



NATURAL HEALTH PRODUCT

ECHINACEA – *ECHINACEA PURPUREA*

This monograph is intended to serve as a guide to industry for the preparation of Product Licence Applications (PLAs) and labels for natural health product market authorization. It is not intended to be a comprehensive review of the medicinal ingredient.

Notes

- ▶ Text in parentheses is additional optional information which can be included on the PLA and product label at the applicant’s discretion.
- ▶ The solidus (/) indicates that the terms and/or statements are synonymous. Either term or statement may be selected by the applicant.

Date

December 18, 2018

Proper name(s), Common name(s), Source material(s)

Table 1. Proper name(s), Common name(s), Source material(s)

Proper name(s)	Common name(s)	Source material(s)		
		Proper name(s)	Part(s)	Preparation(s)
<i>Echinacea purpurea</i>	<ul style="list-style-type: none"> ▶ Eastern purple-coneflower ▶ Echinacea ▶ Purple coneflower 	<i>Echinacea purpurea</i>	Herb top	<ul style="list-style-type: none"> ▶ Dried ▶ Juice
			<ul style="list-style-type: none"> ▶ Root ▶ Herb top and root 	Dried

References: Proper name: USDA 2018; Common names: Blumenthal et al. 2000, McGuffin et al. 2000, 1997; Source materials: Barnes et al. 2007, ESCOP 2003.

Route of administration

Oral

Dosage form(s)

This monograph excludes foods or food-like dosage forms as indicated in the Compendium of Monographs Guidance Document.



Acceptable dosage forms by age group:

Children 2 years: The acceptable dosage forms are limited to emulsion/suspension and solution/liquid preparations (Giacoaia et al. 2008; EMEA/CHMP 2006).

Children 3-5 years: The acceptable dosage forms are limited to chewables, emulsion/suspension, powders and solution/liquid preparations (Giacoaia et al. 2008; EMEA/CHMP 2006).

Children 6-11 years, Adolescents 12-17 years, and Adults 18 years and older: The acceptable dosage forms for this age category and specified route of administration are indicated in the Compendium of Monographs Guidance Document.

Use(s) or Purpose(s)

- ▶ Traditionally used in Herbal Medicine to help relieve cold symptoms (Moerman 1998; Grieve 1971; Remington and Wood 1918).
- ▶ Traditionally used in Herbal Medicine to help relieve symptoms of upper respiratory tract infections (Moerman 1998; Grieve 1971; Remington and Wood 1918).
- ▶ (Traditionally) used in Herbal Medicine to help fight off infections, especially of the upper respiratory tract (Hoffmann 2003; Mills and Bone 2000; Grieve 1971; Remington and Wood 1918).
- ▶ Supportive therapy in the treatment of upper respiratory tract infections (e.g. common colds) (Goel et al. 2004; Schulten et al. 2001; Brinkeborn et al. 1999; Hoheisel et al. 1997; Bräunig et al. 1992).
- ▶ Helps to relieve the symptoms and shorten the duration of upper respiratory tract infections (Goel et al. 2004; Schulten et al. 2001; Brinkeborn et al. 1999; Hoheisel et al. 1997; Bräunig et al. 1992).

The following combined use(s) or purpose(s) is/are also acceptable:

Traditionally used in Herbal Medicine to help relieve symptoms of colds and upper respiratory tract infections (Goel et al. 2004; Schulten et al. 2001; Brinkeborn et al. 1999; Moerman 1998; Hoheisel et al. 1997; Bräunig et al. 1992; Grieve 1971; Remington and Wood 1918).

Note

Claims for traditional use must include the term “Herbal Medicine”, “Traditional Chinese Medicine”, or “Ayurveda”.

Dose(s)

Subpopulation(s)

As specified below.

Quantity(ies)

Methods of preparation: Dry, Powder, Non-Standardised Extracts (Dry extract, Tincture, Fluid extract, Decoction, Infusion)

HERB TOP

Table 2. Dose information for *Echinacea purpurea* herb top per day

Subpopulation(s)		Dried herb top (gram/day)	
		Minimum	Maximum
Children ¹	2-4 years	0.4	1.0
	5-9 years	0.6	1.5
	10-11 years	1.3	3.0
Adolescents ¹	12-14 years	1.3	3.0
	15-17 years	2.5	6.0
Adults ^{2,3}	18 years and older	2.5	6.0

¹ Children and adolescent doses were calculated as a proportion of the adult dose (JC 2018). The use of *Echinacea purpurea* herb top in children is supported by the following references: McIntyre 2005; Bove 2001; Schilcher 1997.

