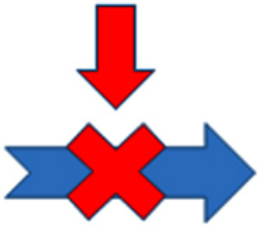
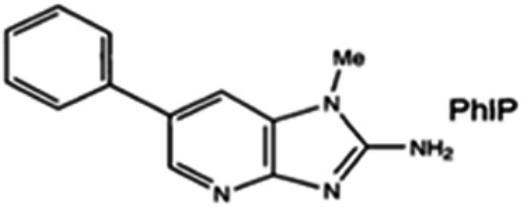
Protection against production of cancer-causing agents in cooked meats by apple peel extracts

There is increasing evidence that the presence of cancer causing compounds in the diet are responsible for variations in cancer rates among different populations worldwide. Cancer causing agents are known to be generated during high temperature cooking of meats and fish, which could lead to the development of cancers of the breast, prostate, pancreas and colon. One of the major cancer causing products generated in cooked meat are heterocyclic aromatic amines (HCAs). The International Agency for Research on Cancer has recommended to limit human exposure to dietary HCAs in order to decrease the risk of cancer development. These compounds are produced when the meat-containing creatine compound reacts with proteins and sugar at high temperatures (?150 °C) during barbecuing, pan frying and oven cooking. Cooking guidelines to minimize formation of HCAs include avoidance of cooking meat at high temperatures for prolonged periods of time, microwaving prior to exposure to high temperatures, removing charred portions of meat and continuously turning meat over a high heat source.





An additional approach that could protect against the cancer risk from consuming such cooked meats is the addition of ingredients during the cooking of meat that block the formation of HCAs. As generation of HCAs during cooking could be inhibited by antioxidants, there is the possibility to block their formation with natural plant food-containing antioxidants called polyphenols. There are many different types of polyphenol compounds found in plant foods. Human population studies, however, have suggested protection against colon cancer from high dietary intake of flavonoids, which are a type of polyphenols found in some fruits and vegetables, tea, chocolate and red wine. Dried apple peel powder (DAPP^{TM}), which is composed of 100% dried apple peel, is a by-product of apple processing that has a very high flavonoid content. We wanted to examine whether adding DAPP^{TM} as an ingredient in ground beef patties could prevent the production of HCAs by pan

frying. Prior to frying, we added DAPP^{TM} at different doses (0.1, 0.15 and 0.3%, i.e., 0.1, 0.15, 0.3 g DAPP^{TM}/100 g meat) either mixed thoroughly within the beef patty or applied onto the beef patty surface and then we measured for HCAs after frying at 223^{o}C. There was no detectable effect on the taste of the cooked patties from either surface or mixed application of DAPP. We found that DAPP^{TM} was highly effective in inhibiting generation of cancer causing HCAs by pan frying in a concentration-related manner. Surface application of DAPP^{TM} was more effective as this inhibited the generation of HCAs by 71% as compared to mixing DAPP^{TM} within the beef patty that showed 45% inhibition. The exterior portions of meat most exposed to direct cooking generate higher amounts of HCAs, which can explain the better efficacy from the surface application of DAPP^{TM}. Among the types of HCAs measured, DAPP^{TM} was most effective in diminishing a HCA compound called 2-amino-1-ethyl-6-phenylimidazo[4,5-b]pyridine (PhIP), which was inhibited by 83% at the highest dose of DAPP^{TM}. This is a significant observation since the presence of PhIP has been particularly linked with the cancer causing properties of cooked meat. These studies demonstrate that surface application of DAPP^{TM} could be a practical, straightforward approach to minimize the generation of the potent cancer causing HCAs, which could complement modified cooking methods to reduce their formation in cooked meats.

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Publication

Inhibitory effects of apple peel polyphenol extract on the formation of heterocyclic amines in pan fried beef patties.
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