Translational Research in Urology

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Review

The Effect of Herbal Extracts on the Treatment and Prevention of Prostate Cancer: A Literature Review

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HIGHLIGHTS

- Natural resources and medicinal plants in prostatic hyperplasia.
- Importance and value of complementary therapies and nutrition in the treatment of prostate cancer.

ARTICLE INFO

Document type: Review
Receive Date: 28 August 2019
Accept Date: 24 Septembe 2019
Avaliable online: 20 November 2019
DOI: 10.22034/TRU.2020.231129.1021

ABSTRACT

Today, prostate cancer is the second leading cause of death in men. Disorders of this gland have side effects on fertility and cause urinary problems. As people aged, the prostate gland can have some problems, including benign hyperplasia and prostate cancer, which are caused by abnormal growth of the gland. Various natural supplements that affect the growth and proliferation of prostate cells have been found using epidemiological, laboratory, and clinical studies. With the help of findings from herbal medicine, the problems caused by prostate disorders can be controlled and treated largely. In this review article, the mechanism of action of some of these natural substances is considered including garden thyme, spirulina algae, ruta graveolens L, wheat germ, nettle root extract urtica dioica, lycopene, saw palmetto, garlic, curcumin, pumpkin seeds, green tea, and soy. The main functional mechanism of most of these plant extracts may be the inhibition of the enzyme 5 alpha-reductase. This enzyme converts testosterone to dihydrotestosterone, which causes dihydrotestosterone to cause carcinogens in the prostate. The purpose of writing this article is to introduce and use some medicinal plants that help treat prostate cancer.

Keywords: Herbal Extracts; Prostate Cancer Treatment; Prostate Cancer

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Introduction

The prostate is one of the glands in the reproductive system of men, and its lesions and diseases are of great prevalence and importance (1). The prostate is a small gland under the bladder that covers the upper part of the urethra. In developed countries, prostate cancer is the second most common cancer (after skin cancer) and the second deadliest cancer (after lung cancer) in men (1, 2). Due to the importance of prostate diseases, especially carcinoma, and laboratory research to find a drug or a new method in the treatment of endocrine disorders, has a lot of value. On the other hand, common treatments for prostate carcinoma are currently associated with a variety of limitations, failures, and side effects (3, 4). Due to the high cost of treatment and side effects of chemical drugs, it is very important to find herbal medicines that are less expensive, have side effects, and can be antioxidant activity.

Garden thyme

There are compounds in the hydro-alcoholic extract of garden thyme that inhibit these enzymes and reduce oxidative stress (5, 6). Thyme is one of the medicinal plants that can attributes various therapeutic effects. The aforementioned effects include anti-inflammatory, antiseptic, antitussive, antispasmodic, and expectorant properties (7). The hydroalcoholic extract of the leaves and flowering branches of the thyme plant garden has various compounds, the most important ones are thymol and carvacrol. The biological and traumatic effects of the extract are mainly the consequence of these compounds. It should be noted that the above-mentioned compounds in the hydroalcoholic extract of garden thyme include a high and significant percentage (8). Various studies have shown that cyclooxygenase enzymes play a very important role in carcinogenic mechanisms. As an example, the inhibition of apoptosis has been demonstrated by the intensification of cyclooxygenase enzymes (9, 10). Decreased apoptosis during cancer has also been confirmed by some studies (11). It has been shown that the activity of cyclooxygenase enzymes increases cell proliferation (12). Other research has shown that regression, cellular proliferation, and suppression of defense responses are observed following the intensification of cyclooxygenase enzymes (13). The above explanations suggest that the therapeutic and preventive effects of the hydroalcoholic extract of the thyme plant extract may be related to pre-cancerous lesions and carcinoma of the parenchymal cells of the prostate gland and the neurotransmitter of the carcinoma (14). Flavonoids are another compound found in garden thyme hydroalcoholic extract (8). One study found that flavonoids inhibited the growth and inhibition of lung carcinoma in mice (15). So, flavonoids, in addition to thymol and carvacrol, may play a role in reducing or preventing the progression of cancerous lesions and inhibiting carcinogenic mechanisms.

