Efficacy of testing for illegal medication in horses

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SUMMARY

The efficacy of testing for illegal drugs in race horses was surveyed by evaluating 27 questionnaires received from 28 racing jurisdictions polled. Large variations in the number of samples tested and drugs detected were reported. Some jurisdictions reported only illegal medications, whereas others also reported permitted medications. To facilitate comparison, stimulants, depressants, local anesthetics, narcotic analgesics, and tranquilizers were classified as hard drugs. Other drugs, which are legal in some jurisdictions, were classified as soft. To evaluate the efficacy of testing, positive test results were compared for hard drugs only.

Positive test results varied from zero in some jurisdictions for some years to 14.8/1,000 samples tested for one small jurisdiction in one year. The mean rates over the years 1975 to 1983 varied from 0.2 to 6.5/1,000, with a modal positive test result of about 1/1,000. Beside the fact that prerace blood testing is less effective than is postrace urine testing, no cause for these variations in the positive test results could be identified.

The positive test results also were compared for jurisdictions with differing medication rules for phenylbutazone (PBZ). Jurisdictions that did not allow PBZ had a mean positive test result for hard drugs of about 1.3 ± 0.9/1,000 samples tested. Jurisdictions that allowed more liberal use of PBZ had a mean positive test result for hard drugs of about 1.3 ± 1.0/1,000 samples tested. Seemingly, the presence of PBZ in equine forensic samples did not reduce the ability of forensic laboratories to detect the use of hard or illegal drugs.

ALL 28 RACING JURISDICTIONS in North America with pari-mutuel betting test for illegal medications in the blood or urine of horses after a race or, in some cases, before and after a race.[1] Such drug testing programs have been in place for about 50 years in North America and for longer in some European jurisdictions.

When an analyst identifies an illegal drug in a forensic sample and reports it to the racing authority, it is considered a positive test. As such, a positive test is an administrative event, and there are no accepted chemical criteria for a positive test. However, positive tests may result in disciplinary action and penalties, so they usually are based on good analytic data and constitute good evidence for the presence of an illegal drug in the sample in question.[1]

Although analysts and analytic equipment vary, the ≥20 laboratories that test blood and urine samples from horses use the same basic techniques. Similarly, many of the horses and horsemen are the same, moving from jurisdiction to jurisdiction as the racing season changes. Therefore, the positive test results in each racing jurisdiction should be similar.

Among the factors that vary from jurisdiction to jurisdiction are medication rules, the analysts, the quality of their equipment, and the authorities' policies on medication. A major perceived difference among various jurisdictions has been their policies on the use of medications such as phenylbutazone (PBZ). For example, some states permit relatively free use of PBZ, whereas others are more restrictive.[1,2] This has been controversial, partly because it has been suggested that the use of PBZ in racing horses will mask or interfere with the detection of illegal medications.[3,a] To examine this possibility, we compared the positive test results for jurisdictions that permitted the use of PBZ with those that did not. Thus, if use of PBZ was associated with a reduced positive test rate for illegal drugs in racing horses, then PBZ did mask or interfere with the detection of illegal medications.[4]

Materials and Methods

In the fall of 1982, letters were sent to all racing jurisdictions in North America requesting information on their medication rules, a list of positive test results each year for the last 5 years, and the total number of urine samples tested each year. Of 28 racing jurisdictions polled, 27 responded with all or partial data (Table 1).

To allow accurate and fair comparison of positive test results between jurisdictions, only drugs considered illegal in all jurisdictions were compared. These drugs are the stimulants, depressants, local anesthetics, tranquilizers, and narcotic analgesics. All jurisdictions ban the use of these drugs at any detectable amount. We designated drugs

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[a]Takade DY, Vasilikos DC. Evaluation of the scientific literature concerning the effect of administration of furosemide and phenylbutazone on screening tests for drugs affecting the performance of horses. Midwest Research Institute, Project #7551-C, 1982

TABLE 1—Hard-drug positive test results (mean yearly values) reported in North America

