

# A review of horses sent to slaughter for human consumption: impact of horsemeat consumption, residual banned drugs, and public health risks

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## ABSTRACT

Nearly all of the American horses exported to Mexico and Canada are slaughtered for human consumption, and their meat is either exported around the world or consumed locally. Previous work showed that 18 Thoroughbred racehorses purchased by rescues that would have otherwise been sold for export for the sole purpose of slaughter to produce meat for human consumption were administered phenylbutazone. We report the number of American horses exported to Canada and Mexico from 2016 to 2021, the presence of contaminated horsemeat from Canadian slaughterhouses, and the human use and idiosyncratic effects of veterinary phenylbutazone and side effects of clenbuterol, 2 of the drugs that were found in contaminated Canadian horsemeat. The number of live American horses exported to Canada declined precipitously from 2016 to 2017, and a second decline occurred in 2020. All food-producing animals are under strict regulatory control to prevent animals administered banned drugs to enter the food chain. A major principle of this program is zero tolerance for banned drugs and testing for compliance. No regulatory process is in place to remove horses administered banned drugs such as phenylbutazone. The efficacy lasts for more than 24 hours as a result of the irreversible binding to cyclooxygenase, slow elimination, and long elimination half-life of its metabolite oxyphenbutazone. High or frequent doses of phenylbutazone result in disproportionately increased plasma concentrations, which result in the residual presence in tissues. It is this fact that underlies the ban of this drug in food-producing animals. No human clinical surveillance program is in place to monitor individuals on the possible short- and long-term consequences of banned drugs in contaminated horsemeat. If the United States is unable to put in place a regulatory program to remove horses administered banned drugs as exists for all food-producing animals, the exportation of American horses across both borders for the sole purpose of slaughter for human consumption must end.

## Introduction

### Global horsemeat market

Institutional, economic, religious, cultural, intellectual, and social forces together with escalating food insecurity appear to dictate the consumption of horsemeat. Some countries such as Norway, Iceland, and Sweden have banned horsemeat consumption. In contrast, China, Kazakhstan, the United States, and Mexico are the 4 top producers of horsemeat. Despite this fact, there are no operating horse slaughter plants in the United States. European countries are the main consumers of horsemeat. Data obtained in 2014 list Italy as the largest importer of horsemeat followed by Belgium and France with Finland importing the least amount of horsemeat whereas Belgium, Argentina, Canada, and Mexico are the top exporters of horsemeat. Belgium (1.2 kg/person/year),

Italy (1.0 kg/person/year), Netherlands (1.0 kg/person/year), and Luxembourg (0.75 kg/person/year) are the top consumers of horsemeat. Overall, about 10% of the approximately 60 million horses worldwide are slaughtered for human consumption. There was about a 2.75% increase in the number of horses slaughtered around the world in 2013 compared with 2009 although there was a 3% and 10% reduction in world exports and imports, respectively. However, the flow of horsemeat in markets varies. There was a 14% reduction and an 82% increase in European imports and exports of horsemeat, respectively, from 2009 to 2011. Still, horsemeat exports are an ~500 million US dollars per year industry.<sup>1</sup>

Regarding taste preferences, a group of subjects from Alberta, Canada were surveyed about different aspects of certain meats, including horsemeat. Words such as “cruelty,” “aversion,” “disgust,” “pet,”

“unethical,” and “entertainment” were cited by this cohort pertaining to horsemeat, whereas beef was synonymous with “barbeque” and “burger,” terms that were not used to describe horsemeat.<sup>2</sup>