Spirulina algae

Spirulina algae is one of the plants that is rich in antioxidant compounds. The algae were previously classified according to its genetic, biochemical, and biophysical characteristics, but is now in the plant family (16). Various studies have pointed to the anticancer role of spirulina, and various studies have shown that the anticancer role of spirulina in its effect on the mitochondria of cancer cells affects the message pathways (17). In 2001, Estrada Pinero et al., investigated the antirheumatic effect of spirulina plants and showed that the compounds ficobioleoprotein and phycocyanin present in the extract of this algae had a very strong antioxidant status (18). In a 2005 study by Khan and colleagues, he noted the anti-cancer role of spirulina algae. This group also acknowledged that this related property is due to the antioxidant properties of this alga (19). Spirulina extract, by affecting the main gene of the immortality pathway (Oct4, Nanog, and Stat3) and reducing their expression, helps to reduce the immortality characteristic of the cell, and this reduction prevents the development of cancerous tissue (20). Therefore, it can be said that taking spirulina as an herbal supplement can increase cell death and eliminate the basic cells of prostate cancer and increase the risk of cancer eradication.

Ruta graveolens L

Ruta graveolens is a medicinal herb that has been applied for a long time versus several diseases. Ruta graveolens extract contains bioactive combinations such as methanolic extract that prevent proliferation and survival of cancer cells via multiple goals. *Ruta graveolens* extract can decrease the viability, the levels of phospho-Akt and cyclin B1, activation of caspase-3, and the p53 pathway (21). *Sedabs* are a species of the genus Sedabia (citrus) of the order Sedab (Rotal = Tarbental). According to the scientific classification of linen, there are three types of sediments: *Ruta Chalepensis L.*, *Ruta Graveolens L*, *Ruta Montana L*. In the famous book of Abu Ali Sina's law, Dyscorides is quoted as saying that there are three types of sediments: desert, implantable, and mountainous, which may be the same as the three types of sedimentary scientific classification sediments, especially that Montana means "mountain". The implant is known as Ruta graveolens L (22). The aqueous and hydroalcoholic extracts of sedab plant have some cytotoxic effects. On the other hand, the antioxidant properties of blueberry extract and hydroalcoholic plant sedab is the same ratio.

Wheat germ

wheat germ extract (FWGE; trade name AVEMAR)

Wheat germ is a nutrient with high nutrients and high nutritional value (23). Synthesis of beneficial compounds

such as vitamins, phenols, and other antioxidants occurs during seed germination. Wheat germ is rich in high antioxidant components with high absorbency (24). Imir et al., 2018, showed that the mechanism of the anti-angiogenic effect of AVEMAR on tumor cells. They indicated that AVEMAR can inhibit the induced vascular endothelial growth factor (VEGF) and Cox-2 levels (25). Wheat germ extract with strong antioxidant content has been able to inhibit the negative and toxic effects of lead on prostate tissue structure. Oral consumption of wheat germ is useful in inhibiting oxidative stress on the tissue structure of prostate rats exposed to lead (24).

Nettle root extract

Urtica dioica

Nettle is a plant belonging to the *Urticaceae* family that is used to treat a variety of diseases. The nettle genus usually consists of perennial herbaceous plants 8-10 cm high, and most of its aerial parts are covered with hook-like or conical hairs (26, 27). In 1994, Wagner first reported the anti-prostatic origin of *nettle* root. It should be noted that today the most common use of nettle root in disorders is related to the prostate gland (28). As the most common herbal medicine in the treatment of prostate cancer and its various extracts have been shown to have anti-prostate effects, this plant is widely used in Europe for the treatment of benign prostatic hyperplasia (29-31). The most important compounds in nettle root, which have pharmacological effects, include lignans, sterols, flavonoids, polysaccharides, lectins, and fatty acids (32, 33). There is also linoleic acid in nettle root, which lowers cholesterol, thus lowering testosterone levels (34). Aqueous extract of nettle leaves significantly inhibits the activity of adenosine deaminase in prostate tissue. Also, the presence of hydrophilic steroid compounds in nettle root extract inhibits the activity of the sodium-potassium pump of the prostate membrane, thereby suppressing the metabolism and cell growth of the prostate (35). It has also been reported that nettle root extract has anti-proliferative properties on prostate cells in the laboratory (36-38). Conrad et al., In a study titled the inhibitory effect of nettle root extract on human prostate cancer cells showed that nettle root extract is effective in reducing the proliferation of prostate cancer cells (38). In a study by Nahata A, Dixit V 2012 the effects of nettle remediation on testosterone mouse prostatic hyperplasia showed that nettle herb could be used as an effective drug to treat prostate hypertrophy by inhibiting the 5α-reductase enzyme (26). In 2004, Durak et al., demonstrated the effect of blueberry extract on the significant inhibition of prostate adenosine deaminase activity and believed that it could be one of the mechanisms by which the plant extract was used to treat prostate cancer. blueberry extract has hydrophilic steroid compounds. The presence of hydrophilic steroid compounds in nettle root extract inhibits the activity of the sodium potassium pump of the prostate membrane, thereby suppressing the metabolism and cell growth of the prostate (32). Herbal dichromethanol extract can be a good candidate as an anti-cancer compound.

