

References

In this guide

[In this guide](#)

1. [Annex A to TOX/2026/11 - Introduction and Background](#)
2. [Annex A to TOX/2026/11 - Existing authorisations for Echinacea products in the UK](#)
3. [Annex A to TOX/2026/11 - European Medicines Agency \(EMA\) assessment reports and conclusions](#)
4. [Annex A to TOX/2026/11 - Health-based guidance values \(HBGVs\)](#)
5. [Annex A to TOX/2026/11 - Toxicokinetics](#)
6. [Annex A to TOX/2026/11 - Effects on cytochrome P450 and P-glycoprotein](#)
7. [Annex A to TOX/2026/11 - Reproductive and developmental studies on Echinacea](#)
8. [Annex A to TOX/2026/11 - Toxicity Studies](#)
9. [Annex A to TOX/2026/11 - Adverse effects in humans](#)
10. [Annex A to TOX/2026/11 - Duration of use](#)
11. [Annex A to TOX/2026/11 - Mechanism of action](#)
12. [Annex A to TOX/2026/11 - Contaminants](#)
13. [Annex A to TOX/2026/11 - Exposure Assessment](#)
14. [Annex A to TOX/2026/11 - Risk Characterisation](#)
15. [Annex A to TOX/2026/11 - Conclusions](#)
16. [Annex A to TOX/2026/11 - List of Abbreviations](#)
17. [Annex A to TOX/2026/11 - References](#)

This is a paper for discussion. This does not represent the views of the Committee and should not be cited.

Ahmadi, F., Kariman, K., Mousavi, M., Rengel, Z. (2024). *Echinacea*: Bioactive Compounds and Agronomy. *Plants* 13, 1235.

<https://doi.org/10.3390/plants13091235>

Ardjomand-Woelkart, K., Bauer, R. (2015). Review and Assessment of Medicinal Safety Data of Orally Used *Echinacea* Preparations. *Planta Med.* 82, 17–31.
<https://doi.org/10.1055/s-0035-1558096>

Ardjomand-Woelkart, K., Kollroser, M., Derendorf, H., Bauer, R., Butterweck, V. (2012). Herb-Drug Interactions: Effects of *Echinacea* preparations on cytochrome P450 activities in rats. *Planta Med.* 78, s-0032-1320669. <https://doi.org/10.1055/s-0032-1320669>

Barcz, E., Sommer, E., Nartowska, J., Balan, B.J., Chorostowska-Wynimko, J., Ewa, Skopińska-Różewska, E. (2007). Influence of *Echinacea purpurea* intake during pregnancy on fetal growth and tissue angiogenic activity. *Folia Histochem Cytobiol.* ;45 Suppl 1:S35-9.

Barnes, J., Anderson, L.A., Gibbons, S., Phillipson, J.D. (2010). *Echinacea* species (*Echinacea angustifolia* (DC.) Hell., *Echinacea pallida* (Nutt.) Nutt., *Echinacea purpurea* (L.) Moench): a review of their chemistry, pharmacology and clinical properties. *J. Pharm. Pharmacol.* 57, 929–954.
<https://doi.org/10.1211/0022357056127>

Bates, B.; Lennox, A.; Prentice, A.; Bates, C.; Page, P.; Nicholson, S.; Swan, G. (2014) National Diet and Nutrition Survey Results from Years 1, 2, 3 and 4 (combined) of the Rolling Programme (2008/2009 – 2011/2012) [Main heading \(publishing.service.gov.uk\)](http://publishing.service.gov.uk)

Blumenthal, M., Busse, W.R., Bundesinstitut für Arzneimittel und Medizinprodukte (Eds.), (1999). The Complete German Commission E monographs: therapeutic guide to herbal medicines, Reprint. ed. American Botanical Council [u.a.], Austin, Texas.