## Horse slaughter in the United States

The Food and Drug Administration (FDA) considers horses as companion animals and not food-producing animals.<sup>3</sup> Economically, marketing horsemeat in the United States would likely not fare well as most Americans are opposed to horse slaughter and there are a variety of other types of meats available. Despite the elevated status of horses in the United States, multiple horse slaughter plants were scattered across the country more than a decade ago. Most went out of business but there were 3 remaining horse slaughter plants in the United States, 2 in Texas and 1 in Illinois. All 3 plants were foreign owned and all of the horsemeat was sent overseas for human consumption. A Congressional amendment removed funding for inspections of live horses at these plants in 2006. In 2007, the 3 remaining horse slaughter plants were shut down permanently as a result of existing changes to state laws. From 1989 to the time all horse slaughter plants closed, the number of horses slaughtered for food in the United States declined from approximately 350,000 in 1989 to less than 50,000 in 2007.<sup>4</sup> A major goal of the present review is the examination of what has recently changed in the United States regarding the export of live horses destined for slaughter.

## Methods

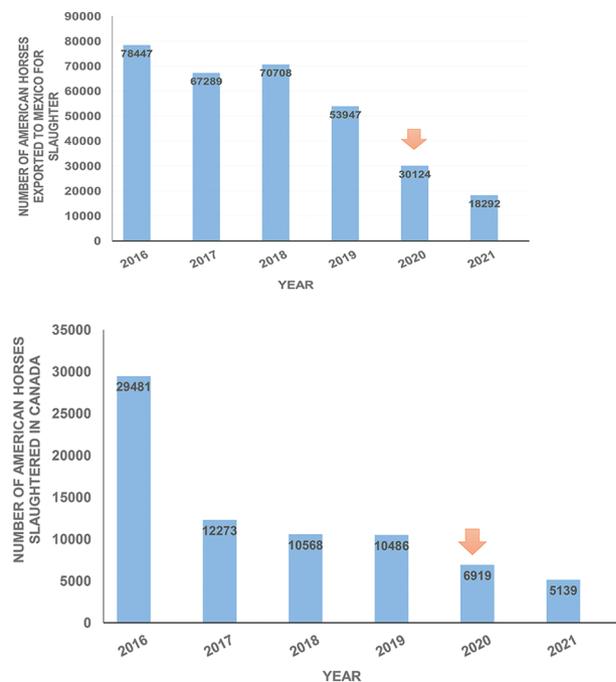
This work was performed using the guidelines of PRISMA.<sup>5</sup> The number of horses exported to Canada for human consumption is located at the website,<sup>6</sup> and by sending a message one can be added to the distribution list at: [aa.fc.redmeat-vianderouge.aac@agr.gc.ca](mailto:aa.fc.redmeat-vianderouge.aac@agr.gc.ca). The number of horses exported to Mexico for slaughter and human consumption was obtained on the website.<sup>7</sup> Searches were conducted in PubMed and Evidence-Based Medicine (EBM) reviews-Cochrane Database of Systematic Reviews. The search was limited to articles published in English. The search strategy was designed to find studies on banned veterinary drugs in food-producing animals, hematological and other adverse effects in humans of banned drugs in food-producing animals, and adverse effects of contaminated horsemeat in humans. We identified 330 papers in EBM reviews; none were relevant to this article. In PubMed, there were 8,982 citations on phenylbutazone alone as a keyword and 3 citations using phenylbutazone and horsemeat in combination. Forty-seven citations from the PubMed literature search and another 30 eligible articles found in the reference lists were used in the preparation of this study. Keywords were as follows: phenylbutazone, bone marrow suppression, oxyphenbutazone, aplastic anemia, agranulocytosis, thrombocytopenia, food-producing animals, horsemeat, idiosyncratic, human effects, teratogenic, genotoxic, clenbuterol, contamination,

adverse effects, veterinary, horses, legal drugs, illegal drugs, and banned drugs.