² Adult dose supported by the following reference: Mills and Bone 2000.

³ Includes pregnant and breastfeeding women.

ROOT

Table 3. Dose information for *Echinacea purpurea* root per day

Subpopulation(s)		Dried root (gram/day)	
		Minimum	Maximum
Children ¹	2-4 years	0.15	0.8
	5-9 years	0.23	1.1
	10-11 years	0.45	2.3
Adolescents ¹	12-14 years	0.45	2.3
	15-17 years	0.90	4.5
Adults ^{2,3}	18 years and older	0.90	4.5

¹ Children and adolescent doses were calculated as a proportion of the adult dose (JC 2012). The use of *Echinacea purpurea* root in children is supported by the following references: McIntyre 2005; Bove 2001; Schilcher 1997

² Adult dose supported by the following references: Mills and Bone 2000; Bräunig et al. 1992

³ Includes pregnant and breastfeeding women

HERB TOP and ROOT

Table 4. Dose information for *Echinacea purpurea* preparations containing a combination of herb top and root per day

Subpopulation(s)		Dried herb top and root (gram/day)	
		Minimum	Maximum
Children ¹	2-4 years	0.5	0.9
	5-9 years	0.8	1.4
	10-11 years	1.5	2.8
Adolescents ¹	12-14 years	1.5	2.8
	15-17 years	3.0	5.5
Adults ^{2,3}	18 years and older	3.0	5.5

¹ Children and adolescent doses were calculated as a proportion of the adult dose (JC 2012). The use of *Echinacea purpurea* in children is supported by the following references: McIntyre 2005; Bove 2001; Schilcher 1997.

² Adult dose supported by the following reference: Mills and Bone 2000.

³ Includes pregnant and breastfeeding women.

Method of preparation: Juice

HERB TOP

Table 5. Dose information for the juice of *Echinacea purpurea* herb top per day

Subpopulation(s)		Juice of herb top (milliliter/day)	
		Minimum	Maximum
Children ¹	2-4 years	0.7	1.7
	5-9 years	1.0	2.5
	10-11 years	2.0	5.0
Adolescents ¹	12-14 years	2.0	5.0
	15-17 years	3.9	10.0
Adults ^{2,3}	18 years and older	3.9	10.0

¹ Children and adolescent doses were calculated as a proportion of the adult dose (JC 2018). The use of *Echinacea purpurea* herb top in children is supported by the following references: McIntyre 2005; Bove 2001; Schilcher 1997.

² Adult dose supported by the following references: Schulten et al. 2001; Hoheisel et al. 1997.

³ Includes pregnant and breastfeeding women.

Direction(s) for use

Take at the first sign of infection (Goel et al. 2004; Schulten et al. 2001; Brinkeborn et al. 1999; Hoheisel et al. 1997).

Duration(s) of use

Consult a health care practitioner/health care provider/health care professional/doctor/physician for use beyond 8 weeks (ESCOP 2003; Blumenthal et al. 2000).



Risk information

Caution(s) and warning(s)

- ▶ Consult a health care practitioner/health care provider/health care professional/doctor/physician if symptoms persist or worsen.
- ▶ Consult a health care practitioner/health care provider/health care professional/doctor/physician prior to use if you have a progressive systemic disease such as tuberculosis, collagenosis, multiple sclerosis, AIDS and/or HIV infection or an auto-immune disorder (Brinker 2010; EMA 2010; McGuffin et al. 1997).
- ▶ Consult a health care practitioner /health care provider/health care professional/doctor/physician prior to use if you are taking medications to suppress the immune system (immunosuppressive medications) (Brinker 2010; Mills and Bone 2005).

Contraindication(s)

No statement required.

Known adverse reaction(s)

Preparations containing herb top

Stop use if hypersensitivity/allergy occurs (MHRA 2018; EMA 2010; Kligler 2003; WHO 1999).

Non-medicinal ingredients

Must be chosen from the current Natural Health Products Ingredients Database (NHPID) and must meet the limitations outlined in the database.

Storage conditions

No statement required.

Specifications

- ▶ The finished product specifications must be established in accordance with the requirements described in the Natural and Non-prescription Health Products Directorate (NNHPD) Quality of Natural Health Products Guide.
- ▶ The medicinal ingredient must comply with the requirements outlined in the NHPID.



