



Performance and image enhancing substance use among young people in Sweden

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ABSTRACT

The aim of this study was to investigate the prevalence of performance- and image-enhancing substances (PIES) use, and factors related to this, among a representative sample of the general Swedish population aged 16–25. We used a quantitative cross-sectional self-report design to examine prevalence and possible relationships between PIES use and socio-demographics, physical activity, attitudes towards muscle building and doping, friends' use, body image, and body modification. Approximately 12% of the respondents reported that they used or had used PIES. A logistic regression analysis pointed out the importance of the social context – friends who used PIES, how body image affected social life, and how others viewed one's body – as more important factors for using PIES than attitudes towards muscle building and doping. Taken together, these results indicate a need to pay attention to the use of PIES among young people as a potential public health problem.

1. Introduction

A focus on health and a healthy body is a significant feature of today's society. In this context, having a fit body can be seen as proof of good health (Kirk & Colquhoun, 1989). However, striving for a fit body has involved an increasing use of performance- and image-enhancing substances (PIES) (Smith, Stewart, Westberg, & Stavros, 2018). Many of these substances are associated with health risks and have implications for public health (Pope et al., 2014).

In order to form effective prevention programmes, there is a need for more knowledge about the use of PIES and predictors. Young people who are building their identity in a society with a strong focus on the body can be assumed as an especially vulnerable group. Previous research targeting this group has mostly focused on high school students or young people who exercise. Therefore, our interest is focused on the general Swedish population aged between 16 and 25.

There are a number of terms used to describe performance- and/or image-enhancing substances. In this study, the use of the concept of

performance- and image-enhancing products (PIES) includes doping products as they are described in the Swedish doping law, mainly targeting anabolic androgenic steroids (AAS), testosterone and growth hormones (The Swedish Doping Act 1991:1969). Doping is a term that is defined differently in various contexts. One definition, discussed in public health policy, refers to substance use outside competitive sport in relation to Swedish law (see, e.g., Mickelsson, 2009). Another definition refers to substances and methods prohibited in sports by the World Anti-Doping Code (WADA, 2021). In this study, we are interested in the prevalence and also the reasons for use of PIES; therefore PIES will be applied as an umbrella term for muscle-building products and performance-enhancing products.

1.1. Prevalence of PIES use in different contexts

Studies of the use of PIES and predictors for their use in the general population are few (Pope et al. 2014) and tend to focus on the prevalence of muscle-enhancing substances, predominantly AAS, in gym and

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fitness culture. In a meta-analysis by Sagoe, Torsheim, Molde, Schou Andreassen and Pallesen (2015), Sweden stands out as having the highest prevalence of AAS use (4%) of the five Nordic countries. Studies examining use of prohibited substances in Swedish gyms show prevalence ranges from 3.9% to 5.1% (Leifman, Rehnman, Sjöblom, & Holgersson, 2011; Hoff 2013; Molero, Bakshi, & Gripenberg, 2017).

When focusing on young people, PIES use is often studied among students. In Swedish studies, the prevalence for AAS use among students between 16 and 18 years old has been found to range between 1.2% and 3.6% (Nilsson, Baigi, Marklund, & Fridlund, 2001; Nilsson, Spak, Marklund, Baigi, & Allebeck, 2005). Hoff (2013) found that the prevalence of use of banned substances among high school students in Sweden was 2%. High school students in other countries have been found to have a 1.5–2.1% prevalence of using illegal PIES (Lucidi et al., 2008; Mallia, Lucidi, Zelli, & Violani, 2013), and in a study by Papadopoulos, Skalkidis, Parkkari, & Petridou (2006), the prevalence among tertiary students was 2.6%. In another study, the prevalence of high school students' use of legal PIES is higher (6.7%) (Mallia et al., 2013). In the Nordic countries, the age of onset for the use of illegal PIES in fitness contexts has been found to range from 18 to 25 (Mickelsson, 2009), thus making the years after high school important to study.

In a European study focusing on the same age group as our study (16–25 years of age) but only including exercisers, the self-reported lifetime prevalence of PIES use was as high as 18.2% (Lazarus et al., 2017). As the abuse of PIES represents an increasing health problem (Smith et al., 2018), it could be problematic from a public health perspective that almost one in five young exercisers has experience of using PIES. It is not clear whether this problem is restricted to exercisers and if it applies to a Swedish context; to our knowledge, there are no recent studies exploring the prevalence of PIES in a representative sample of the general population aged 16–25.

1.2. Factors related to the use of PIES

Factors related to the use of PIES can differ between social contexts, and have been found to be associated with gender, level of exercise, education, norms and attitudes, having a friend that uses PIES, and body image (see, e.g., Ahmadi & Svedsäter, 2016). Gender has been found to be associated with substance use, as men are highly overrepresented in relation to use of AAS (Sagoe et al., 2015; Christiansen, 2017). A meta-analysis in the Nordic countries showed that men's use of AAS was more than ten times higher than women's (2.9% vs. 0.2%) (Sagoe et al., 2015), a result in line with studies in other countries (cf. Mallia et al., 2013; Ntoumanis, Ng, Barkoukis, & Backhouse, 2014).

Belonging to a *sport or fitness context* has also been shown to relate to the use of PIES. Two separate meta-analyses found that athletes were more likely to use PIES than non-athletes; Sagoe et al. (2015) found a prevalence of 32.3% among athletes and only 1.2% among non-athletes, while Ntoumanis et al. (2014) found that the prevalence varied between different kinds of athletes, with gym users more likely than competitive athletes to report illegal PIES use. In a compilation of the use of muscle-enhancing substances in the general population of Danish men aged 15–60 and the group training in fitness centres, the prevalence more than doubled in the group who trained in fitness centres (Singhammer & Ibsen, 2010). Training frequency also seems to matter; among those training in fitness centres or gyms, the use of muscle-enhancing substances is more common among those who train more often (Kryger Pedersen, 2010; Singhammer & Ibsen, 2010).

Level of education has been found to be a predictor of PIES use. Higher education (Kryger Pedersen, 2010) and being a student (Ntoumanis et al., 2014; Sagoe et al., 2015) are both negatively related to banned PIES use.

Perceived social norms and positive attitudes towards PIES, especially doping substances, have a small to medium effect on behaviours but a strong effect on intentions to use PIES (Ntoumanis et al., 2014). In recent years, several studies have brought attention to the relationship between psychosocial processes and reasons for doping among recreational

bodybuilders (e.g., Hutchinson, Moston, & Engelberg, 2018). Personal norms, beliefs about performance outcomes, and perceived behaviour of others are psychosocial factors that can affect use (Wiefferink, Detmar, Coumans, Vogels, & Paulussen, 2008). Intention to use is affected by positive attitudes towards PIES, perceptions that significant others would approve of PIES use, and strong convictions that the use can be justified; low capacity to resist pressure from the surrounding context could also play a role (Lucidi et al., 2008).