Buettner, C., Mukamal, K.J., Gardiner, P., Davis, R.B., Phillips, R.S., Mittleman, M.A., (2009). Herbal Supplement Use and Blood Lead Levels of United States Adults. *J. Gen. Intern. Med.* 24, 1175–1182. <https://doi.org/10.1007/s11606-009-1050-5>

Burger, R.A., Torres, A.R., Warren, R.P., Caldwell, V.D., Hughes, B.G. (1997). *Echinacea*-induced cytokine production by human macrophages. *Int. J. Immunopharmacol.* 19, 371–379. [https://doi.org/10.1016/S0192-0561\(97\)00061-1](https://doi.org/10.1016/S0192-0561(97)00061-1)

Blumenthal M, Busse WR, Goldberg A, (1998). The Complete German Commission E Monographs: Therapeutic Guide to Herbal Medicines. Boston, MA: American Botanical Council.

Chow, G., Johns, T., Miller, S.C. (2006). Dietary *Echinacea purpurea* during Murine Pregnancy: Effect on Maternal Hemopoiesis and Fetal Growth. *Neonatology* 89, 133–138. <https://doi.org/10.1159/000088795>

Clifford, L.J., Nair, M.G., Rana, J., Dewitt, D.L. (2002). Bioactivity of alkylamides isolated from *Echinacea purpurea* (L.) Moench. *Phytomedicine* 9, 249–253. <https://doi.org/10.1078/0944-7113-00105>

Committee on herbal medicinal products (HMPC) (2007). Community list entry on *Echinacea purpurea* (L.) Moench, herba recens. [Community list entry Echinaceae purpureae \(L.\) Moench, herba recens \(europa.eu\)](https://www.euro.who.int/en/medicines/quality/monographs/communitary-list-entries/echinacea-purpurea-l-moench-herba-recens)

Currier, N., 2000. Natural killer cells from aging mice treated with extracts from *Echinacea purpurea* are quantitatively and functionally rejuvenated. *Exp. Gerontol.* 35, 627–639. [https://doi.org/10.1016/S0531-5565\(00\)00106-6](https://doi.org/10.1016/S0531-5565(00)00106-6)

Currier, N.L., Miller, S.C. (2002). The Effect of Immunization with Killed Tumor Cells, with/Without Feeding of *Echinacea purpurea* in an Erythroleukemic Mouse Model. *J. Altern. Complement. Med.* 8, 49–58. <https://doi.org/10.1089/107555302753507177>

Cuzzolin, L., Francini-Pesenti, F., Verlato, G., Joppi, M., Baldelli, P., Benoni, G. (2010). Use of herbal products among 392 Italian pregnant women: focus on pregnancy outcome. *Pharmacoepidemiol. Drug Saf.* 19, 1151–1158. <https://doi.org/10.1002/pds.2040>

Dabbou, S., Rotolo, L., Kovitvadhi, A., Bergagna, S., Dezzutto, D., Barbero, R., Rubiolo, P., Schiavone, A., De Marco, M., Helal, A.N., Zoccarato, I., Gasco, L. (2016). Rabbit dietary supplementation with pale purple coneflower. 1. Effects on the reproductive performance and immune parameters of does. *Animal* 10, 1101–1109. <https://doi.org/10.1017/S1751731115002979>

Dapas, B., Dall'Acqua, S., Bulla, R., Agostinis, C., Perissutti, B., Invernizzi, S., Grassi, G., Voinovich, D. (2014). Immunomodulation mediated by a herbal syrup containing a standardized *Echinacea* root extract: A pilot study in healthy human subjects on cytokine gene expression. *Phytomedicine* 21, 1406–1410. <https://doi.org/10.1016/j.phymed.2014.04.034>

De Fougérolles, A.R., Baines, M.G. (1987). Modulation of the natural killer cell activity in pregnant mice alters the spontaneous abortion rate. *J. Reprod. Immunol.* 11, 147–153. [https://doi.org/10.1016/0165-0378\(87\)90018-0](https://doi.org/10.1016/0165-0378(87)90018-0)

Di Lorenzo, C., Ceschi, A., Kupferschmidt, H., Lüde, S., De Souza Nascimento, E., Dos Santos, A., Colombo, F., Frigerio, G., Nørby, K., Plumb, J., Finglas, P., Restani, P. (2015). Adverse effects of plant food supplements and botanical preparations: a systematic review with critical evaluation of causality. *Br. J. Clin. Pharmacol.* 79, 578–592. <https://doi.org/10.1111/bcp.12519>

EMA (2012): Assessment report on *Echinacea angustifolia* DC., radix. EMA/HMPC/688212/2008. [Assessment report on Echinacea angustifolia DC., radix \(europa.eu\)](#)

