Doping prevalence among preadolescent athletes: a 4-year follow-up

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Objective: To describe the prevalence of doping and its progression in a cohort of preadolescent athletes during a 4-year follow-up.

Design and settings: Prospective cohort study. Self-questionnaire survey.

Participants: All of the pupils entering the first year of secondary school (sixth grade) in the Vosges Département (east France) and followed for 4 years.

Main outcome measurements: Drug use (prohibited substances, tobacco, alcohol, cannabis), intention to use, reported health hazards, perceived drug effectiveness, self-esteem, trait anxiety.

Results: At the beginning of the study, 1.2% (95% CI 0.8 to 1.6) stated that they had taken doping agents at least once in the preceding 6 months, and this had risen to 3.0% (95% CI 2.3–3.7) 4 years later ($p < 0.001$). Of those who had used doping agents, 4% reported that they had experienced a health problem related to doping, and 44% reported that they had won at least one sports event as a result of using the drug. Use of doping agents is linked to the number of hours of practice per week, intention to use, use of other drugs, self-esteem and trait anxiety.

Conclusions: The results show that doping does exist in preadolescent athletes who train every day. This fact should be taken into account in preventive actions.

The use and misuse of performance-enhancing drugs in sport is concerned with substances registered on an annually updated list, "The prohibited list. International standard" (World Anti-Doping Code, World Anti-Doping Agency (WADA)), and other drugs such as tranquillisers, painkillers and creatine, which are not considered here, except for tobacco. Use of the first group of drugs is termed "doping".

Depending on the survey methods used, it has been estimated that doping may involve 3–5% of adolescents, whatever the substance used.¹ For example, studies carried out in southern France with 2926 young athletes, aged 13–20 years, and in eastern France with 1501 athletes, aged 15–19 years, showed that 2.4% and 4.0%, respectively, had used banned substances at least once in their life.^{2,3}

It is now well established that doping prevalence is higher among boys and sports competitors and also increases with age and level of competition.^{2–5}

However, most studies on doping in young people have focused on adolescents (usually older than 13–14 years), who are training hard (for example, 10 h a week) and taking part in competitions. Moreover, to our knowledge, all studies have been carried out at a given time and thus provide only an "instantaneous" picture of the situation.

Questions that remain are: does doping also affect preadolescent athletes in every day life, and is it present in both sexes, at all levels and in all types of sport, and in those for whom improved physical performance is not always the main goal? These questions are important in the field of prevention, so that the most relevant populations can be targeted and effective education programmes can be designed.

The aim of this work was to describe the prevalence of doping and its progression in a cohort of young athletes (sixth grade) during a 4-year follow-up.

METHODS

Subjects

The participants had taken part in a prospective cohort study, "Cohorte Myrtilles", which included all pupils entering the first year of secondary school (sixth grade) in the Vosges

Département (Lorraine region, east France) during the school year 2001–2002 and followed for 4 years.

In November 2001, the cohort included 3564 pupils. This number gradually fell to 2199 because of absence at the time of data collection (illness, etc), moving away from the département, redetermination (changing school course) and repeating a year.

At the beginning of the study, the responding pupils comprised 53.2% boys and 46.8% girls. The mean (SD) age was 11.2 (0.6) years. The distribution of the social and occupational groups of the parents was similar to that generally found in the Vosges Département.

Methods

We used self-reported questionnaires, designed with an easy answer format and tested beforehand on 120 young people. The final document contained the usual sociodemographic items and included an evaluation of:

- extracurricular sports participation (nature and volume schedule)
- self-esteem, defined as an overall evaluation of one's worth or value, as measured by Rosenberg's Self-esteem Scale⁶
- trait anxiety. To define anxiety, a distinction between state and trait has become commonplace. State anxiety is defined as an unpleasant emotional arousal in the face of threatening demands or danger. Trait anxiety reflects individual differences in the tendency to respond with state anxiety in the anticipation of threatening situations. Trait anxiety was measured by Spielberger's State-Trait Anxiety Inventory.⁷ State anxiety was not retained, because this variable is too dependent on the situation. Trait anxiety, which is more stable over the course of time, is the most commonly used indicator
- drug use: tobacco, alcohol, cannabis and doping agents (WADA prohibited list).

