment to cope with the bodily and emotional change after cessation of psychoactive substances. She had competed in various sports in her late teens and early twenties and explained that she then started using clenbuterol to reduce weight and get a feeling of heightened energy level in order to exercise more. In that setting she found that GHB had several desired effects and counteracted the side effects of clenbuterol:

Yes, I took a lot of GHB. It improves sleep and calms you. And it was also sedating, of course. [..] It wasn't pleasant at all to get a pounding heart and tremors [side effects of clenbuterol] and such. So, having a bottle [GHB] available made it easy to calm oneself down after exercise.

Over some years, she developed dependence of several psychoactive substances, including GHB and central stimulants, and was admitted to inpatient SUD treatment. At this stage, she was underweight and to her, inpatient treatment involved experiencing withdrawal symptoms, less activity, exercise restrictions and more access to food. She explains how her mental state during withdrawal and bodily dissatisfaction after weight gain motivated AAS initiation to get fast results during inpatient treatment:

...you are in a vulnerable state, you start eating more, right, put on weight. Yes. It is… you may not exercise like you are used to. Because they have exercise restrictions, right. You are not supposed to exchange one thing [dependence] with another.

...when you stop using drugs, how can I put it? You get lazy, powerless, have no initiative, all that, at least in my head, so that's when I thought about anabolic steroids, that could... [..] It could give me the boost I needed to get myself off the couch.

She was asked by a trusted male outside the institution, if she knew whether any inpatients wanted 'steroids' and then made an impulsive choice to get it for herself. He gave her an injectable form of testosterone and instructions on how to inject it. She conveyed the instructions to another female inpatient who gave her the injections. She explained that none of them had any previous experience with intramuscular injections, and thus she risked getting infections and other injection related harms. During her first cycle, she experienced a rapid mental and desired bodily change:

You see the differences and you grow so much [muscle volume] on it. You kind of go from being really malnourished and underweight, to kind of, even if you put on weight, you get help - by something illegal, and you regain your confidence, self-esteem, you see your body change. You get muscles, right, not only fat.

At the end of the cycle, she experienced severe acne, agitation and masculinizing side effects such as increased body hair, darker voice, and genital change. Her experience of masculinizing effects and behavioral changes made her decide to not use AAS again and she describes how she then weighed the positive against the negative effects in the risky situation of being an inpatient with random and unsafe access to AAS:

Yes, I thought: "Is that all it takes to get in such a good shape", kind of. But all these negative things [side effects] really scared me. It didn't come right away, it kind of came when I finished the cycle, and then I just felt that "Damn it, I can't risk it. I can't destroy myself completely". Then it's kind of, you never know what you get. People may trick you.

She stopped using AAS after a single cycle with highly androgen steroids that had a long-lasting effect. Her AAS use became an issue among other inpatients as the treatment institution was mainly based on group therapy. When looking back, she could see how her behavior changed while using AAS and affected her interaction with the other inpatients. She described how she snapped easily, was self-centered, sometimes agitated and felt like being physically aggressive towards others. Additionally, she would rather exercise than doing her tasks as a member of the group. Other inpatients shared information with treatment staff that she had been using AAS and she explains what followed:

I wasn't [evicted], but I wasn't allowed to exercise, and a group session took place where everybody kind of pointed their fingers at me and it was not nice at all. [..]They let me hear it, kind of. How irresponsible I had been… and that this is a place where you're supposed to use nothing, [be] completely sober, and that I could kind of tempt others to do it [use illegal substances].

Her AAS use was seen as an immoral violation of house rules that could influence other patients to use substances and trigger relapse. Although experiencing it as difficult during SUD treatment, in retrospect, she expressed that she was glad her AAS use became a public matter and that her experience with and motivations to use AAS then became a subject in individual therapy sessions.

4. Discussion

In this study among 16 women with lifetime AAS use; 12 of 16 participants reported lifetime use of illicit psychoactive substances. Substance use problems were found among eight participants; seven had lifetime AAS dependence, where five also had clinically significant drug and/or alcohol dependence scores. The findings do not show a clear substance use pattern but suggest that some avoid psychoactive substances due to fear of interaction with AAS, some use psychoactive substances unrelated to their AAS use, and some use illicit psychoactive substances to counteract the effects of AAS. On the other hand, AAS might also be used to cope with bodily and emotional changes following withdrawal from psychoactive substances or after long-term substance use. Also, being in inpatient SUD treatment may be a gateway to AAS initiation also among females.