EMA (2014): Assessment report on *Echinacea purpurea* (L.) Moench., herba recens. EMA/HMPC/557979/2013. [Assessment report on Echinacea purpurea \(L.\) Moench., herba recens \(europa.eu\)](#)

EMA (2018): Assessment report on *Echinacea pallida* (Nutt.) Nutt., radix. EMA/HMPC/737379/2017. [Assessment report on Echinacea pallida \(Nutt.\) Nutt., radix \(europa.eu\)](#)

EMA monograph (2012): Community herbal monograph on *Echinacea angustifolia* DC., radix. EMA/HMPC/688216/2008. [Community herbal monograph on Echinacea angustifolia DC., radix \(europa.eu\)](#)

EMA monograph (2014): European Union herbal monograph on *Echinacea purpurea* (L.) Moench, herba recens. (EMA/HMPC/104945/2006. [European Union herbal monograph on Echinacea purpurea \(L.\) Moench, herba recens \(europa.eu\)](#)

EMA monograph (2017): European Union herbal monograph on *Echinacea purpurea* (L.) Moench, radix. EMA/HMPC/577784/2008. [European Union herbal monograph on Echinacea purpurea \(L.\) Moench, radix \(europa.eu\)](#)

EMA monograph (2018): European Union herbal monograph on *Echinacea pallida* (Nutt.) Nutt., radix. (EMA/HMPC/332350/2008. [European Union herbal monograph on Echinacea pallida \(Nutt.\) Nutt., radix \(europa.eu\)](#)

Espinosa-Paredes, D.A., Cornejo-Garrido, J., Moreno-Eutimio, M.A., Martínez-Rodríguez, O.P., Jaramillo-Flores, M.E., Ordaz-Pichardo, C. (2021). *Echinacea Angustifolia* DC Extract Induces Apoptosis and Cell Cycle Arrest and Synergizes with Paclitaxel in the MDA-MB-231 and MCF-7 Human Breast Cancer Cell Lines. *Nutr. Cancer* 73, 2287–2305. <https://doi.org/10.1080/01635581.2020.1817956>

Filipiak-Szok, A., Kurzawa, M., Szłyk, E. (2015). Determination of toxic metals by ICP-MS in Asiatic and European medicinal plants and dietary supplements. *J. Trace*

Elem. Med. Biol. 30, 54–58. <https://doi.org/10.1016/j.jtemb.2014.10.008>

Fonseca, F.N., Papanicolaou, G., Lin, H., Lau, C.B.S., Kennelly, E.J., Cassileth, B.R., Cunningham-Rundles, S. (2014). *Echinacea purpurea* (L.) Moench modulates human T-cell cytokine response. *Int. Immunopharmacol.* 19, 94–102.

<https://doi.org/10.1016/j.intimp.2013.12.019>

Freeman C, Spelman K (2008). A critical evaluation of drug interactions with *Echinacea* spp. *Mol Nutr Food Res.* 2008 Jul;52(7):789-98.

<https://doi.org/10.1002/mnfr.200700113>

Fusco, D., Liu, X., Savage, C., Taur, Y., Xiao, W., Kennelly, E., Yuan, J., Cassileth, B., Salvatore, M., Papanicolaou, G.A. (2010). *Echinacea purpurea* aerial extract alters course of influenza infection in mice. *Vaccine* 28, 3956–3962.

<https://doi.org/10.1016/j.vaccine.2010.03.047>

Gallo, M., Sarkar, M., Au, W., Pietrzak, K., Comas, B., Smith, M., Jaeger, T.V., Einarson, A., Koren, G. (2000). Pregnancy Outcome Following Gestational Exposure to *Echinacea*: A Prospective Controlled Study. *Arch. Intern. Med.* 160, 3141.

<https://doi.org/10.1001/archinte.160.20.3141>

Gan, X.-H., Zhang, L., Heber, D., Bonavida, B. (2003). Mechanism of activation of human peripheral blood NK cells at the single cell level by *Echinacea* water soluble extracts: recruitment of lymphocyte–target conjugates and killer cells and activation of programming for lysis. *Int. Immunopharmacol.* 3, 811–824.