Data were collected every 6 months. Questionnaires were administered by school doctors, school nurses or school social workers and completed individually at school. Pupils supplied their number of anonymity, and placed the questionnaire in an

Table 1 Use of doping agents (at least once in the preceding 6 months) reported by preadolescent athletes during a 4-year follow-up

	6th grade (%)		7th grade (%)		8th grade (%)		9th grade (%)	
	Nov 01 (n = 3594)	May 02 (n = 3503)	Nov 02 (n = 3253)	May 03 (n = 3019)	Nov 03 (n = 2867)	May 04 (n = 2775)	Nov 04 (n = 2665)	May 05 (n = 2199)
Total	1.2	1.6	2.4	3.0	2.5	2.9	2.7	3.0†
Sex								
Boys	1.7**	2.2**	3.4***	4.3***	3.7***	4.2***	3.8***	3.7*
Girls	0.6	1.0	1.4	1.7	1.3	1.8	1.8	2.3
Regularity of practice								
ECS	0.4	0.7	1.6	2.0	3.6	1.3	1.8	4.1
IECS	1.4	1.6	2.7	3.2	2.4	3.7	3.2	2.9
NECS	0.0	0.0	0.0	0.0	0.0	0.9	1.0	1.0
Hours of practice per week								
<3 h	1.0	1.0	1.7	2.7	1.8	2.2	2.0	2.2
3–6 h	1.6	2.3	2.2	4.2	3.3	4.0	3.0	4.4
>6 h	1.4	3.5***	6.2***	6.2**	5.8***	4.5*	6.7***	3.2
Nature of sport								
Individual	1.6	1.7	2.8	2.2	2.3	2.7	2.4	3.3
Team	1.0	2.5	3.2	5.5**	5.2**	3.9	4.2	4.0

ECS, extracurricular sports practice group; IECS, intermittent extracurricular sports practice group; NECS, no extracurricular sports practice group.

Comparison by sex, age, involvement in practice (regularity and volume), and nature of sport (χ^2 test): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

†Comparison between May 05 and November 01: $p < 0.001$.

envelope, which was sealed at once. The confidentiality and anonymity of the respondents were guaranteed, and they were asked to give honest answers.

Statistical analysis

The data were managed and analysed using the Modalisa 4.6 (Kynos, Paris, France) survey processing software (data entry verified by two operators). Frequency and summary statistics were calculated on all variables. According to the nature of the variable, comparisons were made by the χ^2 test or analysis of variance. The significance threshold used was $p < 0.05$.

Subjects' welfare

Ethical approval is not required in France for anonymous self-completed questionnaire surveys, but we followed the French bioethics law, which is comparable to the APA Ethics Code. The study received the approval of the Inspection of Academy of Vosges. Each headmaster, duly informed by mail, had the choice to participate or not (three declined to participate). A letter containing information about the study was sent to the parents, who could refuse to allow their child to participate. According to French law, our computerised data files were authorised by the CNIL (National Committee of Data-Processing and Liberty).

RESULTS

Sports participation

Only 460 pupils (10.7%) stated that they had taken part in any physical activity outside of school with a sports association from November 2001 to May 2005 (extracurricular sports practice group). On average, they were taking part in 3.5 h a week of sport when they entered the cohort (November 2001) and 5.2 h a week 4 years later (May 2005), but this difference was not significant ($F = 1.13$, $p = 0.09$). Most (69.5%) were involved in team sports (eg, volleyball, basketball, soccer), and 30.5% in individual sports (eg, athletics, gymnastics, judo). All of them were taking part in competitions, mainly on a weekly basis.

In contrast, 109 (2.5%) told us that they had not taken part in any physical activity at all outside of school during this period (no extracurricular sports practice group).

The rest of the sample (86.6%) only occasionally took part in any physical activity outside of school (intermittent extracurricular sports practice group). On average, they were taking

part in 2.5 h of sport a week at the beginning, and 3.2 h at the end of the follow-up ($F = 1.61$, $p < 0.01$). In this group, 32.9% were involved in a team sport and 67.1% in an individual sport.

Use of doping substances Prevalence

In November 2001, 1.2% (95% CI 0.8 to 1.6) of the sample stated that they had taken doping agents at least once in the preceding 6 months, and this had risen to 3.0% (95% CI 2.3 to 3.7) 4 years later ($p < 0.001$) (table 1).

Tables 1, 2 and 3 show links between prevalence of use of doping agents and other factors.

Overall, the main prohibited substances used to improve physical performance were salbutamol (45.5% of the quoted drugs), corticosteroids (10.2%), cannabis—which is prohibited in France—(6.3%), and others, eg, other stimulants, anabolic agents, etc (38.0%). (To the question “If you have taken a doping substance, please indicate what it was”, the respondents specified the nature, the trademark or the class of the substance. We subsequently classified these answers in accordance with the WADA prohibited list.)

