Available on line at : www.eijppr.com

International Journal of Pharmaceutical and Phytopharmacological Research

ISSN (Online) 2249 – 6084

ISSN (Print) 2250 – 1029

Int.J.Pharm.Phytopharmacol.Res. 2012, 1(6): 396-402

(Review Article)

Natural Remedies for Polycystic Ovarian Syndrome (PCOS) : A Review

[*]Priyanka Kantivan Goswami, Dr. Anubha Khale, Sunita Ogale

H K College of Pharmacy, Jogeshwari (West), Mumbai- 400102

Received on: 02/05/2012 ***Accepted on:*** 26/06/2012

ABSTRACT

Polycystic ovarian syndrome (PCOS) is a heterogeneous endocrine disorder that affects about one in 15 women worldwide. It is a major disorder characterized by elevated levels of male hormones (androgens), acne and hirsutism. It can even cause insulin resistance, anovulation and infertility on prolong incidence of cysts. Since PCOS is a curable disorder, it can be cured by use of natural remedies or allopathic medication. The natural remedies include treatment with phytoestrogenic and non-estrogenic herbs such as Liquorice, Ginseng, Black cohosh, Dong qui, Hops and Kelp which are effective and safe. In this review, an attempt has been made to study the use of natural remedy for treatment of PCOS.

Key Words: PCOS, Hormone, Liquorice, Ginseng, Exercise

INTRODUCTION

Herbs can be defined generally in commerce as a plant, plant part or extract there of used for flavour, fragrance or medicinal purposes. Traditional herbal medicines are naturally occurring substances with minimal or no industrial processing that have been used to treat various illnesses. Traditional herbal medicines are getting significant attention in global health debates. Traditional medicine has established promotive, preventive, curative and rehabilitative role[1-3].

Herbal therapy has reached a turning point. It is fighting to be recognised as a science-a particular field with its own identity. It has become necessary to show that herbal therapy can match other fields of medicine in the thoroughness of its scientific work and its practical use. Benefit of herbal therapy compared to conventional therapy is that herbal therapy is safe with lesser side effects and presence of multiple active compounds in medicinal herbs altogether provides a potentiating effect[4-5].

The polycystic ovary syndrome is originally called as the Stein–Leventhal syndrome. Polycystic Ovarian Syndrome (PCOS) is a serious disorder in women in which the ovaries become enlarged with many 'cysts' which are in fact small undeveloped follicles. Over time there is thickening and fibrosis of the ovarian casing which prevents any follicles which do ripen from being released. PCOS is associated with anovulation and menstrual irregularities, infertility and insulin resistance. There may be acne, hirsutism and weight gain. As the condition progresses it may become associated with dysfunctional uterine bleeding, obesity, Type 2 diabetes, endometrial cancer, high cholesterol and cardiovascular disease[6-7].

CAUSES OF PCOS

Following are few important causes[8] of PCOS:

1) Genetic predisposition
2) Strong stimulation in adrenals in childhood
3) Raised insulin levels
4) Contraceptive pills
5) Hormonal imbalance
6) Stress

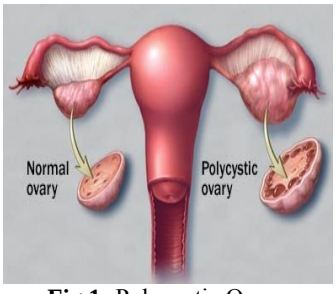

Fig.1: Polycystic Ovary

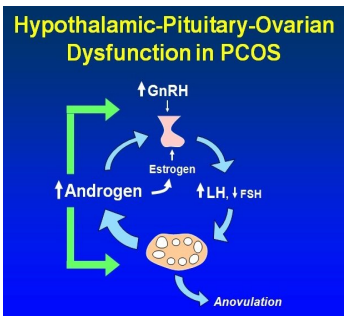

Fig.2: Role of Hypothalamus in PCOS

SIGN and SYMPTOMS OF PCOS

The principal signs and symptoms[9] of PCOS are :

