

**DOI:**

10.22301/IJHMCR.2528-3189.702

Article can be accessed online on:  
<http://www.ijhmcr.com>

**INTERNATIONAL JOURNAL  
OF HEALTH MEDICINE AND  
CURRENT RESEARCH**

REVIEW ARTICLE

## EFFECTS AND MECHANISMS OF MEDICINAL PLANTS ON OXYTOCIN: A SYSTEMATIC REVIEW

Farinaz Farahbod <sup>1</sup>, Saeid Heidari-Soureshjani <sup>2\*</sup>

<sup>1</sup> Isfahan University of Medical Sciences, Isfahan, Iran;

<sup>2</sup> Medical Plants Research Center, Basic Health Sciences Institute, Shahrekord University of Medical Sciences, Shahrekord, Iran.

### ARTICLE INFO

**Article History:**

Received 06th November, 2017

Received in revised form

16th November, 2017

Accepted 01th December, 2017

Published online 23th December,  
2017

**Key words:**

Herbal medicine, Phytotherapy,  
Oxytocin, Lactation.

**\*Correspondence to Author:**

**Saeid Heidari-Soureshjani**

Circuit of Research and Technology,  
Shahrekord University of Medical  
Sciences, Iran, Tel: +989131833509,  
Fax: +98383351031

**E-mail:**

heidari\_62@yahoo.com

### ABSTRACT

Oxytocin (OT) plays different roles in the body and contributes mainly to humans' love behaviors, sexual function and childbirth. Given the various and determinative roles of OT, this review article is to report the effects of medicinal plants on OT and their action mechanisms. Articles indexed in the databases *Institute for Scientific Information* and *PubMed* were retrieved by the relevant search terms using the *EndNote* software. Then, the articles regarding the effects of medicinal plants and the related products in intensifying, modulating and neutralizing the adverse effects of OT, published between 2007 and 2017, were included in final analysis. Certain plants and their derivatives such as *Psidium guajava* Linn., *Ficus capensis*, *Ficus deltoidea*, *Dracaena arborea*, *Artemisia monosperma*, *Scutellariae Radix*, *Citrus aurantium*, genistein, daidzein, moxibustion, Danggui-Shaoyao-San, Shao-Fu-Zhu-Yu decoction, and Xiang-fu-si-wu decoction are effective to decrease dysmenorrhea and early miscarriage and to increase lactation. Herbs can induce their tocolytic effects by inhibiting OT-induced uterine contractions via influencing its levels in the body including the neuraxis, and therefore relieve dysmenhorea and increase lactation. Therefore, they can be used as alternatives to produce effective drugs on OT-dependent disorders. However as with chemical drugs, certain cautions should be taken into account in consuming such medications during pregnancy to minimize fetal and maternal side effects.

Copyright © 2017, **Saeid Heidari-Soureshjani**. This is an open access article distributed under the creative commons attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Citation: Farahbod F <sup>1</sup>, Heidari-Soureshjani S <sup>2</sup>, 2017 "Effects And Mechanisms Of Medicinal Plants On Oxytocin: A Systematic Review", *International Journal of Health Medicine and Current Research*, 2, (04), 702-708.**

