TARGET: Zero Hunger
FAO Podcast

Episode #2 –
"Catching food fraudsters through isotopes"

[Sandra] Hello and welcome to the second episode of *Target: Zero Hunger* -- a podcast that explores the food challenges and solutions of our time, brought to you by the UN's Food and Agricultural organization. I'm your host, Sandra Ferrari.

[Spy music in]

[Sandra] In this episode, we will take you into the labs of the the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture in Seibersdorf, Austria, where researchers are on the trail of a special kind of foil in our food chain: the food fraudster. Along the way, we will hear from experts in Pakistan and India… But today our journey starts… in Rome….

[Street noise motorino]

[Street buskers' saxophone]

[Sandra] On recent sunny Saturday afternoon, our producer Kim-Jenna Jurriaans stopped by Beppe I suoi formaggi, a speciality cheese shop in the old Jewish ghetto in Rome, not far from the Tiber river.

[Sound of door opening to cheese shop]

[Kim-Jenna] Ciao! Sono Kim. Lavoro con la FAO.

[Sandra] Giuseppe Giovale's family has been in the milk and cheese-making business for decades. The majority of cheeses on display at the store is produced with milk from Beppe's own cows that graze on pasture far north of the city in Italy's Piemonte region.

[Beppe scrapping cheese]

[Sandra] But there are also artisanal breads and carefully selected wines on sale in the quaint shop.

[Chatter between clerk and customer in background]

[Kim-Jenna] Qual è il suo nome?

[Beppe] Giuseppe Giovale. My role here is to discover good products from Italy -- authenticity and simplicity. We used to be suppliers to this shop and then we were proposed a collaboration with the former owner. And now we are the store owners. And we like to evangelize a bit about good food and simplicity.

[Sandra] While Beppe and his staff are busy attending to customers and arranging the cheeses on display, Antonio Menconi, the store manager resident bread expert, spoke to Kim-Jenna about the importance of the authenticity of food.

[Antonio] Beppe's cheeses are made with milk from his own cows. Some of the other cheeses we have here are French and they are made with the same principles in mind. For example, the parmigiano reggiano we have comes from a cooperative that is a partner of our cooperative and therefore they produce under the same principles. The same goes for the bread. The bread we have here I selected from producers who make bread the way bread should be made. The world of

cheese is truly fascinating. It's also a world of great injustice, because customers these days buy whatever product. And as a result the quality of food has gone down a lot and the prices paid by the companies and the consumers is really low too. And the producers in many ways are barely surviving. The breed of cow that Beppe uses produces maybe 10- 5 liters of milk a day. The cows that are used in today's industrial scale production give 50 to 60 liters a day. That's where the difference is.

[Sandra] Beppe later joined the conversation and we asked him about a recent case of food fraud involving parmigiano reggiano cheese. In this particular case, some parmigiano reggiano cheese sold in the United States turned out to have wood pulp mixed in to the ingredients. We asked him if something like that would be possible with his cheeses.

[Kim-Jenna] And what about the cheeses on display here. Would it be possible that any of them have been tampered with?

[Beppe] Absolutely not. When I taste food I don't want to know its colour or who produced it, I close my eyes and my mouth has to tell if it's good or not, if it's a yes or no. I'm fortune that I was brought up in a family where the authenticity of food was the most important thing.

[Kim-Jenna] Why is the authenticity important to you?

[Beppe] It's what gives us life… eating… not just for me but it should be like that for everybody. The most important thing for every person should be nutrition. If you are healthy you live well and you can think well. If you eat things that are unhealthy, you can't live well.

[Sandra] And why is the authenticity of his food important to Beppe?

[Beppe] Because It's our livelihood. It's why people come here.

[Store sounds – bread being cut, water running etc]

[Kim-Jenna chatting to the clerk]

[Sound of check register]

[Sound of door opening to cheese shop]

[Street sound up and out]

[Sandra] For Beppe Giovale, the authenticity and quality of his cheeses are his livelihood and he's personally making sure each piece of cheese that crosses his counter is up to his high standards. But not every food vendor is able to have such a direct connection with their producers and the products they sell. And even with artisanal foods, like Beppe's, in the end it all comes down to a relationship of trust between the storekeeper and the customer. And the farther removed we are from those who produce our food, the more opportunities there are for fraud.