1) Irregular or absence of periods
2) Acne
3) Excess body hair (hirsutism)
4) Weight gain or difficulty losing weight
5) Pain in Pelvic region
6) Elevated Luteinizing Hormone (LH) and decreased Follicle stimulating hormone (FSH)
7) Infertility (difficulty becoming pregnant)

HISTOLOGICAL FEATURES OF PCOS

Histological features[10] of PCOS includes:

1) Whole ovarian hypertrophy
2) Thickened capsule (>100 µ)
3) Increased number of sub capsular follicle cysts
4) Scarcity of corporea lutea or albicantia
5) Hyperplasia and fibrosis of the ovarian stroma
6) Premature luteinization of theca cells

ALLOPATHIC THERAPY FOR PCOS

1) Nafarelin-a specific gonadotropin-releasing-hormone agonist[11]
2) Triglitazone[12]
3) Clomiphene[13]
4) Metformin[14]
5) Spironolactone[15]
6) Laproscopy[16]

ALTERNATIVE REMEDIES AVAILABLE FOR PCOS

1. Medicinal Herbs

Liquorice

(Botanical Name: *Glycyrrhiza glabra*, Family:Leguminosae)

Fig. 1.1: Licorice

The effect of liquorice was investigated on androgen metabolism in nine healthy women 22–26 years old, in the luteal phase of the cycle. They were given 3.5 g of a commercial preparation of licorice (containing 7.6% W/W of glycyrrhizic acid) daily for two cycles. They were not on any other treatment. Plasma renin activity, serum adrenal and gonadal androgens, aldosterone, and cortisol were measured by radioimmunoassay. Total serum testosterone decreased gradually within two months. It returned to pre-treatment levels after discontinuation. Licorice can reduce serum testosterone probably due to the block of 17-hydroxysteroid dehydrogenase and 17–20 lyase. Licorice could be considered an adjuvant therapy of hirsutism and polycystic ovary syndrome[17].

Spearmint Tea

(Botanical Name: *Mentha spicata*, Family: Labiatae)

Fig. 1.2: Spearmint

The study was carried out in Turkey in a two centre as 30 day randomized controlled trial. Forty two volunteers were randomized to take spearmint tea twice a day for a 1 month period and compared with a placebo herbal tea. At 0, 15 and 30 days of the study serum androgen hormone levels and gonadotropin were checked; the degree of hirsutism was clinically rated. 41 out of 42 patients completed the study. Free and total testosterone levels and degree of hirsutism were reduced over the 30 day period in the spearmint tea group. LH and FSH were increased. It was demonstrated and confirmed that spearmint has antiandrogen properties[18].

Ginseng saponin

(Botanical Name: *Panax ginseng*, Family: Araliaceae)

Fig. 1.3: Ginseng

Female Sprague-Dawley rats (190-210 g) were induced polycystic ovary with intramuscular injection of Estradiol Valerate (EV) and separated into three groups: EV control (n=10), EV plus Ginseng Total Saponins (n=10), and oil control (n=10). Ovarian morphology and Nerve Growth Factor (NGF) protein expression were observed. Increased expression of Nerve Growth Factor was noted in the ovaries and the brain of rats with Poly Cystic Ovary. Ginseng Total Saponis administration attenuated NGF expression in the ovaries[19].

Flaxseed

(Botanical Name: *Linum usitatissimum*, Family: Linaceae)

Fig. 1.4: Flaxseed

In this study the impact of flaxseed supplementation (30 g/day) on hormonal levels in a 31-year old woman with

PCOS was observed. During a four month period, the patient consumed 83% of the flaxseed dose. Height, weight measurement and fasting blood samples taken at baseline and 4-month follow-up indicated significant decrease in Body Mass Index (BMI), insulin, total serum testosterone and free serum testosterone levels. The patient also reported a decrease in hirsutism at the completion of the study period. The clinically-significant decrease in androgen levels with a concomitant reduction in hirsutism reported in this case study[20].