Having a friend who uses PIES increases the risk of individual use by six to eight times (Papadopoulos et al., 2006; Ntoumanis et al., 2014). Perceptions of the prevalence of use among other athletes also seem to be important for the decision to engage in use of performance-enhancing drugs (Wiefferink et al., 2008). Thus, social learning processes are shown to be an explaining factor related to use of PIES (see e.g., Kabiri et al., 2018).

Body image has been found to be related to both intention and use of illegal PIES (Ntoumanis et al., 2014). An Italian study found a relationship between PIES use and psychiatric and body dysmorphic disorders (Piacentino, et al., 2017). Being ashamed of one's body is also more common among those who use illegal PIES than among those who do not (Barland & Tangen, 2009).

Dissatisfaction with one's body has been shown to relate to willingness to use *body modification* techniques (Biolcati, Ghigi, Mameli, & Passini, 2017). Since body image seems to influence the prevalence of PIES use, it would be useful to examine the relationship between the propensity to change one's body and use of PIES.

In summary, we can conclude that most studies on prevalence and predictors of PIES use outside the sport context focus on gym and fitness centres. In studies focusing on young people, these have mainly concentrated on students or younger individuals who are training. As Sweden has the highest prevalence of AAS use of the five Nordic countries (Sagoe et al., 2015), this could indicate that Sweden deviates in values and norms regarding the use of performance- and image-enhancing substances. Previous studies that focus on the younger general population in Sweden have studied high school students up to 18 years of age. Therefore, the aim of this study is to examine PIES use among the general Swedish population aged between 16 and 25. The following research questions are posed:

RQ1. What is the prevalence of PIES use in this age group?

RQ2. What is the prevalence of potential predictors?

RQ3. How do these predictors co-vary with PIES use in a multivariate analysis?

2. Method

A quantitative cross-sectional study was conducted between November 2016 and January 2017. Before data collection the study was approved by an Ethical Review Board in Sweden.

2.1. Sample and procedure

To provide a nationally random selection of Swedish young people between the ages of 16 and 25, the sample was recruited from the Novus Sweden Panel.⁵ This panel consists of approximately 35000 active members, and is nationally representative of gender, region, and age. An

⁵ Novus is a full-service Swedish research company that conducts qualitative studies and quantitative surveys. The company has a large, high-quality web panel, which was randomly recruited. <https://novus.se/vara-tjanster/sverigepanel/>

Table 1
Measures used in the study.

Variable	Response categories	Used in
Prevalence of PIES:		
Use of substances to increase physical performance	Daily, weekly or monthly, Rarely, Never	Descriptive results
Use of muscle-building substances	Daily, weekly or monthly, Rarely, Never	Descriptive results
A combination of the above	1= used any of them or both, 0= none of them	Logistic regression
Socio-demographics:		
Gender	Man, women	Both
Age	16-19, 20-25	Both
Employment	Student, working, unemployed, other	Descriptive results
Place of birth	In Sweden, elsewhere	Descriptive results
Parents place of birth	In Sweden, elsewhere	Descriptive results
Physical activities:		
Frequency of exercising	never/seldom, 1–2 times/week, <3–4 times/week	Both
Motivation for exercising	Multiple-choice question with 14 alternatives.	Descriptive results
Attitudes to substances to improve physical performance:		
General attitude to substances to improve physical performance (GAttitude PRE).	Five categories from very negative to very positive	Descriptive results
Attitudes to muscle building substances:		
General attitude to muscle-building substances (GAttitude MBS).	Five categories from “very negative” to “very positive”	Descriptive results
5 Statements about muscle-building substances (Attitude MBS).	Five categories from “totally agree” to “do not agree at all”	Both
Attitudes to doping:		
12 Statements about doping (Attitude DOP).	Five categories from “totally agree” to “do not agree at all”	Both
Use of PIES by friends/acquaintances:		
Friend/s using PIES	Yes, no	Both
Body Image:		
Important to have a body that you think looks fit (Body image 4)	Important, unimportant	Descriptive results
Important to have a body that other people think looks fit (Body image 1)	Important, unimportant	Both
Concerned that some part of your body isn't attractive enough (Body image 5)	Concerned, not at all	Descriptive results
Satisfied with your body's appearance (Body image 3)	Dissatisfied, Satisfied/neither	Descriptive results
Body image has a disturbing impact on social life, school or work (Body image 2)	Frequently, Rarely/never	Both
Body modification/cosmetic changes, (separate measures on willing to do and have done):		
Muscle building substances	Willing, not - Done, not	Descriptive results
Liposuction	Willing, not - Done, not	Descriptive results
Plastic surgery	Willing, not - Done, not	Descriptive results
Operation to eat less	Willing, not - Done, not	Descriptive results
Silicone implants	Willing, not - Done, not	Descriptive results
Botox	Willing, not - Done, not	Descriptive results
Tattoos/piercing	Willing, not - Done, not	Descriptive results
Preparations to look young	Willing, not - Done, not	Descriptive results
Index on willing to do the above (CosMay)	Additive index	Logistic regression
Index on have done the above (CosDone)	Additive index excluding muscle building preparations	Logistic regression

online questionnaire and information about the study were e-mailed to a nationally random selection of the panel with the inclusion criterion that the participants should be in the requested age group (16–25).⁶ After giving their consent to participate, the participants were able to access the questionnaire by clicking a link in the email. Before the questionnaire was distributed, it was tested in a pilot with 400 members of the panel. The pilot test provided an opportunity to validate the questionnaire and this revealed no problems in understanding and answering the questions. Only minor linguistic corrections were necessary. Of the 4650 persons contacted, 2101 responded, giving a response rate of 45%. The sample used in this article was weighted by gender and age, and all results represent weighted estimates. This post-stratification was necessary to avoid biased results (Lee & Forthofer, 2006).⁷

⁶ NOVUS determined the sample size to secure reasonable power in testing for differences between different age groups. They decided that approximately 200 respondents for the 10 different age groups was a sufficient size. Participants aged 16–17 years are recruited to the Novus Sweden panel via their parents. The invitation to participate was sent to the parents, who then gave their consent.

⁷ The logistic regression analysis was also calculated without weights, and no fundamental differences between the weighted and the unweighted analysis were found.

2.2. Measures

The measures (Table 1) were divided into topic areas, such as prevalence of PIES, socio-demographics, physical activity, attitudes towards PIES and doping, users among friends/acquaintances, body image/appearance, and body modification. These areas are described below along with details of the questions and operationalization made in the regression analysis.