Psychoactive substances to counteract effects of AAS and clenbuterol. Five women had clinically significant drug dependence scores, and experiences with central stimulants were commonly reported. Psychostimulant use has previously been described among female AAS users (Börjesson et al., 2016; Gruber & Pope Jr, 1999; Lundholm, Kall, Wallin, & Thiblin, 2010; Nøkleby, 2013; Skårberg et al., 2008), including cases where the AAS use was motivated by weight loss (Zahnow, McVeigh, Bates, & Winstock, 2020). Such combined use of AAS and central stimulants will likely increase the health risk substantially (Zahnow et al., 2020). Another substance seemingly linked to the use of AAS was GHB, where initial use was motivated by its sedative effect, which is ideal to counteract the cardiovascular and neurological side effects of clenbuterol and AAS. GHB and AAS were provided by a trusted male bodybuilder, who advised using GHB to be able to relax when initiating AAS. GHB is of particular concern as low doses induce euphoria, and high doses produce the sedative and sleep-inducing effects. Since the substance has a narrow therapeutic effect, the users may risk overdose with deep sleep, respiratory depression and death (Corkery et al., 2015; Knudsen, Greter, & Verdicchio, 2008). In addition, the substance has strong addictive properties (Brunt, Koeter, Hertoghs, van Noorden, & van den Brink, 2013; Gonzalez & Nutt, 2005). GHB has the ability to release human growth hormone (Brailsford, Bartlett, Kicman, & Cowan, 2017; Takahara et al., 1977; Van Cauter et al., 1997), and was therefore promoted and embodied in the gym culture and later became used as a recreational drug among non-AAS users (McVeigh et al., 2020). We have previously described that female users let close, trusted, males decide which AASs regimen to use (Havnes, Jørstad, Innerdal, et al., 2020). These trusted AAS-providers may in addition introduce and provide psychoactive substances to females. The 'gym' has been described to be an arena where AAS, non-prescribed medications and illicit psychoactive substances are provided to male members (Salinas et al., 2019). In line with this, our findings suggest that some male users may redistribute psychoactive substances to female partners, clients or friends as part of a suggested AAS use regimen to counteract effects of AAS use. Needless to say, this practice comes with a risk of developing SUDs, developing more severe side effects, and for some substances, potential lethal effects.

AAS use to cope with the bodily and emotional change following withdrawal. Inpatient SUD treatment is directed towards complex treatment needs involving severe SUDs and co-occurring health and socioeconomic problems. Discontinuation of psychoactive substances leads to acute mental and physical withdrawal symptoms, which, depending on the substances used, may last for days, weeks and months. In addition, the patient must navigate the social system, local house rules, a more passive lifestyle and cope with emotional distress. AAS use is found to be relatively common practice among male and female SUD inpatients (Havnes, Jørstad, McVeigh, et al., 2020) and use may involve a range of desired effects on the body, mood, energy level and self-esteem (Havnes, Jørstad, Innerdal, et al., 2020; Skårberg et al., 2009). However, AAS use during inpatient treatment also involves the risk of sanctions, including being evicted (Nøkleby, 2013). Our findings suggest that SUD treatment institutions can place someone in a position where AAS use is motivated by emotional distress following withdrawal and bodily change due to excess food, inactivity and exercise restrictions. Eating disorder symptoms are common among female SUD patients and weight gain may therefore be difficult to cope with (Nøkleby, 2013). Our

findings illustrate that first-time AAS use may also be initiated within the SUD-institution. The choice of substance for a female inpatient may be limited to accessibility, involving heightened risk of masculinizing and other physical and mental side effects. In addition, it may involve risk of injection harms (Evans, 1997; Frude, McKay, & Dunn, 2020; Kimergård & McVeigh, 2014; Van de Ven et al., 2018) for the novice user due to lack of access to knowledge and experience with intramuscular injections and is a contrast to the institutionalized injection practice described among AAS-using female bodybuilders in a gym environment (McLean, 2020). The link between female AAS use and psychoactive substance use has previously been described, where a woman had oscillated between severe substance use and focus on bodily change as a replacement. This was accomplished by weight lifting and AAS use resulting in serious psychological side-effects, whereby she restarted drug use and therefore entered SUD treatment (Skårberg et al., 2008).

AAS to counteract bodily effect of long-term substance use. Our previous (Havnes, Jørstad, Innerdal, et al., 2020) and current findings show that AAS typically are used to get the desired body that may range from 'normal fit' to the 'women's physique' body ideal. In a sample of six female SUD inpatients, motivations to use AAS were to get thinner, improve self-esteem and endure more exercise (Nøkleby, 2013). Specifically, within the SUD population, AAS use was motivated by the desire to build up a thin body after substance use (Havnes, Jørstad, McVeigh, et al., 2020; Nøkleby & Skårderud, 2013). Hence, exploring experience with or plans for future use of AAS and other enhancement drugs, together with body satisfaction, should be a part of SUD treatment for female and male patients, independent of substances used.