[Static TV SFX – volume button - NEWS CLIP roundup of cases of food fraud]

[Newsperson] For a period of time in 2007 and 2008, scandals involving the quality of imported Chinese products dominated the news in the United States. Consumers have had to deal with a seemingly unending series of revelations. The food industry has been especially hard hit and now there comes word that a brand of popular rice may not be what it claims to be.

[Theme music in]

[Sandra] Each year, food fraudsters skim and scam about 50 billion dollars from our food chain by passing off products for something else than they really are. Often, this comes in the form of intermediaries mixing low quality contents into high-quality products. But it can also involve elaborate import schemes by which fraudsters skirt around quotas and collect subsidies that they wouldn't otherwise be entitled to. This is a problem for consumers who want to be sure that what they eat is safe and authentic. It's a problem for producers who have a reputation too uphold and risk to lose business if their products get a bad reputation. And there are damages and implications at the national level for countries with trade relations based on the premium quality of a specific food product. But first - if you can't always tell with the naked eye when there's been foul play in our food chain, how does one catch these food fraudsters? Why, with stable isotopes of course.

[Car starting and driving]

[Bed of footsteps to lab]

[Sandra] Steve Thachet – a colleague with the International Atomic Energy Agency – drove out to the Agencies laboratories, 40 miles outside of Vienna in Seibersdorf, Austria. There he spoke to one of the lead scientists about how Isotopes are the unlikely allies helping national governments and food safety experts combat these crimes that affect consumers and food producers alike.

[Lab door opening]

[Spy music]

[Simon] Hello. My name is Simon Kelly. I'm a food safety specialist in traceability. I'm working with the International Atomic Energy Agency in the joint division of the IAEA-FAO nuclear techniques on food and agriculture.

[Sandra] Simon is an expert in analysing stable isotopes. And stable Isotopes are like Mother Nature's signature on food. Imagine that each chemical element in nature has its own identity. And that identity is created by atoms that have a certain number of protons and neutrons. What's important for Simon's work is that, depending on where and how and under what conditions a food is produced, the number of neutrons in those chemical elements will be slightly different. And those variations are called Isotopes. For Simon, they are like fingerprints on a crime scene.

[Simon] It's been used since the early 1970s to detect the addition of adulterants in food, for example, to detect the addition water to fruit juice. So, the isotopes give unequivocal evidence because it's information, which is actually stored within the atoms in the food and not just in its chemical composition. So, for example, we can look at oxygen isotopes, the stable isotopes of oxygen, in the water and a fruit juice in which you can tell whether the water has come from naturally occurring oranges, for example, or whether the water has been added from a ground water source, because the isotopic signature is very different.

[Sandra] Even though it's hard to measure if food fraud has gone down since these forensic methods have become more widespread, Simon is convinced that isotope testing sends a strong message to the fraudsters.

[Simon] It's a very powerful technique and when organized crime syndicates and other people might be tempted to carry out food adulteration become aware of these methods, they can act as a very powerful disincentive.

[Sandra] Simon explained that in some cases, these isotopic tests have become standardized industry methods, for example, to detect cane sugar in honey or the addition of sugar to wine.

[Simon] These are all very established methods. There is an increasing number of examples now where stable isotopes are actually being incorporated into the definition of premium products such as Grana Padano cheese, parmigiano reggiano, so that the isotopic and trace element signatures or fingerprints of those materials is actually incorporated into the definitions. And these all act to protect the commodities and make sure that the chances of adulteration going undetected are very small.

[Sandra] In other words, you're only allowed to call your if it matches the isotopic fingerprint for parmigiano reggiano. But the technique is not just used in the richest countries, a large part of his team's raison d'etre, Simon says, is to enable governments in developing countries to do the same kind of authentication and safety testing of their food.