Aloe-vera
(Botanical Name: *Aloe barbadensis*, Family: Liliaceae)


Fig. 1.5: Aloe-vera

In the present study, the efficacy of Aloe vera gel formulation in a PCOS rat model was checked. Five month old Charles Foster female rats were orally fed with letrozole, a non-steroidal aromatase inhibitor, to induce PCOS. The rats were then treated orally with the Aloe vera gel formulation (1 ml dose daily for 45 days). This restored their estrus cyclicity, glucose sensitivity, and steroidogenic activity. Co-treatment of the inductive agent (letrozole) with the Aloe vera gel prevented the development of the PCO phenotype. Aloe vera gel formulation exerts a protective effect in against the PCOS phenotype by restoring the ovarian steroid status, and altering key steroidogenic activity. This can be attributed to phyto-components present in the extract[21].

Cinnamon
(Botanical Name: *Cinnamomum zeylanicum*, Family: Lauraceae)


Fig. 1.6: Cinnamon

Cinnamon extract has been shown to reduce insulin resistance in in vitro and in vivo studies by increasing phosphatidylinositol 3-kinase activity in the insulin signaling pathway and thus potentiating insulin action. Fifteen women with polycystic ovary syndrome (PCOS) were randomized to daily oral cinnamon and placebo for 8 weeks. Comparisons of post-treatment to baseline insulin sensitivity indices using fasting and 2-hour oral glucose tolerance tests showed significant reductions in insulin resistance in the cinnamon group but not in the placebo group[22].

Chaste berry
(Botanical Name: *Vitex agnus-castus*, Family: Lamiaceae)


Fig. 1.7: Chaste tree

In this study, 93 women who had tried to conceive for 6-36 months were given a supplement containing chaste tree, L-arginine, vitamins and minerals. Their progesterone level, menstrual cycle length, pregnancy rate and side effects were documented. After 3 months, the supplementation group demonstrated increased mid-luteal progesterone and normalized menstrual cycles compared to no significant changes in the placebo group. 14 out of the 53 women who received the supplement became pregnant as compared to 4 of the 40 women who received placebo. 3 other women in the supplement group conceived after 6 months. The recommended dose is 1-4 ml of 1:2 dried plant tincture of 500-1000 mg of dried berries daily[23].

White peony
(Botanical Name: *Paeonia lactiflora*, Family: Paeoniaceae)


Fig. 1.8: White peony

In the present study, we investigated the in vivo effects of unkei-to (Japanese herbal medicine) and its compounds on the steroidogenesis and cytokine secretion in human granulosa cells. Unkei-to stimulate the secretions of 17-beta-estradiol and progesterone from highly luteinized granulosa cells obtained from in vitro fertilization patients. Effect observed due to its key ingredients like *Paeoniae radix, Paeonia lactiflora*, *Cinnamomi cortex* and *Cinnamomum cassia*. The various beneficial actions of unkei-to on the ovary may result from a combination of different ingredient herbs with different stimulatory effects on both steroidogenesis and the ovulatory process within the ovary, as well as stimulatory effect on the hypothalamus-pituitary axis[24-25].

Milk thistle
(Botanical Name: *Silybum marianum*, Family: Asteraceae)


Fig. 1.9: Milk thistle

In this study, the effect of silymarin which is known to have insulin sensitivity effects on the levels of glucose, insulin, testosterone, leutinizing hormone (LH) and progesterone was tested. Ovulation rate and Homeostasis Model Assessment of insulin Resistance (HOMA) ratio were determined. A 3-months of treatment were conducted in 60 PCOS patients in three well-matched groups. The first one (n=20), received silymarin (750mg/day). The second group received metformin (1500mg/day) while the third group treated by combination of metformin (1500mg/day) and silymarin (750mg/day). All these groups had taken the drugs in divided doses. The results showed significant increment in progesterone levels after completion of treatment. In conclusion the addition of silymarin to metformin in treatment of PCOS patients has improving effect on disturbed hormones and ovulation rate[26].