Lycopene

Lycopene is a chemical found in some fruits and vegetables and is highly effective in inhibiting prostate cancer. Lycopene is currently being studied in many research centers. Lycopene is a carotenoid in the blood that has antioxidant properties (39). A new study in mice found that lycopene can inhibit prostate tumor formation specifically (attack on target tissue) (40). A randomized clinical trial showed that in men with high-grade neoplasia of the prostate tissue, the administration of lycopene was able to reduce the progression and severity of cancer (41). Another study found that taking lycopene reduced prostate specific antigen (PSA) levels and slowed the progression of the disease in patients (42, 43).

Saw Palmetto

Iranian date palm fruit extract has been shown to have the greatest effect on improving symptoms, increasing urinary flow, and reducing nocturnal enuresis, which is comparable to *Finasteride* (the most effective drug in the treatment of benign human hyperplasia of human prostatitis (44, 45). This plant is mostly used in benign prostatic hypertrophy and is used in the treatment of large prostate. Research shows that high-concentration sawdust extract blocks the enzyme 5-alpha reductase, which converts testosterone to dihydrotestosterone, and acts like a chemical and fumigant blocking drug like finasteride. *Saw palms* contain the antioxidants epicatechin and methyl gallate, which prevent cell damage, reduce inflammation, and protect against chronic disease, and in mice with enlarged prostate glands. Reduced swelling and some inflammatory markers, including interleukin-6, have been reported. *Saw palms* inhibit the conversion of testosterone to di-hydro-testosterone in prostate tissue (46).

Garlic

Garlic contains a large amount of an ingredient called *Allicin*, which stimulates blood circulation and blood flow to the genitals of men and women. The hydrogen sulfide in garlic has a direct relationship with prostate health because it protects against benign prostatic hyperplasia. One study found that garlic has properties that can kill cancer-causing factors. There is a compound in garlic that has been shown to inhibit the growth of prostate cancer cells in the living environment (47). Preliminary studies on garlic suggest that a compound called alum has high anti-tumor properties in prostate cancer. A separate study found that a component of garlic called

s-allyl mercaptoist had high antitumor properties and converted residual testosterone products into low-risk substances (48). A review study has shown that aluminum can powerfully inhibit the proliferation of Lncap prostate cancer cell lines (49). Another review study confirms the anti-tumor effects of garlic on prostate cancer (50-52). Another study has shown that a compound in garlic called di-allyl disulfide can inhibit the growth of prostate cancer cells. An additional study showed that di-allyl di-sulfide could affect the programmed cell death of prostate cancer (apoptosis) and play an important role in controlling this cancer (53).

Curcumin

Curcumin is a natural product found in turmeric that has unique biological and medicinal properties due to its special chemical structure. Curcumin, through various cellular and molecular mechanisms, inhibits the onset of cancer cell formation or inhibits its growth. The mechanism of action of curcumin anti-cancer activity in prostate cancer is the modification of several signaling pathways, including activation of the PI3K/Akt/mTOR pathway, and molecular targeting of NF-κB and Bcl-2 molecules (54). Studies in mice with Curcumin have shown anti-carcinogenic properties in the treatment of various cancers. While the mechanism of action of this substance is still unknown, curcumin is also effective on the human cancer cell category (55). A new study in mice has shown that curcumin has been shown to inhibit the proliferation of prostate cancer cells (both androgen-dependent and androgen-independent). A study has found that curcumin blocks the growth of prostate cancer cells by inhibiting the activity of the enzyme tyrosine kinase, a receptor for an epiphyseal growth factor (56). One study found that curcumin was an effective substance in treating androgen-dependent prostate cancer (54). In another study, curcumin was able to inhibit prostate cancer cells by blocking the effects of factors such as NF-κB and AP-6 (57-60).