## Results

The United States has been exporting horses to slaughter to Canada and Mexico since 1999. Canada ships the vast majority of its horsemeat to Europe and non-European Union (EU) countries with a relatively small amount for domestic consumption. Mexico slaughters horses across the country, regards horsemeat as a poor substitute for beef, and uses horsemeat as a filler domestically.<sup>4</sup> The number of American horses exported to Canada from 2016 to 2021 is shown (Figure 1). On average, American horses represent about 50% of the horses slaughtered for food in Canada. The results show a precipitous reduction in the number of horses exported to Canada for slaughter in 2017 and another almost 50% reduction in 2020 compared with 2017. The number of American horses exported to Mexico for slaughter is shown (Figure 1). The percentage of American horses sent to Mexico for slaughter compared with the overall annual number of horses slaughtered in Mexico is not available. Here, the precipitous reduction in the number of American horses exported for slaughter occurred in 2020.

In response to the contaminated horsemeat scandal in the United Kingdom, the European Union instituted a new policy in 2017. This policy change was



**Figure 1**—The number of American horses slaughtered for human consumption by Canada and Mexico. The number of American horses exported to Canada<sup>6</sup> (A) and Mexico<sup>7</sup> (B) for slaughter for human consumption from 2016 to 2021 is represented on the x-axis and the year is represented on the y-axis. The arrow (orange) indicates the year of the Coronavirus pandemic.

due to a variety of reasons including our prior report<sup>8</sup> demonstrating that all identified rescued racehorses were administered the banned drug phenylbutazone that would otherwise have been sent to slaughter for human consumption. As a result, horses slaughtered in Canada whose meat would be shipped to the European Union must be held for 6 months in Canada before slaughter.<sup>9</sup> American horses can be imported into Canada and slaughtered for human consumption within 4 days,<sup>10</sup> and the meat can probably be shipped to some non-EU countries. As a result of research published in 2013, all Swiss, several Belgian, French, and Dutch supermarkets stopped importing horsemeat from Mexico. In 2015, the largest Swiss importer, Basler GVFI, stopped the importation, which was mainly due to animal welfare reasons. In Switzerland, horsemeat imports from overseas have fallen by around 75% over the past 9 years.<sup>11,12</sup> The new 6-month policy was most likely responsible for the precipitous drop in the number of American horses imported into Canada for slaughter for human consumption in 2017.

Later, in 2020, the COVID-19 pandemic caused urban lockdowns, closure of amenities, border restrictions, travel bans, curfews, and high levels of unemployment across the United States and elsewhere. The severe public health-dictated restrictions in mobility across the country reduced the demand for transportation services.<sup>13</sup> The transportation industry itself suffered substantial unemployment during the pandemic compared with other industries; truck tonnage decreased by about 9% between March and April of 2020.<sup>14</sup> The negative economic impact of the COVID-19 pandemic on the transportation industry ranging from lockdowns across the country to high unemployment and deaths among workers possibly contributed significantly to a further reduction in the number of horses exported to Mexico and Canada for slaughter in 2020 and 2021 (Figure 1).

### **Horsemeat, food safety, and public health risk**

Horses are prone to developing musculoskeletal injuries due to their various roles including pleasure riding, hunter/jumper, racing, and other performance-type work. The most common drug to treat musculoskeletal injuries in horses is phenylbutazone. Based on the annual sales of phenylbutazone in the United States, our group estimated that every adult horse receives at least 1 dose of phenylbutazone during its lifetime.<sup>8</sup> There are 500 pounds of dressed horsemeat per horse. The number of American horses exported to Canada for slaughter in 2019 was 10,486; this translates into 5,243,000 pounds of dressed horsemeat. Given that the US Department of Agriculture does not have a system to remove horses administered banned substances from the slaughter pipeline, more than 5,000,000 pounds of dressed horsemeat sent to the EU and non-EU countries in 2019 were likely contaminated with banned substances.