References cited

- Barnes J, Anderson LA, Philipson JD. Herbal Medicines, 3rd edition. London (UK): The Pharmaceutical Press; 2007.
- Blumenthal M, Goldberg A, Brinkmann J, editors. 2000. Herbal Medicine: Expanded Commission E Monographs. Boston (MA): Integrative Medicine Communications.
- Bove M. 2001. An Encyclopedia of Natural Healing for Children and Infants. New Canaan (CT): Keats Publishing, Incorporated.
- Bräunig B, Dorn M, Limburg, Knick E, Bausendorf. 1992. Echinaceae purpureae radix: zur Stärkung der körpereigenen Abwehr bei grippalen Infekten. Zeitschrift für Phytotherapie 13:713.
- Brinkeborn RM, Shah DV, Degenring FH. 1999. Echinaforce and other *Echinacea* fresh plant preparations in the treatment of the common cold. A randomized, placebo controlled, double-blind clinical trial. Phytomedicine 6(1):1-6.
- Brinker F. Herb Contraindications and Drug Interactions, 4th edition. Sandy (OR): Eclectic Medical Publications; 2010.
- EMA 2010: European Medicines Agency (GB). EMA/HMPC/577784/2008. Community herbal monograph on *Echinacea purpurea* (L.) Moench., radix. Draft. [Accessed 2018 September 27]. Available from:
http://www.ema.europa.eu/docs/en_GB/document_library/Herbal__Community_herbal_monograph/2011/01/WC500101497.pdf
- EMEA/CHMP 2006: European Medicines Agency: Pre-authorization Evaluation of Medicines for Human Use. Committee for Medicinal Products for Human Use. Reflection Paper: Formulations of choice for the paediatric population. Adopted September 2006. EMEA/CHMP/PEG/194810/2005. [Accessed 2018 September 27]. Available from:
http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003782.pdf
- ESCOP 2003: ESCOP Monographs: The Scientific Foundation for Herbal Medicinal Products, 2nd edition. Exeter (GB): European Scientific Cooperative on Phytotherapy and Thieme.
- Giacoaia GP, Taylor-Zapata P, Mattison D. Eunice Kennedy Shriver National Institute of Child Health and Human Development Pediatric Formulation Initiative: selected reports from working groups. Clinical Therapeutics 2008; 30(11):2097-2101.
- Goel V, Lovlin R, Barton R, Lyon MR, Bauer, Lee TDG, Basu TK. 2004. Efficacy of a standardized echinacea preparation (Echinilin) for the treatment of the common cold: a randomized, double-blind, placebo-controlled trial. Journal of Clinical Pharmacy and Therapeutics 29(1):75-83.



- Grieve M. A Modern Herbal. Volume 1. New York (NY): Dover Publications; 1971 [Reprint of 1931 Harcourt, Brace & Company publication].
- Hoffmann D. 2003. Medical Herbalism. Rochester (VT): Healing Arts Press.
- Hoheisel O, Sandberg M, Bertram S, Bulitta M, Schäfer M. 1997. Echinagard treatment shortens the course of the common cold: a double-blind, placebo-controlled clinical trial. *European Journal of Clinical Research* 9:261-268.
- JC 2018: Justice Canada. Natural Health Products Regulations [Internet]. Ottawa (ON): Justice Canada. [Accessed 2018 September 27]. Available from: <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2003-196/index.html>
- Kligler B. 2003. Echinacea. *American Family Physician* 67(1):77-80. [Accessed 2018 September 27]. Available from: <http://www.aafp.org/afp/2003/0101/p77.html>
- McGuffin M, Kartesz JT, Leung AY, Tucker AO, editors. 2000. *Herbs of Commerce*, 2nd edition. Silver Spring (MD): American Herbal Products Association.
- McGuffin M, Hobbs C, Upton R, Goldberg A, editors. 1997. *American Herbal Products Association's Botanical Safety Handbook*. Boca Raton (FL): CRC Press.
- McIntyre A. 2005. *Herbal Treatment of Children - Western and Ayurvedic Perspectives*. Toronto (ON): Elsevier Limited.
- MHRA 2018: Medicines and Healthcare products Regulatory Agency (GB). Press release: Echinacea herbal products should not be used in children under 12 years old. [Accessed 2018 September 27]. Available from: <http://webarchive.nationalarchives.gov.uk/20141206151420/http://www.mhra.gov.uk/home/groups/comms-po/documents/news/con180628.pdf>
- Mills S, Bone K. 2005. *The Essential Guide to Herbal Safety*. St. Louis (MO): Elsevier Churchill Livingstone.
- Mills S, Bone K. 2000. *Principles and Practice of Phytotherapy*. Toronto (ON): Churchill Livingstone.
- Moerman DE. *Native American Ethnobotany*. Portland (OR): Timber Press; 1998.
- Remington JP, Woods HC, editors. *The Dispensatory of the United States of America* [Internet] 20th edition; 1918. Abridged; botanicals only. Scanned by Michael Moore, director, The Southwest School of Botanical Medicine, Bisbee (AZ). [Accessed 2018 September 27]. Available from: <http://www.swsbm.com/Dispensatory/USD-1918-complete.pdf>
- Schilcher H. 1997. *Phytotherapy in Paediatrics: Handbook for Physicians and Pharmacists*. Stuttgart (D): Medpharm Scientific Publishers.