Pumpkin seeds

Pumpkin seeds, extracts, and pumpkin oil are very important in improving men's reproductive ability. It is also recommended to use this plant in the daily diet to reduce the side effects of lead contamination and the desired sexual status. The most important ingredients in pumpkin seed extract contain unsaturated fatty oils, vitamin E, and phytosterols. In addition to these compounds, this plant also contains minerals, pigments, and phenolic compounds. Today, pumpkin oil is used as an effective treatment for benign prostatic enlargement, According to the researchers' findings, the use of pumpkin seed oil in clinical terms can be effective as a complementary and alternative drug treatment for benign prostatic hyperplasia (61). The absorption of pumpkin seed extract is associated with a reduction in the symptoms of benign prostatic hypertrophy. Pumpkin extract improves hormones secreted by testicular tissue and is therefore is an effective extract in male infertility. Pumpkin seed extract reduces the number of abnormal sperm and has a great effect on the prevention and treatment of male infertility (62, 63). Pumpkin extract inhibits the enzyme 5-alpha reductase and prevents the conversion of testosterone to dihydrotestosterone (64).

Green tea

Green tea has been shown to have inhibitory effects on prostate cancer several times. Studies on rats have shown that green tea has been shown to inhibit the enzyme 5 alpha-reductase (65). This enzyme converts testosterone to dihydrotestosterone, which causes dihydrotestosterone to cause carcinogens in the prostate. The strongest compound in green tea is epigallocatechin 3-gallate. A study in mice showed that green tea even on other enzymes and prostate cancer growth factors also have a restraining effect. The combination of epigallocatechin 3-gallate is found in high concentrations in the blood of green tea consumers. Green epigallocetin 3 - gallstones and other green tea compounds inhibit an enzyme called the proteasome. Proteaseam is a key factor in the formation of prostate cancer (66, 67). Green tea can block the formation of prostate cancer, as well as reduce the risk of developing prostate cancer by lowering the levels of polyamines. Green tea polyphenols not only inhibit the growth of prostate cancer cells in mice, but also prevent their metastasis to nearby tissues (66, 68).

Soy

Soybeans have adequate amounts of phytosterols (vegetable fats). These phytosterols are known to decrease the level of cholesterol properties. Phytosterols have been shown to have positive effects in the treatment of benign hyperplasia. Saponins are another class of substances found in soybeans. Saponins (Triterpene glycosides) are also found in many other types of plants such as Lagenaria siceraria (69), and Holothuria leucospilota (70). Soy saponins are olenan-type tripotropic glycosides. Soy saponins are involved in several biological activities such as hepatic protection, anti-cancer, antioxidant, anti-lipid, etc. (71). They are known to have various anti-cancer properties. Phytates are another class of substances found in soy. These substances increase the body's ability to kill natural cells. Studies show that phytates also have anti-cancer activity. On the other hand, phytate prevents proteolysis by inhibiting the activity of digestive proteins. The anti-cancer activity of myoinositol Hexa phosphate is achieved by reducing cell proliferation and increasing the differentiation of malignant cells, leading to the return of

cells to their normal phenotype (72). The phytoestrogens found in soy show anti-estrogenic effects, and again, these properties enhance the function of preventing prostate cancer in soy. In general, phytoestrogens can have an inhibitory effect on the enzyme, which is thought to be due to their effect on inhibiting-5 alpha reductase (73, 74).

Conclusions

In this article, a review of several compounds isolated from natural resources and medicinal plants with significant medical and pharmacological effects is discussed in cancer treatment supplementation and benign prostatic hyperplasia. This article provides an overview of the importance and value of complementary therapies and nutrition in the treatment and prevention of prostate cancer. Due to the costs and side effects of chemical drugs, the use of medicinal plants with lower costs and side effects and with much antioxidant activity is much more economical.

Acknowledgments

Special thanks to Urology Research Center (URC), Tehran University of Medical Sciences, Tehran, Iran.

Authors' contributions

All authors contributed equally.

Conflict of interest

All authors claim that there is no competing interest.

Funding

There was no founding.

Ethics statement

Not applicable.

Data availability

Not applicable.