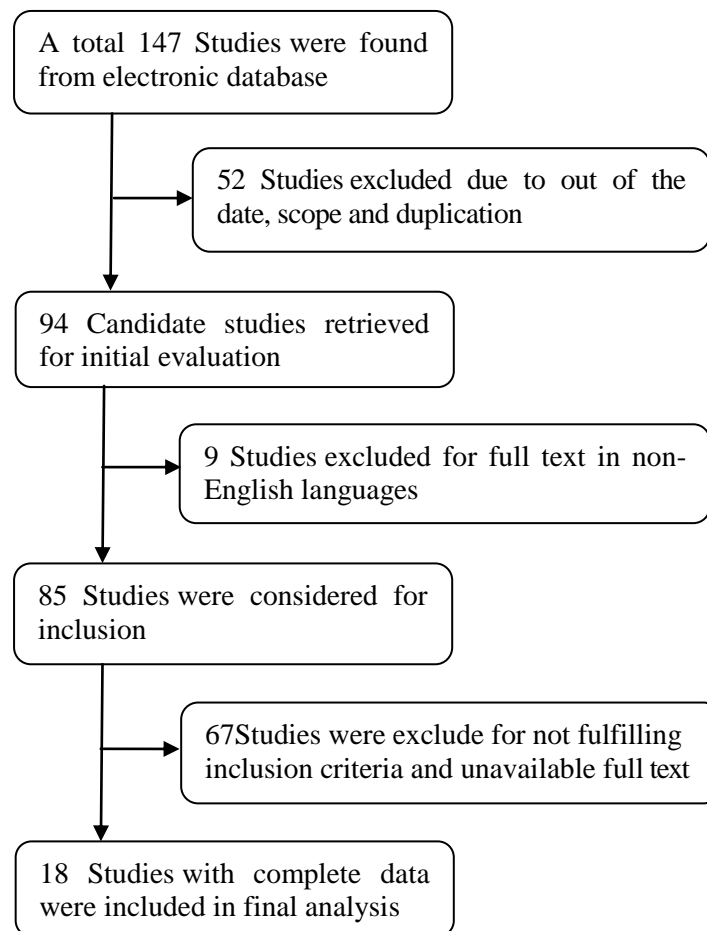
## INTRODUCTION

Oxytocin (OT) is a neurohypophysial peptide that is secreted from the posterior pituitary and enters into the blood flow. This hormone is synthesized in the peripheral tissues such as heart, testicles, uterus, placenta, and corpus luteum (1). OT plays different roles in the body and contributes mainly to humans' love and erotic behaviors and childbirth, and therefore serves important purposes in women's bodies. Besides that, OT plays a role in sexual activity, genital erection, ejaculation, uterine contraction at delivery, lactation, maternal behavior, stress (2), ethical behaviors (3, 4), parenting behaviors (5), aggressive behaviors and other mental states (6). Regarding the various functions of OT in the body, identifying its agonists and receptor antagonists in the body can contribute to the development of pharmacology and the treatment of certain disorders and diseases (7).

Despite the availability of different treatments for different aspects of health, chemical and herbal treatments remain significant in treating different disorders and diseases (8, 9). Meanwhile, medicinal

plants are increasingly being used due to comparatively lower cost and fewer side effects. These plants have potential to serve as effective therapies for different diseases including psychological and physiological (10-17). Regarding the physiological significance of OT, this review article is to report the effects of medicinal plants on OT and their action mechanism in intensifying, modulating, and neutralizing the adverse effects of OT.

In this systematic review, the key words such as "oxytocin" in combination with "medicinal plant", "herb\*" and "phyto\*" were searched via *Endnote* software. Relevant papers from *institute for scientific information (ISI)* and *PubMed* databases were retrieved. Then, the plants and the plant-based products that were effective on oxytocin were selected. The papers included in this review were published between 2007-2017. The articles whose full texts were not accessible, studies with non-positive effects, non-English language studies, and were not related to the purpose of this study were excluded after the authors' agreement was achieved. Figure 1 is the flowchart to illustrate how the articles were selected for final analysis.



**Figure 1.** Flowchart of the process of analyzing the articles

Plants and herbal combinations can be effective to decrease dysmenhorea and early miscarriage through various mechanisms (Table 1).

**Table 1.** Medicinal plants and phytochemicals effective on oxytocin.

Plants/Phytochemical names	Type of administration/ Origin	Main effects and mechanisms	Ref.
<i>Psidium guajava</i> Linn.	Extract	Exerting spasmolytic effect to treat dysmenorrhoea	(18)
<i>Ficus capensis</i>	Extract	Reducing OT level and can be treatment for remedy against threatened abortion	(19)
<i>Ficus deltoidea</i>	Extract	Inducing uterine contraction mediated by multiple uterotonic receptors (muscarinic, oxytocin and prostaglandin F2 alpha)	(20)
<i>Dracaena arborea</i>	Extract	Inhibiting bulbospongiosus muscles activity by blocking oxytocinergic and dopaminergic receptors	(21)
<i>Artemisia monosperma</i>	Extract	Increasing serum oxytocin hormone level and inducing abortion	(22)
<i>Citrus aurantium</i>	Extract	Reducing oxytocin and barium chloride-induced uterine contractions and relieving dysmenorrhea	(21)
<i>Scutellariae Radix</i>	Root of Scutellaria baicalensis	Inhibiting oxytocin (IC50 12.34 microM) and exerting tocolytic effect.	(23)
Genistein and daidzein	Soy bean	Elevating plasma oxytocin and influencing the endocrine status of pigs; modulating the hypothalamic OXT neurons	(24, 25)

