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Doping, Drugs and Drug Abuse among Adolescents in the State of Thuringia (Germany): Prevalence, Knowledge and Attitudes

Abstract

Goal-directed measures to prevent doping and drug abuse in sports requires empirical data. In this connection, a cross-sectional analysis was carried out in 2004. The purpose of the study, on the one hand, was to register reliable data of the current situation in Thuringia, and, on the other hand it was to give information on possible interventional steps with scientific support. Within three months, 2319 adolescents from 16 Thuringian schools (5 regular schools, 4 secondary schools, 3 sport schools and 4 vocational schools) were surveyed. Three hundred and forty-six (15.1%) students out of 2287 students (26 students without a statement) indicated use of prohibited substances from the WADA list in the previous year [27]: 16 (0.7%) anabolic-androgenic steroids (AAS), 10 (0.4%) growth hormones, 56 (2.4%) stimulants, 305 (13.2%) cannabis, 2 (0.1%) diuretics, 52 (2.2%) cocaine/heroin and 6 (0.3%) erythropoeitin. Moreover, nonathletes (N = 490) reported a substance use that was approximately 5.0% higher than that of recreational athletes (N = 1254) and nearly three times higher than that of competitive athletes (497). All three groups (nonathletes, recreational athletes and competitive athletes) performed poorly on a knowledge test regarding doping in general with an average below 60% in each case. Another main aspect of the study was to determine factors influencing substance use in sports. Besides the doping specific knowledge ($\beta = 0.06$, $p < 0.05$), age contributed ($\beta = 0.09$, $p < 0.05$), as well as anti-doping attitude ($\beta = -0.34$, $p < 0.05$), to the resulting variance. Gender, however, played no role. The findings of the study point towards the need for improvement of specific knowledge of doping among students and that their attitude towards doping must be altered. The goal in this case is to test the effectiveness of appropriate scientific intervention.

Key words
Doping · drugs · drug abuse in sports · adolescents · cross-sectional analysis

Introduction

In the interest of the prevention of doping, drugs and drug use in sports by Thuringian adolescents, it is essential to know their use of banned substances from the list. While the number of international studies, particularly concerning the prevalence of anabolic androgenic steroids (AAS) [5,6,12,14,17–19,23–26], has increased during the last few years, the data in Germany is, to a large extent, unknown because of a lack of research. In 2004, the National Anti-Doping-Agency (NADA) provided information on 72 doping cases resulting in sanctions in competitive sports, among which AAS was found to be the most commonly abused substance. A survey on the abuse of drugs in leisure sports in north German sport studios [1] showed a use of AAS by 24% of men and 8% of the women. Numerous international studies [5,6,12,14,17,24,26] have shown a mean use of anabolic-androgenic steroids by adolescents of 2.8% (Min = 1.7%, Max = 3.9%), with boys using them to a greater extent than girls. The standard

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Table **1** Description of school type by gender and grade

	Regular school		*Secondary school*		*Sport school*		*Vocational school*		*Total*	
	N	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*
Gender										
Male	142	53.8	323	38.6	256	62.6	350	44.3	1071	46.6
Female	122	46.2	514	61.4	153	37.4	440	55.7	1229	53.4
Grade										
Grade 7	78	3.4	208	9.0	70	3.0			356	15.4
Grade 9	190	8.2	343	14.8	160	6.9			693	30.0
Grade 11			287	12.4	180	7.8			467	20.2
First year of vocational school							794	34.4	794	34.4

of knowledge among the students has been in light of the few existing surveys [14,15,22,24] poorly assessed. Luetkemeier et al. [14] found that the knowledge of students, grades 7 to 12, on a test regarding anabolic androgenic steroids was below 70 percent, with users less knowledgeable than nonusers.

The limitation of studies to only anabolic-androgenic steroids demonstrates the need for information about the prevalence of other substances from the prohibited list. However, it is difficult to differentiate between specific performance-enhancing drug use and the use of drugs socially, which inadvertently affects sports performance. Studies concerning multiple substance use by adolescents [12,17,19] show a connection between the use of other legal and illegal drugs and anabolic-androgenic steroids.