The FDA considers American horses as companion animals and as such all approved drugs can be

administered.<sup>15</sup> The “administration” of phenylbutazone or any other banned substance is not allowed in food-producing animals. Both EU and non-EU governments have published a list of banned drugs and drugs with withdrawal periods.<sup>16,17</sup>

### **The journalistic record**

Newspaper articles have been published about horses given banned drugs and slaughtered for food. In 2013, a racehorse named Backstreet Bully, a Canadian racehorse, was sent to slaughter for human consumption in Canada. At the time, the Stronach Farm (Ontario) tried to no avail to rescue this horse from the Canadian slaughter plant. The reporters obtained the medical records for the horse from the Stronach farm, the former owner of the horse. The horse had been administered phenylbutazone, nitrofurazone, and stanozolol, 3 banned drugs on the Canadian list (ie, these drugs have no withdrawal times). According to the newspaper report, nitrofurazone and phenylbutazone were administered to Backstreet Bully “dozens of times.” The *Toronto Star* also reported on the discovery of the falsified equine identification document (EID). EIDs have been required by the Canadian government since January 2010. Backstreet Bully’s owner stated he had “uninterrupted care and possession of the horse for the last six months, had been drug-free for the last six months” and “had not been given any nonpermitted substances listed on the government’s website.” In short, the horse owner owned him for about 24 hours before the horse was slaughtered. The Canadian slaughter plant refused to say whether the horse’s meat was shipped overseas for people to eat.<sup>18</sup> The European Commission had severe reservations about the validity of the EIDs. In 2012, an audit of European-run slaughter plants in Mexico discovered that officials were unable to confirm the validity of documents pertaining to American horses that were so-called drug-free where about 80% of the slaughtered horses were American. In that same year, the FDA sent a letter to a feedlot owner for horses destined for slaughter for export stating that a horse tested positive for phenylbutazone and clenbuterol.<sup>19</sup> In 2011, a report<sup>20</sup> showed that 63 EIDs were incomplete including omissions and descriptions of individual horses that did not match the horse pictures at a slaughter plant in Canada; the vast majority of the horses at the plant were American. Also, some of the EIDs had written “drug-free six months” in the same handwriting or with the same ink pen indicating that auction house workers were adding this information on the EID.<sup>20</sup> An article<sup>21</sup> published by the *Toronto Star* in 2013 also reported irregularities with EIDs at an auction where they found that signatures did not match and that auction house workers filled out some of the information on the EID rather than owners as required. This article also cited evidence of glaring inconsistencies in the EIDs of horses at the auction; however, these horses were not held and were sold for slaughter. A trail horse with falsified/misleading statements on the EID was slaughter bound. Rescuers were allowed to purchase the

horse because the horse dealer thought he could make a substantial profit by selling the horse rather than sending it to slaughter. The small amount of time afforded to this horse allowed the horse to be rescued. This horse had also been administered phenylbutazone and nitrofurazone just weeks before being sold at auction.<sup>21</sup> In another case, 2 horses were brought to auction without the permission of the owner, and the EID was falsified indicating that the horses were his and were sold for slaughter. The owner took this person to court who was convicted and ordered to pay a fine and restitution. However, it was too late for the owner's horses as they had already been slaughtered.<sup>22</sup> In 2012, a Standardbred named Silky Shark was slaughtered for human consumption in Canada. The horse had laryngeal surgery twice and had been administered phenylbutazone.<sup>23</sup> As per Canadian regulations, this horse along with Backstreet Bully, the trail horse, and all of the horses with falsified EIDs should never have been eligible for slaughter for human consumption.

Racing Quarter Horses have been the subject of doping scandals in regulated and nonregulated racetracks. It has been known for a long time that horses are administered legal and illegal drugs to enhance performance. On the legal side, phenylbutazone is a drug known to be administered just before a race at certain US tracks.<sup>24</sup> Lasix (furosemide), a diuretic, is another drug administered to horses on race day to reduce the risk of hemorrhage in the lungs.<sup>25</sup> In a recent study,<sup>26</sup> over 50,000 blood and urine samples from racing thoroughbreds and racing Quarter Horses, the number one horse sent to slaughter from the United States, were analyzed posttrace from all 4 racetracks operating in the state of Louisiana from 2016 to 2020. Results showed that phenylbutazone with or without other drugs and clenbuterol (a sympathomimetic amine bronchodilator) were the most common drugs detected in thoroughbred and Quarter Horse racehorses. While the authors stated that medication violations in racehorses in Louisiana represented 1% of the total number of samples analyzed, only posttrace racehorse blood and urine samples were analyzed for testing.<sup>26</sup> Significantly, these results correlate well with the same 2 drugs detected in contaminated horsemeat by food safety organizations.