Abbreviations

PSA	Prostate specific antigen
VEGF	Vascular endothelial growth factor

References

1. Jemal A, Murray T, Ward E, Samuels A, Tiwari RC, Ghafoor A, et al. Cancer statistics, 2005. CA: a cancer journal for clinicians. 2005;55(1):10-30.
2. Patel AR, Jones JS. Optimal biopsy strategies for the diagnosis and staging of prostate cancer. Current opinion in urology. 2009;19(3):232-7.
3. Pollack A, Zagars GK, Smith LG, Lee JJ, Von Eschenbach AC, Antolak JA, et al. Preliminary results of a randomized radiotherapy dose-escalation study comparing 70 Gy with 78 Gy for prostate cancer. Journal of Clinical Oncology. 2000;18(23):3904-11.
4. K Watson E, O'Brien R, Campbell C, Weller D, D Neal R, Wilkinson C, et al. Views of health professionals on the role of primary care in the follow-up of men with prostate cancer. Family practice. 2011;28(6):647-54.
5. Mastelic J, Jerkovic I, Blažević I, Poljak-Blaži M, Borović S, Ivančić-Baće I, et al. Comparative study on the antioxidant and biological activities of carvacrol, thymol, and eugenol derivatives. Journal of agricultural and food chemistry. 2008;56(11):3989-96.
6. Hotta M, Nakata R, Katsukawa M, Hori K, Takahashi S, Inoue H. Carvacrol, a component of thyme oil, activates PPARα and γ and suppresses COX-2 expression. Journal of lipid research. 2010;51(1):132-9.
7. Vigo E, Cepeda A, Perez-Fernandez R, Gualillo O. In-vitro anti-inflammatory effect of Eucalyptus globulus and Thymus vulgaris: nitric oxide inhibition in J774A. 1 murine macrophages. Journal of Pharmacy and Pharmacology. 2004;56(2):257-63.
8. Keefover-Ring K, Thompson JD, Linhart YB. Beyond six scents: defining a seventh Thymus vulgaris chemotype new to southern France by ethanol extraction. Flavour and fragrance journal. 2009;24(3):117-22.
9. Dubois RN, Abramson SB, Crofford L, Gupta RA, Simon LS, A. Van De Putte LB, et al. Cyclooxygenase in biology and disease. The FASEB journal. 1998;12(12):1063-73.
10. Kim H-J, Chung J-I, Lee SH, Jung Y-S, Moon C-H, Baik EJ. Involvement of endogenous prostaglandin F2α on kainic acid-induced seizure activity through FP receptor: The mechanism of proconvulsant effects of COX-2 inhibitors. Brain research. 2008;1193:153-61.
11. Dannenberg AJ, Altorki NK, Boyle JO, Dang C, Howe LR, Weksler BB, et al. Cyclo-oxygenase 2: a pharmacological target for the prevention of cancer. The lancet oncology. 2001;2(9):544-51.
12. Higashi Y, Kanekura T, Kanzaki T. Enhanced expression of cyclooxygenase (COX)-2 in human skin epidermal cancer cells: Evidence for growth suppression by inhibiting COX-2 expression. International journal of cancer. 2000;86(5):667-71.
13. Singh-Ranger G, Salhab M, Mokbel K. The role of cyclooxygenase-2 in breast cancer. Breast cancer research and treatment. 2008;109(2):189-98.
14. Kaefer CM, Milner JA. The role of herbs and spices in cancer prevention. The Journal of nutritional biochemistry. 2008;19(6):347-61.
15. Zheng W, Gao X, Chen C, Tan R. Total flavonoids of Daphne genkwa root significantly inhibit the growth and metastasis of Lewis lung carcinoma in C57BL6 mice. International immunopharmacology. 2007;7(2):117-27.
16. Finamore A, Palmery M, Bensehaila S, Peluso I. Antioxidant, immunomodulating, and microbial-modulating activities of the sustainable and ecofriendly spirulina. Oxidative medicine and cellular longevity. 2017;2017.
17. Li X-L, Wong Y-S, Xu G, Chan JC. Selenium-enriched Spirulina protects INS-1E pancreatic beta cells from human islet amyloid polypeptide-induced apoptosis through suppression of ROS-mediated mitochondrial dysfunction and PI3/AKT pathway. European journal of nutrition. 2015;54(4):509-22.
18. Miranda M, Cintra R, Barros SBdM, Mancini-Filho J. Antioxidant activity of the microalga Spirulina maxima. Brazilian Journal of Medical and biological research. 1998;31(8):1075-9.
19. Khan M, Shobha JC, Mohan IK, Naidu MUR, Sundaram C, Singh S, et al. Protective effect of Spirulina against doxorubicin-induced cardiotoxicity. Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives. 2005;19(12):1030-7.
20. Zamani L, Zaker Bostanabad S, Salehipour M. Evaluation spirulina extract effect on DU145cell line and oct4 gene expression pattern in treated cell. New Cellularand Molecular Biotechnology Journal. 2018;8(32):53-64.
21. Gentile MT, Ciniglia C, Reccia MG, Volpicelli F, Gatti M, Thellung S, et al. Ruta graveolens L. induces death of glioblastoma cells and neural progenitors, but not of neurons, via ERK 1/2 and