N-acetyl cysteine (NAC)
(Source: amino acid derivative of cysteine)
One hundred fifty women diagnosed with Clomiphene citrate (CC) resistant PCOS; aged 18-39 years, undergoing therapy for infertility were selected. The patients were assigned randomly to receive either NAC 1.2 gm/day (group I) or placebo (group II) with CC 100 mg/day for 5 days starting at day 3 of the cycle. Ovulation rate and pregnancy rate were observed. Combination of CC and NAC significantly increased both ovulation and pregnancy rate and PR in women with CC-resistant PCOS[27].

D-chiro-inositol
(Source: breakdown of phytic acids found in vegetables, fruits, legumes, nuts and whole grains[28])
In this study 44 obese women with PCOS were selected for clinical trial. Serum steroids and glucose tolerance tests were carried out before and after the oral administration of 1200 mg of D-chiro-inositol or placebo once daily for six to eight weeks. The serum progesterone concentration was measured weekly to monitor for ovulation. The level of serum free testosterone, plasma triglyceride and blood pressure was found to be decreased and 19 out of the 22 women who received D-chiro-inositol ovulated[29].

Kasip Fatimah
(Botanical Name: *Labisia pumila* var. alata, Family: Myrsinaceae)
In this study, effect of a Malaysian herb Kasip Fatimah had been checked on 9 week old PCOS rats. PCOS was induced in female rats before puberty by treating continuously with dihydrotestosterone. The PCOS rats were randomly subdivided into two groups; PCOS herb treated and PCOS control.


Fig. 1.12: Kasip Fatimah

PCOS herb treated rats received a daily oral dose of (50mg/kg body weight), dissolved in 1 ml of deionised water, for 4-5 weeks. PCOS controls received 1 ml of deionised water on the same schedule. Result showed reducing body weight gain in ovariectomized rats. Herb treatment increases uterine weight, indicating estrogenic effects and improves insulin sensitivity and lipid profile in PCOS rats without affecting body composition[30].

Chamomile
(Botanical Name: *Matricaria Chamomilla, Family*: Asteraceae)


Fig. 1.13: Chamomile

Thirty virgin adult cycling Wistar rats, weighting 200 - 220 g were divided into two groups and housed every six mice into cage under standard conditions (21 ± 2°C, 12-hour light/ 12-hour dark cycles) for at least one week before and throughout the study. Estrous cyclicity of 30 virgin adult cycling rats was monitored by vaginal smears obtained between 0800 and 1200 hours. After about 4 days, each rat received an i.m. injection of Estradiol Valerate), 2 mg in 0.2 ml of corn oil, to induce PCO. Corn oil was injected to the rats in the control group. All the rats in the experimental group were evaluated for follicular cysts 60 days after the injection. Rats with PCOS were treated by multiple doses (25, 50, 75 mg/kg) of intraperitoneal injections of Chamomile alcoholic-extract for ten days. The histological and hormonal results showed that Chamomile can decrease the signs of PCOS in the ovarian tissue and help LH secretion in rats[31].

Astragalus polysaccharide
(Botanical Name: *Astragalus* spp, Family: Fabaceae)


Fig. 1.14: Astragalus

In this study, 32 women with PCOS were administered with combined application of astragalus polysaccharides and diane-35 for 3 months. Sex hormones, insulin sensitivity and

blood lipid were evaluated before and after the therapy. After the treatment, fasting serum insulin levels, LH/FSH ratio was found be reduced and insulin sensitivity index increased significantly. Astragalus polysaccharides plus diane-35 can be effective in improving insulin resistance, high androgen hormone status and lipid metabolism in patients with PCOS and it may be alternative for PCOS[32].

2.Acupuncture

Poly cystic ovary syndrome (PCOS) is associated with peripheral and central factors that influence sympathetic nerve activity. Thus, the sympathetic nervous system may be an important factor in the development and maintenance of PCOS. Acupuncture can affect PCOS via modulation of endogenous regulatory systems, including the sympathetic nervous system, the endocrine and the neuroendocrine system[33].