[Simon] We're very much in the business of developing the skills, helping developing countries with establishing methodologies, robust methods so that they can use stable isotopes to build databases that they can use to characterize their own premium products such as, for example, basmati rice in India and Pakistan.

[Spy music out]

[Sandra] To hear more on what that quest for pure basmati looks like, we spoke to Muhammad Arif and Dileep Singh, scientist based in Pakistan and India.

[Spy music out]

[Arif] My name is Muhammad Arif and I am working as a principal scientist at the national Institute for biotechnology and genetic engineering in Faisalabad. My lab is a focal lab for the detection of the adulteration in basmati rice, using molecular markers.

[Dileep] I am Dileep Singh. I am the professor in the department of zoology in the University of Delhi, Delhi, India. This is a central government university and I'm working on food and food traceability and environmental toxicology and soil microbiology. Actually, when you talk about the basmati rice, the word means the rice which gives the fragrance. And, in India, mainly in the area of the foothills of the Himalayan region, we grow the basmati rice. And they are of very good quality.

[Sandra] In Pakistan, the Punjab is the premium basmati rice region. Both countries export a larger part of their premium products to the European Union and the Middle East. Beside basmati, they also export other, non-basmati rice to countries like Bangladesh, Indonesia, Philippines, and many African countries. Those different types of rice shouldn't be mixed. But a few years ago, the EU got suspicious and checked the basmati imported from Pakistan and India. And they discovered that it was, indeed, not as pure as it should be. In other words, there was non-basmati rice in the basmati.

[Arif] And that was the main problem of the European Union that they found more than 10 percent of non-basmati mixing in basmati rice.

[Sandra] Arif explains that this food adulteration can happen at various stages and isn't always intentional. For example, In the Punjab, Basmati and non-basmati rice is sometimes grown together -- so at harvest time the two can get mixed together. The other more benign type of mixing can happen when the rice gets to the middle man, who stores different types of rice in big heaps in their storage facility. And then… there is the food fraudster.

[Arif] The last stage is the food fraudsters. Sometimes they intentionally mix the inferior quality rice with the basmati rice, because for basmati they get very good premium quality. In local market, basmati rice is rice is more expensive as compared to the non-basmati rice. In Pakistan, basmati rice is 100 rupees per kg. You can get non-basmati rice around 60-70 rupees per kg.

[Sandra] India is dealing with the same nefarious market forces.

[Dileep] We are all facing food adulteration. Particularly in the case of India. The non-basmati with the same kernel size replacing the basmati rice. The price for the premium basmati rice is very high. But when they mix with the non-basmati rice they take the same price but the quality is compromised. So, in that case, we need a technology, we need a system which can easily differentiate that what we are eating is actually the basmati or not basmati.

[Sandra] As Arif and Dileep explained to me, there are various ways to test foods for fraud. You can look at the size of the kernels, for example, plus laboratories nowadays can easily use DNA analysis to test if a rice is high or low quality. But those methods are not good at determining the region of the product – for that, isotope analysis is simply the best tool. And that geographic marker can be a key quality factor for premium products like basmati.

[Arif] If you grow basmati in UK or USA or outside the Punjab region you will not get the same flavour or same aroma, because it depends on the soil characteristics and environment at the time of maturity. The region of Pakistan and India, they are the basmati region. If you grow basmati in that specific area you will get the aroma you will get the specific pleasant flavour. But if you grow rice outside the Punjab region you will not get the same quality. So, quality is the main issue. So we use stable isotopes to detect what is the origin of this rice. Where it has been grown? Has it been grown in the Punjab region? Or in another region?

[Dileep] From the isotopes you can differentiate that this basmati is coming from India and this basmati is coming from Pakistan and this basmati is coming from some other part of the world.

[Sandra] Arif and Dileep both collaborate with Simon's team at IAEA to come up with the unique finger prints for their premium basmati rice. In Arif's case, this includes collecting rice seeds, water and soil samples from all over the Punjab and analysing their isotopes.

