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Introduction

Current era has witnessed increased reproductive health issues among adolescent girls, reproductive age and post-menopausal women. Female infertility posed the main threat among the young reproductive age women. Polycystic Ovarian Syndrome (PCOS) is a top ranked heterogeneous condition, encompassing alterations in metabolism, compromised reproductive health, imbalance and dysfunctions of several hormones and has higher interrelation to pregnancy complications. The prevalence is intensifying in developing countries like India and the root causes are rapid nutritional transitions due to westernized dietary and lifestyle pattern. Dietary habits are most probably handed down from mother to daughter, and also from ancestors and food habits are very closely linked to socio economic status and geographic area. Nutrition and health are intimately connected throughout the lifecycle. Maintaining optimal nutrient intake is crucial to the health of women, especially in their young years. Very few studies have come up appreciating the aspect of micronutrients in the nutritional care and support of PCOS. In this context, the present research has focused to search new alternative medical nutrition therapy options for management of Polycystic ovarian syndrome.

Polycystic ovarian syndrome (PCOS) is a disorder involving endocrine system, presenting with combined signs and symptoms which include metabolic derangements, hormonal changes and a range of phenotypes, including reproductive issues, very frequently associated with psychological impairments including stress , mood disorders, anxiety and depression (Lujan,2013). There are several accepted definition of PCOS, the Rotterdam criteria(2003) is the most relevant, most widely recognized criteria followed in Asia for the diagnosis of PCOS (Wołczyński, 2012). The existence of hyperandrogenism, chronic anovulation, and polycystic ovaries on ultrasound findings, and among these at least two if present in a person confirms the diagnosis as per Rotterdam criteria (Rotterdam, 2004) .The definition by Androgen Excess for diagnosing PCOS is excessive androgen levels in blood and ovarian dysfunction (Azziz,2009).Rotterdam criteria classifies the PCOS into different phenotypes, Classic PCOS exhibits symptoms such as ovulatory dysfunction and anovulation, ovarian cyst and increased androgen levels in blood. The second type is Classic noncystic type is seen with hyperandrogenaemia and anovulation but without ovarian cyst. The third type is Non-classic ovulatory type with regular menstrual cycles, cyst in the ovaries and hyperandrogenism. The fourth type is

Non-classic mild or normo-androgenic anovulation, ovarian cyst and normal testosterone levels in the blood (Gaine, 2019).

The definite aetiology and pathogenesis of PCOS are under investigation and disputable causes ranging from genetic predisposition to ecological factors both intrauterine and in the postnatal period (Goodarzi, 2011).Depending upon the criteria used to define the syndrome, PCOS affects between 3.7 to 22.5 percent of Indian women of reproductive age (Ganie, 2019). There are a number of debatable explanations for PCOS, including genetic predisposition and environmental variables that are present both intrauterinally and postnatally (Goodarzi, 2011). PCOS affects 4-20% of women of reproductive age (Deswal, 2020).The prevalence rate in South India and Central Travancore region was six and thirty three percent respectively (Bharathi *et al.,* (2017) &Roy and Malini (2014).Prevalence of PCOS was suggestively greater in young women ≤ 35 years, than among elder women having more than or equal to thirty six years (Koivunen, 2011).

PCOS commonly causes cluster groups of small, cysts of pearl like appearance in the ovaries and induce symptoms in about 5 to 10 percent of reproductive age women in the adolescent and adult years (Stepto, 2013 and Yildiz, 2012). The main reason for PCOS can easily be find out by signs and symptoms, which include oligo-anovulation, elevated androgen level, abnormal hair growth in the face and other body parts, alopecia, acne, acanthosis nigricans, weight gain, hypertension, and dyslipidaemia. More than 50 percent of PCOS women suffer from obesity and increased amount of body fat when cross checked to healthy controls even if they are normal weight. Fat when accumulated extensively resulting a negative effect on health leading to several metabolic disorders. Possibility of various co-morbid conditions are associated with obesity in PCOS, particularly heart disease, diabetes mellitus, obstructive sleep apnoea, cancer , osteoarthritis, abnormal glucose tolerance ,reduced action of insulin and psychological issues . The predominance of resistance to insulin in PCOS varies from 50 -70 percent and occurs even in lean individuals .Inflammation in the body is linked to increased androgen levels in the blood (Yildiz, 2012). The characteristic clinical manifestations of polycystic ovarian syndrome are irregular menstrual cycle such as amenorrhea, oligomenorrhea, or other uneven and abnormal uterine bleeding, ovulation irregularities normally less than eight cycles per year. Absence of ovulation would be expected after the menopause only, but anovulation present even in young adolescent girls having this syndrome.