Schulten B, Bulitta M, Ballering-Brühl B, Köster U, Schäfer M. 2001. Efficacy of *Echinacea purpurea* in patients with a common cold. A placebo-controlled, randomised, double-blind clinical trial. *Arzneimittelforschung* 51(7):563-8.

USDA 2018: United States Department of Agriculture, Agricultural Research Service, National Genetic Resources Program. Germplasm Resources Information Network (GRIN) [Internet]. *Echinacea purpurea* (L.) Moench. Beltsville (MD): National Germplasm Resources Laboratory. [Accessed 2018 September 27]. Available from: http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl

WHO 1999: World Health Organization. WHO Monographs on Selected Medicinal Plants, Volume 1. Geneva (CH): World Health Organization; 1999.

References reviewed

Altamirano-Dimas M, Hudson JB, Cochrane D, Nelson C, Arnason JT. 2007. Modulation of immune response gene expression by echinacea extracts: results of a gene array analysis. *Canadian Journal of Physiology and Pharmacology* 85(11):1091-1098.

Barnes J, Anderson LA, Gibbons S, Phillipson JD. 2005. *Echinacea* species (*Echinacea angustifolia* (DC.) Hell., *Echinacea pallida* (Nutt.) Nutt., *Echinacea purpurea* (L.) Moench): a review of their chemistry, pharmacology and clinical properties. *The Journal of Pharmacy and Pharmacology* 57(8):929-954.

Barnes J, Anderson LA, Philipson JD. 2002. *Herbal Medicines: A Guide for Healthcare Professionals*, 2nd edition. London (GB): The Pharmaceutical Press.

Barrett B. 2003. Medicinal properties of echinacea: a critical review. *Phytomedicine* 10(1):6686.

Barrett BP, Brown RL, Locken K, Maberry R, Bobula JA, D'Alessio D. 2002. Treatment of the common cold with unrefined echinacea: a randomized, double-blind, placebo-controlled trial. *Annals of Internal Medicine* 137(12):939-946.

Barrett B, Brown R, Volland R, Maberry R, Turner R. 2006. Relations among questionnaire and laboratory measures of rhinovirus infection. *The European Respiratory Journal* 28(2):358-363.

Barrett B, Harahan B, Brown D, Zhang Z, Brown R. 2007. Sufficiently important difference for common cold: severity reduction. *Annals of Family Medicine* 5(3):216-223.

Barrett B, Vohmann M, Calabrese C. 1999. Echinacea for upper respiratory infection. *The Journal of Family Practice* 48(8):628-635.

Barton R. 2005. Efficacy of echinilin for the common cold. *Clinical Infectious Diseases* 41(5):761-762.



