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Is frying oil a dietary source or an endocrine disruptor? Anti-estrogenic effects of polar compounds from frying oil in rats

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Statement of the Problem: The objective was to investigate endocrine-disrupting effects of polar compounds from oxidized frying oil. Estrogenicity of polar compounds was tested with a rat uterotrophic bioassay. Dietary oxidized frying oil (containing 50% polar compounds) or polar compounds isolated from it were incorporated into feed (in lieu of fresh soybean oil) and fed to ovariectomize rats, with or without treatment with exogenous ethynyl estradiol. Exogenous estrogen restored uterine weight, and caused histological abnormalities (stratified epithelia and conglomerate glands) as well as proliferation of uterine epithelial cells. However, tamoxifen or polar compounds reduced these effects. Furthermore, tamoxifen or polar compounds down-regulated uterine mRNA expression of estrogen receptor (ER)-target genes, implicating reduced ER activity in this hypo-uterotrophic effect. Inhibition of ER signaling and mitosis by polar compounds were attributed to reduced MAPK and AKT activation, as well as a reduced ligand binding domain-transactivity of ERα/β. We concluded polar compounds from frying oil are potential endocrine-disrupting chemicals, with implications for food and environmental safety.

Methodology & Theoretical Orientation: In the study, a uterotrophic bioassay in rodents, suggested by EPA test guidelines (OPPTS 890. 1600), was used to test *in vivo* estrogenicity of polar compounds from oxidative frying oil. To eliminate interference from endogenous estrogens or the hypothalamic-pituitary-gonadal axis, ovariectomized mature female rats were used. Chemicals with agonistic or antagonistic activities toward natural estrogens are assessed based on uterine weight or uterotrophic response. In addition, an *in vitro* ER reporter assay was conducted to verify (anti)estrogenic effects of saponifiables (hydrolysis released fatty acids) from polar compounds (compared to fresh oil).

Findings: Polar compound fraction (PC) in oxidized frying oil is anti-estrogenic; the hypouterotrophic effect of PC was attributed to suppress ER signaling; PC inhibited epithelial proliferation by reduced MAPK and AKT activation and PC reduced ligand binding domain transactivity of ERα/β.

Conclusion & Significance: This study provided evidence of the endocrine-disrupting potential of polar compounds from OFO. Inhibition of ER signaling and mitosis in the uterus by polar compounds were attributed to reduced MAPK and AKT activation, as well as a reduced ligand binding domain-transactivity of ERα/β. Despite food safety limits of a maximum of 25% polar compounds in many countries, the potential and relative risk for endocrine disruption remains to be determined.

Biography

Yu-Shun Lin has completed his Doctor Degree in China Medical University in Taiwan. Currently, after finishing his PhD, he is pursuing his Postdoctoral research. He has expertise in studying the safety of oxidative frying oil, researching the topic for a long time. His research finding evidence shows for the first time that oxidative frying oil influences estrogen receptor function having the endocrine disrupting potential.

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