The thoroughbred industry is replete with examples of medication violations by trainers. Last year, a trainer was fined on 3 occasions in 1 year after 2 of his horses tested positive for phenylbutazone and 1 tested positive for isoflupredone (a synthetic corticosteroid), while a second trainer was fined because a horse tested positive for methocarbamol (a skeletal muscle relaxant).<sup>27</sup> In 2019, 2 horses tested positive for phenylbutazone and the trainer was fined for the medication violations in both cases. In addition, the California Horse Racing Board found a medication cabinet unlocked containing 25 medications that were not properly labeled and an unsecured phenylbutazone paste.<sup>28</sup> While this trainer has been cited for multiple medication violations, he was not alone. The most egregious example of the illegal

use of doping came in 2020 when American horse trainers and veterinarians were indicted for the illegal administration of performance-enhancing drugs to racehorses. Twenty-seven people were charged for administering performance-enhancing drugs that were either very difficult or impossible to be detected by standard testing methods. The compounds either increased endurance, blocked pain signals, increased oxygen carriage capacity, or had anti-inflammatory properties. Seven of the defendants pleaded guilty to the charges of doping in 2021.<sup>29</sup>

Perhaps, the most illustrative example of the number of drugs administered to racehorses was exemplified by a thoroughbred racehorse named Coronado Heights. As illustrated in the *New York Times* article, Coronado Heights was administered phenylbutazone, estrone, flunixin, hyaluronic acid, Lasix, adequan, xylazine, detomidine, vitamin B1, methylprednisolone, and calcium<sup>30</sup> once or twice over a week before race day. This is just 1 example of the number and frequency of drugs administered to racehorses. Racing Quarter Horses are also administered legal and illegal drugs at tracks. At 1 non-regulated racetrack, cocaine, methamphetamine, and methylphenidate were identified in syringes around the track by the horse racing laboratory at the University of California at Davis.<sup>31</sup>

In 2020, the Association of Racing Commissioners International (ARCI) approved a multiple medication violation penalty system. In this system, classes of legal and illegal drugs are categorized using a point system that is then assigned and registered against trainers with class violations. The severity of the violation is then used to assign an appropriate penalty.<sup>32</sup> Those trainers that incur the maximum number of points, maintained by the ARCI, can be suspended from racing for 1 to 60 months.<sup>33</sup>

The Horseracing Integrity and Safety Act (HISA) was passed by Congress and signed into law at the end of 2020. The law creates one standard for thoroughbred racing throughout the United States. The Federal Trade Commission has oversight of HISA; HISA has 2 standing committees, a racetrack safety standing committee and an anti-doping and medication control standing committee. HISA started its work in July 2022.<sup>34</sup> This organization oversees important aspects of the racing industry. Unfortunately, there is no oversight over the non-regulated racetracks that span 89 tracks in 27 states across the country.

## Drug residue found in horsemeat

In 2017, oxyphenbutazone, an active metabolite with a long half-life, of the banned drug phenylbutazone, was detected in Canadian horsemeat.<sup>35</sup> The total amount of horsemeat affected was 7,333.86 kg. In 2019, the Rapid Alert System for Food and Feed (RASFF) in the European Union found phenylbutazone in Canadian horsemeat; the risk classification was determined to be "serious."<sup>36</sup> The EID stated that the horse had not been given any drugs over the past 6 months, which was apparently false. In another case, Canada recalled horsemeat because the