The aim of the Thuringian survey was, therefore, to show the prevalence of substances from the list, along with differences in use by age and gender. Differences in sporting activity in regards to substance use and general knowledge were also analyzed. In order to help prevention and intervention as needed, the question of which factors cause doping and drug abuse in sports must be answered.

Materials and Methods

Data collection

Over a period of three months (September 20, 2004 – December 21, 2004) adolescents of Thuringia were interviewed in the course of a cross-sectional analysis by use of an anonymous questionnaire on doping, drugs and drug abuse in sports. The selection of the 16 schools (5 regular schools, 4 secondary schools, 3 sport schools and 4 vocational schools) occurred by chance drawing, except for the intentionally chosen sport schools. Students from the entire grades 7 and 9 of the regular schools, secondary schools and sport schools were interviewed. Also included was the entire grade 11 of the secondary schools and sport schools, as well as the entire first year of the apprenticeship vocational schools. The conducting of the survey was standardized, with few exceptions, to occur during the first lesson of the school day in the presence of a member of the survey project. On average, 76% of students participated in the survey.

Data reduction

The students filled in the anonymous questionnaire voluntarily. In addition, a written approval from the parents was obtained. The headmasters of each school were in agreement to allow the survey, which was based on the granted permission of scientific research in schools according to § 57 (5) of the Thuringian School Law of the Cultural Ministry dated April 24, 2004.

Six out of the 2319 questionnaires were excluded after the data exploration, the reason being the obviously untrue information provided by students, especially in relation to the prevalence of banned substances from the list, which would have been contradictory to their apparent state of health. Consequently, the findings of the study are based on the evaluation of 2313 questionnaires.

Sample

The demographic characteristics of the total sample are followed by the description of the demographic characteristics after their classification in groups by athletic participation: nonathletes, recreational athletes and competitive athletes.

Demographic characteristics of the total sample

The total sample consisted of 2313 students with an average age of 15.8 years (SD = 2.2, Min = 12, Max = older than 21). Three hundred and fifty-six students belonged to grade 7 (M = 12.6, SD = 0.6, Min = 12, Max = 14), 693 students belonged to grade 9 (M = 14.6, SD = 0.6, Min = 13, Max = 17), 467 students were in grade 11 (M = 16.7, SD = 0.7, Min = 15, Max = 19), and the majority of 794 students (M = 17.9, SD = 1.7, Min = 15, Max = older than 21) belonged to the first year of vocational school. The distribution of the adolescents in school types by gender and grade are shown in Table **1**.

Demographic characteristics after classification by athletic participation

To determine the sporting activity of the students, a selection of specific questions (see below) was used to classify the total sample into three groups. These are subdivided into 490 nonathletes (21.9%), 1254 recreational athletes (65.0%) and 497 competitive athletes (22.2%). Seventy-two students could not be assigned to any of these three groups. Consequently, the evaluation is based

Table **2** Description of athletic participation by gender and type of school

	Nonathletes		*Recreational athletes*		*Competitive athletes*		*Total*	
	N	*(%)*	*N*	*(%)*	*N*	*(%)*	*N*	*(%)*
Gender								
Male	147	14.2	579	56.1	307	29.7	1033	100.0
Female	339	28.3	670	56.0	187	15.6	1196	100.0
Type of school								
Regular school	65	25.5	176	69.0	14	5.5	255	100.0
Secondary school	157	19.2	610	74.6	51	6.2	818	100.0
Sport school					411	100.0	411	100.0
Vocational school	268	35.4	468	61.8	21	2.8	757	100.0

on the remaining 2241 students. Table **2** shows the exact distribution of athletic participation by gender and type of school.

Instruments

The applied questionnaire consists of a number of different integrated questionnaires. It is subdivided into:

1. questions on socio-demographic characteristic (8 items)
2. questions on sporting activity (12 items)
3. questions on motivation to participate in sports (23 Items)
4. questions on stress effects (16 items)
5. questions on psychiatric disorders, SDQ[1] (33 items)
6. questions on health related quality of life, Kiddo-KINDL® [2] (31 items)
7. questions on attitude towards doping, knowledge and prevalence of doping, drugs and drug abuse in sports (124 items)

This first part of the evaluation of the study is limited to the information on socio-demographic data, sporting activity, attitude towards doping, knowledge and prevalence of doping, drugs and drug abuse in sports. The actual questionnaires used are to follow.