Frequency of use

On average, the frequency of use in November 2001 was every day (23%), at least once a week (15%), and less than once a month (62%). Four years later, we observed a significant increase: every day (24%), at least once a week (38%), at least once a month (10%), and less than once a month (28%) ($p < 0.01$).

Health hazards

Every 6 months, on average 4% of those who had used doping drugs reported that they had a health problem related to doping, and 11% did not know (no difference during the follow-up).

Only four respondents described the problem: “I became violent” (stimulant), “I had a raucous voice” (salbutamol), and two reported having had a “syncope” (salbutamol). These may be impressions rather than facts.

None of those who stated having had a health problem said that they had spoken about it with someone else such as a friend, a doctor, a school nurse, a relative, or another adult.

Table 2 Use of doping agents and recreational drugs and intention to use doping agents in preadolescents

	6th grade (%)		7th grade (%)		8th grade (%)		9th grade (%)		Global OR (95% CI)
	Nov 01 (n=3594)	May 02 (n=3503)	Nov 02 (n=3253)	May 03 (n=3019)	Nov 03 (n=2867)	May 04 (n=2775)	Nov 04 (n=2665)	May 05 (n=2199)	
Tobacco†									
Yes	2.8***	4.5***	6.0***	7.2***	5.1***	5.8***	5.5***	5.1***	5.9 (4.9 to 7.2)
No	0.8	0.6	0.9	1.1	1.2	1.2	1.0	1.6	
Alcohol†									
Yes	2.6***	3.2***	5.1***	6.1***	5.1***	4.9***	4.6***	4.1***	7.3 (5.8 to 9.4)
No	0.3	0.7	0.6	0.6	0.6	0.7	0.5	1.4	
Alcohol intoxication†¶									
Yes	12.9***	10.8***	15.3***	16.3***	8.0*	10.1***	9.2***	6.9*	4.2 (3.3 to 5.2)
No	2.0	1.8	3.7	3.7	3.8	2.5	1.6	2.9	
Recreational cannabis†									
Yes	16.0***	15.3***	16.3***	20.8***	11.6***	11.3***	10.7***	7.8***	10.9 (9.1 to 13.1)
No	0.8	1.0	1.4	1.6	1.6	1.8	1.5	2.3	
Intention to use doping drug‡									
Yes		0.0	15.7***	8.5**	21.8***	9.0*	11.4***	9.7*	6.9 (4.7 to 10.2)
No		1.6	1.7	1.8	1.8	1.7	1.5	2.0	

Comparison by recreational drug use, and intention to use doping drug (χ^2 test): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ie, in May 05, 5.1% of tobacco smokers compared with 1.6% of non-smokers stated that they had used a doping drug.

†At least once during the previous 6 months. ‡Stated 6 months ago by non-users. ¶This question was completed only by alcohol users.

Perceived drug effectiveness

Overall, 44% of those who had used doping agents reported that they had won at least one sporting event as a result, and 18% did not know (no difference during the follow-up).

DISCUSSION

As usual with questionnaire surveys, our results must be considered with caution. Indeed, data are self-declared. Although this is a common method, the investigators are not able to check the answers. However, studies exploring the validity of answers to questions about personal consumption of illicit substances have concluded that the self-completed questionnaire is a reliable tool for gathering information.^{8,9}

The following substances deserve comment: salbutamol, corticosteroids and tobacco. Although salbutamol and corticosteroids are on the prohibited list, an athlete with asthma can obtain therapeutic use exemption. Consequently, it is not regarded as doping to use them in this case. We took account of this: when questionnaires were administered, it was specified that "doping agents" were not to be used in the context of a disease. Tobacco use is as common among preadolescents in the study region as in other regions of France.

In our study, 1.2% of the respondents entering the cohort and 3.0% 4 years later reported that they had used doping substances at least once during the preceding 6 months. This

result shows that doping does exist among very young athletes, whatever their level of sports participation, including leisure. Of course, this report is valid only for Vosges, but the results could be extended to the rest of France as young people throughout the country are similar.

The percentage of drug users appears to be low at the beginning of the study, and then increases gradually with age, as previously observed for adolescent athletes.^{2,4,5} Moreover, not only does the number of users rise, but also the daily and weekly frequency of use. Taking into account the nature of the main substances used (salbutamol, corticosteroids and cannabis to improve performance), even though the amounts taken are not known from this study, we can assume that the probability of an adverse effect increases too. However, only a few of these young users, 4%, described such an effect. There are various possible explanations for this: there may have been adverse health effects, but (a) they were very few, (b) they were denied or minimised by the athletes, as reported elsewhere,^{4,10} or (c) they were identified, but these young people failed to establish links between the effect and their drug use.