Jurisdiction	Urine samples (X)	Medications reported (X)	Soft drugs* (X)	Hard drugs† (X)	Hard drugs†/1,000 ± SD (X)	Range (hard drugs†)	Years	PBZ rule
Arizona	3,300.0	6.0‡	4.0‡	2.0	0.6 ± 0.4	0.3 to 1.2	1978 to 1982	Changed to 2 µg/ml, May 1981
Arkansas	652.4	3.0	1.4	1.6	2.5 ± 2.7	0.0 to 6.6	1977 to 1981	No PBZ permitted
California	19,903.3	24,320.1	24,311.4	8.7	0.4 ± 0.1	0.3 to 0.7	1975 to 1981	PBZ permitted
Canada	77,792.0	134.6‡	88.2‡	46.4	0.6 ± 0.2	0.4 to 1.0	1978 to 1982	PBZ permitted
Colorado	3,447.5	5.0‡	0.5‡	4.5	1.3 ± 0.5	0.5 to 1.8	1976 to 1981	PBZ permitted
Delaware	696.2	2.6‡	0.0‡	2.0	4.4 ± 5.2	0.0 to 13.2	1978 to 1982	No PBZ in 1981, 1982
Florida	11,172.1	45.9‡	36.1‡	9.7	0.8 ± 1.1	0.1 to 3.2	1977 to 1983	Rule changed over period
Idaho	1,465.7	8.7	6.3	2.3	1.6 ± 2.6	0.0 to 4.5	1979 to 1981	No PBZ permitted
Illinois	14,625.0	32.2	8.2	24.0	1.6 ± 1.1	0.3 to 2.7	1980 to 1983	NA
Kentucky	8,922.1	4,746.7	4,721.0	25.7	2.9 ± 1.7	0.6 to 5.8	1976 to 1982	PBZ permitted
Louisiana	7,105.5	48.2‡	28.0‡	20.2	2.8 ± 1.8	1.1 to 4.9	1979 to 1982	PBZ permitted
Maine	2,110.9	7.0	3.5	3.5	1.7 NA	NA	1975 to 1982	NA
Maryland	11,601.3	24.7‡	11.3‡	13.3	1.1 ± 0.9	0.3 to 2.7	1978 to 1983	No PBZ after 1980
Massachusetts	6,245.8	14.4‡	3.1‡	11.3	1.9 ± 1.5	0.7 to 5.5	1976 to 1983	PBZ permitted
Michigan	9,070.8	32.2‡	26.8‡	6.5	0.6 ± 0.3	0.2 to 1.0	1977,78,80,82	PBZ permitted
Montana	1,098.0	3.7	2.0	1.7	1.5 ± 1.9	0.0 to 4.8	1976 to 1981	NA
Nebraska	2,938.0	2,746.2	2,743.4	2.8	1.0 ± 0.7	0.0 to 1.9	1978 to 1982	PBZ permitted
New Jersey	19,409.8	43.0	38.4	4.6	0.2 ± 0.1	0.1 to 0.4	1978 to 1982	No PBZ permitted
New York§	224,024.3	167.7	106.0	58.7	0.3 ± 0.1	0.4 to 1.0	1981 to 1983	Trace (about 2 µg/ml in plasma)
Ohio	15,564.4	30.8‡	14.9‡	15.9	1.0 ± 1.0	0.0 to 2.5	1975 to 1983	PBZ permitted
Pennsylvania	20,679.7	282.3	237.7	44.7	2.2 ± 0.4	1.8 to 2.5	1979 to 1981	Rule changed frequently
Puerto Rico	2,121.8	7.4	4.6	2.8	1.4 ± 0.3	1.0 to 1.9	1978 to 1982	No PBZ permitted
Rhode Island	1,845.4	13.6	12.0	1.6	0.9 ± 0.7	0.0 to 1.6	1974 to 1978	Rule changed over period
South Dakota	413.2	2.7	0.0	2.7	6.5 ± 6.8	0.0 to 14.8	1976 to 1981	NA
Washington	3,412.4	14.6‡	13.4‡	1.2	0.4 ± 0.3	0.0 to 0.9	1977 to 1981	PBZ permitted
West Virginia	7,647.9	25.4‡	14.6‡	10.9	1.5 ± 1.3	0.3 to 3.4	1976,78 to 1983	PBZ permitted
Wyoming	124.0	0.3‡	0.2‡	0.2	1.6 ± 2.4	0.0 to 6.0	1976 to 1981	PBZ permitted

*Nonsteroidal anti-inflammatory drugs, diuretics, antibiotics, and steroids. †Stimulants, depressants, narcotics, tranquilizers, and local anesthetics. ‡Does not include PBZ in controlled medication program. §Pre- and postrace blood and urine samples.
NA = not available.

that were illegal in all jurisdictions as hard drugs; medications prohibited by some jurisdictions but not by others were called soft drugs.