Physical activity

To describe the total sample regarding their physical activity, a classification into three groups concerning athletic participation (nonathletes, recreational athletes and competitive athletes) was made.

In reliance on the physical-activity questionnaire for children and adolescents by the Robert Koch Institute [3], various questions were selected on physical activity upon which the type of athlete is based (Table **3**). According to this, non-athletes take part in, on average, two hours of sports per week (school sports and leisure time activities), recreational athletes engage in, on average, seven hours of sports per week (school sports, leisure time activities and activities in a sports club), and competitive athletes practice, on average, twenty hours of sports per week (school sports, leisure time activities, activities in a sports club and competitive sports).

Table **3** Questions on sporting activity leading to classification by athletic participation

Sporting activity
1. Are you in a sport school?
2. How many times per week do you have sports lessons at school?
3. Are you a member of a sports club?
4. How many times per week are you active at a sports club?
5. Do you take part in competition at a sports club?
6. How many days in the past week were you physically active outside of a sports club or sports school? (for example: did you ride a bike, play soccer ...)
7. How much effort did you expend in this activity?

Attitude

To define the attitude towards doping, the students were asked eight questions. For example, they had to answer if they would take substances from the list: 1) if there were no risk of getting caught, or 2) if they knew all other athletes had used them, or 3) if they could earn 1 million euros in a sporting competition (respective answer choices: yes/no/don't know). Furthermore, it was of interest as to whether information about the adverse health effects of AAS would be useful for students (answer choices: yes/no/don't know); in addition, with a four-stage answer choice from "not at all" to "greatly", whether sporting performance would improve by taking substances from the list. An anti-doping index was set up to compare the attitude towards doping to further variables. This index consisted of three items (items 1 and 3 are to be inverted) asking questions on attitudes towards doping (Table **4**), these could be answered five ways from "totally wrong" (0) to "exactly right" (4). The reliability of the attitude scale can be estimated sufficiently in terms of the internal consistency of $\alpha = 0.45$.

[1] SDQ – the Strength and Difficulties Questionnaire by Goodman [11] is a validated screening questionnaire to measure behavioral characteristics of children and adolescents.

[2] Kiddo-KINDL® is a reliable questionnaire by Ravens-Sieberer & Bullinger [21] measuring the health related quality of life.

Knowledge

The students' specific knowledge about doping was detected on the basis of answering eight questions concerning this matter. Six out of eight questions could be answered by multiple responses, as shown in Table **5**. Among other things, the students were asked to indicate which substances are on the doping list, and which effects, as well as side-effects, are caused by the taking of AAS and stimulants. In addition, they were asked if one can get addicted to cannabis, and if dietary supplements can be harmful to health (respective answer choices: yes/no/don't know). According to the definition of a correct (1 point) and incorrect (0 points) answer, a score of 33 points was possible. Whenever the answer "don't know" was marked, all further answers concerning the question were assessed with 0 points. Subsequent to the adding up of points, the student's knowledge about doping was classified into three groups: poor knowledge (≤ 60% = 0 to 20 points), moderate knowledge (61.0 – 84.0% = 21 to 27 points) and good knowledge (≥ 85.0% = 28 to 33 points). The bases for this classification were the evaluation results of the gymnasium secondary level.

Consumption

Doping, drugs and drug abuse were detected using 11 questions. These questions covered: alcohol, tobacco, snuff and dietary supplements, as well as substances from the list (AAS, growth hormones, stimulants, cannabis, diuretics, cocaine/heroin and erythropoeitin).