- Bauer R, Remiger P. 1989. TLC and HPLC analysis of alkamides in echinacea drugs. *Planta Medica* 55(4):367-371.
- Bielory L. 2002. Adverse reactions to complementary and alternative medicine: ragweed's cousin, the coneflower (echinacea), is "a problem more than a sneeze". *Annals of Allergy, Asthma & Immunology* 88(1):7-9.
- Binns SE, Purgina B, Bergeron C, Smith ML, Ball L, Baum BR, Arnason JT. 2000. Lightmediated antifungal activity of echinacea extracts. *Planta Medica* 66(3):241-244.
- Bioforce 2008: Bioforce (GB) Ltd.. Echinaforce Tablets. [Internet]. Irvine (GB): Bioforce (GB) Ltd. [Accessed 26 June 2008]. Available from: http://www.bioforceshop.co.uk/products/echinaforce_tablets
- Block KI, Mead MN. 2003. Immune system effects of echinacea, ginseng, and astragalus: a review. *Integrative Cancer Therapies* 2(3):247-267.
- Blumenthal M. 2003. *The ABC Clinical Guide to Herbs*. New York (NY): Theime.
- Blumenthal M, Busse W, Goldberg A, Gruenwald J, Hall T, Riggins C, Rister R, editors. 1998. *The Complete German Commission E Monographs: Therapeutic Guide to Herbal Medicines*. Austin (TX): American Botanical Council.
- Bohlmann F, Hoffmann H. 1983. Further amides from *Echinacea purpurea*. *Phytochemistry* 22(5):1173-1175.
- Bone K. 1997. Echinacea: what makes it work? *Alternative Medicine Review* 2(2):87-93.
- Bone K. 1997. Echinacea: When should it be used? *Alternative Medicine Review* 2(6):451-458.
- Boon H, Smith MJ. 1999. *The Complete Natural Medicine Guide to the 50 Most Common Medicinal Herbs*, 2nd edition. Toronto (ON): Robert Rose Inc.
- Bisset NG, Wichtl M, editors. 2001. *Herbal Drugs and Phytopharmaceuticals*. 2nd edition. Stuttgart (Germany): medpharm GmbH Scientific Publishers.
- Bradley PR, editor. 1992. *British Herbal Compendium: A Handbook of Scientific Information on Widely Used Plant Drugs, Volume 1*. Bournemouth (GB): British Herbal Medicine Association.
- Carr RR, Nahata MC. 2006. Complementary and alternative medicine for upper-respiratory-tract infection in children. *American Journal of Health-System Pharmacists* 63:33-39.
- Caruso TJ, Gwaltney JM Jr. 2005. Treatment of the common cold with Echinacea: a structured review. *Clinical Infectious Diseases* 40(6):807-810.



- Cheminat A, Zawatzky R, Becker H, Brouillard R. 1988. Caffeoyl conjugates from echinacea species: structures and biological activity. *Phytochemistry* 27(9):2787-2794.
- Chevallier A. 1996. *The Encyclopedia of Medicinal Plants*. New York (NY): DK Publishing Inc.
- Classen B, Csavas M, Borbas A, Dingermann T, Zundorf I. 2004. Monoclonal antibodies against an arabinogalactan-protein from pressed juice of *Echinacea purpurea*. *Planta Medica* 70(9):861865.
- Clifford LJ, Nair MG, Rana J, Dewitt DL. 2002. Bioactivity of alkamides isolated from *Echinacea purpurea* (L.) Moench. *Phytomedicine* 9(3):249-253.
- Cohen HA, Varsano I, Kahan E, Sarrell EM, Uziel Y. 2004. Effectiveness of an herbal preparation containing echinacea, propolis, and vitamin C in preventing respiratory tract infections in children: a randomized, double-blind, placebo-controlled, multicenter study. *Archives of Pediatrics & Adolescent Medicine* 158(3):217-221.
- Ernst E. 2002. The risk-benefit profile of commonly used herbal therapies: Gingko, St John's Wort, Ginseng, Echinacea, Saw Palmetto and Kava. *Annals of Internal Medicine* 136(1):42-53.
- Felter HW. 1983. *The Eclectic Materia Medica, Pharmacology and Therapeutics*. Sandy (OR): Eclectic Medical Publications; [Reprint of 1922 original].
- Felter HW, Lloyd JU. 1983. *King's American Dispensatory, Volume 1, 18th edition*. Sandy (OR): Eclectic Medical Publications; [Reprint of 1898 original].
- Foster S. 1996. *Echinacea. The Purple Coneflowers*. Austin (TX): Steven Foster.
- Fugh-Berman A. 1999. Herbal medicinals: selected clinical considerations, focusing on known or potential drug-herb interactions. *Archives of Internal Medicine* 159(16):1957-1958.
- Gallo M, Sarkar M, Au W, Pietrzak K, Comas B, Smith M, Jaeger TV, Einarson A, Koren G. 2000. Pregnancy outcome following gestational exposure to echinacea: a prospective controlled study. *Archives of Internal Medicine* 160(20):3141-3143.
- Gertsch J, Schoop R, Kuenzle U, Suter A. 2004. Echinacea alkylamides modulate TNF- α gene expression via cannabinoid receptor CB2 and multiple signal transduction pathways. *FEBS Letters* 577(3):563-569.
- Giles JT, Palat CT, Chien SH, Chien SH, Chang ZG, Kennedy DT. 2000. Evaluation of Echinacea for treatment of the common cold. *Pharmacotherapy* 20(6):690-697.
- Goel V, Lovlin R, Chang C, Slama JV, Barton R, Gahler R, Bauer R, Goonewardene L, Basu TK. 2005. A proprietary extract from the Echinacea plant (*Echinacea purpurea*) enhances systemic immune response during a common cold. *Phytotherapy Research* 19(8):689-694.



