

## Doping Disaster for Finnish Ski Team: a Turning Point for Drug Testing?

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A recent doping scandal at the world cross-country skiing championships may mark a turning point in the war on illegal drug use in sport. Six Finnish skiers tested positive for hydroxy-ethyl starch (HES), a plasma volume expander and masking agent against EPO use. The athletes knew the drug was on the banned substance list, but neither they nor the doctors and coaches who assisted them knew that the World Anti-Doping Agency had developed a urine test for HES.

**KEYWORDS:** banned substance, blood doping, cross-country skiing, EPO, ergogenic, HES, hydroxy-ethyl starch

In late February, the World Nordic skiing championships in Lahti, Finland, became the latest battleground in the war on doping in sport. For once, it was the drug testers who had the bigger guns. Actually, they had a hidden gun.

In endurance sport, we are all aware that the central target of this battle has become use of erythropoietin (EPO). Hemoglobin boosting has been rampant in cross-country skiing for years, both via natural (altitude training), semi-natural (altitude houses), and illegal methods (EPO use now, blood transfusions previously). Blood testing initiated in 1997 (see [various articles](#) at this site) has had some impact, but with an upper limit of 18.5 g/dl, and still no accepted method in place to directly detect EPO administration, eradication of EPO use has remained a pipe dream.

This year, the International Ski Federation (FIS) reduced the acceptable "safe" hemoglobin limit to 17.5 mg/dl for men, thereby raising the chance of a positive test. In fact, some athletes reach this limit after altitude exposure. Some athletes, via their doctors, quickly learned that by combining EPO administration with the use of plasma volume expanders such as Dextran 70 and the newer HES (hydroxy-ethyl starch, a chemically modified form of corn starch), they could achieve performance enhancing combination of elevated total blood volume and high hemoglobin, all while holding hemoglobin below the legal limit. HES is a very large molecule (450,000 Daltons)--five times larger than the more familiar Dextran, which exercise physiologists use in studies of plasma volume. The molecules of HES and other plasma volume expanders are so large that they stay in the blood. As osmotic agents, they hold extra fluid in the blood, thereby elevating plasma volume and total blood volume. These agents are unique on the banned substance list, in that they enhance performance and mask the presence of another banned substance.

HES must be delivered intravenously via a drip bag and a large-gauge cannula. In other words, HES infusions aren't something that athletes are likely to pull off alone. The disadvantage of this product is that the starch is only partly broken down by the body. The large molecule is slowly cleaved into smaller sections by the liver. A part

is excreted via the urine, another part via the bile, but a last part remains in the circulation for weeks and is slowly deposited in the tissues, particularly the skin.

HES was officially placed on the banned substances list 1 year ago. Often, substances are banned before they can be detected, and HES was no exception. The Finns were informed, apparently by international sources, that HES could not yet be detected in urine samples. Their head coach, two national team doctors, and 6 team athletes therefore chose to systematically use HES in the two weeks prior to the world championships. Meanwhile, the new World Anti-Doping Agency (WADA) and its certified drug-testing labs had purposefully not announced that they had a detection method for HES in place prior to the world championships. This method was the hidden gun. For once it was the drug testers who had a secret.

The first Finnish skier to test positive was medallist Jari Isometsaa. This unexpected positive created panic in the Finnish team, some of whom responded desperately by faking accidents and illness. For example, Jani Immonen had the incredible "bad luck" to ruin a ski binding in one race and break a ski pole in another. Meanwhile, Finnish spokesmen claimed that the one positive test was an isolated incident. Jari Isometsa tried to protect his team by claiming that his actions were in cooperation with a foreign doctor unknown to the Finnish support crew. When "accident prone" Janne Immonen tested positive two days later, systematic doping was suspected. Yet, even after they knew that HES was being detected, they chose to start the men's 4 x 10-km relay with HES-injected athletes.

To make bad things worse for the Finns, a physician's bag containing used needles and drip bags was found at a gas station near the Helsinki airport. The bag turned out to belong to the Finnish cross-country team. In this story, we might call this bag "the smoking gun".