[https://doi.org/10.1016/S1567-5769\(02\)00298-9](https://doi.org/10.1016/S1567-5769(02)00298-9)

Gendron, R.L., Baines, M.G. (1988). Infiltrating decidual natural killer cells are associated with spontaneous abortion in mice. *Cell. Immunol.* 113, 261–267.

[https://doi.org/10.1016/0008-8749\(88\)90025-1](https://doi.org/10.1016/0008-8749(88)90025-1)

George, L., Ioannis, E., Radostina, T., Antonios, M. (2006). Severe thrombotic thrombocytopenic purpura (TTP) induced or exacerbated by the immunostimulatory herb *Echinacea*. *Am. J. Hematol.* 81, 224–224.

<https://doi.org/10.1002/ajh.20531>

Goel, V., Chang, C., Slama, J.V., Barton, R., Bauer, R., Gahler, R., Basu, T.K. (2002). *Echinacea* stimulates macrophage function in the lung and spleen of normal rats. *J. Nutr. Biochem.* 13, 487–492.

[https://doi.org/10.1016/S0955-2863\(02\)00190-0](https://doi.org/10.1016/S0955-2863(02)00190-0)

Goey AK, Rosing H, Meijerman I, Sparidans RW, Schellens JH, Beijnen JH. (2012) The bioanalysis of the major *Echinacea purpurea* constituents dodeca-2E,4E,8Z,10E/Z-tetraenoic acid isobutylamides in human plasma using LC-MS/MS. *J Chromatogr B*, 902:151-156. [10.1016/j.jchromb.2012.06.022](https://doi.org/10.1016/j.jchromb.2012.06.022)

Gorski, J. (2004). The effect of echinacea (*Echinacea purpurea* root) on cytochrome P450 activity *in vivo*. *Clin. Pharmacol. Ther.* 75, 89-100. <https://doi.org/10.1016/j.clpt.2003.09.013>

Gurley, B., Gardner, S., Hubbard, M., Williams, D., Gentry, W., Carrier, J., Khan, I., Edwards, D., Shah, A. (2004). *In vivo* assessment of botanical supplementation on human cytochrome P450 phenotypes: *Citrus aurantium*, *Echinacea purpurea*, milk thistle, and saw palmetto. *Clin. Pharmacol. Ther.* 76, 428-440. <https://doi.org/10.1016/j.clpt.2004.07.007>

Gurley, B.J., Swain, A., Hubbard, M.A., Williams, D.K., Barone, G., Hartsfield, F., Tong, Y., Carrier, D.J., Cheboyina, S., Battu, S.K. (2008). Clinical assessment of CYP2D6-mediated herb-drug interactions in humans: Effects of milk thistle, black cohosh, goldenseal, kava kava, St. John's wort, and *Echinacea*. *Mol. Nutr. Food Res.* 52, 755-763. <https://doi.org/10.1002/mnfr.200600300>

Hall, H.G., Griffiths, D.L., McKenna, L.G. (2011). The use of complementary and alternative medicine by pregnant women: A literature review. *Midwifery* 27, 817-824. <https://doi.org/10.1016/j.midw.2010.08.007>

Hansen, T.S., Nilsen, O.G. (2009). *Echinacea purpurea* and P-glycoprotein drug transport in Caco-2 cells. *Phytother. Res.* 23, 86-91. <https://doi.org/10.1002/ptr.2563>

Heitmann, K., Havnen, G.C., Holst, L., Nordeng, H. (2016). Pregnancy outcomes after prenatal exposure to *Echinacea*: the Norwegian Mother and Child Cohort Study. *Eur. J. Clin. Pharmacol.* 72, 623-630. <https://doi.org/10.1007/s00228-016-2021-5>

Hellum, B.H., Hu, Z., Nilsen, O.G. (2007). The Induction of CYP1A2, CYP2D6 and CYP3A4 by Six Trade Herbal Products in Cultured Primary Human Hepatocytes. *Basic Clin. Pharmacol. Toxicol.* 100, 23-30. <https://doi.org/10.1111/j.1742-7843.2007.00011.x>

Hellum, B.H., Nilsen, O.G. (2007). The *in vitro* Inhibitory Potential of Trade Herbal Products on Human CYP2D6-Mediated Metabolism and the Influence of Ethanol. *Basic Clin. Pharmacol. Toxicol.* 101, 350-358. <https://doi.org/10.1111/j.1742->