To measure the frequency of substance use, a time frame was constructed based on the previous 12 months. A 7-point rating scale from "at no time" to "at all times" was used to answer. Four out of eleven questions indirectly served the purpose of exposing substance use by providing incomplete sentences with an appropriate selection of answering items, also recorded with the aforementioned seven answer choices. The current analysis refers exclusively to the substances from the prohibited list, as mentioned above. In consideration of these substances as main categories, alcohol was excluded, even though it is registered according to the list as a specified substance. It is, however, only prohibited in specific sports. Furthermore, it is important to mention that stimulants as well as cannabis are solely relevant in competitive conditions and are not banned out-of-competition. But since both substances (e.g., stimulants as medical treatment) are also widespread among adolescents, it is important to take care, according to the doping list, that they will not get used in-competition.

To conduct regression analyses examinations on the use of substances from the list, a so called "doping-consumption index" was established based on the sum of the total number of used substances and the average frequency of use. Charting these results contributed to a differentiated determination of substance use.

Statistical analysis

The data were analyzed using the SPSS statistical program (version 11.0.1) for personal computers. A chi-square statistic and univariate analyses of variance followed by a post hoc comparison with the Scheffé test as well as the Student's *t*-test (test value = 0) were applied to test for differences.

Table **4** Indication of the question and answering items, upon which the anti-doping index is based

When I get asked about my opinion on doping, I think ...
1. the taking of substances from the list is fair
2. anyone who takes substances from the list damages their health
3. substances from the list should be liberalized

Table **5** Example of a question with the appropriate answering items concerning the knowledge about doping

The taking of stimulants ...
– is used for tranquilization
– leads to psychological addiction
– is used for increased performance
– poses a risk to health
– is only effective for competitive athletes
– don't know

The non parametric procedures Kruskall-Wallis H test and the Mann-Whitney U test were used when abnormally distributed variables occurred.

A single logistic regression (stepwise method) was carried out for an analyses of the association between different suggested influencing factors and substance use.

Statistical significance was set at a level of $p < 0.05$.

Results

Three hundred and forty-six students (15.1%, male = 16.3%, female = 13.9%) out of 2313 surveyed adolescents indicated use of banned substances from the list in the previous 12 months: 16 (0.7%) anabolic-androgenic steroids (AAS), 10 (0.4%) growth hormones, 56 (2.4%) stimulants, 305 (13.2%) cannabis, 2 (0.1%) diuretics, 52 (2.2%) cocaine/heroin und 6 (0.3%) erythropoeitin. Table **6** lists the percentage of students, by gender, grade and type of athlete, who reported substance use.

While 277 (12.0%) students indicated use of one of the substances, 69 (3.0%) students stated that they had used two or more substances. Nonathletes reported a substance use that was approximately 5.0% higher than that of recreational athletes and nearly three times as high as that of competitive athletes (Fig. **1**).

All three types of athletes differ significantly ($p < 0.05$) from each other, in use of substances from the list. One hundred and seventy-four (7.5%) students (1% nonathletes, 4.4% recreational athletes, 2.2% competitive athletes) reported a supply of substances

Table **6** Prevalence of substances from the list by Thuringian adolescents in the previous 12 months

	Anabolics	*Growth hormones*	*Stimulants*	*Cannabis*	*Diuretics*	*Cocaine/ heroin*	*Erythro-poeitin*
Gender							
Male	0.5%	0.5%	2.4%	15.0%*	0%	2.0%	0.2%
Female	0.9%	0.3%	2.4%	11.8%*	0.2%	2.5%	0.3%
Grade							
Grade 7	1.1%	0.6%	0.9%	2.8%**	0.3%	2.0%	0.6%
Grade 9	0.4%	0.4%	1.9%	12.4%	0%	1.6%	0.1%
Grade 11	0%	0.4%	1.5%	13.9%	0%	0.9%**	0%
First year of vocational school	1.2%	0.4%	4.3%**	18.8%**	0.1%	3.9%**	0.4%
Type of athlete							
Nonathlete	0.4%	0.4%	4.1%*	18.8%**	0.4%*	4.1%**	0.8%*
Recreational athlete	0.9%	0.6%	2.3%	14.3%	0%	2.4%	0.2%
Competitive athlete	0.4%	0.2%	1.2%	5.5%**	0%	0%**	0%

Comparison of subgroups to the total sample with chi-square test; */** $p < 0.05/0.01$