When doping is suggested, the following common, not new,¹¹ question from trainers, health professionals and parents arises: are there signs or symptoms that could indicate use of a prohibited substance? Some studies have already tried to answer this question. For instance, frequent alcohol intoxication and involvement in power sports may predict use of anabolic steroids

Table 3 Self-esteem, trait anxiety and happiness in users of doping agents

	6th grade		7th grade		8th grade		9th grade	
	Nov 01	May 02	Nov 02	May 03	Nov 03	May 04	Nov 04	May 05
Global score of self-esteem†								
Users	29.2	29.6*	30.4*	30.3*	29.7**	29.8**	31.5	31.2
Non-users	30.3	31.2	31.6	31.6	31.6	31.6	31.7	31.6
Global score of trait anxiety‡								
Users	46.3**	46.1***	43.0*	42.0**	43.5*	43.0*	42.6	41.4
Non-users	40.8	39.5	39.6	39.9	39.9	40.5	40.4	40.7
Feeling happy								
Yes (%)	1.0	1.4	2.1	2.6	2.3	2.5	2.4	2.5
No (%)	3.3**	3.5**	5.0**	3.8	3.2	5.2*	5.4**	5.5**

Comparison by happiness (percentage of users, χ^2 test), and by global score of self-esteem and global score of anxiety trait (analysis of variance): * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

†Measured by Rosenberg's Self-esteem Scale.⁶ The higher the score, the higher the self-esteem.

‡Measured by Spielberger's State-Trait Anxiety Inventory.⁷ The higher the score, the higher the trait anxiety.

What is already known on this topic

- Doping may involve 3–5% of adolescents athletes.
- This prevalence is higher among boys and increases with age, number of hours of practice per week, and level of competition.
- There are also links with use of psychoactive drugs such as alcohol, tobacco and cannabis.

What this study adds

- Use of prohibited substances exists among preadolescent athletes, whatever their level of participation, including leisure.
- The number of users increases with age, and so does the daily and weekly frequency of use.
- Doping is linked to intention to use (at least 6 months before), self-esteem and trait anxiety.

in high school students.¹² In a previous paper on athletes aged 15–19 years, we showed links between prohibited substance use and sex, number of hours of practice a week, and use of psychoactive drugs such as alcohol, tobacco or cannabis.³ The present study not only confirms these results in committed preadolescent athletes, but also provides additional information: the importance of the intention to use doping agents.

Intention, or representation of a goal, is related to the perception of the judgement of others and to the degree of control that the person has, or imagines he/she has, over his/her own behaviour. It is the heart of the Theory of Reasoned Action/Planned Behaviour, which is used in prevention.^{13–14} In the field of psychoactive substances, many studies have underlined the predictive potential of intention, for instance for use of tobacco, alcohol or illicit substances by adolescents.^{15–17} In a study on 3600 athletes aged 13–18 years, Valois *et al.*¹⁸ stressed that adolescents who say that they intend to use doping agents have a greater probability of doing so. We confirm the importance of this factor.

Finally, compared with non-users, our young users of prohibited substances show low self-esteem and high trait anxiety. However, these two psychological factors are potentially linked to risk behaviours, such as risky sexual behaviour, suicidal thoughts and attempts, dieting, and substance misuse.^{19–22} This may help to explain the link between use of doping agents and use of alcohol and cannabis.

The present findings support our previous ones: young athletes who use doping agents are more likely to be boys, invest much time in training, are ready users of psychoactive substances, and, importantly, they appear to be in some distress (do not feel happy, low self-esteem, high trait anxiety). Furthermore, at least 6 months previously, they have said that they had been tempted to try a prohibited drug. Adults responsible for young people should be alerted by these signs, even though the results are from an epidemiological study and therefore must be applied to individual people with care.

From a prevention point of view, this population of dedicated preadolescent athletes should be monitored. This will probably not be easy, as most users think that they won at least one competition as a result of their use of a prohibited substance!

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COMMENTARY

Everybody knows that drug abuse and abuse of medicaments is a growing problem, not only for sportsmen but for many young people and their health in our societies. The author has followed a large number of pupils during 4 years. He found that, in a region which does not appear to have these problems (almost no large towns or big industries), the problem does exist and is getting bigger with every year. The problem is also linked to high level sport and the amount of training; sport does not seem to be a protective factor. The study explains the risk behaviour by two psychological factors—low self-esteem and high trait anxiety. This is why traditional prevention measures (which try to provoke fear of the danger) are not successful. Instead, they should include measures to promote higher self-esteem and less anxiety, and less importance should be given to sports results and the presentation of the body to the public.

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