For each jurisdiction, for each year reported, a positive test result of hard drugs/1,000 analyzed urine samples was calculated, and a mean of the rates over the years reported was generated. The data provided included samples from the horses of all pari-mutuel racing tracks, including Thoroughbreds, Standardbreds, and Quarter Horses.

A preliminary analysis of these data and a request for a review of our analysis were sent to each participating jurisdiction. Michigan and Canada responded to this request. There were only minor differences between our analysis of the data and theirs, and we have published their analysis of their own data. Authorities from both jurisdictions expressed reservations about our approach to this problem.

The only effective way to evaluate the data on PBZ was to classify the jurisdictions as (1) no PBZ jurisdictions, (2) trace of PBZ jurisdictions, and (3) jurisdictions that permitted amounts of PBZ consistent with a 24-hour medication rule. Therefore, we reviewed the medication rule information available for each jurisdiction and grouped them (Table 2).

TABLE 2—Positive test results for hard drugs in jurisdictions that allow differing amounts of phenylbutazone (PBZ)

Jurisdiction	Positive test (X̄/1,000)	No. of samples tested/yr
No PBZ		
Canada	0.6	77,792
Arkansas	2.5	652
Idaho	1.6	1,465
New Jersey	0.2	19,409
Puerto Rico	1.4	2,122
Mean	1.3 ± 0.9	...
Total	...	101,440
Trace or ~2 µg/ml in plasma or NASRC guidelines		
New York*	0.25	224,024
24-Hour PBZ rule or higher amount		
California	0.4	19,903
Louisiana	2.8	7,105
Kentucky	2.9	8,922
Washington	0.4	3,412
Massachusetts	1.9	6,246
Colorado	1.3	3,477
Michigan	0.6	9,070
Nebraska	1.0	2,938
Ohio†	0.5	28,630
Mean	1.3 ± 1.0	...
Total	...	89,703

*Includes prerace testing samples, and the corrected positive test results refer only to 1981 to 1983. †1975 to 1980 only.
NASRC = National Association of State Racing Commissions.

Results and Discussion

The jurisdictions involved ranged from no-medication jurisdictions, such as Canada, through states following or approximating National Association of State Racing Commissions (NASRC) guidelines,[1] to those with more liberal medication policies, such as California and Kentucky. The number of samples tested per jurisdiction per year ranged from about 225,000/year in New York to about 125/year in Wyoming. The total number of medications reported by the jurisdictions varied from about 24,000/year in California to about 0.3/year in Wyoming.

The numbers of tests performed, drugs detected, and hard drugs called positive varied widely between jurisdictions. On an absolute and relative basis, California reported the greatest number of medications in postrace blood and urine samples. The next highest number was reported by Kentucky, followed by Nebraska and Pennsylvania. New York, although performing about 50% of the total number of tests, reported only about 165 medications/year, with an estimated ⅓ of these being hard or illegal drugs.

Of the positive test results for North American jurisdictions, the lowest were for New Jersey and New York, with rates of about 0.2/1,000 (Fig 1). The modal positive test result was between 0.5 to

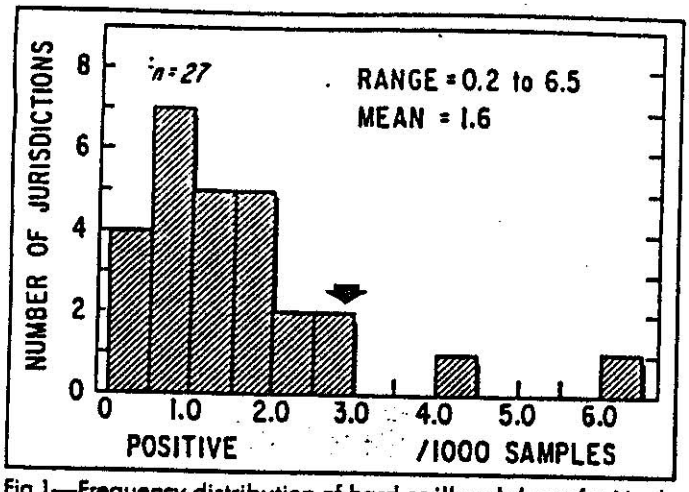

Fig 1—Frequency distribution of hard or illegal drugs for North American jurisdictions. n = No. of jurisdictions. (Arrow = ?)