AKT activation. PLoS One. 2015;10(3):e0118864.
22. Al-Snafi AE. A review on Cyperus rotundus A potential medicinal plant. IOSR Journal Of Pharmacy. 2016;6(7):32-48.
23. ZHU KX, ZHOU HM, QIAN HF. Comparative study of chemical composition and physicochemical properties of defatted wheat germ flour and its protein isolate. Journal of food biochemistry. 2006;30(3):329-41.
24. Adibmoradi M, Morovvati H, Moradi HR, Sheybani M-T, Amoli JS, Mazaheri Nezhad Fard R. Protective effects of wheat sprout on testicular toxicity in male rats exposed to lead. Reprod Syst Sex Disord. 2015;4(4):1-9.
25. Imir NG, Aydemir E, Şimşek E. Mechanism of the anti-angiogenic effect of avemar on tumor cells. Oncology letters. 2018;15(2):2673-8.
26. Nahata A, Dixit V. Ameliorative effects of stinging nettle (Urtica dioica) on testosterone-induced prostatic hyperplasia in rats. Andrologia. 2012;44:396-409.
27. Pavone C, Abbadessa D, Tarantino M, Oxenius I, Lagana A, Lupo A, et al. Associating Serenoa repens, Urtica dioica and Pinus pinaster. Safety and efficacy in the treatment of lower urinary tract symptoms. Prospective study on 320 patients. Urologia Journal. 2010;77(1):43-51.
28. Ghorbanibirgani A, Khalili A, Zamani L. The efficacy of stinging nettle (Urtica dioica) in patients with benign prostatic hyperplasia: a randomized double-blind study in 100 patients. Iranian Red Crescent Medical Journal. 2013;15(1):9.
29. Engelmann U, Walther C, Bondarenko B, Funk P, Schläfke S. Efficacy and safety of a combination of sabal and urtica extract in lower urinary tract symptoms. Arzneimittelforschung. 2006;56(03):222-9.
30. Safarinejad MR. Urtica dioica for treatment of benign prostatic hyperplasia: a prospective, randomized, double-blind, placebo-controlled, crossover study. Journal of herbal pharmacotherapy. 2005;5(4):1-11.
31. Namazi N, Esfanjani A, Heshmati J, Bahrami A. The effect of hydro alcoholic Nettle (Urtica dioica) extracts on insulin sensitivity and some inflammatory indicators in patients with type 2 diabetes: a randomized double-blind control trial. Pakistan Journal of Biological Sciences. 2011;14(15):775.
32. Durak I, Biri H, Devrim E, Sözen S, Avcı A. Aqueous extract of Urtica dioica makes significant inhibition on adenosine deaminase activity in prostate tissue from patients with prostate cancer. Cancer biology & therapy. 2004;3(9):855-7.
33. Koch E. Extracts from fruits of saw palmetto (Sabal serrulata) and roots of stinging nettle (Urtica dioica): viable alternatives in the medical treatment of benign prostatic hyperplasia and associated lower urinary tracts symptoms. Planta medica. 2001;67(06):489-500.
34. Chrubasik JE, Roufogalis BD, Wagner H, Chrubasik S. A comprehensive review on the stinging nettle effect and efficacy profiles. Part II: urticae radix. Phytomedicine. 2007;14(7-8):568-79.
35. Hirano T, Homma M, Oka K. Effects of Stinging Nettle Root Extracts and Their Steroidal Components on the Na+, K+-ATPase of the Benign Prostatic Hyperplasia1. Planta medica. 1994;60(01):30-3.
36. Gülçin I, Küfrevioğlu Öİ, Oktay M, Büyükokuroğlu ME. Antioxidant, antimicrobial, antiulcer and analgesic activities of nettle (Urtica dioica L.). Journal of ethnopharmacology. 2004;90(2-3):205-15.
37. Pagano E, Laudato M, Griffo M, Capasso R. Phytotherapy of benign prostatic hyperplasia. A minireview. Phytotherapy research. 2014;28(7):949-55.
38. Konrad L, Müller H-H, Lenz C, Laubinger H, Aumüller G, Lichius JJ. Antiproliferative effect on human prostate cancer cells by a stinging nettle root (Urtica dioica) extract. Planta medica. 2000;66(01):44-7.
39. Di Sebastiano KM, Mourtzakis M. The role of dietary fat throughout the prostate cancer trajectory. Nutrients. 2014;6(12):6095-109.
40. Jiang L-N, Liu Y-B, Li B-H. Lycopene exerts anti-inflammatory effect to inhibit prostate cancer progression. Asian journal of andrology. 2019;21(1):80.
41. Bunker CH, McDonald AC, Evans RW, De La Rosa N, Boumosleh JM, Patrick AL. A randomized trial of lycopene supplementation in Tobago men with high prostate cancer risk. Nutrition and cancer. 2007;57(2):130-7.
42. Hardell L, Degerman A, Tomic R, Marklund S, Bergfors M. Levels of selenium in plasma and glutathione peroxidase in erythrocytes in patients with prostate cancer or benign hyperplasia. European journal of cancer prevention: the official journal of the European Cancer Prevention Organisation (ECP). 1995;4(1):91-5.
