

Formation of Glycidol Fatty Acid Esters from Cooking Condition

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Glycidol fatty acid esters (GEs) are process contaminants recently found in edible fats and oil. After possible safety concerns especially for infant fed formulas were reported in the initial risk assessment of GEs issued by the German Federal Institute for Risk Assessment (BfR), an extensive study has been initiated to gain insights into the mechanism of formation and mitigation. Several studies reported that primal factors responsible for greater GEs formation were: 1) refining process at higher temperature such as deodorization 2) higher contents of partial acylglycerols. However, little data concerning the formation of GEs under practical cooking condition is available at this point.

In the present study, we examined the GEs levels of cooked oil and cooked food stuffs under practical cooking conditions. We also compared the levels of GEs cooked with triacylglycerol (TAG) oil and diacylglycerol (DAG) oil in order to examine the effects of partial acylglycerols. GEs were quantified by using the direct method with HPLC-MS system. TAG oils were purchased from commercially available products in Japanese market. DAG oil (diacylglycerol >80%, GEs; below LOQ) was prepared at the bench-top lab scale. We selected wide variety of cooking, those are ranked as frequently cooked menus in home kitchen based on the diet data source, such as stir-fried vegetable, deep-fried chicken, deep-fried French fry, fried rice and grilled beef etc.

The results revealed that some TAG oil (palm-blended oil and rice bran oil) had relatively high level of GEs (6-8 ppm) at the initial. However, there was no significant increase in GEs in all types of cooking oil even after repeatedly cooked conditions. Since the range of temperature during these cooking were 120-200°C, it is presumed that the formation of GEs is much less compared with the industrial heat refining condition at 200°C or more.

In conclusion, no significant increase in GE was found in all type of cooking oil under practical cooking condition. Further studies are needed to clarify the formation of 3-monochloropropane-1,2 diol fatty acid ester under the similar cooking condition.