2.3. Prevalence of PIES

The participants were asked questions regarding the use of PIES to increase physical performance and muscle building (Hoff, 2013). The questions were: ‘Have you ever used or do you use performance-enhancing substances (substances that enhance your physical capacity to make you run faster, jump higher, lift heavier weights, and so on)?’ and ‘Have you ever used or do you use muscle-building substances (that affect your bodily appearance to give you bigger muscles and a more resilient look, such as growth hormones, anabolic steroids, testosterone and clenbuterol)?’ Both questions had five response categories: ‘Every day’, ‘Every week’, ‘Every month’, ‘Seldom’, and ‘Never’. The dependent variable in the logistic regressions was use of PIES, dichotomized as 1=ever used, 0=never used, with 1 indicating a positive answer to one or both of the questions above and 0 indicating a negative answer to both.

2.4. Predictors

2.4.1. Socio-demographics

The questionnaire included socio-demographic questions such as age, gender, employment, and place of birth of respondents and their parents. Gender was measured by a standard question asking whether the respondent was female or male. The place of birth for both respondents and parents had five response alternatives: Sweden, the Nordic countries, EU, the rest of Europe, and outside Europe. The question regarding employment was 'What is your main occupation?', with seven alternatives: worker, official (tjänsteman)⁸ self-employed, pensioner, student, unemployed, other. The total age-span of the respondents (16–25) was divided into a binary variable comparing respondents aged 16–19 with those aged 20–25.

2.4.2. Physical activities

In terms of exercising, we assessed frequency and reasons for physical activity. The question on exercise, 'How often do you exercise (heart rate rising, makes you breathless, sweat)?', originally had six values, which in the regression were collapsed into three (never/seldom, 1–2 times/week, ≥ 3 –4 times/week). The question regarding reasons for exercising, 'Which are the main reasons why you engage in physical activity?', had 14 multiple-choice alternatives: 'to increase stamina', 'to increase performance', 'to get a better body', 'to be healthy', 'to increase self-esteem', 'to deal with my worries', 'to be part of a social context', 'to lose weight', 'to have something to do', 'to increase muscle mass', 'to get stronger', 'to get respect', 'to feel safe', 'other reason', and 'do not exercise'.

2.4.3. Attitudes towards PIES and doping

The questionnaire measured attitudes to PIES using both questions on general attitudes and specific statements regarding muscle-building substances.⁹ The questions on general attitudes were: 'What is your overall attitude to using substances to increase physical performance?' and 'What is your overall attitude to using muscle-building substances?' Both questions had four response categories ranging from 'Very negative' to 'Very positive'. The specific statements about attitudes to muscle-building substances were: 'It's acceptable to use ... if you're not competing', 'Using ... is a personal matter', 'It's okay to use ... if it's not unhealthy', 'It's okay to use ... if nobody knows about it', and 'It's okay to use ... if it's controlled by a medical doctor' (Singhammer & Ilsen, 2010).

To investigate attitudes regarding the conception of doping, the questionnaire also included 12 statements on doping in general (Svedsäter & Wedman, 2006). The term 'doping' was used in the questionnaire, as our assessment was that the respondents are more familiar with the concept of doping than that of PIES. The questions were: 'Doping isn't cheating, it's a way to enhance your performance or muscles', 'The risks related to doping are exaggerated', 'The media blows the doping issue out of proportion', 'I can imagine doing doping if the risk of detection is small', 'Doping is a way to adapt to society as it is today', 'Doping is okay if it only happens occasionally', 'In my training environment, I feel that I am influenced to use substances for muscle building', 'It is up to each individual to decide whether to use doping', 'Doping is an increasing societal problem', 'The medical risks of doping are exaggerated', 'I would use doping if it guaranteed an ideal body', and 'Doping is unacceptable'. Two of these statements were

extracted from the Performance Enhancement Attitude Scale (PEAS) (Petróczi & Aidman, 2009).¹⁰

Two attitude scales were constructed, one measuring attitudes to muscle-building substances (Attitude MBS) and one measuring general attitudes to doping (Attitude DOP).¹¹ All items in both scales had five response categories, ranging from 'Totally agree' to 'Do not agree at all'. In the regression, both scales were used as simple additive indexes of several items/statements transformed to z-scores by subtracting the mean from each standardized index and dividing the result by the standard deviation (Orme & Combs-Orme, 2009).

2.4.4. Use of PIES by friends/acquaintances

One question was used to measure users among friends/acquaintances: 'Do you know anyone who uses performance-enhancing or muscle-building substances?' with a dichotomous answer alternative coded 1 for yes and 0 for no.

2.4.5. Body image/appearance

Participants' perceptions of and satisfaction with their own bodies were measured using modified versions of questions from Brohede, Wingren, Wijma and Wijma (2013) dealing with concern about certain areas of the body and interference with social life. These questions were rated on a five-point scale ranging from 'Not at all concerned' to 'Very much concerned'. The first question was 'Are you concerned about the appearance of some part(s) of your body that you consider especially unattractive?' The second question measured negative consequences of body image in different life areas: 'Has your view of your physical appearance affected your social life, school work or job? By how much?' This was asked as three separate questions for social life, school work, and job, and the answers were added together in the regression as a z-standardized index (Body image 2).¹²

Three more questions regarding body image were also included. The first two concerned the importance of the respondents'/others' views of the respondent's physical fitness: 'How important or unimportant is it that you/others think that your body looks physically fit?' with four response categories ranging from 'Very important' to 'Very unimportant'. The third question was 'How satisfied or dissatisfied are you with your body appearance?' with five response categories ranging from 'Very satisfied' to 'Very dissatisfied'.

2.4.6. Body modification

The use of body modification methods was measured by eight items asking the respondents whether they had undergone any of these specific forms of modifications/cosmetic changes. There were also questions about willingness to use any of these methods. The questions were 'Have you had/used' and 'Are you willing to have/use' the following: 'muscle-building substances to achieve a muscular body', 'liposuction on body parts that you are dissatisfied with', 'plastic surgery to change your facial features', 'an operation that makes it possible for you to eat anything you want without gaining weight', 'silicone implants in your breasts or in other parts of your body to make them more attractive', 'botox to improve your appearance', 'tattoos/piercing on parts of your body', and 'substances to make you look young'. In the regression, the propensity to change one's body was indicated by one index on completed cosmetic changes and one on the willingness to undergo such changes in the future (excluding the item on muscle-building substances).¹³ The indexes were additive and z-standardized.

⁸ The Swedish term "tjänsteman" is not used exactly the same way as official is used in the English language, but it is the best translation available.

⁹ The questions on general attitudes measure the respondents' own views of how they feel about muscle-building and performance-enhancing substances. We think it is interesting to study both such self-assessing measures and more objective measures with scales of items to be answered. They are two different things but the more subjective measure on muscle-building substances and the scale show a quite high correlation (gamma = 0.60).

¹⁰ 'The risks related to doping are exaggerated' and 'The media blows the doping issue out of proportion'.

¹¹ Cronbach's alpha for Attitude MBS = 0.85 and for Attitude DOP = 0.84.