1.0/1,000, after which the number of positive test results declined. Only 2 jurisdictions had positive test results above 3.0/1,000. The highest North American positive test result (6/1,000) was that of South Dakota, largely because of 10 positive tests for butorphanol in 1979.

Racing medication statistics from Great Britain and other overseas jurisdictions were compiled from samples tested by Britain's Racecourse Security Services Laboratory at Newmarket, United Kingdom (Table 3).[8] The total number of medication reports was small, and most of those reported were hard or illegal drugs. The positive test results for hard drugs varied from 0.7/1,000 in Greece to a high of 122/1,000 in Iran.

The highest positive test result for hard drugs reported for any racing jurisdiction worldwide was about 122/1,000 from Iran in 1979 and 1980.[8] If the Iranian rate reflects use of medication in a relatively uncontrolled situation, apparently, in the absence of penalties, about 12% of horses would be illegally medicated. This figure would decrease markedly with the introduction of sanctions.

Approximately a 12% positive rate in an unregulated situation, such as in Iran, is supported by Moss and Heywood.[6] When testing for medications was introduced in Trinidad, the positive test results decreased from about 19% to 0% within 3 months. Similarly, when screening for anabolic steroids was introduced in England, the positive test results decreased from about 12% to 0% in a period of weeks and remained at 0% for 2 years after the introduction of testing.[8] Therefore, ≥10% of horses will be medicated illegally in the absence of regulation. Introduction of testing and appropriate sanctions can reduce this amount to close or equal to 0% for individual drugs in a short period.

When examining the possibility that PBZ could interfere with the detection of hard drugs, the jurisdictions were separated into 3 groups. Canada was included as a major racing jurisdiction that has never permitted detectable amounts of PBZ or its metabolites in its postrace urine samples. In Canada, the presence of any detectable PBZ or PBZ metabolite constitutes a positive test, and veterinarians were advised not to administer PBZ within 96 hours before post time.[1] This is a stringent regulation and likely is stricter than the regulations in most American racing states. However, New Jersey, Arkansas, Idaho, and Puerto Rico have medication rules lower than the NASRC guidelines.[1] Together, these states and Canada form the principal no-medication jurisdictions. These jurisdictions have a mean positive test rate of about 1.3 ± 0.9 hard drug positive/1,000 samples tested, and they test about 100,000 samples/year.

In contrast with these strict no-medication rules, the industry standard for medication rules in the United States for the last 3 years has been the NASRC guideline.[1] Under medication rules based on these guidelines, the only permitted medication is PBZ at plasma concentrations of ≤2 μg/ml. Although this is a relatively conservative rule, it is more liberal than those in Canada, Arkansas, or Idaho. New York is a major American racing jurisdiction that approximated the NASRC standard for PBZ for the period of this survey.

Interpretation of the data from New York was made difficult because data on the actual drugs identified were only made available for 3 years. Also, it was not possible to determine the proportion of prerace blood tests, which are less likely to detect hard drugs than are postrace urine tests. However, if the ratio of hard/soft drugs for the years that data were made available was the same as that for the years of this survey, then about ⅓ of the medications detected in New York were hard or illegal drugs. This would give a positive test rate of about 0.25/1,000. However, even if all the drugs detected before 1981 in New York were hard or illegal, the positive test result for these years could not be >0.8/1,000.

