

DRUG TESTING IN SPORT

A REVIEW OF RECENT DEVELOPMENTS

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INTRODUCTION

The World Anti-Doping Agency (WADA) has provided clear guidance with respect to anti-doping in sport through the publication of the World Anti-Doping Code¹. The Code provides the framework for harmonising anti-doping policies, rules and regulations within sports organisations and public authorities. It operates in conjunction with five International Standards documents, which deal with:

- Testing.
- Laboratories.
- Therapeutic Use Exemptions (TUEs).
- List of Prohibited Substances and Methods.
- Protection of Privacy and Personal Information.

The World Anti-Doping Code lists eight Anti-Doping Rule Violations (ADRV) that

may result in a sanction against an athlete. (Table 1)

The first of these ADRV is based on laboratory analytical results. The remainder are referred to as non-analytical findings. An athlete can be sanctioned for contravening any one (or more) of these ADRV.

In line with previous cases, based on analysis of Athlete Biological Passports, the recent decision by the United States Anti-Doping Agency (USADA) to impose a sanction of lifetime ineligibility and disqualification on cyclist Lance Armstrong shows that the anti-doping authorities use the full range of non-analytical ADRV to sanction athletes and those associated with athletes who have contravened the anti-doping regulations². However, the identification of the presence of a Prohibited Substance in an athlete through the

analytical testing of urine or blood samples remains the principal method to determine an ADRV.

This article outlines the procedures for the testing of substances and methods in sport according to the WADA International Standard on Testing³. Emphasis is placed on recent developments to strengthen these testing procedures. Finally, a brief review is made of the testing systems that were in place at the London 2012 Olympic and Paralympic Games.

PROCEDURES FOR DRUG TESTING OF ATHLETES

Each Anti-Doping Organisation, with responsibility for testing, must develop a plan for the efficient and effective allocation of its testing resources across the different sports under its authority. In the case of a

WADA ANTI-DOPING RULE VIOLATIONS

National Anti-Doping Organisation, this plan should be across the different countries within its jurisdiction and in the case of an International Federation (IF), across the different disciplines within the sports under its control.

The procedure for drug testing can be broadly divided into the following stages:

- Selection of athletes.
- Athlete notification for testing.
- Sample collection.
- Declaration and certification.
- Transfer of the sample to the laboratory.
- Laboratory testing.
- Reporting results.

During the results reporting stage, where an ADRV has occurred, there are precise rules concerning the imposition of sanctions.

Selection of athletes for testing

Athletes are subject to testing both 'in-competition' and 'out-of-competition'. The WADA Prohibited List⁴ differentiates between these circumstances. Some classes of prohibited substances are tested for at all times, both 'in-competition' and 'out-of-competition'. These include anabolic agents, peptide hormones, beta-2 agonists and diuretics and other masking agents. During 'in-competition' periods, additional classes of prohibited substances are tested for. These include stimulants, narcotics, cannabinoids and glucocorticosteroids.

Selection of athletes for 'in-competition' testing

At national and international sporting events, the period of testing is normally from 12 hours prior to competing up until the end of the competition. However, this period may vary, as described below for Olympic Games. Within competition, athletes are normally selected for testing as a result of their success in an event, however random selection of athletes is also undertaken.

- 1** Presence of a prohibited substance or its metabolites or markers in an athlete's sample.
- 2** Use or attempted use by an athlete of a prohibited substance or a prohibited method.
- 3** Refusing or failing without compelling justification to submit to sample collection or otherwise evading sample collection.
- 4** Violation of applicable requirements regarding athlete availability for out-of-competition testing, including failure to file required whereabouts information and missed tests.
- 5** Tampering or attempted tampering with any part of doping control.
- 6** Possession of prohibited substances and prohibited methods.
- 7** Trafficking or attempted trafficking in any prohibited substance or prohibited method.
- 8** Administration or attempted administration to any athlete any prohibited substance or method or assisting, encouraging, aiding, abetting, covering up or any other type of complicity involving an anti-doping rule violation or any attempted anti-doping rule violation.

