

## Popular science summary

### **Can natural antioxidants in meatballs decrease the risk of colorectal cancer?**

In June 2015, a project was started at Lund University with the goal of evaluating if oxidation, a chemical reaction releasing free oxygen radicals harmful to the intestine, is the underlying mechanism linking processed meat consumption to the rising prevalence of colorectal cancer among meat consumers. This theory is one of the more prevalent ones in the field since red meat contains a lot of iron which is easily oxidised and may oxidise other food components such as proteins or fat. Except for the approximately 75 percent water contained in a piece of meat, precisely these other two components are present, why this theory is one of the more popular ones. Processed meat products are regarded as even more problematic, seeing as they are often smoked and additionally usually contain nitrite salts and a higher amount of fat. To study this matter, we started by producing a processed meat product easily subjected to oxidation. Meatballs, one of our most common Swedish dishes, were therefore chosen for the project. A range of properties such as; type of meat, fat content, salt content, cooking type, and storage time were studied before the optimal oxidised meatball was found.

The background for this project was that the U.N. World Health Organisation (WHO) published a report in October 2015 together with the International Agency for Research on Cancer (IARC) placing processed meat in the same carcinogenicity group as smoking or alcohol consumption (Group I carcinogens). The statistics in the report show that you have an 18 percent increased risk of colorectal cancer for every 50 grams daily consumption of processed meat products. This is a number that we in Sweden exceeded in 2016 with our average of 52 grams daily consumption per person. The corresponding numbers for red meat was reported to be 17 percent increased risk for colorectal cancer for every 100 grams daily consumption of red meat. In Sweden, we average 145 grams per day.

The project at LTH, Lund University, was a part of an EU financed research project called SUSMEATPRO (Sustainable Plant Ingredients for Healthier Meat Products – Proof of concept). A collaboration between scientists in five different countries, namely; Sweden, Denmark, Finland, Estonia, and Latvia whose common goal was to find antioxidants powerful enough to counteract the harmful oxidation in the meat products.

In total, 28 different antioxidant extracts were analysed from all collaborating countries. These were first tested in a so called meat model system made of the part of the meat containing the iron, together with an oil that easily oxidises. These two components were mixed with one antioxidant at a time, before the mixture was heated, to resemble an industrial heating process of processed meat products. When the mixture had cooled down, the level of oxidation was measured in the mixtures both with and without antioxidants after specific periods of time. The antioxidants with the best effects were then added to the previously manufactured oxidation meatball to see if they were powerful enough to counteract the oxidation in a real product. Which they could.

In the next step of the project, we wanted to see if the consumption of these meatballs with antioxidants lead to a decrease in colorectal cancer compared to meatballs with no antioxidants. This we did by feeding mice a diet containing 20 percent of our meatballs (with and without antioxidants) since this number approximately corresponds to the average amount of meat consumed by an adult in a balanced diet. Since colorectal cancer almost always is preceded by an inflammation, we induced a low grade one using a substance slightly irritating to the intestines. To not induce an inflammation would have made the study far too long, due to that tumours take long to develop, and it would have increased the long-term suffering of the trial animals. We know that oxidation is counteracted by antioxidants. However, the results of the animal trial are not conclusive in if these special meatballs were truly healthier than regular meatballs. Some

differences were noticed, in for instance the gut microflora, but the study should probably have had to be longer for clearer results to be seen. It is also reasonable to believe that the oxidation is not the only factor in meat linked to colorectal cancer, but rather an interplay between many mechanisms and environmental circumstances. The mice did also consume their meatballs together with a feed containing fibre, which has a protective effect against colorectal cancer. In summary, natural and relatively unexplored antioxidants were found to efficiently inhibit lipid oxidation in both meat model and processed meat product. Moreover, these antioxidant-enriched meatballs were then found to show some health-related differences in the *in vivo* trial.