[7843.2007.00121.x](#)

HMR 2012: The Human Medicines Regulations 2012. [The Human Medicines Regulations 2012 \(legislation.gov.uk\)](#)

Holst, L., Wright, D., Haavik, S., Nordeng, H. (2011). Safety and efficacy of herbal remedies in obstetrics—review and clinical implications. *Midwifery* 27, 80–86. <https://doi.org/10.1016/j.midw.2009.05.010>

Hudson, J., Vimalanathan, S., Kang, L., Amiguet, V.T., Livesey, J., Arnason, J.T. (2005). Characterization of Antiviral Activities in *Echinacea* Root Preparations. *Pharm. Biol.* 43, 790–796. <https://doi.org/10.1080/13880200500408491>

Hudson, J.B. (2012). Applications of the Phytomedicine *Echinacea purpurea* (Purple Coneflower) in Infectious Diseases. *J. Biomed. Biotechnol.* 1–16. <https://doi.org/10.1155/2012/769896>

Huntley, A.L., Thompson Coon, J., Ernst, E. (2005). The Safety of Herbal Medicinal Products Derived from *Echinacea* Species: A Systematic Review. *Drug Saf.* 28, 387–400. <https://doi.org/10.2165/00002018-200528050-00003>

Husain, I., Dale, O.R., Martin, K., Gurley, B.J., Adams, S.J., Avula, B., Chittiboyina, A.G., Khan, I.A., Khan, S.I. (2023). Screening of medicinal plants for possible herb-drug interactions through modulating nuclear receptors, drug-metabolizing enzymes and transporters. *J. Ethnopharmacol.* 301, 115822. <https://doi.org/10.1016/j.jep.2022.115822>

Jacobsson, I., Jönsson, A.K., Gerdén, B., Hägg, S. (2009). Spontaneously reported adverse reactions in association with complementary and alternative medicine substances in Sweden. *Pharmacoepidemiol. Drug Saf.* 18, 1039–1047. <https://doi.org/10.1002/pds.1818>

Jawad, M., Schoop, R., Suter, A., Klein, P., Eccles, R. (2012). Safety and Efficacy Profile of *Echinacea purpurea* to Prevent Common Cold Episodes: A Randomized, Double-Blind, Placebo-Controlled Trial. *Evid. Based Complement. Alternat. Med.* 2012, 1–7. <https://doi.org/10.1155/2012/841315>

Jeong, J.-S., Kim, J.-W., Kim, J.-H., Chung, E.-H., Lee, D.-R., Choi, B.-K., Ko, J.-W., Kim, T.-W. (2024). Oral toxicity and genotoxicity assessment of standardized *Echinacea purpurea* (L.) extract and the pharmacokinetic profile of its active ingredient chicoric acid. *Toxicol. Res.* 40, 457–472. <https://doi.org/10.1007/s43188-024-00238-z>

Kemp, D.E., Franco, K.N. (2002). Possible leukopenia associated with long-term use of Echinacea. *J. Am. Board Fam. Pract.* 15, 417.

Khaksary Mahabady, M., Ranjbar, R., Arzi, A., Papahn, A.A., Najafzadeh, H. (2006). A comparison study of effects of *Echinacea* extract and levamisole on phenytoin-induced cleft palate in mice. *Regul. Toxicol. Pharmacol.* 46, 163–166.

<https://doi.org/10.1016/j.yrtph.2006.06.005>

Kocaman, O., Hulagu, S., Senturk, O. (2008). *Echinacea*-induced severe acute hepatitis with features of cholestatic autoimmune hepatitis. *Eur. J. Intern. Med.* 19, 148. <https://doi.org/10.1016/j.ejim.2007.04.014>

Kovitvadhi, A., Gai, F., Dabbou, S., Ferrocino, I., Rotolo, L., Falzone, M., Vignolini, C., Gennero, M.S., Bergagna, S., Dezzutto, D., Barbero, R., Nebbia, P., Rosati, S., Cocolin, L., Zoccarato, I., Gasco, L. (2016). Rabbit dietary supplementation with pale purple coneflower. 2. Effects on the performances, bacterial community, blood parameters and immunity of growing rabbits. *Animal* 10, 1110–1117.