¹² Cronbach's alpha for Body image 2 = 0.86.

¹³ Cronbach's alpha for CosmMay = 0.79 and for CosmDone = 0.87.

Table 2
Prevalence of PIES (n= 2101).

	Daily, weekly or monthly ¹	Rarely ¹	Never ¹
Use of substances to increase physical performance	5,1 (4,2 – 6,0)	6,5 (5,4 – 7,6)	88,4 (87,0 – 89,8)
Use of muscle-building substances	1,9 (1,3 – 2,5)	2,7 (2,0 – 3,4)	95,4 (94,5 – 96,3)

¹ = Percent, 95% confidens limits in brackets (LCL - UCL). The frequency is related to both past and present use.

Table 3
Socio-demographic characteristics and physical activities (n= 2101).

Variable	Percent (n)
Female	48,4 (1017)
Age 16-19	34,4 (722)
Age 20-25	65,6 (1379)
Student	61,7 (1295)
Working	31,7 (666)
Unemployed	3,4 (72)
Other	2,0 (241)
Born in Sweden	96,0 (2017)
Exercise: ≥3-4 t/w	40,3 (846)
1-2 t/w	29,2 (613)
Never/seldom	30,5 (642)

Table 4
Different statetements on using MBS (n= 2101).

Statements on MBS		Percent (n)	LCL- UCL
It is accepted to use substances that are muscle building if you do not compete	Negative	49,9 (1049)	47,8 - 52,0
	Neither	28,3 (594)	26,4 - 30,2
	Positive	21,8 (457)	20,0 - 23,6
Using muscle building substances is a personal matter	Negative	31,1 (695)	29,1 - 33,1
	Neither	34,0 (713)	32,0 - 36,0
	Positive	33,0 (692)	31,0 - 35,0
If there is no health risk it is OK to use substances that is muscle building	Negative	36,2 (761)	34,1 - 38,3
	Neither	32,3 (678)	30,3 - 34,3
	Positive	31,5 (662)	29,5 - 33,5
It is OK to use substances that is muscle building if no one knows	Negative	72,1 (1515)	70,2 - 74,0
	Neither	24,6 (518)	22,8 - 26,4
	Positive	3,3 (69)	2,5 - 4,1
It is OK to use substances that is muscle building if it is under medical supervision	Negative	28,3 (595)	26,4 - 30,2
	Neither	33,6 (706)	31,6 - 35,6
	Positive	38,1 (800)	36,0 - 40,2

¹ = 95% confidens limits, LCL= lower confidens limit, UCL= upper confidens limit.

2.5. Statistical analyses

As a first step, the univariate and some bivariate results for the variables were analysed, including relative frequencies (%) and absolute figures with significance tests and confidence limits. These are given in [Appendix A](#), together with bivariate correlations between use of PIES and independent variables (or potential predictors). In a second step, the data were analysed using multivariate logistic regression with the aim of studying the effects of variables on the use of PIES when the other variables were held constant. The binary logistic regression method is considered suitable when the dependent variable is binary; that is, dichotomous ([Menard, 2001](#); [Orme & Combs-Orme, 2009](#)). The dependent variable measures the use or non-use of PIES, and the odds ratios indicating the effect of independent variables show how much the odds of using PIES change with one unit change in the independent variable. Odds ratios greater than 1 indicate higher odds of using PIES and less than 1 lower odds. It is important not to confuse odds with risk/probability, as odds ratios tend to overstate the effect ([Menard, 2001](#)). If the independent variables are dummies, the change is related to the reference category; otherwise, it reflects a change of one unit on the variable's scale. The relative strength of independent variables can be compared if measured in the same way; that is, if they are on the same scale ([Orme & Combs-Orme, 2009](#)). This is true for the indexes and the binary/dichotomous variables used in the present analysis (see details under 2.4 Predictors above).

The approach chosen in the logistic regression analysis was a so-called sequenced or hierarchical entry of independent variables ([Orme & Combs-Orme, 2009](#)), with independent variables added in blocks representing separate regressions. Cases with missing values on any of the independent variables in any block were deleted to ensure that differences in results between the blocks were not due to missing cases.

2.6. Limitations

The attrition rate in the study was 65%. The higher the attrition rate, the higher the risk of non-representative results. Post-stratification will have helped in making the sample more representative, but it is still possible that some of the measures used have been distorted. Nevertheless, when it comes to sensitive questions the bias would probably go in the direction of underestimation.

Using self-reported data has its pros and cons. The definitions of things asked about is more or less left to the respondents, and could vary between individuals. Moreover, respondents could, for various reasons, give untrue answers. Factors related to problems with memory, social desirability, and the will to give true answers are well known sources of errors in self-reported data. Using established measures from previous research and trying out the questionnaire in a pilot were strategies used in this study to minimize the risk of such problems.

When using cross-sectional data, it is not possible to determine the causal direction of correlations and effects. Some of the predictors naturally precede the use of PIES (e.g., gender, age, place of birth), but the rest could be seen as having been caused by the use of PIES. It is also important to point out that we do not think that the predictors used in this study represent a full explanation for the use of PIES. The study should be viewed as descriptive and exploratory, rather than as a full-blown explanatory analysis of the use of PIES.

3. Results

3.1. Prevalence of PIES (RQ1)

Results regarding the use of PIES for muscle-building or in order to increase physical performance are given in [Table 2](#).

When the variables were divided into the dichotomy 'ever used' versus 'never used', the results showed that just under 12% used and/or had used substances to improve physical performance and 5% used and/

Table 5

Results regarding different measures on body image (n= 2101).

Variables		Percent (n)	LCL- UCL
How important/unimportant is it to have a body that you think looks fit? ¹	Important	69,5 (1421)	67,5 - 71,5
	Unimportant	30,5 (624)	28,5 - 32,5
How important/unimportant is it to have a body that other people think looks fit? ²	Important	50,6 (1019)	48,4 - 52,8
	Unimportant	49,4 (995)	47,2 - 51,6
Are you concerned that some part of your body isn't attractive enough? ³	Concerned	73,9 (1553)	72,0 - 75,8
	Not at all	26,1 (548)	24,2 - 28,0
Are you satisfied with your body's appearance? ⁴	Dissatisfied	28,2 (590)	26,3 - 30,1
	Satisfied/ neighter	71,8 (1504)	69,9 - 73,7
Body image has a disturbing impact on: ⁵ Social life	Frequently	21,0 (426)	19,2 - 22,8
	Rarely/never	79,0 (1603)	77,2 - 80,8
School	Frequently	11,2 (226)	9,8 - 12,6
	Rarely/never	88,8 (1603)	86,0 - 91,1
Work	Frequently	10,2 (201)	8,9 - 11,5
	Rarely/never	89,8 (1764)	88,5 - 91,1

¹= 95% confidens limits, LCL= lower confidens limit, UCL= upper confidens limit. 1= Body image4 in Appendix A, 2= Body image1 in Appendix A, 3= Body image5 in Appendix A, 4= Body image3 in Appendix A, 5= Body image2 in Appendix A.