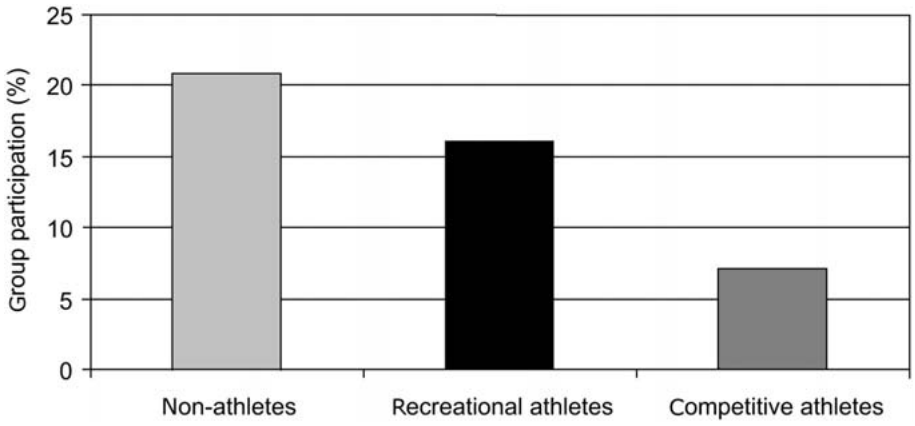

Fig. **1** Description of the use of substances from the 2004 list in the previous 12 months of the survey in connection to the type of athlete. Substances surveyed: anabolics, growth hormones, stimulants, cannabis, diuretics, cocaine/heroin, erythropoeitin.

to improve sport performance, with friends most commonly stated as the provider.

Answering questions pertaining to the specific knowledge about doping, students achieved, on average, 20 (SD = 3.8) points out of 33 points (100%). Altogether, 29 (1.3%) students had substantial knowledge, 949 (43.2%) students had a moderate knowledge and 1276 (55.5%) students had a poor knowledge regarding doping in general. Besides effects on the type of athlete ($F [2, 2216] = 6.53$, $p < 0.05$), there appeared effects at grade level, i.e., age, as shown in Table **7**.

The doping specific knowledge was significantly higher for competitive athletes (M = 20.4, SD = 3.53, N = 493) than for recreational athletes (M = 19.9, SD = 3.71, N = 1241, $p = 0.001$ with Scheffé test). In addition, there were significant differences in the mean knowledge scores of the respective grade levels. On the other hand, significant differences between knowledge and gender could not be found; nor were there significant interaction effects on the type of athlete, grade level or gender.

While 72.7% (70.5% male, 74.5% female) of the students thought that doping harms health, only 33.7% (13.7 male, 20.0% female) knew about liver diseases, and only 28.3% (12.6% male, 15.8% female) were aware of advanced aggression as side effects of the use of AAS.

The potential determining factors influencing substance use (Table **8**) revealed that an anti-doping attitude, along with knowledge and age of the students, made significant contributions to the obvious variances ($F [3, 2263] = 109.89$, $p < 0.01$, $R^2 = 0.13$). However, there was no significant variance by gender ($\beta = -0.002$, n.s.). Accordingly, the less the anti-doping attitude and the older the students, the more often substances from the list were consumed. Adolescents with a higher use rate of doping substances also claim a higher specific knowledge of doping.

Discussion

The goal of this survey was to document, for the first time, the prevalence, knowledge and attitudes regarding doping, drugs

Table **7** Knowledge and effects of the factors: type of athlete, grade level and gender univariate variance analysis

Dependant variable	*M (SD)*		*F*	*P*
Type of athlete			6.53	0.001
Nonathlete	20.0	(4.0)		
Recreational athlete	19.9	(3.7)		
Competitive athlete	20.4*	(3.5)		
Grade			65.75	0.001
Grade 7	17.6+	(3.2)		
Grade 9	19.5+	(3.4)		
Grade 11	21.9+	(3.0)		
First year of vocational school	20.5+	(3.9)		
Gender			2.08	0.15
Male	19.8	(3.7)		
Female	20.2	(3.8)		

Scheffé test for mean differences; * $p < 0.05$ in comparison to athletes; + $p < 0.05$ in comparison of all grades together