<https://doi.org/10.1017/S1751731115002980>

Lee, A.N., Werth, V.P. (2004). Activation of Autoimmunity Following Use of Immunostimulatory Herbal Supplements. *Arch. Dermatol.* 140.

<https://doi.org/10.1001/archderm.140.6.723>

Lee Soon, S., Crawford, R.I. (2001). Recurrent erythema nodosum associated with *Echinacea* herbal therapy. *J. Am. Acad. Dermatol.* 44, 298–299.

<https://doi.org/10.1067/mjd.2001.112219>

Li, Y., Wang, Y., Wu, Y., Wang, B., Chen, X., Xu, X., Chen, H., Li, W., Xu, Xiaogang, (2017). *Echinacea purpurea* extracts promote murine dendritic cell maturation by activation of JNK, p38 MAPK and NF- κ B pathways. *Dev. Comp. Immunol.* 73, 21–26. <https://doi.org/10.1016/j.dci.2017.03.002>

Maass, N., Bauer, J., Paulicks, B.R., Böhmer, B.M., Roth-Maier, D.A. (2005). Efficiency of *Echinacea purpurea* on performance and immune status in pigs. *J. Anim. Physiol. Anim. Nutr.* 89, 244–252. <https://doi.org/10.1111/j.1439-0396.2005.00501.x>

Mahajan, D., Sharma, N. R., Kancharla, S., Kolli, P., Tripathy, A., Sharma, A. K., Singh, S., Kumar, S., Mohanty, A. K., & Jena, M. K. (2022). Role of Natural Killer Cells during Pregnancy and Related Complications. *Biomolecules*, 12(1), 68.:

<https://doi.org/10.3390/biom12010068>

Maskatia, Z.K., Baker, K. (2010). Hypereosinophilia Associated with *Echinacea* Use: South. Med. J. 103, 1173-1174.

<https://doi.org/10.1097/SMJ.0b013e3181f1ed8b>

Matthias A, Addison RS, Penman KG, Dickinson RG, Bone KM, Lehmann RP (2005). *Echinacea* alkamide disposition and pharmacokinetics in humans after tablet ingestion. Life Sci, 77(16):2018-2029. <https://doi.org/10.1016/j.lfs.2005.04.009>

Matthias, A., Merika, H., Addison, R., Bone, K., Lehmann, R. (2008). Bioavailability of *Echinacea* alkylamides in human breast milk. Planta Med. 74, s-0028-1083939. <https://doi.org/10.1055/s-0028-1083939>

Melchart D, Linde K, Worku F, Sarkady L, Holzmann M, Jurcic K, Wagner H (1995). Results of five randomized studies on the immunomodulatory activity of preparations of *Echinacea*. J Altern Complement Med. Summer;1(2):145-60. <https://doi.org/10.1089/acm.1995.1.145>

Melchart, D. (1998). *Echinacea* Root Extracts for the Prevention of Upper Respiratory Tract Infections: A Double-blind, Placebo-Controlled Randomized Trial. Arch. Fam. Med. 7, 541-545. <https://doi.org/10.1001/archfami.7.6.541>

Mengs, U., Clare, C.B., Poiley, J.A. (1991). Toxicity of *Echinacea purpurea*. Acute, subacute and genotoxicity studies. Arzneimittelforschung. 41, 1076-1081.

Merali, S., Binns, S., Paulin-Levasseur, M., Ficker, C., Smith, M., Baum, B., Brovelli, E., Arnason, J.T. (2003). Antifungal and Anti-inflammatory Activity of the Genus *Echinacea*. Pharm. Biol. 41, 412-420. <https://doi.org/10.1076/phbi.41.6.412.17828>

Modarai, M., Gertsch, J., Suter, A., Heinrich, M., Kortenkamp, A. (2010). Cytochrome P450 inhibitory action of *Echinacea* preparations differs widely and co-varies with alkylamide content. J. Pharm. Pharmacol. 59, 567-573. <https://doi.org/10.1211/jpp.59.4.0012>

Mullins, R.J. (1998). *Echinacea*-associated anaphylaxis. Med. J. Aust. 168, 170-171. <https://doi.org/10.5694/j.1326-5377.1998.tb126773.x>