43. Webber MM. Selenium prevents the growth stimulatory effects of cadmium on human prostatic epithelium. Biochemical and biophysical research communications. 1985;127(3):871-7.
44. Tacklind J, MacDonald R, Rutks I, Stanke JU, Wilt TJ. Serenoa repens for benign prostatic hyperplasia. Cochrane Database of Systematic Reviews. 2009(2).
45. Wilt TJ, Ishani A, Rutks I, MacDonald R. Phytotherapy for benign prostatic hyperplasia. Public health nutrition. 2000;3(4a):459-72.
46. Talpur N, Echard B, Bagchi D, Bagchi M, Preuss HG. Comparison of Saw Palmetto (extract and whole berry) and Cernitin on prostate growth in rats. Molecular and cellular biochemistry. 2003;250(1-2):21-6.
47. Shukla Y, Kalra N. Cancer chemoprevention with garlic and its constituents. Cancer letters. 2007;247(2):167-81.
48. Omar S, Al-Wabel N. Organosulfur compounds and possible mechanism of garlic in cancer. Saudi Pharmaceutical Journal. 2010;18(1):51-8.
49. Fleischauer AT, Arab L. Garlic and cancer: a critical review of the epidemiologic literature. The Journal of nutrition. 2001;131(3):1032S-40S.
50. Devrim E, Durak I. Is garlic a promising food for benign prostatic hyperplasia and prostate cancer? Molecular nutrition & food research. 2007;51(11):1319-23.
51. Pinto JT, Rivlin RS. Antiproliferative effects of allium derivatives from garlic. The Journal of nutrition. 2001;131(3):1058S-60S.
52. Arunkumar A, Vijayababu MR, Srinivasan N, Aruldhas MM, Arunakaran J. Garlic compound, diallyl disulfide induces cell cycle arrest in prostate cancer cell line PC-3. Molecular and cellular biochemistry. 2006;288(1-2):107-13.
53. Keehn A, Taylor J, Lowe FC. Phytotherapy for benign prostatic hyperplasia. Current urology reports. 2016;17(7):53.
54. Lajis NH, Abas F, Othman I, Naidu R. Mechanism of Anti-Cancer Activity of Curcumin on Androgen-Dependent and Androgen-Independent Prostate Cancer. Nutrients. 2020;12(3):679.
55. Tomeh MA, Hadianamrei R, Zhao X. A review of curcumin and its derivatives as anticancer agents. International journal of molecular sciences. 2019;20(5):1033.
56. Teiten M-H, Gaascht F, Eifes S, Dicato M, Diederich M. Chemopreventive potential of curcumin in prostate cancer. Genes & nutrition. 2010;5(1):61-74.
57. Wagner H, Willer F, Samtleben R, Boos G. Search for the antiprostatic principle of stinging nettle (Urtica dioica) roots. Phytomedicine. 1994;1(3):213-24.
58. Tiwari R, Geliebter J, Garikapaty V, Yedavelli S, Chen S, Mittelman A. Anti-tumor effects of PC-SPES, an herbal formulation in prostate cancer. International journal of oncology. 1999;14(4):713-22.
59. Pfeifer B, Pirani J, Hamann S, Klippel K. PC-SPES, a dietary supplement for the treatment of hormone-refractory prostate cancer. BJU international. 2000;85(4):481-5.
60. Yu C-L, Tsai M-H. Fetal fetuin selectively induces apoptosis in cancer cell lines and shows anti-cancer activity in tumor animal models. Cancer letters. 2001;166(2):173-84.
61. Hong H, Kim C-S, Maeng S. Effects of pumpkin seed oil and saw palmetto oil in Korean men with symptomatic benign prostatic hyperplasia. Nutrition Research and Practice. 2009;3(4):323-7.
62. Vahlensieck W, Theurer C, Pfitzer E, Patz B, Banik N, Engelmann U. Effects of pumpkin seed in men with lower urinary tract symptoms due to benign prostatic hyperplasia in the one-year, randomized, placebo-controlled GRANU study. Urologia internationalis. 2015;94(3):286-95.
63. Mendiola J, Torres-Cantero AM, Vioque J, Moreno-Grau JM, Ten J, Roca M, et al. A low intake of antioxidant nutrients is associated with poor semen quality in patients attending fertility clinics. Fertility and sterility. 2010;93(4):1128-33.
64. Njoku R-CC, Abarikwu SO, Uwakwe AA, Mgbudom-Okah CJ, Ezirim CY. Dietary fluted pumpkin seeds induce reversible oligospermia and androgen insufficiency in adult rats. Systems Biology in Reproductive Medicine. 2019;65(6):437-50.
65. Park J-S, Yeom M-H, Park W-S, Joo K-M, Rho H-S, Kim DH, et al. Enzymatic hydrolysis of green tea seed extract and its activity on 5α-reductase inhibition. Bioscience, biotechnology, and biochemistry. 2006;70(2):387-94.
66. Yasumoto R, Kawanishi H, Tsujino T, Tsujita M, Nishisaka N, Horii A, et al. Clinical evaluation of long-term treatment using cernitin pollen extract in patients with benign prostatic hyperplasia. Clinical therapeutics. 1995;17(1):82-7.
67. Buck A, Cox R, Rees R, Ebeling L, John A. Treatment of Outflow Tract Obstruction due to Benign Prostatic Hyperplasia with the Pollen Extract Cernilton: A Double-blind, Placebo-controlled Study. British journal of urology. 1990;66(4):398-404.