- Gorski JC, Huang S-M, Pinto A, Hamman MA, Hilligoss JK, Zaheer NA, Desai M, Miller M, Hall SD. 2004. The effect of Echinacea (*Echinacea purpurea* root) on cytochrome P450 activity in vivo. *Clinical Pharmacology and Therapeutics* 75(1):89-100.
- Grieve M. 1971. *A Modern Herbal, Volume 1*. New York (NY): Dover Publications; [Reprint of 1931 Harcourt, Brace & Company publication].
- Grimm W, Müller HH. 1999. A randomized controlled trial of the effect of fluid extract of *Echinacea purpurea* on the incidence and severity of colds and respiratory infections. *The American Journal of Medicine* 106(2):138-143.
- Gunning K. 1999. Echinacea in the treatment and prevention of upper respiratory tract infections. *The Western Journal of Medicine* 171(3):198-200.
- Haddad PS, Azar GA, Groom S, Boivin M. 2005. Natural health products, modulation of immune function and prevention of chronic diseases. *Evidence-Based Complementary and Alternative Medicine* 2(4):513-520.
- Hemilä H. 2005. Echinacea, vitamin C, the common cold and blinding. *Clinical Infectious Diseases* 41(5):762-763.
- Hill LL, Foote JC, Erickson BD, Cerniglia CE, Denny GS. 2006. *Echinacea purpurea* supplementation stimulates select groups of human gastrointestinal tract microbiota. *Journal of Clinical Pharmacy and Therapeutics* 31(6):599-604.
- Islam J, Carter R. 2005. Use of Echinacea in upper respiratory tract infection. *Southern Medical Journal* 98(3):311-318.
- Kemp DE, Franco KN. 2002. Possible leucopenia associated with long-term use of echinacea. *The Journal of the American Board of Family Practice* 15(5):417-419.
- Knight V. 2005. Echinacea treatment for the common cold. *Clinical Infectious Diseases* 40(6):811-812.
- Le Tourneau M. 2004. Echinacea fails to show efficacy in treating colds in a pediatric population. *Alternative Therapies* 10(1):16.
- Lee AN, Werth VP. 2004. Activation of autoimmunity following use of immunostimulatory herbal supplements. *Archives of Dermatology* 140:723-727.
- Li T. 1998. Echinacea: cultivation and medicinal value. *HortTechnology* 8(2):122-129.
- Linde K, Barrett B, Wölkart K, Bauer B, Melchart D. Echinacea for preventing and treating the common cold. *Chochrane Database of systematic Reviews* 2006; Issue 1. Art. No.: CD000530. DOI: 10.1002/14651858.CD000530.pub2



- Lindenmuth GF, Lindenmuth EB. 2000. The efficacy of echinacea compound herbal tea preparation on the severity and duration of upper respiratory and flu symptoms: a randomized, double-blind, placebo-controlled study. *Journal of Alternative and Complementary Medicine* 6(4):327-334.
- Livesey J, Awang DVC, Arnason JT, Letchamo W, Barrett M, Pennyroyal G. 1999. Effect of temperature on stability of marker constituents in *Echinacea purpurea* root formulations. *Phytomedicine* 6(5):347-349.
- Luettig B, Steinmüller C, Gifford GE, Wagner H, Lohmann-Matthes ML. 1989. Macrophage activation by the polysaccharide arabinogalactan isolated from plant cell cultures of *Echinacea purpurea*. *Journal of the National Cancer Institute* 81(9):669- 675.
- Madaus 2008: Madaus AG. Echinacin Madaus Liquidum. [Internet]. Köln (Germany): Madaus Aktiengesellschaft. [Accessed 26 June 2008]. Available from: <http://www.madaus.de/Echinacin-MadausLiquidum.178.0.html>
- Matthias A, Addison RS, Penman KG, Dickinson RG, Bone KM, Lehmann RP. 2005. Echinacea alkamide disposition and pharmacokinetics in humans after tablet ingestion. *Life Sciences* 77(16):2019-2029.
- McGregor RL. 1968. The taxonomy of the genus echinacea (compositae). *University of Kansas Science Bulletin* 48(4):113-142.
- Melchart D, Linde K, Fischer P, Kaesmayr J. Echinacea for preventing and treating the common cold. *Chochrane Database of systematic Reviews* 1999; Issue 1. Art. No.: CD000530. DOI: 10.1002/14651858.CD000530.
- Melchart D, Linde K, Worku F, Bauer R, Wagner H. 1994. Immunomodulation with echinacea—a systematic review of controlled clinical trials. *Phytomedicine* 1:245-254.
- 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. *Journal of Alternative and Complementary Medicine* 1(2):145-160.
- Melchart D, Walther E, Linde K, Brandmaier R, Lersch C. 1998. Echinacea root extracts for the prevention of upper respiratory tract infections. *Archives of Family Medicine* 7(6):541-545.
- Merali S, Binns S, Paulin-Levasseur M, Ficker C, Smith M, Baum B, Brovelli E, Arnason JT. 2003. Antifungal and anti-inflammatory activity of the Genus *Echinacea*. *Pharmaceutical Biology* 41(6):412-420.
- Miller LG. 1998. Herbal medicinals: selected Clinical considerations focusing on known or potential drug-herb interactions. *Archives of Internal Medicine* 158(20):2200-2211.

