

Study of dietary phytoestrogens and estrogenic activity in pet animal diets

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Abstract

It is considered that both phytoestrogens and organochlorine pesticides found in pet animal diets are possible sources of interference with bioassays that assess estrogenic activity. In the present study, we investigated the levels of dietary phytoestrogens, organochlorine pesticides, and estrogenic activities in various commercial pet animal diets and discussed the potential contributions of these substances to the estrogenic activity in comparison to those tested in previous studies. Following hydrolysis by β -glucuronidase, genistein and daidzein were detected in all of the tested diets, and these results were comparable to the data from previous investigations. In addition, organochlorine pesticides, such as α -HCH, β -HCH, HCB, *p,p'*-DDE and dieldrin, were detected in 2 of 15 tested diets. All of these diets exhibited higher levels of activation of the estrogen receptor β (ER β) than the estrogen receptor α (ER α) in an *in vitro* yeast-based bioassay. These results indicated that phytoestrogens, such as genistein and daidzein, were the main substances contributing to the estrogenic activity of the diets. Moreover, the levels of phytoestrogen found in 5 of 15 tested diets may have sufficient amounts to produce a significant estrogenic activity in pet animals.

Keywords : phytoestrogen, genistein, daidzein, estrogenic activity, pet animal diet

I Introduction

Public and scientific concern exists that endocrine-disrupting chemicals (EDCs) are present in human diets and in the environment, where their potential to disrupt the normal hormonal status in humans and wildlife has become a high-profile international issue¹⁻³⁾. Many of these EDCs have similar structures to natural and synthetic hormones, and can accidentally bind to steroid hormone receptors such as estrogen, androgen and thyroid receptors. In order to regulate and minimize the release of hormonally active agents into the environment, the Organization for Economic Cooperation and Development (OECD) initiated a high-priority activity in 1997 to develop new and revised guidelines for the screening and testing of potential EDCs⁴⁾. For the screening of

estrogenic substances, many *in vitro* and *in vivo* assays were developed and conducted; i.e., the: MCF-7 cell proliferation assay (E-screen assay)⁵⁾, yeast estrogen-screen assay (YES assay)⁶⁾, yeast two-hybrid assay^{7, 8)}, rat uterotrophic assay⁹⁾ and vitellogenin (Vg, egg yolk protein precursor) production assay^{10, 11)}.

Phytoestrogens in laboratory diets are possible sources of interference with bioassays that assess the estrogenic activity. Phytoestrogens and their derivatives, such as genistein, daidzein, coumestrol and equol, could disturb the reproductive functions in mammals^{12, 13)}. Many of these compounds may act as agonists of estrogen receptors by binding to estrogen receptors and stimulating estrogen-responsive gene expressions^{14, 15)}, or they may antagonize the binding of endogenous estrogen to its receptors and exert anti-estrogenic