

## Prevalence of Detection of Prohibited Drugs on Doping Tests of Pre- and Post-races in Korea (2002-2013)

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**Abstract :** There was no study on the prevalence of doping control of racehorses in Korea. The purpose of this study was to determine prohibited substances in horse races of a drugs testing program. Blood samples were taken from those 298,543 starters prior to racing and the that finished top 3 runners of each race and horses designated by the stewards shall be taken for collection of 91,482 urine samples for the purpose of post-race doping test in Seoul, Busan and Jeju Race Park between 2002 and 2013. Detection and measurement of prohibited substances were carried out by ELISA, GC/MS and LC/MS using standard methods at the Doping Control Center, Korea Racing Authority. Total 0.0030% of pre-races and total 0.0186% of post-races tested positive for prohibited substances. In pre- and post-race, caffeine and ketoprofen were the most detected prohibited substance respectively. We thought that characteristics of pharmacokinetics and pharmacodynamics of drugs resulted in different between plasma and urine. These substances have also been detected with other prohibited drugs suggesting that unintentional feeding or bedding may be the reason and groomers' confusion of candidate horses based by the stewards' research.

**Key words :** doping test, Korea, ponies, prohibited drugs, Thoroughbred horses.

### Introduction

The use of drugs in competing horses is regulated worldwide (4). Drugs likely to be encountered in competitive horses have been classified by the Racing Drug Testing and Quality Assurance Program. Drug testing laboratories are in charged with the task of identifying the presence of foreign substance in the urine of competing horses. The prevalence of a particular drug or drug class in racehorse urine samples varies among and within racing jurisdictions over time (4).

Until now, there are no recorded data concerning the use of prohibited substances in domestic racehorses. The purpose of this study was to determine the prevalence of positive tests for prohibited substances in horse races of a drugs testing program in Korea.

Blood samples were taken from those 298,543 starters prior to racings and the that finished top 3 runners of each race and horses designated by the stewards shall be taken for collection of 91,482 urine samples for the purpose of post-race doping test at in Seoul, Busan and Jeju Race Park between 2002 and 2013. Detection and measurement of prohibited substances were carried out by ELISA, Gas Chromatography Mass Spectrometry and Liquid Chromatography Mass Spectrometry using standard methods at the doping control center, Korea Racing Authority (KRA).

During the 12 years, 3 prohibited drugs such as caffeine,

flunixin and phenylbutazone were detected in pre-race (Table 1). Whereas caffeine, dipyrone, flunixin, ketoprofen, testosterone and boldenone were detected in post-race (Table 2). Total 0.0030% of pre-races and total 0.0186% of post-races tested positive for prohibited substances. In pre- and post-race, caffeine and ketoprofen were the most detected prohibited substance respectively.

In another study, almost 83% of horses tested positive for prohibited substances once in the first year, 15% tested positive twice and 2% tested positive 3 times. Morphine was the most used prohibited substance and was detected 42 times during the survey, followed by caffeine and phenylbutazone (9).

Caffeine is prohibited as a doping agent in human sport and horseracing (8). It markedly enhanced the running performance of horses (11). Among the reasons that caffeine can be a forensic problem is its ease of detection, its long plasma half-life, and its tendency to metabolize into other easily detectable drugs such as theobromine (11). In this study, caffeine was the most detected prohibited substance in plasma due to long plasma half-life.

Flunixin is a potent analgesic commonly used to control severe intestinal pain or colic in the horse (1). Perhaps the most commonly used drug for the control of visceral pain are the non-steroidal anti-inflammatory drugs (NSAID), such as dipyrone and Banamine<sup>®</sup>. Dipyrone is chemically closely related to aminopyrine and has been a very popular treatment for colic in horses. It is claimed to be an analgesic, antipyretic and antispasmodic and to be particularly useful in the treatment of equine colics (11).

Ketoprofen is a propionic acid derivative that, exists as two

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**Table 1.** Prohibited drugs on doping test of pre-races in Korea (2002-2013)

Drugs	Seoul	Busan	Jeju	Total
Starters	139,335	68,419	90,789	298,543
Caffeine	2	3	1	6
Dipyron	0	0	0	0
Flunixin	1	0	0	1
Ketoprofen	0	0	0	0
Phenylbutazone	0	1	1	2
Testosterone	0	0	0	0
Boldenone	0	0	0	0

**Table 2.** Prohibited drugs on doping test of post-races in Korea (2002-2013)

Drugs	Seoul	Busan	Jeju	Total
Samples	40,854	20,338	30,290	91,482
Caffeine	0	2	0	2
Dipyron	2	0	0	2
Flunixin	2	0	0	2
Ketoprofen	5	0	4	9
Phenylbutazone	0	0	0	0
Testosterone	0	1	0	1
Boldenone	1	0	0	1

enantiomers. It, like most NSAIDs, has a short plasma half-life of approximately 1-1.5 h (7). So, in this study, ketoprofen was the most detected prohibited substance in urine.

Phenylbutazone is the most popular NSAID used in the horse. It has a prolonged duration of action with a long half-life (3-8 h), which may be related to its ability to penetrate inflamed tissue. Excretion of phenylbutazone into the urine can vary depending on the pH of the urine (6,12).

In the horse, the androgens, of which testosterone is the primary example, produce both the increase in bone and muscle mass. Boldenone produce enhanced appetite, increased muscle mass and, to some extent, masculinization. International Federation for Equestrian Sports (FEI) has a basically drug free policy. This is a prohibited substance (5).

Most racing jurisdictions do not permit the presence of drugs, even if prescribed for the treatment of injury or disease, in horses during competition (3). Occasionally, unintentional feeding of animal feed containing drug may cause drug to appear in the urine samples taken at racehorses (10).

The doping control is positively necessary for fairness racing. In that way KRA would strengthen the fairness. How-

ever, 26 cases in 12 years were relatively very rare. In this study, 0.0030% of pre-races and total 0.0186% of post-races tested positive for prohibited substances. We thought that clearance or characteristics of pharmacokinetics and pharmacodynamics of drugs resulted in difference between plasma and urine. The cause of detection of prohibited drugs was unknown. However, these substances have also been detected with other prohibited drugs suggesting that unintentional feeding or bedding may be the reason such as Brazil's case and groomers' confusing of candidate horses.

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## 국내 경주마 도핑검사에서 금지약물 검출빈도 및 종류(2002-2013)

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**요 약** : 국내경주마에서 검출되는 금지약물의 종류와 빈도는 보고된 바 없다. 본 연구의 목적은 국내 경마장에서 검출되는 금지약물의 종류와 검출빈도를 알아 보고자 2002년부터 2013년까지 국내 3개의 경마장에서 298,543 마리의 경주 전 경주마에서 채혈하였고, 경주 후에 3위 이내의 경주마와 재결지정마 91,482 마리에서 채뇨하여 효소면역분석법, 가스 크로마토그래프 질량분석계 그리고 액체 크로마토그래프 질량분석계를 이용하여 한국마사회 도핑검사소에서 검사하였다. 기간 중 경주전후 도핑 양성률은 각각 0.0030%, 0.0186%였으며, 경주 전에는 caffeine 그리고 경주 후에는 ketoprofen이 가장 많이 검출되었다. 약물의 약물동력적 및 약력학적 특성 때문에 혈액과 뇨의 결과가 달랐다고 생각된다. 그리고 재결위원의 조사결과, 금지약물검출은 오염된 사료 또는 깔짚에서 말에게 옮겨졌거나 출주예정마에 대한 말관리사의 혼란에서 비롯되었다.

**주요어** : 경주마, 금지약물, 대한민국, 도핑검사, 포니