3.Life Style Modification

a. Exercise

The study was carried out to check whether 5 weeks of voluntary exercise influence ovarian morphology and the expression of sympathetic markers in the Estradiol Valerate (EV)-induced PCO rat model. The effect of exercise on (i) ovarian morphology; (ii) mRNA and protein expression of nerve growth factor (NGF); and (iii) mRNA and number of ovarian-expressing cells for the NGF receptor (p75 neurotrophin receptor) and the α1a-, α1b-, α1d- and β2-adrenergic receptors (ARs) in rats with EV-induced PCO was evaluated. PCO was induced by a single intramuscular injection of EV, and controls were injected with oil alone in adult cycling rats. The rats were divided into four groups: (i) control (oil); (ii) exercise group (oil + exercise); (iii) a PCO group (EV); and (iv) a PCO exercise group (EV + exercise). The exercise and PCO exercise groups ran voluntarily for 5 weeks in computer-monitored wheels placed in the cages where they were housed. The results obtained indicated that ovarian morphology was almost normalised in the PCO exercise group; NGF mRNA and protein concentrations were normalised in the PCO exercise group; high numbers of NGF receptor expressing cells in PCO ovaries were lowered by exercise; and the number of immunopositive cells of the different AR subtypes were all reduced after exercise in the PCO group, except for the α1b- and β2-AR whereas the mRNA levels were unaffected, indicating transcriptional regulation. In conclusion, our data indicate a beneficial effect of regular exercise, as a modulator of ovarian sympathetic innervation, in the prevention and treatment of human PCOS[34].

b. Dietary intake

Low glycemic index diet may helps to manage insulin resistance, cardiovascular risk and irregular menstrual patterns in women with PCOS. One should avoid saturated fat intake. Lifestyle modification, including effective exercise regimens and dietary advice, should be the first line of treatment in women with polycystic ovary syndrome[35-37].

FUTURE COMPLICATION OF PCOS

1) Cardio vascular disorders[38]
2) Diabetes mellitus[39]
3) Obesity[40]
4) Metabolic syndrome[41]
5) Endometrial carcinoma[42]

Table 1: Medicinal Herbs used in Poly Cystic Ovarian Syndrome[43-53]

No.	Name	Botanical Name	Family	Part Used	Constituent Present	Other Uses
1	Bitter melon	*Momordica charantia*	Curcurbitaceae	Fruit	Glycoside	Anti diabetic
2	Indian madder	*Rubia cordifolia*	Rubiaceae	Root	Resin,	Amenorrhea,
					Phenolic compounds	DysmenorrheaManopause, Manorrhagia,
3	Angelica	*Angelica glauca*	Umbelliferae	Root	Coumarin,	Liver and Heart disorder
					Sesquiterpene	
4	Myrrh	*Commiphora molmol*	Burseraceae	Oil	Volatile oil	Laxative, Anti-inflammatory
5	Sesame	*Sesame indicum*	Pedaliaceae	Seeds	Protein	Culinary
6	Rose	*Rosa spp*	Rosaceae	Flower	Carotenoids	Perfumary
7	Black seed	*Nigella sativa*	Ranunculaceae	Seeds	Fatty acid	Anti oxidant
8	Garlic	*Allium sativum*	Liliaceae	Flower buds	Sulphides	Anti atherosclerotic
9	Triphala	*1. Emblica Officinalis*	Euphorbiaceae	Fruit	Tannin	Astringent
		2. Terminalia beletica	Combretaceae			
		3. Terminalia chebula				
10	Cummin	*Cuminum cyminum*	Umbeliferae	Fruit	Volatile oil	Digestant
11	Betel nut	*Areca Catechu*	Palmae	Seed	Alkaloid	Anti parasitic
12	Colic root	*Dioscorea villosa*	Dioscoreaceae	Root	Steroidal saponin	Rheumatism
13	Kelp	*Nereocystis leutkeana*	Laminariaceae	Seaweed	Algin	Hormone balance
14	Dandelion root	*Taraxacum officinale*	Asteraceae	Whole plant	Germacronalide	Bitter
15	Bladder wrack	*Fucus vesiculosus*	Fucaceae	Aerial part	Iodine	Cosmetics
					Bromine	
16	Sqauw vine	*Mitchella repens*	Rubiaceae	Aerial part	Resin	Hypotension
17	Oat straw	*Avena sativa*	Poaceae	Seed	Carbohydrate	Food
18	Mugwort	*Artemisia vulgaris*	Asteraceae	Leaves	Essential oil	Antidote
				Seed oil		
19	Blue cohosh	*Caulophyllum thalictroides*	Berberidaceae	Root,	Saponin	Female problems
				Rhizome		
20	Dong quai	*Angelica sinesis*	Apiaceae	Root	Coumarine	Female, Anti coagulant
21	Hops	*Humulus lupulus*	Cannabinaceae	Female cons	Essential oil	Flavouring agent
22	Alfalfa	*Medicago sativa*	Fabaceae	Seed	Protein	Anti oxidant
23	Sarsaparilla	*Smilax officinalis*	Smilacaceae	Rhizome	Resin	Antibiotic
24	Saraca	*Saraca indica*	Fabaceae	Flower	Tannin	Uterine tonic
				Leaves		
25	Black Cohosh	*Actaea racemosa*	Ranunculaceae	root	Glycoside	Women problems
26	Red Clover	*Trifolium pretense*	Fabaceae	flower	Glycoside	Skin problem