Certain compounds such as galactogogues (26) and moxibustion (27) have been reported to contribute to increasing OT and lactation. However, some other studies did not report any documented results regarding the effects of medicinal plants in increasing OT (28-30). In addition, controlling OT levels has been reported to be effective in treating diseases such as dysmenorrhea. In addition, Danggui-Shaoyao-San is a Chinese herbal combination that reduces inflammatory reactions by suppressing OT-evoked prostaglandins F2 alpha (PGF2-alpha) production and other mechanisms, and therefore helps to treat dysmenhorea (31). Shao-Fu-Zhu-Yu decoction (32-34) and Xiang-fu-si-wu decoction (35) are two Chinese herbal combinations that are effective to reduce OT-induced complications such as dysmenhorea by inhibiting signaling pathways and expression of inflammatory cytokines, and modulating OT levels (33).

The treatments for modulating OT levels in the body, serve their purpose mainly by targeting OT receptors (2). Certain treatments for dysmenhorea, relieve the associated pains by decreasing (OT-induced) contraction of uterine smooth muscle via blocking calcium (Ca<sup>2+</sup>) channels and lowering the levels of Ca<sup>2+</sup>, PGF2-alpha, and nitric oxide (35-37). Therefore, certain plants relieve dysmenhorea by analgesic and

anti-inflammatory effects and affecting on nerve growth factor (NGF) and bradykinin, and protein and mRNA levels of NGF and bradykinin B1 receptor, and exerting anti-contractile properties rather than influencing OT levels (35-52).

However, available evidence suggests that the response to oxytocin is related to several factors including genetic factors and the presence of OT receptor genes (53), which highlights the need for more extensive studies. Medicinal plants are attracting attention due to exerting several effects mediated by antioxidant and anti-inflammatory effects on the different functions of the body's physiological system, and therefore their effects are being studied to find new therapeutic agents (54-63). However, the side effects of these drugs are often disregarded. The effects of the consumption of phytoestrogens on hormone-sensitive organs such as the brain and the genitalia during pregnancy and lactation, leads to many abnormalities in the endocrine system and genital cancers in adulthood (64,65).

On the other hand, the regulation of OT actions, which is performed by certain phytoestrogens, on uterine contractions is essential for maintaining pregnancy and preventing early miscarriage or abortion (66). The

oxytocic activities of certain plants, which are due to their compounds or high dosages, leads to severe spontaneous contractile frequency of the uterus and abortion (67,68). Certain phytoestrogens lead to ovarian dysfunction by affecting the OT synthesis in the ovary and the corpus luteum (69). Although most studies have been conducted *in vitro* and with laboratory animals, medicinal plants should be consumed in pregnancy and lactation with special cautions.

## CONCLUSION

Herbs and their derivatives can induce their tocolytic effects through inhibiting OT-induced uterine contractions by influencing its levels in the body including the neuraxis, and relieve dysmenhorea and increase lactation. Therefore, they can be used with chemical drugs to treat OT-associated disorders. However as with chemical drugs, certain cautions should be taken into account in consuming these remedies during pregnancy to minimize fetal and maternal side effects.

## ACKNOWLEDGMENTS

The authors would like to acknowledge Research and Technology Deputy of Shahrekord University of Medical Sciences for supporting this study.

## Conflicts of interest

There are no competing interests.