68. Belaiche P, Lievoux O. Clinical studies on the palliative treatment of prostatic adenoma with extract of Urtica root. Phytotherapy research. 1991;5(6):267-9.
69. Gangwal A, Parmar S, Mardia R, Sheth N. Immunomodulatory activity of saponin mixture isolated from Lagenaria siceraria fruits. Nig J Nat Prod Med. 2008;12:43-6.
70. Rodriguez J, Castro R, Riguera R. Holothurinosides: New antitumour non sulphated triterpenoid glycosides from the sea cucumber holothuria forskalii. Tetrahedron. 1991;47(26):4753-62.
71. Jun H-S, Kim S-E, Sung M-K. Protective effect of soybean saponins and major antioxidants against aflatoxin B1-induced mutagenicity and DNA-adduct formation. Journal of medicinal food. 2002;5(4):235-40.
72. Lee BJ, Hendricks DG. Phytic acid protective effect against beef round muscle lipid peroxidation. Journal of Food Science. 1995;60(2):241-4.
73. Peterson G, Barnes S. Genistein and biochanin A inhibit the growth of human prostate cancer cells but not epidermal growth factor receptor tyrosine autophosphorylation. The Prostate. 1993;22(4):335-45.
74. Hammar M, Frisk J, Grimas O, Hook M, SPETZ A-C, Wyon Y. Acupuncture treatment of vasomotor symptoms in men with prostatic carcinoma: a pilot study. The Journal of urology. 1999;161(3):853-6.

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How to cite this article

Mirzaei A, Khatami F, Ebrahimi M, Mousavibahar SH, Narouie B.The Effect of Herbal Extracts on the Treatment and Prevention of Prostate Cancer: A Literature Review. Translational Research in Urology. 2019 Nov;1(2):67-73.
DOI: 10.22034/TRU.2020.231129.1021
URL: http://www.transresurology.com/article_111002.html