banned drug clenbuterol was detected at the Bouvry slaughter plant in 2019<sup>37</sup> and at the Viande Richelieu slaughter plant in 2020.<sup>38</sup> Recent information from the Canadian Food Inspection Agency (CFIA) indicates that < 1% of horse carcasses are tested for drug residues. Overall, these findings indicate that Canada's reliance on the honor system for traceability of banned drugs using the EIDs for horses sent for slaughter for human consumption is seriously flawed. Moreover, the fact that drug-tainted horsemeat has been slipping through the monitoring system in Canada and is then being picked up by either the Canadian government or the EU surveillance program clearly indicates why horses that are not raised for food must never enter the food chain. The magnitude of the issue is further complicated by the fact that Canadian residue testing represents < 1% of the total carcasses tested. Further exacerbating the health risk is the practice of trucking American racehorses in sealed trailers and slaughtering them within 4 days in Canada where the horsemeat is then exported overseas presumably to non-EU countries.<sup>10</sup> In summary, there are no assurances that hazardous and banned drugs/chemicals can be kept out of horsemeat derived from American horses.

## Discussion

The United States has been exporting live horses to slaughter across the Mexican and Canadian border since 1999. Unlike horses destined for the human food chain in other countries, American horses are not raised for food. American horses can be administered drugs that are banned in food-producing animals. The United States does not have a program in place to remove horses administered banned drugs before they are exported across the borders to slaughter for human consumption.

Food agencies around the world are tasked with keeping drug-tainted horsemeat out of the food chain in those countries that sell/serve it. Canada, the EU and non-EU countries, and Japan must realize that the absence of a drug history of the legal drugs administered to horses in addition to the illegal drugs/compounds (ie, doping administered to horses) makes them ineligible for slaughter for human consumption and puts the public at elevated risk compared with eating meat from food-producing animals where regulations and safeguards are in place to protect public health. Furthermore, the practice of using sealed trailers to transport American horses to Canada and slaughtering them within 4 days is particularly disturbing in that it appears to circumvent standard drug-monitoring practices. The health risk to consumers is further increased when the meat is then shipped to some non-EU countries without adequate safeguards, a list of banned drugs, and safety guidelines in place.

We presented online reports from the European Union that document horsemeat contaminated with phenylbutazone; oxyphenbutazone, an active metabolite of phenylbutazone; and clenbuterol (see Results). The testing level of horse carcasses by the

CFIA is not publicly available. However, contaminated Canadian horsemeat has been detected by the European Union, some of which has been determined to be serious using the best testing method,<sup>39</sup> which underscores the importance of testing for negative levels of banned drugs with zero tolerance.

The hematological side effects of phenylbutazone and oxyphenbutazone have been extensively reviewed in the literature. Chaplin<sup>40</sup> stated that oxyphenbutazone and phenylbutazone are 10 and 4 times more likely to cause potentially fatal bone marrow suppression, respectively, than Indocin, another nonsteroidal anti-inflammatory drug on the market for human use, and that these numbers may likely be an underestimate. Indeed, the recent report<sup>41</sup> of a horsewoman who developed leukopenia, thrombocytopenia, and acute kidney injury after consuming about 1 gram of veterinary phenylbutazone over 3 days underscores the fact that doses lower than those cited in the literature can induce a blood dyscrasia and that the number of cases of these disorders is incomplete. There are other examples of veterinary phenylbutazone that induced side effects in humans including blood dyscrasias.<sup>42,43</sup> Children are especially sensitive to phenylbutazone-induced bone marrow suppression.<sup>44</sup> Adding to the complexity of the phenylbutazone-induced blood dyscrasias is the half-life in humans versus horses. The reported half-life in humans is 50 to 105 hours whereas the half-life in horses is 4 to 6 hours.<sup>45</sup> As stated by Chaplin,<sup>40</sup> "There is no evidence from these data that age, dose or duration of exposure to phenylbutazone are predictive of the development of agranulocytosis," where doses ranged from 5 to 400 grams, the duration of treatment ranged from 2 weeks to 30 months, and the interval to detection of the disorder was 0.5 to 30 months. Chaplin<sup>40</sup> states that "both phenylbutazone and oxyphenbutazone, therefore, cause blood dyscrasias in an unpredictable fashion....," meaning that phenylbutazone/oxyphenbutazone-induced blood dyscrasias (aplastic anemia, agranulocytosis, thrombocytopenia, pancytopenia, leukopenia) are idiosyncratic in nature.<sup>40,46</sup> The idiosyncratic effects of phenylbutazone also occur in other types of animals.<sup>47</sup> Gamma-hydroxyphenylbutazone is also a metabolite of phenylbutazone,<sup>45</sup> and it is pharmacologically active, but its side effect profile in humans is unknown.