Table 1: WADA Anti-Doping Rule Violations.

Selection of athletes for 'out-of-competition' testing

'Out-of-competition' testing may be initiated and directed by:

1. WADA.
2. The International Olympic Committee (IOC) or International Paralympic Committee in connection with the Olympic or Paralympic Games.
3. The athlete's IF.

Any other Anti-Doping Organisation that has testing jurisdiction over the athlete. Athletes subject to 'out-of-competition' testing are principally, though not exclusively, those whose names appear on national or international registered testing pools. These pools are established by each IF and National Anti-Doping Organisation and, as a general principle, include athletes who are part of national teams and/or who compete regularly at the highest level of international competition.

In addition to the random selection of athletes for testing, Anti-Doping

Organisations are required to select athletes for sample collection using target testing methods. Target testing is based on the intelligent assessment of the risks of doping and the most effective use of resources to ensure optimum detection and deterrence. The factors used to determine who should be made the subject of target testing vary between different sports but include some or all of the following:

- Abnormal biological parameters.
- Injury.
- Withdrawal or absence from expected competition.
- Going into or coming out of retirement.
- Behaviour indicating doping.
- Sudden major improvements in performance.
- Repeated failure to provide Whereabouts Filings.
- Athlete sport performance history.
- Athlete age (e.g. approaching retirement, move from junior to senior level).

PROTOCOL FOR WHEREABOUTS FILINGS

- Athlete test history.
- Athlete reinstatement after a period of ineligibility.
- Financial incentives for improved performance.
- Athlete association with a third party such as coach or doctor with a history of involvement in doping.
- Reliable information from a third party.

Testing of athletes can be conducted at any time, in any place and with no prior notice. To facilitate this process, athletes are now subject to Whereabouts Filing⁵ (see Table 2).

Whereabouts Filing information is submitted to the anti-doping stakeholder and WADA and made available through the web-based Anti-Doping Administration and Management System (ADAMS), which is used by the majority of anti-doping organisations. Equivalent management systems are used by other countries. These systems enable athletes to track their testing history and allow other agencies, such as WADA and IFs to view the athlete's whereabouts in order to plan and co-ordinate testing.

Athlete notification for testing

Doping Control Officers (DCO) locate the athlete and confirm his/her identity. They then inform the athlete that he/she has been selected to provide a sample and of his/her rights and responsibilities. The DCO requires the athlete to sign a form to acknowledge and accept the notification.

Athletes are continuously chaperoned from the time of notification to the arrival at the designated Doping Control Station. The DCO/chaperone may at their discretion consider any reasonable request by the athlete to delay reporting to the Doping Control Station. Valid reasons for such a delay are shown in Table 3.

Sample collection

For urine samples, the DCO must ensure an unobstructed view of the sample leaving the athlete's body. The athlete must provide a minimum of 90 ml, which the athlete divides into tamper-proof sample bottles, labelled 'A' and 'B', which are then sealed. The athlete always has control of their own sample.

Athletes who are included in an Anti-Doping Organisation or International Sport Federation Registered Testing Pool are required to give whereabouts information. This information details their availability for out-of-competition testing and is normally provided by the athlete every 3 months.

Details include:

- Home address.
- Training schedule and venues.
- Competition schedule.
- Regular personal activities such as work or school.
- A 60-minute window (between 6:00 am and 11:00 pm) each day where the athlete can be sought for testing.

Table 2: Protocol for Whereabouts Filings.

Blood testing generally follows the same procedures as urine testing except that the sample is taken by a Blood Collection Officer. Blood samples are stored and transported at controlled temperatures between 2 to 12°C.

Declaration and certification

Detailed information is documented at the time of testing. This includes what medications and supplements were taken by the athlete within the previous 7 days. At the end of the sample collection session the athlete and the DCO sign the appropriate documentation to indicate the session was conducted to the satisfaction of both parties.

Transfer of the sample to the laboratory

When the sample and accompanying documents are taken from the Doping Control Station, each transfer of custody from one person to another should be documented, up until the sample arrives at its intended destination (Chain of Custody).