CONCLUSION

Polycystic Ovarian Syndrome (PCOS) is one of the most common female endocrine disorders which may leads to infertility. Herbal drugs have promising role in treatment of PCOS and shows steady effect with minimal side effects. Herbal drugs enhance immunity of the body and also regularize menstrual cycle without fluctuating hormonal level. For regulating menstrual cycle, various poly herbal supplements are being used in India, viz. Evecare syrup-capsule and Geriforte tablets (Himalaya healthcare), M2 Tone Forte syrup (Charak Pharma), Mensta syrup (Dabur India) and Mensonorm capsule (Chirayu Pharma). These herbal supplements, not only prevent ovarian cysts but also cure them. Herbal supplements may take time to cure PCOS but daily usage may treat the disease from its root.

REFERENCES

1) Miller LG, Murray WJ. Herbal medicinals: a clinician's guide. Routledge; 1998. p. 326
2) Tilburt JC, Kaptchuk TJ. Bulletin of the World Health Organization. 86th ed. 2008. p. 594-99.
3) Anonymous. Zanzibar Traditional and Alternative Medicine Policy, 2008.
4) Weiss RF. Weiss's herbal medicine. Thieme; 2001.
5) Benzie IF, Galor SW. Herbal Medicine: Biomolecular and Clinical Aspects. CRC Press; 2011. p. 7.
6) http:\\www.ronawang.com [cited on 2011October 6].
7) Kovacs TG, Norman RJ. Polycystic Ovary Syndrome. Cambridge University Press; 2nd ed. 2007.
8) Dunne N, Slater W. The Natural Diet Solution for PCOS and Infertility: How to Manage Polycystic Ovary Syndrome Naturally. Natural Solutions for PCOS; 2006.
9) Elsheikh M, Caroline M. Polycystic Ovary Syndrome. Oxford University Press; 2008.
10) Azziz R, Nestler JE, Dewailly D. Androgen excess disorders in women: polycystic ovary syndrome and other disorders. Humana Press; 2006. p. 184.
11) Barnes RB, Rosenfield RL, Burstein S, Ehrmann DA. Pituitary-ovarian responses to nafarelin testing in the polycystic ovary syndrome, New Engl J Med, 1989; 320: 559-65.
12) Dunaif et al. The insulin-sensitizing agent troglitazone improves metabolic and reproductive abnormalities in polycystic ovary syndrome, J Clin Endocrinol Metab, 1996; 81(9):3299-3306.
13) Legro RS et al. Clomiphene, Metformin, or Both for Infertility in the Polycystic Ovary Syndrome, New Engl J Med, 2007; 356:551-66.
14) Lord JM et al. Review: Metformin used alone or combined with clomifene may improve ovulation rates in the polycystic ovary syndrome, Br Med J, 2003; 327: 951-56.
15) Decio A et al. Treatment of polycystic ovary syndrome with spironolactone plus licorice,Eur J Obstet Gynecol Reprod Biol, 2007; 131(1): 61-67.
16) Felenbam A et al. Laparoscopic treatment of polycystic ovaries with insulated needle cautery: a reappraisal, Fertil Steril, 2000; 73(2): 266-69.
17) Decio A et al. Licorice reduces serum testosterone in healthy women, Steroids, 2004; 69(11-12): 763-66.
18) Grant P. Spearmint herbal tea has significant anti-androgen effects in polycystic ovarian syndrome: A randomized controlled trial, Phytother Res, 2010; 24(2):186-88.
19) Sok Cheon Pak et al. Role of Korean red ginseng total saponins in rat infertility induced by polycystic ovaries, Fertil Steril, 2005; 84(2): 1139-43.
20) Nowak DA, Snyder DC. The Effect of Flaxseed Supplementation on Hormonal Levels Associated with Polycystic Ovarian Syndrome: A Case Study. Curr Top Nutraceutical Res 2007; 5(4): 177–181.