Table 6

Results regarding body modification (n= 2101).

Variables		Percent (n)	LCL- UCL
Have you done/are you willing to do or use any of the following: Any mod.	Done	33,8 (1328)	31,7 - 35,9
	Willing	65,1 (1369)	63,1 - 67,1
Muscle building subst.	Done	3,1 (63)	2,3 - 3,9
	Willing	9,2 (193)	8,0 - 10,4
Liposuction	Done	1,0 (21)	0,6 - 1,4
	Willing	13,3 (280)	11,8 - 14,8
Plastic surgery	Done	1,4 (28)	0,9 - 1,9
	Willing	11,1 (233)	9,8 - 12,4
Operation to eat less	Done	1,0 (21)	0,6 - 1,4
	Willing	11,9 (250)	10,5 - 13,3
Silicone implants	Done	1,4 (30)	0,9 - 1,9
	Willing	12,5 (262)	11,1 - 13,9
Botox	Done	1,1 (24)	0,7 - 1,5
	Willing	9,1 (192)	7,9 - 10,3
Tattoos/piercing	Done	31,9 (660)	29,9 - 33,9
	Willing	56,1 (1179)	54,0 - 58,2
Preparations to look young	Done	0,9 (18)	0,5 - 1,3
	Willing	9,3 (196)	8,1 - 10,5

¹= 95% confidens limits, LCL= lower confidens limit, UCL= upper confidens limit.

Table 7

Logistic regression with factors related to PIES. Odds ratios.

Variables	Block 1	Block 2	Block 3	Block 4	Block 5
Gender: Woman	1	1	1	1	1
Men	1,87***	1,44*	1,17	1,42	2,22***
Age: 20-25	1	1	1	1	1
16-19	0,48***	0,45***	0,44***	0,43***	0,46***
Exercise: Never/ Seldom	1	1	1	1	1
≥3-4 t/w	3,48***	3,68***	2,93***	2,76***	3,41***
1-2 t/w	1,26	1,45	1,25	1,27	1,47
Attitude MBS		1,38***	1,15	1,20	1,18
Attitude DOP		1,44***	1,35***	1,27**	1,14
Friends using No			1	1	
Yes			8,88***	9,03***	8,64***
Body image 1 Very unimportant				1	1
Very important				3,37**	3,25**
Rather important				1,31	1,45
Rather unimport.				1,28	1,53
Body image 2				1,43***	1,22*
CosmMay					1,45***
CosmDone					1,29**
Constant	0,063***	0,063***	0,029***	0,018***	0,010***
Nagelkerke R ²	0,10	0,16	0,32	0,36	0,40
Model evaluation: -2LL test, p =	0,000	0,000	0,000	0,000	0,000
Goodness-of-fit test:					
Hosmer & Lem. p=	0,726	0,810	0,711	0,911	0,058

*p<0,05, **p<0,01, ***p<0,001. *Exercise*: Respondents level of exercising, *Attitude MBS*: Attitude to muscle building substances (index), *Attitude DOP*: Attitude to doping (index), *Frienduse*: Friends/acquaintances use of PIES, *Body image 1*: Importance of others views on the respondent's physical fitness, *Body image 2*: Negative consequences of body image in different life areas, *CosmMay*: The will to do cosmetic changes, *CosmDone*: The prevalence of cosmetic changes.

or had used substances to build muscle. A combined measure of these two, which was used in the regression analysis (Table 7), showed that 12% of the respondents said they had used some type of PIES. According to the 95% confidence limits, the real value in the population should lie between 10.6% and 13.4%.

There was a correlation between gender and substance use.¹⁴ In comparison to women, men more often used substances to improve physical performance (15% vs. 8%) and substances to build muscles that affect bodily appearance (6% vs. 3%). There were also differences between age groups; the 16–19-year-olds used substances to improve physical performance to a lesser extent than the 20–25-year-olds (8% vs. 13%).

3.2. Potential predictors of PIES use (RQ2)

3.2.1. Socio-demographics and physical activities

The sample consisted of 2101 individuals, 1017 (48%) of whom were female (Table 3). Almost two thirds of the sample were students, and the vast majority were born in Sweden.

A majority (70%) said they took part in physical activity at least once or twice a week. Those aged 16–19 years were more likely than their older counterparts to exercise 5–6 times a week.

The main reasons to engage in training were to increase stamina (50%), to be healthy (42%), to get a more attractive body (35%), and to get stronger (20%). Women reported more often than men that they exercised to be healthy (47% vs. 37%) and to decrease anxiety (16% vs. 7%). Men reported more often than women that they exercised to be able to achieve sporting success (20% vs. 10%).

¹⁴ All differences regarding gender and age mentioned in the results were statistically significant at p<0.05 unless otherwise stated.

3.2.2. Attitudes to PIES and doping

The questionnaire contained three categories of questions and statements about attitudes to PIES and doping. The first category included questions regarding overall attitudes towards muscle-building substances and substances to improve physical performance. The respondents generally had negative attitudes to the use of both types of substances (71% and 73%, respectively), but approximately 8% of them had positive attitudes. The second category contained five statements regarding attitudes to the use of muscle-building substances (Table 4). Approximately one third of the respondents believed it was acceptable to use these substances in the absence of health concerns (38% if it occurred under medical supervision, and 32% if there was no health risk).

The third category contained 12 statements about the conception of doping. As many as 14% of the respondents stated that it was acceptable to use doping, and approximately one third thought that it was up to each person to decide whether to use doping substances and that it was a private matter (Table A1 in Appendix A). The majority of the participants had negative attitudes to most of the statements; that is, they generally had negative attitudes towards the use of doping. Women had somewhat more negative attitudes than men.

3.2.3. Use of PIES by friends/acquaintances

More than one in four respondents (29%) knew someone who used performance-enhancing or muscle-building substances (Table A2 in Appendix A). Men were more likely to do so than women (35% vs. 23%). There were no significant differences between age groups.

3.2.4. Body image/appearance and body modification

A relatively large proportion of respondents considered it important for their body to look physically fit to themselves (70%) and to people around them (51%). There was no significant difference between men and women regarding the first of these, but women were more likely than men to consider it important for their body to look physically fit to people around them (55% vs. 47%). Table 5.

Almost three in four respondents (74%) were concerned that some part of their body was not attractive enough (to different degrees). Women were more concerned than men (83% vs. 66%, $p < 0.01$). Moreover, the 16–19-year-olds were significantly more likely than the older participants to consider it important for their body to look physically fit (73% vs. 68%). Of those who considered it ‘very’ or ‘rather’ important for their body to look physically fit to themselves and to people around them, 37% had used medical substances or surgery to alter their bodily appearance and 48% were willing to do so.