Mullins, R.J., Heddle, R. (2002). Adverse reactions associated with *Echinacea*: the Australian experience. Ann. Allergy. Asthma. Immunol. 88, 42-51. [https://doi.org/10.1016/S1081-1206\(10\)63591-0](https://doi.org/10.1016/S1081-1206(10)63591-0)

Nordeng, H., Bayne, K., Havnen, G.C., Paulsen, B.S. (2011). Use of herbal drugs during pregnancy among 600 Norwegian women in relation to concurrent use of conventional drugs and pregnancy outcome. Complement. Ther. Clin. Pract. 17,

147-151. <https://doi.org/10.1016/j.ctcp.2010.09.002>

Ondrizek, R.R., Chan, P.J., Patton, W.C., King, A. (1999). Inhibition of Human Sperm Motility by Specific Herbs Used in Alternative Medicine. *J. Assist. Reprod. Genet.* 16, 87-91. <https://doi.org/10.1023/A:1022568823262>

Penzak, S.R., Robertson, S.M., Hunt, J.D., Chairez, C., Malati, C.Y., Alfaro, R.M., Stevenson, J.M., Kovacs, J.A. (2010). *Echinacea purpurea* Significantly Induces Cytochrome P450 3A Activity but Does Not Alter Lopinavir-Ritonavir Exposure in Healthy Subjects. *Pharmacother. J. Hum. Pharmacol. Drug Ther.* 30, 797-805. <https://doi.org/10.1592/phco.30.8.797>

Perri D, Dugoua JJ, Mills E, Koren G. (2006): Safety and efficacy of *Echinacea* (*Echinacea angustifolia*, *E. purpurea* and *E. pallida*) during pregnancy and lactation. *Can J Clin Pharmacol*, 13(3): e262-267.

Pilarska, G., Twarużek, M., Altyń, I. (2022). The Presence of Molds and Their Secondary Metabolites in Purple Coneflower-Based Dietary Supplements (*Echinacea purpurea* (L.) Moench). *Toxins* 14, 607. <https://doi.org/10.3390/toxins14090607>

Pleschka, S., Stein, M., Schoop, R., Hudson, J.B. (2009). Anti-viral properties and mode of action of standardized *Echinacea purpurea* extract against highly pathogenic avian Influenza virus (H5N1, H7N7) and swine-origin H1N1 (S-OIV). *Virol. J.* 6, 197. <https://doi.org/10.1186/1743-422X-6-197>

Raman, P., Patino, L.C., Nair, M.G. (2004). Evaluation of Metal and Microbial Contamination in Botanical Supplements. *J. Agric. Food Chem.* 52, 7822-7827. <https://doi.org/10.1021/jf049150>

Raner, G.M., Cornelious, S., Moulick, K., Wang, Y., Mortenson, A., Cech, N.B. (2007). Effects of herbal products and their constituents on human cytochrome P4502E1 activity. *Food Chem. Toxicol.* 45, 2359-2365. <https://doi.org/10.1016/j.fct.2007.06.012>

Rininger, J.A., Kickner, S., Chigurupati, P., McLean, A., Franck, Z. (2002). Immunopharmacological activity of *Echinacea* preparations following simulated digestion on murine macrophages and human peripheral blood mononuclear cells. *J. Leukoc. Biol.* 68, 503-510. <https://doi.org/10.1189/jlb.68.4.503>

Roberts, C.; Steer, T.; Maplethorpe, N.; Cox, L.; Meadows, S.; Page, P.; Nicholson, S.; Swan, G. (2018) National Diet and Nutrition Survey Results from Years 7 and 8

(combined) of the Rolling Programme (2014/2015 – 2015/2016) [National Diet and Nutrition Survey \(publishing.service.gov.uk\)](http://publishing.service.gov.uk)

Schapowal, A., Klein, P., Johnston, S.L. (2015). *Echinacea* Reduces the Risk of Recurrent Respiratory Tract Infections and Complications: A Meta-Analysis of Randomized Controlled Trials. *Adv. Ther.* 32, 187–200.
<https://doi.org/10.1007/s12325-015-0194-4>