Many American horses that go to slaughter are older or may have been ill before slaughter adding to the level of drug residue that may be present. Multiple doses of phenylbutazone lead to the dose-dependent kinetics of the drug due to the liver being overwhelmed at relatively low levels resulting in the accumulation of the drug despite being 99% bound to albumin. Thus, the elimination half-life increases with increasing dose and age. The lipophilicity of phenylbutazone results in the accumulation of the drug in tissues with long-term repeated doses. Many horses may have received these drugs over several months or longer with chronic laminitis, and the protein level decreases in these aged horses. The drug will no longer be 99% protein bound, and there will be more free drug available to be distributed in tissues.<sup>48,49</sup>

An early report<sup>50</sup> showed that about 20% of clenbuterol was found in rat muscle after intravenous administration of 10 mg/kg and the half-life was 3 times longer in muscle compared with serum (6 h vs 2 h). The longer half-life of clenbuterol in muscle increases the risk of contaminated meat. Side effects include the following: cardiac problems, accelerated heart rate, heart, anxiety, tremors, fatigue, and even myocardial infarction if overdoses in humans. Four cases of symptoms in humans developed after eating lamb and bovine meat contaminated with clenbuterol in Portugal.<sup>51</sup> In 1998, 62 people in Italy developed cardiac rhythm abnormalities including atrial fibrillation after eating beef containing clenbuterol residue over a range of 0.8 to 7.4 mg/kg.<sup>52</sup> In 2000, 15 people developed diffuse tremors, palpitations, headache, tachypnea, hyperglycemia, and hypokalemia after ingesting meat contaminated with clenbuterol.<sup>53</sup> Taken together, clenbuterol residue in food has not resulted in fatalities in humans, but symptoms that develop after ingestion of meat containing clenbuterol residue include tremors, tachycardia, headache, muscle aches and pains, nausea, nervousness, and dizziness. Clearly, in hemodynamically vulnerable individuals, these symptoms may precipitate serious pathology.

The incidence of bone marrow depression in humans who consume horsemeat is unknown. No surveillance program has been instituted in countries that eat horsemeat derived from American horses. Despite the extensive evidence that horses are administered legal drugs not permitted in food-producing animals as well as illegal drugs, these animals continue to be slaughtered for food. Whether phenylbutazone found in certain tissues but undetectable in animal muscles has the potential to inflict harm in humans remains unknown. However, ‘knowing that phenylbutazone may act as a “weak genotoxin”..... it would be prudent to continue adopting a zero human exposure regulation for phenylbutazone.”<sup>54</sup> This statement is certainly consistent with the FDA and other food agencies tasked with ensuring that the food we eat is safe.

In a disturbing report this month, Europol and the Spanish Civil Guard discovered a fraudulent horsemeat operation in Spain that may have sold dangerous horsemeat in at least 4 countries. Thirty-five people and 6 companies are under investigation and half a ton of horsemeat was confiscated from butcher shops in Spain because of a public health risk. Shockingly, traceability information was altered including identification documents, similar to the altered EIDs identified in the Canadian horsemeat industry. Horse passports and microchips were also tampered with according to authorities.<sup>55</sup>

In summary, all horses that are administered banned substances in the United States must be removed from the slaughter pipeline as exists for all other food-producing animals. If resources do not permit strict oversight, the United States must end the transportation of American horses across both borders for slaughter for human consumption.

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