## REFERENCES

1. Gimpl G, Fahrenholz F. The oxytocin receptor system: structure, function, and regulation. *Physiological reviews*. 2001;81(2):629-83.
2. Magon N, Kalra S. The orgasmic history of oxytocin: Love, lust, and labor. *Indian Journal of Endocrinology and Metabolism*. 2011;15(Suppl3):S156-S61.
3. Scheele D, Striepens N, Kendrick KM, Schwering C, Noelle J, Wille A, et al. Opposing effects of oxytocin on moral judgment in males and females. *Human brain mapping*. 2014;35(12):6067-76.
4. Zak PJ, Kurzban R, Matzner WT. Oxytocin is associated with human trustworthiness. *Hormones and behavior*. 2005;48(5):522-7.
5. Gordon I, Zagoory-Sharon O, Leckman JF, Feldman R. Oxytocin and the development of parenting in humans. *Biological psychiatry*. 2010;68(4):377-82.
6. Alcorn JL, 3rd, Green CE, Schmitz J, Lane SD. Effects of oxytocin on aggressive responding in healthy adult men. *Behavioural pharmacology*. 2015;26(8 Spec No):798-804.
7. Viero C, Shibuya I, Kitamura N, Verkhatsky A, Fujihara H, Katoh A, et al. Oxytocin: Crossing the Bridge between Basic Science and Pharmacotherapy. *CNS Neuroscience & Therapeutics*. 2010;16(5):e138-e56.
8. Nikfarjam M, Heidari-Soureshjani S, Khoshdel A, Asmand P, Ganji F. Comparison of spiritual well-being and social health among the students attending group and individual religious rites. *World Family Medicine*. 2017;15(8):160-5.
9. Artimani T, Shabani S, Heidari-Soureshjani S, Asadi-Samani M, Luther T. A review of Iranian medicinal plants with teratogenic and abortion-inducing side effects. *International Journal of Pharmaceutical Sciences and Research*. 2017;8(6):2372-7.
10. Shabani S, Khalili S, Lorigooini Z, Malekpour A, Heidari-Soureshjani S. The effect of vaginal cream containing ginger in users of clotrimazole vaginal cream on vaginal candidiasis. *Journal of Advanced Pharmaceutical Technology & Research*. 2017;8(2):80.
11. Shirani M, Heidari-Soureshjani S, Yavangi M. Use of Iranian medicinal plants effective on male fertility indices. *Journal of Global Pharma Technology*. 2016;10(8):36-43.
12. Shirani M, Shabani S, Yavangi M. A systematic review of Iranian medicinal plants effective on female infertility. *Journal of Global Pharma Technology*. 2016;10(8):44-9.
13. Nikfarjam M, Bahmani M, Heidari-Soureshjani S. Phytotherapy for anxiety in Iran: A review of the most important Anti-anxiety medicinal plants. *J Chem Pharm Sci*. 2016;9(3):1235-41.
14. Nikfarjam M, Bahmani M, Heidari-Soureshjani S. Phytotherapy for depression: A review of the most important medicinal plants of flora of Iran effective on depression. *Journal of Chemical and Pharmaceutical Sciences*. 2016;9(3):1242-7.
15. Heidari-Soureshjani S, Asadi-Samani M, Yang Q, Saeedi-Boroujeni A. Phytotherapy of nephrotoxicity-induced by cancer drugs: an updated review. *Journal of Nephropathology*. 2017;6(3):254-63.