- Mishima S, Saito K, Maruyama H, Inoue M, Yamashita T, Ishida T, Gu Y. 2004. Antioxidant and immuno-enhancing effects of *Echinacea purpurea*. *Biological & Pharmaceutical Bulletin* 27(7):1004-1009.
- Moerman DE. 1998. *Native American Ethnobotany*. Portland (OR): Timber Press.
- Mossad SB. 1998. Treatment of the common cold. *BMJ*;317(7150):33-36.
- Mullins RJ, Heddle R. 2002. Adverse reactions associated with echinacea: the Australian experience. *Annals of Allergy, Asthma & Immunology* 88(1):42-51.
- Myers SP, Wohlmuth H. 1998. Echinacea-associated anaphylaxis. *Medicinal Journal of Australia* 168(11):583-584.
- Ondrizek RR, Chan PJ, Patton WC, King A. 1999. Inhibition of human sperm motility by specific herbs used in alternative medicine. *Journal of Assisted Reproduction and Genetics* 16(2):87-91.
- Oomah BD, Dumon D, Cardador-Martinez A, Godfrey DV. 2006. Characteristics of echinacea seed oil. *Food Chemistry* 96:304-312.
- Pepping J. 1999. Echinacea. *American Journal of Health System Pharmacy* 56(2):121-122.
- Percival SS. 2000. Use of echinacea in Medicine. *Biochemical Pharmacology* 60(2):155-158.
- 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. *Canadian Journal of Clinical Pharmacology* 13(3):e262-e267.
- Pietta P, Mauri P, Bauer R. 1998. MEKC analysis of different echinacea species. *Planta Medica* 64(7):649-652.
- Proksch A, Wagner H. 1987. Structural analysis of a 4-*O*-methyl glucuronoarabinoxylan with immuno-stimulating activity from *Echinacea purpurea*. *Phytochemistry* 26(7):1989-1993.
- Randolph RK, Gellenbeck K, Stonebrook K, Brovelli E, Qian Y, Bankaitis-Davis D, Cheronis J. 2003. Regulation of human immune gene expression as influenced by a commercial blended echinacea product: preliminary studies. *Experimental Biology and Medicine* (Maywood, N.J.) 228(9):1051-1056.
- Roesler J, Emmendörffer A, Steinmüller C, Luettig B, Wagner H, Lohmann-Matthes ML. 1991. Application of purified polysaccharides from cell cultures of the plant *Echinacea purpurea* to test subjects mediates activation of the phagocytes system. *International Journal of Immunopharmacology* 13(7):931-941.



Schering-Plough 2008: Schering-Plough AB. Echinagard. [Internet]. Stockholm (Sweden): Schering-Plough Aktiebolag. [Accessed 26 June 2008]. Available from: <http://echinagard.se/echinagard>

Schoop R, Klein P, Suter A, Johnston SL. 2006. Echinacea in the prevention of induced rhinovirus colds: a meta-analysis. *Clinical Therapeutics* 28(2):174-183.

Schwarz E, Parlesak A, Henneicke-von Zepelin HH, Bode JC, Bode C. 2005. Effects of Oral administration of freshly pressed juice of *Echinacea purpurea* on the number of various subpopulations of B- and T-lymphocytes in healthy volunteers: results of a double-blind, placebo controlled cross-over study. *Phytomedicine* 12(9):625-631.