Almost one third (28%) of the respondents were clearly dissatisfied with their bodily appearance, and 21% stated that their body image had frequently affected their social life. Women were significantly more dissatisfied than men with their bodily appearance (33% vs. 24%), as well as more frequently bothered by their body image in social life (27% vs. 15%).

Results regarding the use of different kinds of body modifications and the willingness to use such modifications are given in Table 6. One third of the participants (34%) stated that they had undergone/used any of the modifications specified. Getting a tattoo/piercing was much more common than the other forms of modification, and if this was excluded then only 5% stated that they had undergone/used any of the modifications. A majority of the respondents were willing to use any of the body modifications included in Table 6 (65%). The main reason behind this relatively high percentage was that as many as 56% were willing to get tattoos and/or piercings; only around 10% were willing to undergo/use any of the other forms of body modification. When all forms of body modification aside from tattooing/piercing were combined into one measure, the results showed that 33% of the respondents were willing to undergo/use at least one of them.

To summarize the results so far: 12% of this random sample of 16–25-year-old young people in Sweden either used or had used any

kind of substances to improve their physical performance and muscle growth. Moreover, 70% exercised at least once or twice a week and 40% exercised more than twice a week. Most of the participants had negative attitudes towards doping, but 14% thought it was acceptable to use such substances. Their attitudes towards the use of muscle-building substances were generally negative, although as many as 8% had a positive attitude.

A majority (70%) seemed to be concerned about the appearance and attractiveness of their bodies, and more than one fifth reported that their body image affected their social life. One third were willing to take actions other than tattooing and piercing to modify their body, and 5% had already done so.

3.3. Multivariate logistic regression (RQ3)

When preparing for the regressions, bivariate correlations with PIES were calculated for all the included variables (Table A2 in Appendix A). Two variables that had a significant effect in the bivariate analysis did not show up as significant effects in the logistic regression (Table A3 in Appendix A), namely parents’ and respondents’ places of birth. Moreover, three of the five measures of body image were significantly correlated to the use of PIES, but only two showed significant odds ratios in the logistic regressions (Table A2 in Appendix A).

The five regression models (blocks) included (1) gender, age and exercise, (2) two measures of attitudes, (3) a measure of users among friends/acquaintances, (4) indicators of body image, and (5) indicators of the propensity to change one’s body.

Nagelkerke’s pseudo R^2 indicated that the model’s explanatory power increased for every block (from 0.10 to 0.40), and the -2LL significance test for model evaluation showed that every block was significantly more powerful than the preceding one. The results from block one showed that gender and age significantly affected the odds of using PIES. Gender was only significant in blocks one, two and five, while age was significant in all blocks. Men had nearly double the odds of women for using PIES, and respondents aged 16–19 had approximately half the odds of those aged 20–25. Exercising at least 3–4 times a week was related to significantly higher odds of using PIES in all blocks ($OR = 2.8–3.7$).

The attitude scales showed significant effects in block two, and partly in blocks three and four, but not in block five. According to blocks two, three and four, one standard deviation more positive attitude to doping (Attitude DOP) resulted in 30–40% higher odds of using PIES. The odds ratio for attitude to muscle-building substances (Attitude MBS) showed a similar picture, with 38% higher odds of using PIES in block two. However, this picture changed in blocks three and four. Attitudes to muscle-building substances no longer showed a significant effect on PIES when users among friends was included in block three. A test for interaction between these variables showed that no significant interaction was present. Likewise, in block five, attitudes to doping had no significant effect when variables measuring the propensity to change one’s body were included. Again, tests for interaction between these variables did not show any such effects. This indicates that the relationship between attitudes and use of PIES is spurious, as other variables are more important.

Model 3 added a variable measuring having friends who used PIES. The odds ratio in this case was high; having a friend who used PIES increased the odds of using PIES oneself by between eight and nine times. However, it is important to remember that this is only a point estimate.¹⁵

The indicators of body image included one measure on the importance of others’ views of one’s physical fitness and one on the social consequences of body image. Feeling that others’ views were very important compared to feeling that they were very unimportant raised

¹⁵ The 95% CI for friends using PIES ($OR = 8.64$) was 5.8–12.8 in block five.

the odds of using PIES by 2.4 times in block four and 2.3 in block five. The other measure of body image was also significant in models four and five. One standard deviation higher on the scale of body image affecting social life was related to 20%–40% higher odds of using PIES.

Block five included two variables indicating the propensity to change one's body: one measuring the willingness to undergo different kinds of cosmetic changes and the other the actual completion of such changes. The odds ratios were significant in both cases; an increase of one standard deviation in either scale was associated with higher odds of using PIES (45% and 29% higher, respectively).

When comparing the relative strength of the five indexes used, the differences were not significant. A one standard deviation higher value on the two attitude scales (consequences of body image and cosmetic changes) was related to 22%–45% higher odds of using PIES. When the effect of the three (significant) dichotomous variables was compared, the 95% confidence intervals revealed that only one of them had a significantly higher odds ratio than the other two. Having a friend/acquaintance who used PIES was related to seven times higher odds of using PIES, and this was significantly greater than the effect of gender or age.

In summary, the regressions showed that gender, age, and level of exercising had significant effects on the odds of using PIES. Being male, being older (20–25 years old), and exercising a lot were associated with an increased risk of using such substances when all other variables were held constant. The analysis also suggested that attitudes to doping and muscle-building substances were less important when aspects such as use by friends, body image, and propensity to change one's own body were included as explanatory variables. Having friends or knowing people who used PIES clearly increased the risk of using such substances oneself. Our analysis revealed that attitudes towards PIES were less important when other aspects were included as explanatory variables. The results suggested that knowing people who used PIES was more important than attitudes to the use of such substances. This points towards a learning hypothesis, with the learning process involving imitation components rather than the transformation of values or norms (cf. Akers 2009, Kabiri et al., 2018). The indicators of body image that showed significantly higher risk were considering others' views of your body to be very important, and your view of your physical appearance having had an effect on your social life, school work, or job. Having undergone or being willing to undergo cosmetic changes was also significantly related to the use of PIES.

4. Discussion

The aim of this study was to investigate the prevalence of PIES use, and possible predictors for this use, among a representative sample of the general Swedish population aged between 16 and 25. Our findings show that the lifetime prevalence of the use of PIES is approximately 12% among Swedish young people.