Laboratory testing

For urine, the 'A' sample is subjected to laboratory analysis, using a range of procedures. The analytical tests employed will be appropriate to the prohibited substances that apply to the athlete's sport and whether the testing is conducted 'in-competition' or 'out-of-competition'. Gas chromatography and liquid chromatography are techniques used to separate drugs and their metabolites within the sample. This is coupled with mass spectrometry to determine the structure of any drugs or metabolites identified. Affinity binding assays (immunoassays) are also used routinely to detect macromolecules in urine samples.

Blood testing is used to detect the manipulation of blood through transfusion, to identify biomarkers for human growth hormone and to quantify endogenous blood parameters (haemoglobin, haematocrit and reticulocytes).

Testing of athletes can be conducted at any time, in any place with no prior notice

Regular and frequent monitoring of athletes' blood parameters facilitates indirect detection of doping substances and methods on a longitudinal basis. These parameters are recorded on Athlete Biological Passports (ABP)⁶.

Through the use of ABPs, athletes become their own reference source in contrast to the traditional approach of athletes' variables being measured against norms in the athlete population at large⁷.

Reporting results

The results of laboratory analyses are reported to the appropriate Anti-Doping Organisation, which is normally the sport governing body or the competition event organiser. If the analysis did not detect a prohibited substance or method, the athlete is informed and results are routinely recorded on ADAMS. Some organisations, such as the IOC, retain samples for up to 8 years in order to undertake retrospective analysis.

For samples showing an ADRV, the Anti-Doping Organisation notifies the athlete of:

1. the adverse analytical finding,
2. the anti-doping rule violated, and
3. the athlete's right to request the analysis of the 'B' sample with the opportunity

for the athlete and/or the athlete's representative to attend the 'B' sample opening and analysis.

SANCTIONS

Sanctions for ADRV involve disqualification and ineligibility, according to the nature of the violation. If an ADRV occurs in connection with a competitive event, this may lead to disqualification of the athlete's individual results obtained in that event, including forfeiture of all medals, points and prizes.

Whether in- or out-of-competition, the athlete would also normally serve a period of ineligibility to compete, as determined by their sport governing body. For a first violation, this would routinely be a 2-year period. However, the period of ineligibility may vary. This could depend upon the ADRV(s) and whether any other circumstances pertained. A reduced period may be applied in the case of Specified Substances, which are prohibited substances susceptible to unintentional use, provided the athlete can establish that the use was not intended to enhance performance. On the other hand, the athlete may be given a longer period of ineligibility if the case involves 'Aggravating Circumstance', such

as the use of multiple prohibited substances and/or obstructing the adjudication process.

DRUG TESTING AT THE LONDON 2012 GAMES

The anti-doping programme for London 2012 was conducted by the IOC and International Paralympic Committee in collaboration with the London Organising Committee for the Olympic and Paralympic Games (LOCOG) and United Kingdom Anti-Doping. This was the first time that the IOC worked directly alongside a local National Anti-Doping Organisation.

This brief overview of the testing at London 2012 uses information published in the WADA Independent Observer reports for the Olympic and Paralympic Games^{8,9}. The review highlights innovative procedures that were introduced for London 2012.

Laboratory facilities

The testing services were conducted at a state-of-the-art satellite laboratory. This testing facility was established by the London WADA-accredited Drug Control Centre, with the support of GlaxoSmithKline. This was the first time that a major pharmaceutical company had acted in partnership with a local organising committee.

The laboratory was staffed by 150 anti-doping scientists, recruited from around the world. The facility became fully functional in April 2012 and successfully participated in multiple rounds of WADA quality assessment prior to the Games.