Signs of excessive androgen production are hirsutism, greasy skin, excessive

acne, hair loss and obesity. Excessive levels of androgen (testosterone) is one of the main reason for Hirsutism in PCOS individuals .Hirsutism is the male like distribution of hair in females and affecting around 5-10 percent of women. Acne is more commonly seen in young women and tremendously increasing by affecting more than half of the adolescents and young adult women. It is triggered by changes in skin structures via androgen stimulation. Acne normally presented as non-inflammatory follicular papules or comedones and in severe forms as inflammatory papules, pustules and as nodules in its most severe form. Male pattern hair loss in female due to increased hair shedding up to 50-100 hairs per day or reduction in hair volume or a decrease in hair volume, male pattern hair loss occurs (Tamimi *et.al.* 2019) . Dark velvety patches in the body folds often appears in the armpits, neck and groin is a fairly common skin pigmentation disorder(Acanthosis nigricans) mostly noticed in obese individuals. Acanthosis nigricans is a more serious health problem, causing itching and odour and commonly seen as a sign of insulin resistance and pre-diabetes. These patches may appear on other areas, such as knuckles, elbows, knees, lips, palm, and soles of feet. Hyperlipidaemia is a common complication of PCOS due to alteration in the lipoprotein metabolism. The manifestations are elevated lipid profile but low levels of High Density Lipoprotein (HDL), protracted elevation of arterial Blood pressure above the threshold value and associated cardiovascular risk.

In younger individuals substantial levels of psychological disturbances is noticed mainly mood changes and depressive states. PCOS is also the foremost cause of sterility in Reproductive age women. Cardiovascular complications and metabolic consequences are observed higher in Frank phenotype when compared to other phenotypes. Metabolic consequence such as impaired glucose tolerance, type 2 diabetes, obesity and increased risk of cardiovascular disease was observed even after adjustment for obesity (Diamanti , 2017). PCOS potentially increases the risk for the development of endometrial hyperplasia and neoplasia. The Common manifestations of PCOS include metabolic syndrome, and Insulin resistance, significant levels of psychological disorders, primarily anxiety and depression, are seen in younger people. In addition, PCOS is the main reason for infertility due to anovulation. Endometrial hyperplasia and neoplasia may become more likely in people with PCOS. Insulin resistance and metabolic syndrome are two common PCOS symptoms. Irregular periods, male pattern hair growth and obesity is the most commonly seen symptom among younger women while elder ones are suffering from infertility, risk of miscarriages and other reproductive health issues (Çakıroglu, 2016).