This relatively high prevalence rate corresponds to an earlier comparative study in which Sweden demonstrated the highest prevalence rates (in terms of AAS) among the Nordic countries (Sagoe et al., 2015), which indicates that PIES use in Sweden seems to be an issue that calls for more attention. Further, our figures are notably high when compared with younger sample groups (outside gym and fitness settings); for example, prevalence rates among students in other countries range from 0.9% to 2.6% (Papadopoulos et al., 2006; Lucidi et al., 2008; Sagoe et al., 2015). The prevalence for Swedish 16–18-year-olds has in earlier studies been found to range from 1.2% to 3.6% (Nilsson et al., 2001; Nilsson et al., 2005; Hoff, 2013). Our sample also includes older youngsters and there were significant differences between the age groups. The relatively older group (20–25-year-olds) had used substances to increase their physical capacity to a larger extent than the younger group (16–19-year-olds) (13% vs. 8%), and the respondents aged 16–19 had approximately half the odds of using PIES than those aged 20–25. These findings are in line with earlier research where

relatively older students were found to be overrepresented in the statistics (Mallia et al., 2013), and that the age of onset for the use of PIES in fitness contexts in the Nordic countries ranges from 18 to 25 (Mickelsson, 2009). Although tentative, possible explanations for the difference include financial situation (older people can afford to pay for these substances), social surroundings (older people have established contact with others who use PIES), and psychological factors (older people have developed an identity of being a person focused on appearance, the body, and muscles). Furthermore, the years around the age of 19 can be described as a stage of testing boundaries and societal norms (e.g., Barland & Tangen, 2009), which could also help explain the difference between the age groups. Further studies on different age groups of younger populations could potentially facilitate the designing of prevention programmes to target the right groups. We can nevertheless conclude that the sample in this study, with its relatively high prevalence rate, especially for the less well-studied group of 19–25-year-olds, is noteworthy for its possible implications for public health.

When looking at gender in the present study sample, the analysis showed that men had an increased risk of using PIES. The size of gender differences we have identified is interesting in relation to the results of earlier research showing a far higher prevalence among men than among women (see, e.g., Sagoe et al., 2015). It has been suggested that the extent of women's use of muscle building substances is negligible and can be disregarded in the discussion on prevalence (Christiansen, 2017), yet our results point in another direction. Admittedly, the men in our study had used substances to affect both physical capacity and body appearance (15% and 6% respectively) to a greater degree compared to women (8% and 3% respectively), but the figures for women cannot be ignored. It would be hasty to draw conclusions based on this single study, but perhaps we are seeing a development of young women's use of PIES in the wake of the 'strong is the new skinny' trend. The relatively high prevalence among young women in our study emphasizes the need to direct attention to women as well as men in research and debates on the use of PIES.

A predictor that was significantly associated with the use of PIES was level of exercise. In line with earlier studies (e.g., Lazarus et al., 2017), higher levels of physical activity meant an increased risk of using PIES. This fact could be considered somewhat incongruous from a public health perspective. The health effects of physical activity are widely reported, and it is often pointed out that more people need to engage in physical activities to reduce lifestyle-related morbidity and mortality (Lee et al., 2012; Reis et al., 2016). Many young people are physically active and involved in exercise and a healthy lifestyle, but the health benefits of exercise may be counteracted when training also means an increased risk of exposure to settings involving frequent use of PIES (cf. Quaglio et al., 2009).

In general, our results showed negative attitudes towards the use of PIES, with approximately two thirds of the respondents reporting a negative attitude to the use of these substances. However, there was still a considerable share of the sample that showed positive attitudes towards the use of muscle-building substances (20–38%), which can be assumed to be reflected in the relatively high prevalence evident in our material. Not surprisingly, the intention to use PIES has been found to be affected by positive attitudes towards enhancing substances (Lucidi et al., 2008; Ntoumanis et al., 2014). Interestingly, our analysis nevertheless revealed that attitudes towards PIES were less important when other aspects were included as explanatory variables. The results suggest that knowing someone who uses PIES is more important than attitudes towards the use of such substances. Having a friend who uses PIES, or perceptions of friends' use, have also previously been found to increase the risk of own use (Papadopoulos et al., 2006; Wiefferink et al., 2008; Ntoumanis et al., 2014). This suggests a learning process based on imitation rather than a change in values or norms (cf. Akers 2009, Kabiri et al., 2018). What other people do, or are perceived to do, seems to be more important than the attitudes the respondents hold or express. Another explanation that could help to clarify why knowing people who

used PIES seemed to be important is that having users among one's friends is likely to increase one's opportunities to obtain and use PIES.

The analysis also showed that indicators of body image were more important than attitudes to PIES. This is interesting because it establishes a link between the view of one's own body and the use of PIES, in line with earlier studies (see, e.g., [Ntoumanis et al., 2014](#); [Piacentino et al., 2017](#)). Perhaps even more interesting is the impact of the social dimension of body image on PIES use. Specifically, how others viewed their body and whether their body image affected different areas of their social life, was shown to be important. This, together with results that clearly link the propensity and willingness to undergo cosmetic changes to the use of PIES, suggests that factors affecting social expectations of body appearance among young people are important when it comes to explaining and preventing the use of PIES.

The method used in this study has both its limitations and its benefits. Cross-sectional studies are not well suited as a base for analysing causality, and we cannot know for sure whether the factors we have studied lead to the use of PIES or whether they are its result. Another important reservation is the likely existence of other confounding factors; we do not think that our explanatory variables give a full explanation for the use of PIES. As mentioned earlier, a limitation in the present study is the assessment of incidence by a self-report method, which could result in an under-estimation of the prevalence rate. It is also important to remember that the results could have been affected by a social desirability bias, reflecting values and norms that the respondents believed they should be holding. Relating our findings to previous research is complicated by the fact that the body of research covers the use of a wide spectrum of enhancing substances and methods, and furthermore includes divergent groups of samples regarding, for example, age and sex, as well as divergent contexts for the collection of data (gyms, schools, etc.). Moreover, in some studies prevalence is measured by testing while others use self-report questionnaires, and some studies examine lifetime prevalence while others focus on use during a specific period of time. However, the method used provided a rare sample, representative for the general Swedish population aged between 16 and 25. The study, with its exploratory approach, can hopefully contribute to the understanding of PIES use among young people. Methodological problems can never be totally avoided in empirical studies, but the accumulation of knowledge in this area can take us further.

5. Conclusion

The results of this study indicate a need to pay attention to the use of PIES in the general population of young people, since it cannot be

regarded as a problem limited to only exercisers or only men. Our finding that 12% of young people have experience of PIES use, including a non-negligible proportion of women, is a health concern for society. This is particularly true since women and younger individuals have been shown to have a greater risk of side effects from AAS ([Quaglio et al., 2009](#)).

Interventions are problematic, since the use of PIES reflects a complex interplay of multiple factors ([Petróczi & Aidman, 2008](#); [Tangen & Barland, 2013](#)). This study points out the importance of social context and expectations; for example, friends who use PIES, how body image affects social life, and how others view one's body. Further studies, including studies with a qualitative approach, are needed to gain more knowledge about the underlying factors for using PIES. Our study can contribute with knowledge of PIES use and possible predictors in the Swedish population aged 16–25, and may therefore be of interest for various stakeholders involved in prevention of PIES use.