When two more male skiers from Finland's gold medal relay team and two female skiers subsequently tested positive, Finnish skiing was finished. National heroes Mykka Myllala and the ageless wonder 42-year old Harvi Kirvesniemi, who earned a bronze medal in the Lake Placid Olympics of 1980, tested positive and ended their careers in the worst possible way.

I was visiting the German Sport University (GSU) in Cologne when the first positive test was announced. Besides being perhaps the world's largest sports science and sports education program (6000 students), GSU is the location of one of the world's 24 WADA-certified drug testing laboratories. The man I talked to had just returned from the WADA laboratory in Helsinki. Hidden away on the seventh floor of an 11-story academic building, high performance gas chromatography and mass spectrometry are the big guns in an impressive arsenal of detection methods. Eleven combination HPCG/mass-spec machines sat in one room! The chemicals in the urine are transferred and concentrated into organic solvents. Under high temperature 2-microliter liquid samples become gaseous and are pushed through 17 to 60 meters of super-fine separation tubing to detect banned substances. With eleven HPGC units running, each with their own heating units designed to raise solvent temperatures to 300°C, even the special cooling system in the room is not enough to stop it becoming a sauna. The lab technicians work in T shirts, but the serious looks on their faces tell you that they know what is at stake. By virtue of its structure, each chemical compound moves through the tubing at a different, highly reproducible speed, making separation possible. Separation by HPGC and exact identification by mass spectrometry comprise a "finger-printing" system that can detect the majority of banned substances. A few others are revealed using other methods such as liquid chromatography (HPLC). In the Cologne lab alone, 10,000 human urine samples and 4,000 horse urine samples are tested annually.

The Cologne lab boasts the largest collection of reference samples of banned substances in the world. These samples are the key to the mass spectrometry

identification system and are protected by an impressive system of security measures. All of the WADA labs are subject to unannounced double-blind sample testing and regular inspection for any irregularities in laboratory procedures, chain of evidence, and so on. Had I been a competing athlete with an urge to take a chemical short-cut, this lab tour would have scared me straight. Any athlete who claims that their positive test is a mistake should keep this in mind that the Cologne lab has never produced a single false-positive test in all the double-blind control tests performed over the last 10 years. Not one. So much for the B samples.

Although hardly noticed outside of northern Europe, the demise of Finnish skiing may well represent a breakthrough in the war on doping. The Ben Johnson episode in Seoul in 1988 kick-started a build-up in drug testing technology that has continued for more than a decade. In 2001 the technology and organizational structure for year-round testing in and out of competition is at last beginning to accomplish its mission.

The Finnish scandal also gives hard evidence to strengthen or refute several suspicions that have been whispered for years. First, while the former East German and Soviet sports machines have been disassembled, we have suspected that systematic drug use by isolated national sports organizations is still happening. By "systematic", I mean one or more athletes, doctors, and perhaps coaches working together. In the case of the Finnish incident, it appears that only a small group within the national team was cheating. So, we should not persecute those Finnish skiers who were and are clean. But, Finnish endurance athletes have been suspected since the days of Lasse Viren and old-fashioned blood replacement techniques in the 1970s. In international cross-country skiing, the Finns have displayed an uncanny capacity to be best when it counted. At times their performances in major championships have borne little resemblance to performances during the season. We training theorists and exercise physiologists could not understand how an athlete training 25 hours a week and competing 20 times in three months could suddenly raise his capacity 5% in one week. Our suspicions are now strengthened. There was no training magic. On the other hand, the fact that a Finnish laboratory reported the positive tests on the home team helps refute the claim that the entire drug-testing program is corrupted by sports organizations in an effort to hide positive tests that would cast a bad light on the sport.

Finally, this drug scandal reminds us again that, without doctors and physiologists, much of the drug problem in sport would not exist. Two Finnish doctors gave their blessing and their assistance to the offenders. The guilty athletes are now banned from their sport for cheating. National team sport physicians and top athletes private doctors are in a powerful position to influence athletes regarding all things pharmaceutical. When they directly aid an athlete by providing a banned substance, they are "an accessory to doping." War history buffs know that one key to winning a war is cutting off supply lines. Drug testing is beginning to win battles. When national governments criminalize a doctor's assistance of an athlete using a banned substance, and take away their medical licenses, we could move a big step closer to winning the entire war.

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