16. Shirani M, Raeisi R, Heidari-Soureshjani S, Asadi-Samani M. A review for discovering hepatoprotective herbal drugs with least side effects on kidney. *Journal of Nephro pharmacology*. 2017;6(2):38–48.
17. Solati K, Heidari-Soureshjani S, Luther T, Asadi-Samani M. Iranian medicinal plants effective on sexual disorders: A systematic review. *International Journal of Pharmaceutical Sciences and Research*. 2017;8(6):2415-20.
18. Chiwororo WD, Ojewole JA. Spasmolytic effect of *Psidium guajava* Linn. (Myrtaceae) leaf aqueous extract on rat isolated uterine horns. *Journal of Smooth Muscle Research*. 2009;45(1):31-8.
19. Owolabi OJ, Nworgu ZA, Falodun A, Ayinde BA, Nwako CN. Evaluation of tocolytic activity of ethanol extract of the stem bark of *Ficus capensis* Thunb. (Moraceae). *Acta Poloniae Pharmaceutica*. 2009;66(3):293-6.
20. Salleh N, Ahmad VN. In-Vitro effect of *Ficus deltoidea* on the contraction of isolated rat's uteri is mediated via multiple receptors binding and is dependent on extracellular calcium. *Bmc Complementary and Alternative Medicine*. 2013;13.
21. Watcho P, Modeste WN, Albert K, Carro-Juarez M. *Dracaena arborea* extracts delay the proejaculatory effect of dopamine and oxytocin in spinal male rats. *International Journal of Impotence Research*. 2014;26(6):213-7.
22. Hijazi AM, Salhab AS. Effects of *Artemisia monosperma* ethanolic leaves extract on implantation, mid-term abortion and parturition of pregnant rats. *Journal of Ethnopharmacology*. 2010;128(2):446-51.
23. Shih HC, Hsu CS, Yang LL. In vitro study of the tocolytic effect of oroxylin A from *Scutellaria baicalensis* root. *Journal of Biomedical Science*. 2009;16:27.
24. Norrby M, Madsen M, Saravia F, Lundeheim N, Madej A. Genistein alters the release of oxytocin, prostaglandins, cortisol and LH during insemination in gilts. *Reproduction in Domestic Animals*. 2011;46(2):316-24.
25. Yoshimura R, Yamamoto E, Endo Y. Morphological effects of isoflavones (daidzein and genistein) on hypothalamic oxytocin neurons in the neonatal mouse brain slice cultures. *Neuroscience Letters*. 2011;505(2):87-92.
26. Zuppa AA, Sindico P, Orchi C, Carducci C, Cardiello V, Romagnoli C. Safety and efficacy of galactogogues: substances that induce, maintain and increase breast milk production. *Journal of Pharmacy and Pharmaceutical Sciences*. 2010;13(2):162-74.
27. Coyle ME, Smith CA, Peat B. Cephalic version by moxibustion for breech presentation. *Cochrane Database Systematic Reviews*. 2012(5):CD003928.
28. Mortel M, Mehta SD. Systematic Review of the Efficacy of Herbal Galactogogues. *Journal of Human Lactation*. 2013;29(2):154-62.
29. Ushiroyama T, Sakuma K, Souen H, Nakai G, Morishima S, Yamashita Y, et al. Xiong-gui-tiao-xue-yin (Kyuki-chouketsu-in), a traditional herbal medicine, stimulates lactation with increase in secretion of prolactin but not oxytocin in the postpartum period. *American Journal of Chinese Medicine*. 2007;35(2):195-202.
30. Jing Z, Pistilli MJ, Holloway AC, Crankshaw DJ. The effects of commercial preparations of red raspberry leaf on the contractility of the rat's uterus in vitro. *Reproductive Sciences*. 2010;17(5):494-501.
31. Hua YQ, Su SL, Duan JA, Wang QJ, Lu Y, Chen L. Danggui-Shaoyao-San, a traditional Chinese prescription, suppresses PGF2alpha production in endometrial epithelial cells by inhibiting COX-2 expression and activity. *Phytomedicine*. 2008;15(12):1046-52.
32. Su S, Hua Y, Duan JA, Shang E, Tang Y, Bao X, et al. Hypothesis of active components in volatile oil from a Chinese herb formulation, 'Shao-Fu-Zhu-Yu decoction', using GC-MS and chemometrics. *Journal of Separation Science*. 2008;31(6-7):1085-91.
33. Huang X, Su S, Duan JA, Sha X, Zhu KY, Guo J, et al. Effects and mechanisms of Shaofu-Zhuyu decoction and its major bioactive component for Cold - Stagnation and Blood - Stasis primary dysmenorrhea rats. *Journal of Ethnopharmacology*. 2016;186:234-43.
34. Su S, Hua Y, Duan JA, Zhou W, Shang E, Tang Y. Inhibitory effects of active fraction and its main components of Shaofu Zhuyu decoction on uterus contraction. *American Journal of Chinese Medicine*. 2010;38(4):777-87.
35. Liu P, Duan JA, Hua YQ, Tang YP, Yao X, Su SL. Effects of xiang-fu-si-wu decoction and its main components for dysmenorrhea on uterus