[Spy music]

[Sandra] Now, we were curious to see how isotope technology is being used to catch import fraudster. To help us answer that question, we talked to Andreas Rossmann, head of the stable isotope laboratory in Germany which is a commercial laboratory that has been doing stable isotope analysis since the late 1990s. More specifically, he talked about a case of butter fraud where the product itself was pure, but various companies in Germany and the Netherlands were re-importing their EU butter back into the EU market under false pretences so they could garner more subsidies. Here is Andreas.

[Andreas] The butter that was exported was illegally imported as a product from Baltic States – from Estonia for example. And as it was true butter, conventional methods of analysis were not able to differentiate this butter from that one which has been exported and paid for by subsidies. And if a butter is exported and subsidies are paid they cannot be re-imported to the European market. That was done illegally and by labelling this reimported butter as a product coming, for example form Estonia and with conventional methods of analysis you can only check if it is butter or something else. But you cannot check is this butter coming from Germany or from Ireland or from the Netherlands or from Estonia. The challenge was to find a method to differentiate things which are chemically identical. And that is the advantage of stable isotopes.

[Sandra] After the case ended what was the verdict for the fraudsters?

[Andreas] They have been sentenced to pay, I think, 2.1. Million euro of taxes.

[Sandra] Now is isotope technology standard now in this kind of work?

[Andreas] I can say at least in Germany it's a standard technology for the food control authorities. They check for example wine or juice or vegetables, if they are properly labelled or not. Or if the production method is properly labelled organic or bio or if the production method is conventional recognizes with fertilizers and that can be differentiated with stable isotopes as well.

[Sandra] It's relatively new to use isotope technology in legal matters -- why is that?

[Andreas] There was really a lack of databases, there was a lack of experts who are able to do that work. And the knowledge about the possibilities is still not very widespread in the food industry. And especially in regard to geographic origin. The food industry is not, let's say, very interested to know what products really come from. They are mainly interested to have the cheapest supply of materials. In some countries from example Italy it's very interesting for producers to label products with geographic indication because it can sold at higher prices but there is also a very big risk that unscrupulous producers may take cheap starting material and, for example, prepare Parma Ham or Grana Padano with cheaper supplies.

[Sandra] What needs to happen in the industry you think?

[Andreas] If there occur problems in Germany for example, if there is something wrong with geographic indication, they write it in journals. And if such things are published there's a bit of noise in the industry and then they start to analyse their product and check if it's really what it should be. But after a while they forget about it and after the long run it's too expensive for us so they leave it again. And if a new problem occurs then we start again with analysis. But there's no continuous control of all products as it would be necessary. It's partially done by the public control authorities, but they have limited resources as well.

[Sandra] Ok, we've talked a lot about the economic side of food fraud, but, there's one angle that's extra important to consumers – and that's food safety. It's one thing to pay too much for pseudo basmati. It's another thing to realize there are contaminants and plastics in your food. It's this side of food fraud that's particularly of interest to Markus Lipp, who's a food safety officer at FAO who works with the Expert Committee of Food Additives – a joint initiative by FAO and the World Health Organization.

[Sandra] What do you think about using stable isotopes for mitigation against food fraud?

[Markus] Food is complex. Food is dairy products, food is meat, food is vegetables, food is cereal. So it has a whole range of different compositions. Now all these different compositions meant a very flexible approach to be able to identify that the parmigiano reggiano is, in fact, parmigiano reggiano and not wood. The rice that is labelled basmati rice comes from the right region. The wine that is labelled Bordeaux come from actually Bordeaux and not from some other place. For this application it works fantastic, for other methods don't deliver that strength of discrimination, yet for other goals, other methods need to be employed. Food production in general and food fraud is actually a complex phenomenon with different angles. The economic angles that happen. The erosion of trust. The damaging of every consumers perception that they don't feel safe if they go in the super market anymore. But, there's also a different angle to that, maybe a little further reaching. Because so far the story points to low quality food material being substituted for high quality material. Low quality rice for basmati rice demands a premium in the market, so

there's economic damage. There's also food fraud where non-food items are actually used and disguised as food. So well all heard 2008-2009 about melamine in infant formula that damaged thousands of kids, really health damaged and kidney damage, and there's all the fake rice that's actually plastic that's disguised as rice. So there's real food safety aspects if and when food fraud happens because the people who commit that crime, the very food fraud, the criminals – it's a very criminal act in almost all legislation – they're the only one who knows what happens. Because by the very nature of that crime they are not telling their customers or the consumer that they try to cheat.