Jurisdictions, permitting use of PBZ at amounts above those stipulated by the NASRC guidelines, had horses with blood or urine tolerances of PBZ higher than the guidelines. Together, these jurisdictions tested about 90,000 samples/year. The mean positive test rate in these jurisdictions was 1.3 ± 1/1,000 samples/year. The positive test rate was similar to that of the no-medication jurisdictions. These results do not

TABLE 3—Hard-drug positive test results (mean yearly values) reported outside North America[8]

Jurisdiction	Urine samples (X̄)	Medications reported (X̄)	Soft drugs*	Hard drugs (X̄)	Hard drugs†/ 1,000 ± SD (X̄)	Range (hard drugs)	Years	PBZ rule
Great Britain	5,219.8	27.8	4.4	23.4	4.6 ± 4.4	1.7 to 12.4	1977 to 1981	No PBZ permitted
Greece	833.0	3.2	2.6	0.6	0.7 ± 1.1	0.0 to 2.1	1977 to 1981	NA
Iran	106.3	32.3	19.3	13.0	122.3 ± 79.8	0.0 to 156.1	1978 to 1980	NA
Trinidad and Tobago	428.8	9.3	1.8	7.5	17.9 ± 11.0	9.8 to 34.1	1978 to 1981	NA

*Nonsteroidal, anti-inflammatory drugs, diuretics, antibiotics, and steroids. †Stimulants, depressants, narcotics, tranquilizers, and local anesthetics.
NA = not available.

indicate that use of PBZ in racing horses interferes with the efficacy of drug testing and effective control of illegal medication.

These results are supported by results of other work from our laboratory. In an analysis of the ability of PBZ and oxyphenbutazone to interfere with the detection of 55 basic drugs considered hard in North American racing since 1981, no interference with detection was observed in high-performance thin layer chromatographic screening methods.[6] Therefore, the ability of PBZ and its metabolites to interfere with the detection of these drugs was minimal. Because most of the illegal medications are basic drugs, those results agree with the present results of our survey.

In the absence of testing, or in the presence of testing without effective sanctions, the rate of illegal drug use in racing horses appears to be about ≥10% of horses starting. When an effective testing system is introduced and sanctions are applied, the occurrence of medication violations can decrease to almost 0% for individual drugs and to low percentages (0.25 to 2.5/1,000) of all samples tested. Within this range, it is not clear what factors determine the rates of illegal drug use and the positive test results. Seemingly, there is no evidence that jurisdictions that allow the use of PBZ have lower positive test rates than do those that do not. Therefore, based on a comparison of the positive test rates in North American jurisdictions, the presence of PBZ in forensic samples does not interfere significantly with the detection of hard drugs in the urine of racing horses.

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Book Review: Natural Toxicants in Feeds and Poisonous Plants

This book evolved from a course presented for several years at Oregon State University, and is concerned with plant and mycotic intoxications and their effects on animal production. This includes consideration of botanical characteristics of crop plants and range and pasture weeds, the chemical nature and metabolism of toxicants, the pathologic changes induced by specific toxicants, and an overall appreciation for the significance of toxicoses in livestock. The book is aimed at a readership that includes students in animal science, range management, and veterinary medicine; agricultural extension specialists; toxicologists; veterinarians; and livestock producers. Unlike existing textbooks, it is not oriented toward botanical aspects or with emphasis on clinical signs and pathology; instead, it classifies natural toxicants by chemical structure, eg, alkaloids, glycosides, tannins, and polyphenolics.

The book is well-written and illustrated adequately to allow easy reading. Referenced works are impressively current. Aimed at prevention of animal intoxications, this book has limited value for determining treatment of clinical cases, but it does have good descriptions of clinical signs that might be helpful in establishing a diagnosis. It contains a great amount of information on chemical structures and metabolism especially valuable to the toxicologist, but this does not detract from facts perhaps more important to the clinician or range manager. It emphasizes problems observed predominantly in the northwestern United States, while including plants found more commonly in other areas. Perhaps too much coverage for US veterinarians is given to plant intoxications in Australia, New Zealand, and Africa, but this provides interesting reading, and problems occurring there could become problems in the United States. The last chapter, written by Dr. Shull, is a timely summary of what is presently know about mycotoxins and the problems associated with their ingestion. I find this book a welcome and informative addition to the literature on natural toxicants.—[*Natural Toxicants in Feeds and Poisonous Plants. By Peter R. Cheeke and Lee R. Shull. 492 pages; illustrated. AVI Publishing Co, 250 Post Road East, PO Box 831, Westport, CT 06881. 1985. Price $69.50.*]—CARL T. OLSON