PROJECT REVIEW

"AR.I.E.T.T.A .ARtificial Intelligence Evoking Target Testing in Antidoping"

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Different substances and methods can be used to increase the oxygen carrying capacity of blood, thereby improving an athlete's ability to perform. Doping control procedures are expensive and the problem always exists of who we should test, by what criteria and when.

Research groups have been developing criteria to detect these substances and methods (blood doping, human recombinant erythropoietin, oxygen carriers, the off/on model) International federations, including Biathlon, currently choose athletes based on random selection, standings, high hemoglobin and/or hematocrit and/or reticulocyte counts, off model scores, etc. There is currently no accurate integrated way to combine all variables (individual performance change and laboratory values), to estimate which athletes should be selected at the optimal time for anti-doping tests.

This project aims to develop an intelligent system which is able to identify those athletes whose haematological and multiple variables reflect a pattern consistent with the use of banned substances or methods. These athletes could then be chosen at the optimal time for target testing. The focus of this project is the creation of a software program that will consider haematological values abnormal not only on the basis of high values, but also on the basis of raw data considered concurrently (haematological data in relation to the reference population, intraindividual haematological variations including abnormal low data, performance variations, ranking, nation). This system will produce classes of results associated to a diagnostic probability, useful for targeted selection for both in and out of competition controls.

The system aims to be fast (analysing multiple data simultaneously), unpredictable and self-learning (the new information will be automatically included to improve the knowledge). The project aims to provide a strong deterrent against doping, reducing the risk of evasion by manipulation, and to be cost-effective, ensuring that anti-doping budgets are spent in an evidence based fashion.

Artificial Intelligence Evoking Target Testing in Antidoping (A.R.I.E.T.T.A.)

Results and Conclusions

Different substances and methods can increase the oxygen carrying capacity of blood and the athlete's performance. Validated detection methods for these ergogenic aids are available but doping control procedures are expensive and the screening phase performed by International Federations remains a critical issue. The wrong selection of both athletes to be tested and samples to be analyzed in a laboratory can be a factor responsible of high costs and unsatisfactory results. This project AR.IE.T.T.A. aimed to develop an intelligent system, able to show athletes' profile in order to detect those reflecting an abnormal pattern, consistent with the use of banned substances or methods.

An intelligent system, with different sections and functions has been developed and tested after the input of haematological and performance data of athletes belonging to the International Biathlon Union, who gave their written informed consent to the study.

The AR.I.E.T.T.A. software includes:

- **Log-in section**
- **Data-Entry section: data are inserted, stored** and separated by sports, disciplines, subgroups or by competitions/events;
- **Analysis section:** data can be analysed, validated scores calculated, parameters shown also simultaneously as statistics, table/graphs, individual or population profiles (team, nations, etc);
- **Screening section: an immediate evaluation of the risk profile can be obtained. A risk score for the present sample can be calculated on the basis of different data considered concurrently (haematological and in future performance data, absolute values and inter-intra-individual variations, etc). An analysis of the athlete's risk can also be performed by evaluation of all the sample risk scores calculated for the athlete under study.**

The experience derived by the routine application for a stable target testing program and future studies aiming to evaluate and increase the sensitivity of the diagnostic phase e.g. by inclusion of parameters not altered by haemodilution, will represent a further improvement of the system.

AR.I.E.T.T.A. is an efficient database that enables a quick evaluation and interpretation of blood results. It could favour surveillance programs and timely controls on athletes by the International Federations collecting blood samples for targeted testing purposes.