- contraction. *Journal of Ethnopharmacology*. 2011;133(2):591-7.
36. Sun L, Liu L, Zong S, Wang Z, Zhou J, Xu Z, et al. Traditional Chinese medicine Guizhi Fuling capsule used for therapy of dysmenorrhea via attenuating uterus contraction. *Journal of Ethnopharmacology*. 2016;191:273-9.
  37. Yang L, Chai CZ, Yue XY, Yan Y, Kou JP, Cao ZY, et al. Ge-Gen Decoction attenuates oxytocin-induced uterine contraction and writhing response: potential application in primary dysmenorrhea therapy. *Chinese Journal of Natural Medicines*. 2016;14(2):124-32.
  38. Rowlands DK, Cui YG, Wong HY, Gou YL, Chan HC. Traditional Chinese medicine Bak Foong Pills alters uterine quiescence - possible role in alleviation of dysmenorrhoeal symptoms. *Cell Biology International*. 2009;33(12):1207-11.
  39. Ahangarpour A, Oroojan AA, Amirzargar A, Ghanavati M. Antispasmodic effects of *Citrus aurantium* flowers aqueous extract on uterus of non-pregnant rats. *Iranian Journal of Reproductive Medicine*. 2011;9(4):289-94.
  40. Ma H, Su S, Duan J, Tang Y, Zhou J, Guo J, et al. Evaluation of the analgesic activities of the crude aqueous extract and fractions of Shao Fu Zhu Yu decoction. *Pharmaceutical Biology*. 2011;49(2):137-45.
  41. Shi Y, Wu D, Sun Z, Yang J, Chai H, Tang L, et al. Analgesic and uterine relaxant effects of isoliquiritigenin, a flavone from *Glycyrrhiza glabra*. *Phytotherapy Research*. 2012;26(9):1410-7.
  42. Su S, Hua Y, Wang Y, Gu W, Zhou W, Duan JA, et al. Evaluation of the anti-inflammatory and analgesic properties of individual and combined extracts from *Commiphora myrrha*, and *Boswellia carterii*. *J Ethnopharmacol*. 2012;139(2):649-56.
  43. Bafor EE, Lim CV, Rowan EG, Edrada-Ebel R. The leaves of *Ficus exasperata* Vahl (Moraceae) generates uterine active chemical constituents. *Journal of Ethnopharmacology*. 2013;145(3):803-12.
  44. Chen Y, Cao Y, Xie Y, Zhang X, Yang Q, Li X, et al. Traditional Chinese medicine for the treatment of primary dysmenorrhea: how do Yuanhu painkillers effectively treat dysmenorrhea? *Phytomedicine*. 2013;20(12):1095-104.
  45. Jia J, Li Y, Lei Z, Hao Y, Wu Y, Zhao Q, et al. Relaxative effect of core licorice aqueous extract on mouse isolated uterine horns. *Pharmaceutical Biology*. 2013;51(6):744-8.
  46. Sukwan C, Wray S, Kupittayanant S. The effects of Ginseng Java root extract on uterine contractility in nonpregnant rats. *Physiological Reports*. 2014;2(12).
  47. Bafor EE, Okunrobo LO. In vitro myometrial inhibition by the partitioned aqueous fraction of *Anthocleista djalonensis* leaves. *Canadian Journal of Physiology and Pharmacology*. 2010;88(9):880-7.
  48. Sumi G, Yasuda K, Kanamori C, Kajimoto M, Nishigaki A, Tsuzuki T, et al. Two-step inhibitory effect of kanzo on oxytocin-induced and prostaglandin F<sub>2</sub>α-induced uterine myometrial contractions. *Journal of Natural Medicines*. 2014;68(3):550-60.
  49. Yang L, Chai CZ, Yan Y, Duan YD, Henz A, Zhang BL, et al. Spasmolytic Mechanism of Aqueous Licorice Extract on Oxytocin-Induced Uterine Contraction through Inhibiting the Phosphorylation of Heat Shock Protein 27. *Molecules*. 2017;22(9).
  50. Jingwei C, Huilan D, Ruixiao T, Hua Y, Huirong M. Effect of Bushenwenyanghuayu decoction on nerve growth factor and bradykinin/bradykinin B1 receptor in a endometriosis dysmenorrhea mouse model. *Journal of Traditional Chinese Medicine*. 2015;35(2):184-91.
  51. Sumi G, Yasuda K, Tsuji S, Kanamori C, Tsuzuki T, Cho H, et al. Lipid-soluble fraction of Shakuyaku-kanzo-to inhibits myometrial contraction in pregnant women. *Journal of Obstetrics and Gynaecology Research*. 2015;41(5):670-9.
  52. Ghanadian M, Sadraei H, Asghari G, Abbasi Z. Bioassay-directed isolation of faltarindiol and isoacetovanillon from *Pycnocycla caespitosa* based on KCl-induced contraction in rat uterus smooth muscles. *Research in Pharmaceutical Sciences*. 2017;12(3):249-56.
  53. Cochran D, Fallon D, Hill M, Frazier JA. "The role of oxytocin in psychiatric disorders: A review of biological and therapeutic research findings". *Harvard Review of Psychiatry*. 2013;21(5):219-47.
  54. Heidarian E, Rafieian-Kopaei M. Protective effect of artichoke (*Cynara scolymus*) leaf