21) Maharjan R, Nagar PS. Effect of Aloe barbadensis Mill. formulation on Letrozole induced polycystic ovarian syndrome rat model. J Ayurveda Integr Med 2010; 1(4): 273-279.
22) Wang JG, Anderson RA. The effect of cinnamon extract on insulin resistance parameters in polycystic ovary syndrome: a pilot study. Fertil Steril 2007; 88(1): 240-243.
23) Westphal LM, Polan ML et al. Double-blind, placebo-controlled study of FertilityBlend®: a nutritional supplement for improving fertility in women. Clin Exp Obstet Gynecol 2006; 33(4): 205-208.
24) Sun WS, Imai A et al. In vitro stimulation of granulosa cells by a combination of different active ingredients of unkei-to. Am J Chin Med 2004; 32(4):569-578.
25) Takahashi K, Kitao M. Effect of TJ-68 (shakuyaku-kanzo-to) on polycystic ovarian disease. Int J Fertil Menopausal Stud 1994; 39(2): 69-76.
26) Taher MA, Atia YA et al. Improving an ovulation rate in women with polycystic ovary syndrome by using silymarin. Iraqi J Pharm Sci 2010; 19(2): 11-18.
27) Rizk AK, Bedaiwy MA et al. N-acetyl-cysteine is a novel adjuvant to Clomiphene citrate in Clomiphene citrate-resistant patients with polycystic ovary syndrome. Fertil Steril 2005; 83(2): 367-370.
28) Watson RR. Complementary and Alternative Therapies and the Aging Population: An Evidence-Based Approach. Academic press, San diego, 2008, 317-327.
29) Nestler JE, Jakubowicz DJ at al. Ovulatory and metabolic effects of D-chiro-inositol in the polycystic ovary syndrome. New Eng J Med 1999; 340: 1314-1320.
30) Manneras L, Fazliana M et al. Beneficial metabolic effects of the Malaysian herb Labisia pumila var. alata in a rat model of polycystic ovary syndrome. J Ethnopharmcol 2010; 127(2): 346-351.
31) Zafari ZF, Bagher M et al. Effects of chamomile extracts on biochemical and clinical parameters in a rat model of polycystic ovary syndrome. J Reprod Infertil 2010; 11(3): 169-74.
32) http://en.cnki.com.cn/Article_en/CJFDTOTAL-ZWZX200928006.htm [cited on 2012 May 28]
33) Stener-Victorin E et al. Acupuncture in polycystic ovary syndrome: current experimental and clinical evidence. J Neuroendocrinol 2008; 20(3):290-98.
34) Manni L et al. Effect of exercise on ovarian morphology and expression of nerve growth factor and alpha (1) - and beta (2)-adrenergic receptors in rats with steroid-induced polycystic ovaries. J Neuroendocrinol 2005; 17(12): 846-58.
35) Colombo O, Pinelli G et al. Dietary intakes in infertile women a pilot study. Nutr J 2009; 8: 53.
36) Marsh KA, Steinbeck KS et al. Effect of a low glycemic index compared with a conventional healthy diet on polycystic ovary syndrome. Am J Clin Nutr 2010; 92: 83-92.
37) Balen AH, Michelmore K. What is polycystic ovary syndrome? Are national views important? Hum Reprod 2002: 17: 2219-2227.
38) Giallauria F et al. Cardiovascular risk in women with polycystic ovary syndrome.J Cardiovasc Med 2008; 9(10): 987-92.
39) Legro RS et al. Prevalence and predictors of risk for type 2 diabetes mellitus and impaired glucose tolerance in polycystic ovary syndrome: a prospective, controlled study in 254 affected women. J Clin Endocrinol Metab 1999; 84(1):165-69.
40) Talbott E et al. Adverse Lipid and Coronary Heart Disease Risk Profiles in Young Women with Polycystic Ovary