See, D.M., Broumand, N., Sahl, L., Tilles, J.G. (1997). *In vitro* effects of *Echinacea* and ginseng on natural killer and antibody-dependent cell cytotoxicity in healthy subjects and chronic fatigue syndrome or acquired immunodeficiency syndrome patients. *Immunopharmacology* 35, 229–235. [https://doi.org/10.1016/S0162-3109\(96\)00125-7](https://doi.org/10.1016/S0162-3109(96)00125-7)

Sharma, M., Anderson, S.A., Schoop, R., Hudson, J.B. (2009). Induction of multiple pro-inflammatory cytokines by respiratory viruses and reversal by standardized *Echinacea*, a potent antiviral herbal extract. *Antiviral Res.* 83, 165–170.
<https://doi.org/10.1016/j.antiviral.2009.04.009>

Spielmann H. The Way Forward in Reproductive/Developmental Toxicity Testing. **Alternatives to Laboratory Animals.** 2009;37(6):641-656. doi:
[10.1177/026119290903700609](https://doi.org/10.1177/026119290903700609)

Svedlund, E., Larsson, M., Hägerkvist, R. (2017). Spontaneously Reported Adverse Reactions for Herbal Medicinal Products and Natural Remedies in Sweden 2007–15: Report from the Medical Products Agency. *Drugs - Real World Outcomes* 4, 119–125. <https://doi.org/10.1007/s40801-017-0104-y>

Tournas, V.H. (2009). Microbial contamination of select dietary supplements. *J. Food Saf.* 29, 430–442. <https://doi.org/10.1111/j.1745-4565.2009.00167.x>

Tsai, Y.-L., Chiu, C.-C., Yi-Fu Chen, J., Chan, K.-C., Lin, S.-D. (2012a). Cytotoxic effects of *Echinacea purpurea* flower extracts and chicoric acid on human colon cancer cells through induction of apoptosis. *J. Ethnopharmacol.* 143, 914–919.
<https://doi.org/10.1016/j.jep.2012.08.032>

Tsai, Y.-L., Chiou, S.-Y., Chan, K.-C., Sung, J.-M., Lin, S.-D. (2012b). Caffeic acid derivatives, total phenols, antioxidant and antimutagenic activities of *Echinacea purpurea* flower extracts. *LWT - Food Sci. Technol.* 46, 169–176.
<https://doi.org/10.1016/j.lwt.2011.09.026>

Vimalanathan, S., Kang, L., Amiguet, V.T., Livesey, J., Arnason, J.T., Hudson, J. (2005). *Echinacea purpurea*. Aerial Parts Contain Multiple Antiviral Compounds. Pharm. Biol. 43, 740–745. <https://doi.org/10.1080/13880200500406354>

Vonau, B., Chard, S., Mandalia, S., Wilkinson, D., Barton, S.E. (2001). Does the extract of the plant *Echinacea purpurea* influence the clinical course of recurrent genital herpes? Int. J. STD AIDS 12, 154–158. <https://doi.org/10.1258/0956462011916947>

Yale, S.H., Glurich, I. (2005). Analysis of the Inhibitory Potential of Ginkgo biloba, *Echinacea purpurea*, and *Serenoa repens* on the Metabolic Activity of Cytochrome P450 3A4, 2D6, and 2C9. J. Altern. Complement. Med. 11, 433–439. <https://doi.org/10.1089/acm.2005.11.433>

Woelkart K, Koidl C, Grisold A, Gangemi JD, Turner RB, Marth E, (2005). Bioavailability and pharmacokinetics of alkamides from the roots of *Echinacea angustifolia* in humans. J Clin Pharmacol 45(6):683-689. <https://doi-org.ezproxy1.bath.ac.uk/10.1177/0091270004273493>

WHO (1999). Radix echinaceae. In: WHO monographs on selected medicinal plants, Vol. 1, WHO Geneva 1999, Switzerland: 128-135. [WHO monographs on selected medicinal plants](#)

Zhai, Z., Liu, Y., Wu, L., Senchina, D.S., Wurtele, E.S., Murphy, P.A., Kohut, M.L., Cunnick, J.E. (2007). Enhancement of Innate and Adaptive Immune Functions by Multiple *Echinacea* Species. J. Med. Food 10, 423–434. <https://doi.org/10.1089/jmf.2006.257>