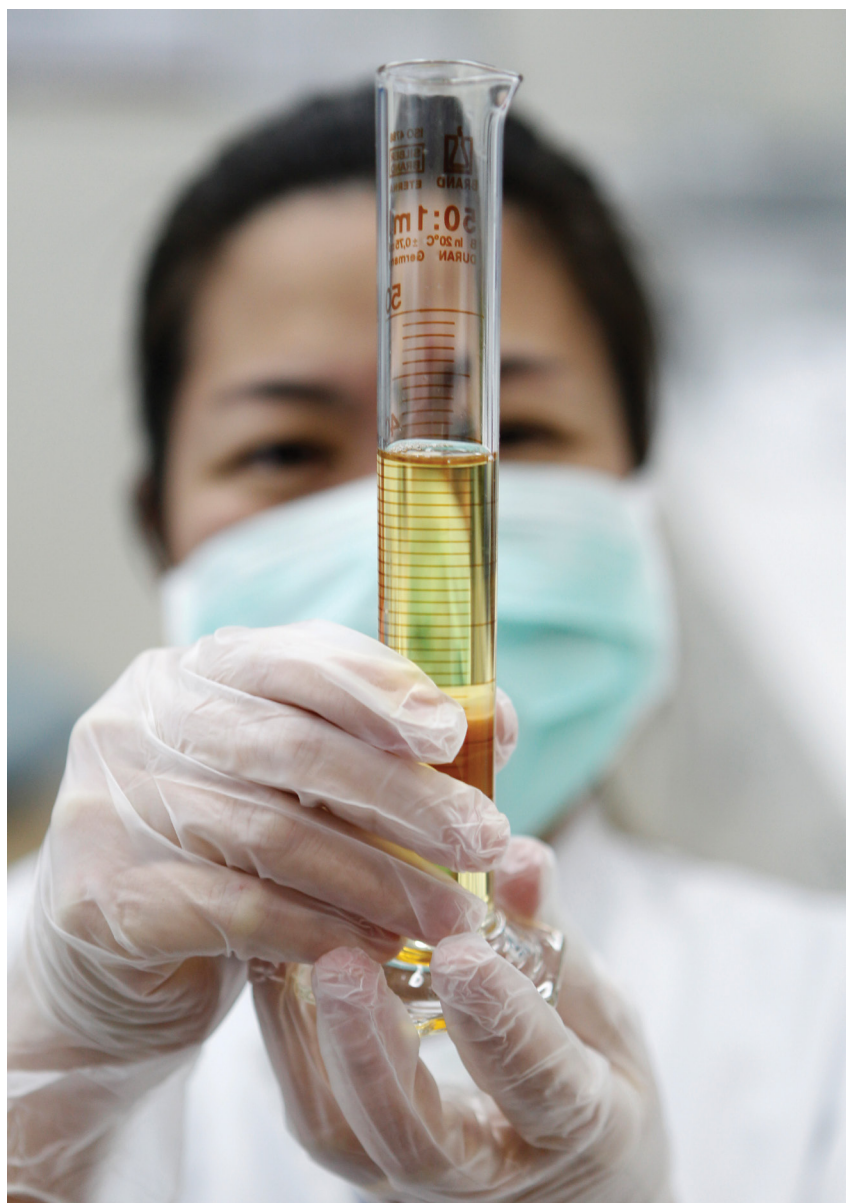
Athlete selection and sample collection

LOCOG recruited DCO from more than 50 countries. In addition to their extensive experience in doping control, these DCO added significant value to this global event through their respective language skills.

The period of testing for the Games extended from the opening of the Athlete Villages on 16 July until the Paralympic Closing ceremony on 9 September. Athletes were subject to testing not only in the athlete villages and other Games-time accommodation but also at all competition venues, holding camps and training venues. A number of new initiatives for athlete selection at an Olympic Games were introduced at London 2012.

FOR IN-COMPETITION TESTING	FOR OUT-OF-COMPETITION TESTING
<i>Participation in a victory ceremony</i>	<i>Locating a representative</i>
<i>Fulfilment of media commitments</i>	<i>Completing a training session</i>
<i>Competing in further competitions</i>	<i>Receiving necessary medical treatment</i>
<i>Performing a warm down</i>	<i>Obtaining photo identification</i>
<i>Obtaining necessary medical treatment</i>	<i>Any other exceptional circumstances which can be justified, and which shall be documented</i>
<i>Locating a representative and/or interpreter</i>	
<i>Obtaining photo identification</i>	
<i>Any other exceptional circumstances which may be justified, and which shall be documented</i>	

Table 3: Valid reasons to allow a delay in reporting to a Doping Control Station.