- extract against lead toxicity in rat. *Pharmaceutical Biology*. 2013;51(9):1104-9.
55. Rafieian-Kopaei M, Baradaran A, Rafieian M. Oxidative stress and the paradoxical effects of antioxidants. *Journal of Research in Medical Sciences*. 2013;18(7):628.
  56. Rafieian-Kopaei M, Asgary S, Adelnia A, Setorki M, Khazaei M, Kazemi S, et al. The effects of cornelian cherry on atherosclerosis and atherogenic factors in hypercholesterolemic rabbits. *Journal of Medicinal Plants Research*. 2011;5(13):2670-6.
  57. Bahmani M, Sarrafchi A, Shirzad H, Rafieian-Kopaei M. Autism: Pathophysiology and promising herbal remedies. *Current pharmaceutical design*. 2016;22(3):277-85.
  58. Ghatreh-Samani M, Esmaeili N, Soleimani M, Asadi-Samani M, Ghatreh-Samani K, Shirzad H. Oxidative stress and age-related changes in T cells: is thalassemia a model of accelerated immune system aging? *Central-European journal of immunology*. 2016;41(1):116-24.
  59. Mirhoseini M, Moradi MT, Asadi-Samani M. Traditionally used Medicinal Plants in the Treatment of Kidney Stone: a Review on Ethnobotanical Studies in Iran. *Ambient Sci*. 2016;3(2):16-21.
  60. Mansouri E, Asadi-Samani M, Kooti W, Ghasemiboroon M, Ashtary-Larky D, Alamiri F, et al. Anti-fertility effect of hydro-alcoholic extract of fennel (*Foeniculum vulgare* Mill) seed in male Wistar rats. *Journal of Veterinary Research*. 2016;60(3):357-63.
  61. Asadi-Samani M, Bagheri N, Rafieian-Kopaei M, Shirzad H. Inhibition of Th1 and Th17 cells by medicinal plants and their derivatives: A systematic review. *Phytotherapy Research*. 2017;<http://onlinelibrary.wiley.com/doi/10.1002/ptr.5837/abstract>.
  62. Asadi-Samani M, Bahmani M, Rafieian-Kopaei M. The chemical composition, botanical characteristic and biological activities of *Borago officinalis*: a review. *Asian Pacific Journal of Tropical Medicine*. 2014;7:S22-S8.
  63. Parsaei P, Karimi M, Asadi SY, Rafieian-kopaei M. Bioactive components and preventive effect of green tea (*Camellia sinensis*) extract on post-laparotomy intra-abdominal adhesion in rats. *International Journal of Surgery*. 2013;11(9):811-5.
  64. Dinsdale EC, Ward WE. Early Exposure to Soy Isoflavones and Effects on Reproductive Health: A Review of Human and Animal Studies. *Nutrients*. 2010;2(11):1156-87.
  65. Patisaul HB. Endocrine disruption by dietary phyto-oestrogens: impact on dimorphic sexual systems and behaviours. *Proceedings of the Nutrition Society*. 2017;76(2):130-44.
  66. Wrobel M, Kotwica J. Phytoestrogens reduce the effect of polychlorinated biphenyls on the contractility of bovine myometrium in vitro. *Veterinari Medicina*. 2007;52(2):55-62.
  67. Nworu CS, Akah PA, Okoli CO, Okoye TC. Oxytocic activity of leaf extract of *Spondias mombin*. *Pharmaceutical Biology*. 2007;45(5):366-71.
  68. Owolabi OJ, Omogbai EK, Falodun A. Oxytocic effects of the aqueous leaf extract of *Costus lucanusianus* - family Costaceae on isolated non-pregnant rat uterus. *Pakistan Journal of Pharmaceutical Sciences*. 2010;23(2):207-11.
  69. Mlynarczuk J, Wrobel MH, Kotwica J. The adverse effect of phytoestrogens on the synthesis and secretion of ovarian oxytocin in cattle. *Reproduction in Domestic Animals*. 2011;46(1):21-8.

\*\*\*\*\*