We have provided a nuanced understanding of the experience of being underweight after long term illicit drug use to gain body fat during SUD treatment and initiation of AAS use to get a 'normal fit' body. This body ideal may meet the female body ideal that has changed from very thin to muscular (Andreasson & Johansson, 2021; Tiggemann & Zaccardo, 2018; Van Hout & Hearne, 2016). 'Normal fit' may be seen as one side of a continuum of AAS use as an aesthetic means to achieve the desired body where the other side of the continuum may include female bodybuilders who aim to achieve a hyper-idealized "acceptable femininity" (Kotze, Richardson & Antonopoulos, 2020). Our findings suggest that on either side of this continuum, female AAS users may have cooccurring problem use of psychoactive substances, AAS dependence and other health issues worth untangling.

There is a high prevalence between substance use disorders and mental illnesses, and although sparsely investigated this seems also to apply to AAS use among females (Gestsdottir et al., 2020; Gruber & Pope Jr, 2000; Ip et al., 2010). There are likely several reasons for such comorbidity, including overlapping genetic vulnerability influencing the development of brain structure and function across life (Kaufmann et al., 2019), and environmental effects such as exposure to stress or trauma (Ganson et al., 2021). Although not the scope of the present study, there is likely that such common risk factors might explain the co-use of AAS and psychoactive substances. The sedative effect of several illicit psychoactive substances is well known (Gossop, 2017), and it has previously been described that heavy resistance training and AAS use among women also might serve as a way of coping with mental health issues after traumatic events (Havnes, Jørstad, Innerdal, et al., 2020).

4.1. Strengths and limitations

The current study engaged 16 women with variety in background and lifetime use of AAS, other enhancement drugs and psychoactive substances, in a hard-to-reach group of female AAS users recruited through different arenas and with participants who had current and/or previous experience with competitions in various fitness disciplines. Some study limitations should be noted. The mixed methods dataset reported previous and present substance use and clinically significant psychoactive substance use through validated instruments, but the participants could underreport use of substances due to it being illegal practices. It should also be noted that MCMI-III is not a diagnostic instrument and as MCMI-III data were later analyzed, the findings did not inform the in-depth interviews that may be a limitation. This may also be a strength as the interviewers did not have a preunderstanding of problem use of substances for the participant in question prior to and during the in-depth interview and analysis. However, substance use was included in the qualitative interview guide, but the qualitative study was originally planned to explore motivations for AAS use, process of initiation and experiences of desired and undesired effects (Havnes, Jørstad, Innerdal, et al., 2020). Also, development of SUDs and use of AAS and psychoactive substances are sensitive topics, and this may have influenced the participants' reflections and decisions to share particular experiences, and also previous and current use. As the study comprised both current and previous users, it is possible that some were motivated to participate as a way of sharing information about negative experiences with both AAS and psychoactive substances so as to warn others. Some information may have been affected by memory bias, as some participants had ceased AAS use several years prior to participation. The findings may contribute to an increased understanding of motivations for polysubstance use involving AAS, other IPEDs and psychoactive substances or how one group of substances may be used to counteract the effect of the use of the other substance group.

4.2. Conclusions

Lifetime use of illicit psychoactive substances, AAS dependence and combinations of AAS dependence and psychoactive substance use was common in this sample of 16 female current and/or previous AAS users. These findings show that use of both substances may involve a substantial risk of developing dependence for both classes of substances. The findings suggest that bodily change, body dissatisfaction and emotional change following withdrawal of psychoactive substances may motivate AAS use. In addition, during inpatient SUD treatment encompassing exercise restrictions, a passive lifestyle, access to food and transformation of an underweight to an unfit body may motivate AAS initiation or use during treatment. To provide tailored treatment among female patients in SUD treatment, it is essential to explore previous and current use of AAS, other image and performance enchancing substances and psychoactive substances as well as emotional needs, experiences of bodily change and body satisfaction. The findings suggest the importance of exploring within clinical and research settings motivations for use of combinations of AAS and psychoactive substances, related positive and negative experiences and health problems. This is essential to be able to prevent harms such as greater substance use severity and poorer physical and mental health, and address individual treatment needs.

Declaration of Competing Interest

None.

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