[Sandra] What are the main issues for you here, from a food safety perspective?

[Markus] From a food safety perspective food frau is relevant because it means often something has been added to food and nobody knows whether it's safe. No regulatory oversight can happen because nobody knows the existence of that until post mortem, after the fact, unfortunately often post mortem because people will show some health effects of die.

[Sandra] What can the consumer do in terms of food safety?

[Markus] We all can help protect ourselves against food fraud by a couple of different approaches. One is asking questions. We can all ask questions. We can call our regulators. We can call the companies. Also- the companies by law have to give a contact point. If not there's always the internet. And ask questions… "How is that made?", "What goes into this food?", "Explain to me why I should buy your product." … those kinds of questions. That is the right of the consumer to know what they eat. And that's perfectly fair. They can talk to their regulators: "How do you help me protect myself against food frau, what do you do?". There's also other things that the consumer can do. There's always a compromise between convenience and having enough information to differentiate things. And easy example: A few years ago there was this horse meat scandal in Europe where horse meet was found in burger patties. So, everybody, on the meadow can tell a part a horse from a cow. When the animal is slaughtered, the meat con still be identified, but it's a little harder. Horse meat is leaner, cow meat is not so lean. Horse meat is a little darker. Cow meat, not so much. So it gets a little harder. If its minced meat mixed together nobody can tell the difference except the analytical chemist with his advanced tools but this is not available for the common household. For example black pepper. Typically whole black pepper beans are typically identifiable. One of the common fraud mechanisms is adding twigs into black pepper and grind it all up. Because once it's ground, it's a grey speckled mess. And I can't tell if this was a twig or a black peppercorn. But if I buy whole black peppercorn, I can easily spot when there are twigs in there. So there are tools like this that the consumer can use, to just use common sense.

[Sandra] What can be done at an international level to mitigate food fraud?

[Markus] We all need to work together to keep food safe. There's no single institution that is big enough, strong enough. There is no single country that is powerful enough to combat food fraud. If it's too good to be true, if the price is too low to be really true it's probably fake material. Regulators need to pour in energy, pour in resources and industry needs to play along – at least the good players need to make sure that everything is above board, that food remains safe. So we all need to work together. FAO plays a part of that through its CODEX Alimentarious activities, setting food standards, for example. And there are numerous other activities in FAO, other organizations play a part. Police work extensively on that. Interpol has extensive campaigns on combating food fraud. Regulatory

authority are concerned about food fraud and all over the world and trying to work together to come up with ways of combatting food fraud by establishing new processes and making people aware.

[Sandra] As we've heard…Food fraud is big business within our global food system, but it's a crime that has implications and damages that resonate and cause ripple effects up and down the food chain - from the producer, to the consumer, to the government.

[Theme music in]

For over 50 years, the Joint FAO-IAEA Division of Nuclear Techniques in Food and Agriculture has worked on the intersection where the fight to eliminate hunger and improve food security meets the peaceful use of atomic energy.

Together, they support countries -with training and technology -- to make sure their food is safe and authentic – and that is part of ensuring our global food systems are healthy and sustainable.

In our next episode, we will delve into the world of biotechnology and discuss with our guests what potential they hold and what needs to be done to ensure these technologies benefit smallholder farmers in developing countries.

We'll hear from experts with with varying perspectives when it comes to biotech.

This episode has been produced by myself and Kim-Jenna Jurriaans. With special thanks to Steve Thachet for collecting the interview audio with Simon Kelly in Seibersdorf.

If you have any questions or feedback for us please write to FAO-audio@fao.org. I'm Sandra Ferrari, thanks for listening.

[Theme Music out]

If you would like to hear the full interviews from guests in this episode, visit our webpage at FAO.org/media/podcast for more information about this series.