

Meat products as potential doping traps?

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Recently published news regarding the food safety in China caused some world-wide disturbance and uncertainty among top athletes and their supporting staff. According to a New York Times article, a member of the United States Olympic team discovered oversized chicken breast when visiting a supermarket in Beijing, China. More interestingly, the chicken contained considerable amounts of anabolic steroids, which were reported to be large enough to cause a failed doping test following the ingestion of the meat (Shpigel 2008).

Based on this case report it appears necessary to assess the danger posed to our (Olympic) athletes by foods and especially meat products on a more general basis. More importantly, our athletes are involved in world-wide travel during the competitive season. Therefore we must not only consider our athletes' local food choices but also the wide variety of foods and regional delicacies our athletes may be confronted with in foreign countries.

Doping risk resulting from drug administration during animal fattening

Anabolic agents and especially anabolic steroids have been used illegally – and in some countries legally – during animal feeding. Theoretically, consumption of meat originating from treated animals could result in inadvertently failing a doping test. Some evidence to this is provided by investigations by Kicman et al., who administered the anabolic steroid methenolone to chicken as fattening agent (Kicman 1994). In this study the steroid was administered intramuscularly as 3 injections (per 1 mg) within 14 days. Eight days after the third injection the chicken meat was prepared and eaten, which led to four of eight volunteers testing positive for a metabolite of methenolone for as long as 24 hours after ingestion of the meat.

Debruyckere et al. also investigated into the administration of anabolic steroids to veal and cattle during fattening: Following the ingestion of raw minced meat obtained from favoured butchers, one of the volunteers provided a urine sample containing metabolites of the anabolic

steroid clostebol (Debruyckere 1992). Since anabolic steroids are chemically stable when exposed to heat, it is likely that previous cooking of the meat would have led to similar results.

In a follow-up study, minced meat was obtained from 50 butchers all over Belgium. Again, two volunteers tested positive for nandrolone and clostebol following the ingestion of the beef (Debruyckere 1993).

As the amount of steroids injected for fattening is obviously unknown, several studies showed that even minor amounts of norandrostendione (down to 10 µg) could have caused positive doping samples. (Catlin 2000, Geyer 2004, Tseng 2005, Judkins 2006)

These results demonstrate that a positive doping sample may be a consequence of consuming contaminated meat, especially when the injection site has been processed. The risk could even increase in countries lacking efficient quality control procedures. As of today, doping analysts are not capable of differentiating between the self-administration of anabolic steroids for doping purposes and unintentional uptake of synthetic steroids from food.

Doping risk resulting from naturally occurring hormones

Besides the apparent danger when consuming meat from animals which were administered drugs, meat from animals exhibiting naturally high levels of certain steroids should also be considered a doping risk.

Due to the naturally high concentrations of nandrolone and norandrostenedione (precursor of nandrolone) occurring in meat and offal from boar (domestic and wild), this meat has been of special interest. Le Bizec et al. fed three volunteers boar meat and offal (heart, kidneys, and liver). Until 24 hours after the meal, 19-norandrosterone and 19-noretiocholanolone was detectable in urine samples from all subjects. According to doping regulations, this would

have been considered a positive finding for the administration of nandrolone or prohormones of nandrolone (Le Bizec 2000).

Ayotte considers the doping risk resulting from boar offal to be minor, since boar is usually not used in food processing (Ayotte 2006). However, in some countries, boar is regarded a delicacy and can be obtained easily in butcher's shops.

Sterk et al. detected nandrolone in liver sausages, which had been purchased from supermarkets in the Netherlands. It occurred that boar liver might have been used in the production process of these sausages, which were labelled to contain 20-40 % pork liver. Even though the detected amounts of nandrolone were considered to be minor, the authors concluded that greater intakes of liver sausage or cooked liver could lead to failing a doping test (Sterk 2002).

In order to differentiate whether the urinary nandrolone metabolites originate from a natural source or from administration of synthetic anabolic steroids, a detection method based on carbon isotope ratio mass spectrometry (IRMS) was developed at the authors' institute (Hebestreit 2006).

Conclusion

Scientific data demonstrates that ingestion of selected meat products can cause positive doping tests. From the present point of view, the risk cannot be quantified for single countries. However, if doping agents have administered in animal feeding, it appears impossible for the athlete to track the adverse analytical finding back to the consumption of contaminated meat. In contrast, the unintentional uptake of naturally occurring hormones such as in boar can be detected by advanced analytic procedures.

For proper protection from doping risks resulting from meat products, athletes, as well as their supporting staff, should consider the following advices, especially in foreign countries:

- At international events, meat products should only be obtained from officially accredited caterers (which is the case in the Olympic village)
- Preferably whole meats (such as steaks) should be eaten, athletes should refrain from minced meat
- Athletes should also refrain from eating indefinable meat dishes (such as pasta filled with meat), which could be made from cheap quality meat
- Athletes should avoid eating boar meat
- Athletes should keep away from pork offal

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