Targeted pre-competition testing ('Intelligent Testing')

The IOC, LOCOG and United Kingdom Anti-Doping conducted a comprehensive review of information and intelligence in order to identify athletes to be tested during the Games, particularly in the pre-competition period. Procedures included the identification of these athletes at highest risk for doping based on their Biological Passport profiles (see below), suspicious whereabouts patterns and those athletes who may have been subject to less robust anti-doping programmes prior to their arrival at the London 2012 Games.

As a result, 20% of the tests carried out during the Games were undertaken in the pre-competition period between 16 July and the start of Olympic competition on 27 July. The Olympic Independent Observers

reported that eight Adverse Analytical Findings (AAFs) were recorded for the London Olympic Games; two as a result of in-competition testing and six emanating from pre-competition control tests. The Paralympic Independent Observers noted six AAFs, of which two were covered by TUEs.

The WADA Olympic Independent Observers recommended that, for future Games, it may be worth the IOC considering fewer random post-competition tests in favour of more Targeted Testing after events.

Athlete Biological Passport programme

At London 2012, the IOC used the WADA Athlete Biological Passport programme⁸. Within this programme, some IFs maintain the records of periodic blood tests on the athletes within their jurisdiction. This

way, the results of blood tests authorised by the IOC, during both the pre- and post-competition periods, could be reviewed within the broader context of the athlete's existing blood profile.

Sample analysis

For the Olympic Games, 5,132 tests were conducted across 132 nationalities. This comprised 30% of all participating athletes at the Olympic Games. In addition to the standard techniques used for urine sample analysis, extensive testing was carried out on blood samples (15% during the Paralympic Games). A newer blood test that was introduced for the first time at these Games was the human growth hormone (hGH) Biomarker Test. This test detects increases in the biomarkers for hGH which are insulin-like growth factor 1 (IGF-1) and procollagen-3 n-terminal peptide (P3NP)^{10,11}. Unlike previous tests for hGH which could only detect the use of the hormone for a very short period of time, the Biomarker Test can detect hGH use for at least 1 week after it has been taken.

Two athletes at the London 2012 Paralympic Games tested positive for hGH and were excluded from the Games, marking a successful introduction at a major event for the new hGH Biomarker Test.

With regard to the testing procedures at the London 2012 Olympic and Paralympic Games, the reports from the WADA teams of Independent Observers were generally very positive^{8,9}. The lessons learnt from the London 2012 testing programme will serve to further enhance the international control of doping in sport.

SUMMARY

Although the World Anti-Doping Code defines eight methods by which an Anti-Doping Rule Violation (ADRV) can lead to a sanction, the analytical testing of urine or blood samples remains the principal method to determine an ADRV. The WADA International Standards for testing are clearly defined. A number of new initiatives relating to the international strategy against doping in sport have been introduced in recent years. These have included:

- Closer working relationships between Anti-Doping Organisations, national and international law enforcement agencies and other organisations to develop Intelligent Testing.



- A greater use of Targeted Testing of athletes through Whereabouts Filing and Athlete Biological Passports.
- The development of new analytical methods such as the human growth hormone Biomarker Test.
- A more rational approach to sanctioning for Anti-Doping Rule Violations based on the circumstances surrounding the violation.

WHERE DO WE GO FROM HERE?

The strategies relating to anti-doping that have been reviewed in this article will undoubtedly be discussed fully at the 4th World Conference on Doping in Sport, to be held in Johannesburg, South Africa on 13 to 15 November 2013.

In the meantime, WADA has set up a consultation process to aid the development of the latest version of the World Anti-Doping Code. You can monitor this process and contribute to the consultation through the following link: <http://www.wada-ama.org/en/World-Anti-Doping-Program/Sports-and-Anti-Doping-Organizations/The-Code/Code-Review/Consultation-Process/>.

The participation of committed, well-informed healthcare professionals is a vital component in the continuing fight against doping in sport.

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