Senchina DS, Flagel LE, Wendel JF, Kohut ML. 2006. Phenetic comparison of seven *Echinacea* species based on immunomodulatory characteristics. *Economic Botany* 60(3):205-211.

Senchina DS, McCann DA, Asp JM, Johnson JA, Cunnick JE, Kaiser MS, Kohut ML. 2005. Changes in immunomodulatory properties of *Echinacea* spp. root infusions and tinctures stored at 4°C for four days. *Clinica Chimica Acta* 335:67-82.

Shah SA, Sander S, White CM, Rinaldi M, Coleman CI. 2007. Evaluation of echinacea for the prevention and treatment of the common cold: a meta-analysis. *The Lancet Infectious Diseases* 7(7):473-480.

Shalaby AS, El-Gengaihi SE, Agina EA, El-Khayat AS, Hendawy SF. 1997. Growth and yield of *Echinacea purpurea* L. as influenced by planting density and fertilization. *Journal of Herbs, Spices & Medicinal Plants* 5(1):69-77.

Sperber SJ, Shah LP, Gilbert RD, Ritchey TW, Monto AS. 2004. *Echinacea purpurea* for prevention and experimental rhinovirus colds. *Clinical Infectious Diseases* 38(10):1367-1371.

Steinmüller C, Roesler J, Gröttrup E, Franke G, Wagner H, Lohmann-Matthes ML. 1993. Polysaccharides isolated from plant cell cultures of *Echinacea purpurea* enhance the resistance of immunosuppressed mice against systemic infections with *Candida albicans* and *listeria monocytogenes*. *International Journal of Immunopharmacology* 15(5):604-614.

Stimpel M, Proksch H, Wagner H, Lohmann-Matthes ML. 1984. Macrophage activation and induction of macrophage cytotoxicity by purified polysaccharide fractions from the plant *Echinacea purpurea*. *Infection and Immunity* 46(3):845-849.

Stotzem CD, Hungerland U, Mengs U. 1992. Influence of *Echinacea purpurea* on the phagocytosis of human granulocytes. *Medical Science Research* 20:719-720.

Taylor JA, Weber W, Standish L, Quinn H, Goesling J, McGann M, Calabrese C. 2003. Efficacy and safety of echinacea in treating upper respiratory tract infections in children: a randomized controlled trial. *JAMA* 290(21):2824-2830.



- Thomas PR. 2001. Echinacea: a natural remedy for the common cold and flu? *Nutrition Today* 36(5):249-253.
- Turner RB. 2001. The treatment of rhinovirus infections: progress and potential. *Antiviral Research* 49(1):1-14.
- Vonau B, Chard S, Mandalia S, Wilkinson D, Barton SE. 2001. Does the extract of the plant *Echinacea purpurea* influence the clinical course of recurrent genital herpes? *International Journal of STD and AIDS* 12(3):154-158.
- Wagner H, Jurcic K. 2002. Immunological studies of revitonil[R], a phytopharmaceutical containing *Echinacea purpurea* and *Glycyrrhiza glabra* root extract. *Phytomedicine* 9(5):390-398.
- Weber W, Taylor JA, Stoep AV, Weiss NS, Standish LJ, Calabrese C. 2005. *Echinacea purpurea* for prevention of upper respiratory infections in children. *The Journal of Alternative and Complementary Medicine* 11(6):1021-1026.
- WHO 1999: WHO monographs on selected medicinal plants. Volume 1. Geneva (CHE): World Health Organization.
- Wills RBH, Stuart DL. 1999. Alkylamide and cichoric acid levels in *Echinacea purpurea* grown in Australia. *Food Chemistry* 67:385-388.
- Woelkart K, Bauer R. The role of alkamides as an active principle of echinacea. 2007. *Planta Medica* 73(7):615-623.
- Wren RC. 1907. *Potter's Cyclopedia of Botanical Drugs and Preparations*. London (GB): Potter and Clark.
- Yale SH, Liu K. 2004. *Echinacea purpurea* therapy for the treatment of the common cold: a randomized, double-blind, placebo-controlled clinical trial. *Archives of Internal Medicine* 164(11):1237-1241.
- Zoutewelle G, Wijk RV. 1990. Effects of *Echinacea purpurea* extracts on fibroblast populated collagen lattice contraction. *Phytotherapy Research* 4(2):77-81.