Syndrome: Results of a Case-Control Study. J Clin Epidemiol 1998; 51(5):415-22.
41) Apridonidze T et al. Prevalence and Characteristics of the Metabolic Syndrome in Women with Polycystic Ovary Syndrome. J Clin Endocrinol Metab 2005; 90(4): 1929-35.
42) Hardiman P et al. Polycystic ovary syndrome and endometrial carcinoma. The Lancet 2003; 362(9389): 1082.
43) Hudson T, Northrup C. Women's encyclopedia of natural medicine: alternative therapies and integrative medicine. McGraw-Hill Professional; 1999.
44) Anonymous. Quick access patient information on conditions, herbs and supplements; Integrative Medicine Communications. Thieme; 2000.
45) Blumenthal M, Brinckmann JA, Wollschlaeger B. The ABC clinical guide to herbs. Routledge; 2003.
46) Singh KP, Tierra M. The Way of Ayurvedic Herbs: The Most Complete Guide to Natural Healing and Health with Traditional Ayurvedic Herbalism. Lotus press; 2009.
47) Hoffmann D. Medical herbalism: the science and practice of herbal medicine. Inner Traditions / Bear and Co; 2003.
48) Raman S, Palep HS. Alternative therapies in polycystic ovarian syndrome. Bombay Hosp J 2010. 52(3): 345-351.
49) Siriwardini SAD, Karunathilaka LPA et al. Clinical efficacy of Ayurveda treatment regimen on Subfertility with Poly Cystic Ovarian Syndrome (PCOS). Ayu 2010; 31(1): 24-27.
50) Grant P, Ramasamy S. An Update on Plant Derived Anti-Androgens. Int J Endocrinol Metab 2012; 10(2): 497-502.
51) Mueller M, Jungbauer A. Red clover extract: a putative source for simultaneous treatment of menopausal disorders and the metabolic syndrome. Menopause 2008; 15(6): 1120-1131.
52) Kishore B, Hazra DK et al. Effects of an Indigenous Drug Formulation (Geriforte) on Hormonal Status. Asian Med J 1983; 11:770.
53) Sharma HK, Sharma RK. Evaluation of Efficacy and Safety of Evecare® Syrup in Infertility due to Polycystic Ovarian Syndrome. Indian J Clin Pract 2010; 21(2): 129-32.

Corresponding Author:
Priyanka Kantivan Goswami
H K College of Pharmacy,Opp. MHADA Building,
Pratiksha Nagar, Jogeshwari (W),Mumbai- 400102
***Email**: priyanka8408@gmail.com*