Table **8** Multiple regression for prediction of the use of substances from the list by adolescents method: stepwise regression

Prediction variable	*β*	*P*
Anti-doping attitude	– 0.34	0.01
Age	0.09	0.01
Knowledge	0.06	0.05

corr. $R^2 = 0.13$, ($F [3, 2263] = 109,89$, $p < 0.01$), excluded variable gender $\beta = – 0.002$, n. s.

and drug abuse in sports among Thuringian adolescents. As mentioned in different studies [5,15,17,24], self-reporting questionnaires pertaining to the use of banned substances often exhibit limitations in the acquisition of valid responses. False responses may be given by students who wish to keep their substance use secret for fear of nonconfidential data handling, or others might even report a higher substance use feeling a need to demonstrate strength and self assurance. In light of this problem, and in order to assure the highest possible validity, the findings of the pilot study were integrated into this survey along with voluntary attendance and complete anonymity. A standardized content and time flow were also fundamental to the questionnaire.

As the findings of the study showed, 15.1% of the surveyed Thuringian adolescents reported use of substances from the list (anabolic-androgenic steroids, growth hormones, stimulants, cannabis, diuretics, cocaine/heroin, erythropoeitin) in the previous 12 months. As shown by the high consumption of cannabis reported from studies throughout Germany [4,13], the use of substances from the list by adolescents is not only international [5,12,17,19], but must be seen as a reality in Germany. However, the correlation of the results to further studies is, in many cases only possible in a limited form. On the one hand, various international studies question almost solely AAS use; on the other hand, data concerning substance use is generally not standardized, neither according to the preceding 12 months of use, nor lifetime prevalence of use.

While 305 (13.2%) students indicated use of cannabis, the use of all other substances from the list turned out to be comparatively low (from 0.1% [2] use of diuretics to 2.4% [56] use of stimulants). The nation wide drug use study of the Federal Center for Health Education (BZgA) of Germany attained a comparable result of cannabis use (13.0%) by students from 12 to 25 years of age in 2004. However, in 2003, the European School Survey Project on Alcohol and Drugs (ESPAD) surveyed students grades 9 and 10 and found a much higher use of cannabis (23.6%) in Thuringia. The gender related trend of both studies [4,13], with males using cannabis to a greater extent than females, was confirmed by statistical results (male = 157 [15.0%], female = 144 [11.8%]).

It turned out that students in their first year of vocational school, with an average age of 17.9 (SD = 1.66) years, showed almost exclusively the highest use of substances from the list. Of further note, the reported substance use of the students in grade 7 was striking, for example, with a use of cocaine/heroin of 2.0% and an AAS use of 1.1%. These figures represent a distinct warning signal for this age group, but must also be discussed, while keeping in mind validity concerns for self-reporting questionnaires mentioned at the beginning. Interesting in terms of comparability among the number of international studies is the single observation on the use of AAS. As the findings revealed, the reported use of AAS of 0.7% (16) was by far lower than the results of the existing studies [5,6,12,14,17,19,24,25], which noted an AAS use from 1.4% up to 3.8%. Likewise, the higher AAS use among females (0.9%) as compared to males (0.5%) was not in accordance with the literature [5,6,12,14,16,17,19,24,25]. A reason for this could be a female fitness trend, but is most likely the current beauty ideal for women, widely spread by the media. Studies [12,18] have confirmed that AAS were not only used for performance enhancement, but also for the conscious changing of appearance.

The highest significant use of substances from the list was found in nonathletes as opposed to recreational athletes and competitive athletes, which was mainly due to the use of cannabis. As suggested by the survey of Boos et al. [1], the use of substances from the prohibited list is obviously not just limited to competitive athletes. The findings among Thuringian adolescents follow this trend and moreover, reveal the social problem of an increased substance use which does not stop at athletes.