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CRediT authorship contribution statement

Göran Svedsäter: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing – original draft, Writing – review & editing, Visualization, Project administration. **Lena Svennberg:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision. **Lars Westfelt:** Conceptualization, Formal analysis, Methodology, Validation, Writing – review & editing, Supervision. **Anna Qvarfordt:** Conceptualization, Methodology, Validation, Writing – review & editing, Supervision. **My Lilja:** Writing – review & editing.

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Appendix A

[Tables A1](#), [A2](#), and [A3](#).

Table A1
Answers to 12 statements about doping

Variables		Per cent (n)
Doping isn't cheating, it's a way to enhance your performance or muscles	Disagree	87.6 (1672)
	Neither	7.3 (140)
	Agree	5.0 (96)
The risks related to doping are exaggerated	Disagree	82.2 (1249)
	Neither	11.1 (169)
	Agree	6.7 (102)
The media blows the doping issue out of proportion	Disagree	65.8 (1064)
	Neither	19.6 (317)
	Agree	14.7 (238)
I can imagine doing doping if the risk of detection is small	Disagree	93.4 (1843)
	Neither	3.5 (69)
	Agree	3.1 (61)
Doping is a way to adapt to society as it is today	Disagree	86.0 (1589)
	Neither	7.6 (140)
	Agree	6.4 (119)
Doping is okay if it only happens occasionally	Disagree	85.7 (1595)
	Neither	8.5 (159)
	Agree	5.8 (107)

(continued on next page)

Table A1 (continued)

Variables		Per cent (n)
In my training environment, I feel that I am influenced to use substances for muscle building	Disagree	86.9 (1526)
	Neither	6.7 (118)
	Agree	6.3 (111)
It is up to each individual to decide whether to use doping	Disagree	54.9 (1045)
	Neither	15.2 (289)
	Agree	29.9 (569)
Doping is an increasing societal problem	Disagree	22.9 (310)
	Neither	28.2 (382)
	Agree	48.8 (661)
The medical risks of doping are exaggerated	Disagree	83.5 (1212)
	Neither	9.8 (142)
	Agree	6.7 (97)
I would use doping if it guaranteed an ideal body	Disagree	85.7 (1679)
	Neither	7.0 (137)
	Agree	7.3 (143)
Doping is unacceptable	Disagree	13.5 (258)
	Neither	9.0 (172)
	Agree	77.5 (1476)

Table A2PIES and potential independent variables. Frequencies, χ^2 tests and correlations

Variables	Per cent (n)	Using PIES (tot=12%)	p (χ^2)	Kendall's tau-b/c
Gender: Woman	48.4 (1017)	8.4	0.000	-0.11**
Man	51.6 (1085)	15.5		
Age: 16–19	34.4 (722)	9.1		
20–25	65.6 (1379)	13.6	0.003	0.06**
Born: Sweden	96.0 (2017)	11.5		
Elsewhere	4.0 (84)	25.0	0.000	0.08**
ParBorn: Both in Sweden	84.0 (1765)	10.8		
One in Sweden	10.0 (210)	15.2	0.000	0.09**
Both elsewhere	6.0 (127)	23.6		
Exercise: ≥ 3 –4 t/w	40.3 (846)	18.4		
1–2 t/w	29.2 (613)	9.1	0.000	-0.15***
Not/seldom	30.5 (642)	6.4		
GAttitudePRE:Negative	70.7 (1303)	4.1		
Neither	21.4 (395)	20.0	0.000	0.26***
Positive	7.9 (146)	63.7		
GAttitudeMBS:Negative	72.9 (1378)	6.2		
Neither	20.0 (378)	16.9	0.000	0.19***
Positive	7.1 (134)	56.0		
Friends use: No	70.9 (1231)	4.5	0.000	0.39***
Yes	29.1 (506)	33.2		
Body image1: Very unimportant	15.1 (305)	6.9	0.000	-0.14***
Rather unimport.	34.2 (689)	9.4		
Rather important	39.8 (801)	11.6		
Very important	10.9 (219)	29.2		
Body image2: Low dest. impact	81.1 (1660)	10.2	0.000	0.11***
High dest. impact	18.9 (387)	19.4		
Body image3: Very satisfied	13.5 (282)	14.2	0.509	-0.01
Somewhat satisfied	44.2 (926)	11.7		
Neither or	14.2 (298)	9.7		
Somewhat dissatis.	20.4 (428)	12.4		
Very dissatisfied	7.7 (161)	13.7		
Body image4: Very unimportant	4.5 (93)	8.6	0.000	0.13***
Somewhat unimp.	26.0 (531)	5.6		
Somewhat import.	51.0 (1042)	11.1		
Very important	18.5 (379)	25.1		
Body image5: Not concerned	26.1 (548)	9.7	0.063	0.05
Somewhat conc.	42.9 (902)	11.3		
Rather concerned	15.9 (334)	14.1		
Very concerned	10.6 (223)	15.2		
Extremely concern.	4.5 (95)	16.8		
CosmMay: No	48.3 (968)	6.7	0.000	0.15***
Yes	51.7 (1038)	16.3		
CosmDone: No	67.0 (1365)	9.3	0.000	0.10***
Yes	33.0 (672)	15.8		

Table A3

Independent variables. Comparison of significance in bivariate and multivariate analysis (x = sig. – =not sig.)

Variable	Bivariate (X^2)	Multivariate (Wald)
Gender	x	x
Age	x	x
Born	x	-
Parentborn	x	-
Exercise	x	x
Body image 1	x	x
Body image 2	x	x
Body image 3	-	-
Body image 4	x	-
Body image 5	-	-
GAttitude MBS	x	(x)
GAttitude PRE	x	-
Attitude DOP		x
Frienduse	x	x
CosmMay	x	x
CosmDone	x	x

Born: Respondent's place of birth.

Parentborn: Respondent's parents' place of birth.

Exercise: Respondent's level of exercising.

Body image 1: Importance of others' views on the respondent's physical fitness.

Body image 2: Negative consequences of body image in different life areas.

Body image 3: Level of satisfaction with body appearance.

Body image 4: How important it is that the respondent thinks his/her body looks fit.

Body image 5: Level of concern regarding the attractiveness of his/her own body.

GAttitude MBS: General attitude to muscle-building substances.

GAttitude PRE: General attitude to performance-enhancing substances.

Attitude DOP: Attitudes to doping (Index of specific statements).

Frienduse: Friends/acquaintances use of PIES.

CosmMay: The willingness to undergo cosmetic changes

CosmDone: The use of cosmetic changes

(O) = Not the same variable. Indexes are used in the regressions.

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