Although there was a comparatively low substance use by competitive athletes, most likely because of extensive sanctions for failed tests, it should nevertheless be seen as a disturbing result. The reported use by nonathletes of AAS, growth hormones, diuretics (each with 0.4%) and erythropoeitin (0.8%) was surprising, and would lead to suspect one more medical application or cosmetic use. The actual data are insufficient to provide detailed information about medical indications. But the frequency rates of therapeutic use of growth hormones (e.g., hypothalamic insuffi-

ciency) or erythropoeitin (e.g., renal insufficiency) in adolescents are expected to already be less than 0.4 or 0.8%.

7.5% (176) of the students indicated friends were the most frequent providers of substances to improve sports performance, as Tanner et al. [24] also reported. Considering the mutual trust required for dealing, in many cases, with illegal substances, this information does not seem surprising. It should, at the same time, be seen as alarming, because peer pressure and the need to "belong" may strongly influence the use of prohibited substances.

The findings concerning specific knowledge of doping revealed a poor state of awareness in Thuringian youths in general, and specifically pertaining to potential effects and side effects of individual substances, as well as their existence on the prohibited list. The doping specific knowledge of all students was, on average, below 60%, by a mean of 20 out of a possible 33 points. Compared to studies on the consumption of AAS [14,24], which also reported generally large gaps in knowledge, it was found, in contrast to reported results, that students who had a higher use of substances from the list also showed a higher state of knowledge regarding doping in general. It may thus be supposed that adolescents who use substances are also informed about them. However, in this context it is important to bear in mind that the use of substances from the list is not only attributed to doping specific knowledge. Other factors, e.g., the attitude towards doping, seem to be even more associated with it.

Competitive athletes showed a significantly higher state of knowledge than recreational athletes, which is probably attributable to the regulation of the prohibited list in competitive sports and to the resulting expansion of the discussion of this topic. Although the type of athlete has a significant effect on knowledge ($F[2,2216] = 6.53$), this must be assessed as quite unimportant compared to the significant effect of the grade level, which has a major influence ($F[3,2216] = 65.75$) according to Bortz et al. [2]. Although the doping specific state of knowledge of an individual grade level differs at any one time significantly from another, it is basically attributable to the large size of the total sample. The actual scores differ only slightly from each other and should, therefore, be interpreted with care. Due to the generally poor results on the knowledge test as seen against the background of substance use, intervention should aim at an increase of knowledge regarding doping in general with the help of age-based intervention strategies. In this connection, the collection of factors influencing substance use gains importance. While specific knowledge of doping ($\beta = 0.06$, $p < 0.01$) and age ($\beta = 0.09$, $p < 0.01$) had indeed a significant, yet small influence on the use of substances from the list, anti-doping attitude ($\beta = -0.33$, $p < 0.01$) proved to be the largest influence. It must be mentioned, though, that the three stated factors, knowledge, age and anti-doping attitude, only define 13% of the variance. As a result, the bigger part of the variance must be attributed to the influence of other factors. Conceivably there are probably social as well as psychological parameters which have to be analyzed.

As a result of the aforementioned findings, there should be major interest in the discussion of the ethics on this topic. Prior studies [7,8] exclusively dealt with the prevention of AAS, suggesting that pure increases in knowledge are not enough and that scare tactics especially with males, may achieve opposite results. Goldberg et al. [9,10] attained positive effects conducting a team-centered, gender-specific intervention study regarding the use of AAS which combined an increase in theoretical knowledge and exercise alternatives with nutrition strategies. One of the few further surveys on intervention by Nilsson et al. [20] reported a trend of declining use of AAS with the help of a health program consisting of various activities to build self-confidence in adolescents and to increase awareness of society's promotion of outward appearance ideals. The goal of individual prevention strategies is, on the one hand, to sensitize adolescents to the topic by educational measures, and, on the other hand, to discuss and modify their attitudes and ethical opinions.

Conclusion

Based on the findings of this study, the use of substances from the prohibited list by adolescents throughout Germany must be assumed. The societal problem of increased substance use is continuing to spread among adolescents in general and has been measurably proven among Thuringian youth in sports.

Intervention measures should be aimed at enhancing specific knowledge of doping among adolescents, as well as increasing their anti-doping attitude. Continuing analysis and further studies are essential in gaining a comprehensive identification of factors influencing the prevalence of doping, drugs and drug abuse in sports.

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