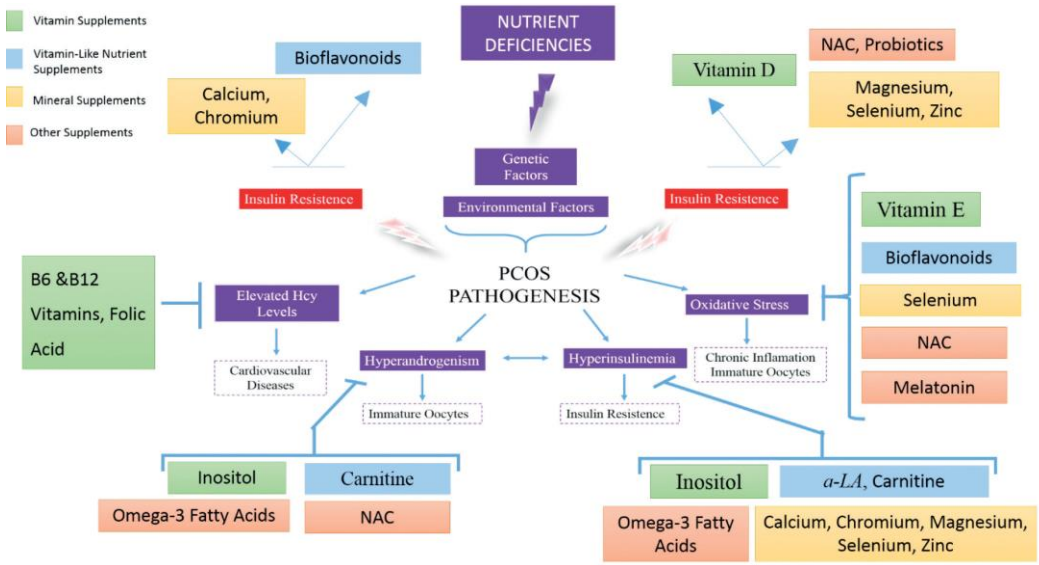
PCOS is connected with higher dominance of Insulin Resistance syndrome, which is a combination of increased blood pressure, central obesity, dyslipidaemia, compromised glucose tolerance and can increase the risk of cardiovascular diseases and Type 2 diabetes. Prediabetes is four to seven times higher in PCOS women compared to non PCOS women. Overweight and Obese pregnant women are at high risk of developing diabetes in pregnancy (gestational diabetes) and the risk increases in obese and overweight pregnant women previously diagnosed to have PCOS. (Soni, 2018). Up to seventy five percent of women are centrally obese. This excessive weight gain is around central abdomen .Most subjects have abdominal obesity or 'apple' shape obesity. Women suffering from PCOS are prone to degenerative diseases such as cerebro vascular accident and cardiovascular diseases in future. Increased lipid profile including high LDL(bad cholesterol)and low HDL more likely to result in cardio metabolic complications , increased levels of inflammatory proteins, can cause insulin resistance, high blood pressure (McCartney, 2016). Sporadic periods in PCOS which may increase the risk of endometrial cancer. Lack of menstruation and shedding of the endometrium further aggravates endometrial thickening and development of abnormal cells that can develop into cancerous cells later on.Maintaining healthy body weight through adequate exercise and increasing basal metabolic rate can contribute to regularising the menstrual cycle and thereby reducing the risk of endometrial cancer (Soni, 2018).

Witchel *et al.* (2019) stated that there are poorly understood relationship exist between genetic and environmental factors in PCOS. Impaired ovarian steroidogenesis, neuro endocrine defects and elevated cortisol metabolism and increased androgen levels are the reported causes for ovarian cyst. The syndrome acquired its name due to occurrence of multiple pearl like cyst which represent follicles which are immature, usually seen in ultrasound examination. The follicles of the ovaries are seen as round or oval structures with a ‘string of pearls’ appearance. These are primordial follicles made up of stem cells, but which will eventually will not turn into eggs due to the disturbed oestrogen production. The follicles can be visible on ultrasound examination. Increased serum levels of insulin is as a result of defective insulin secretion and action. Insulin plays the key role in the pathophysiology of PCOS. Hyperinsulinaemia has realized as the key factor indicating direct link between obesity and PCOS. In addition to increased levels of male hormones, elevated insulin levels is the major reason contributing to major metabolic disturbances in PCOS. Increased insulin in the blood stimulate androgen by ovarian stroma, reduces SHBG and produces increased levels of free testosterone. Abnormally high insulin levels in the blood increases GnRH pulse frequency in PCOS patients

causing higher gonadotropin releasing hormone (GnRH) release, which in sequence results in reduced level of follicle stimulating hormone (FSH) and increased level of luteinizing hormone (LH) and an escalation in LH/FSH ratio. Higher level of luteinizing hormone prompts the production of oestrogen and testosterone and also dihydro epiandrosterone sulphate (DHES).The dominance of LH to FSH amplify the production of ovarian androgen, decreased maturation of follicles and reduced SHBG binding. (Johanna (2011). The following pathways are the main predisposing factors for development of PCOS

- The effects of insulin on theca cells are mediated by an increased production of IGF-1, which is a growth factor that stimulates androgen production further leading to hirsutism ,acne , infertility
- Increased androgen levels in the blood linked to the production cum action of insulin and prevents the synthesis of Sex hormone-binding globulin (SHBG) in the liver. Reduction of this hormone levels can cause hyperandrogenism in PCOS as it is the main plasma protein necessary for production of androgen and oestrogen

A number of substances regulate the insulin signalling pathway and testosterone synthesis. One of the key elements in determining fertility rates is the diet's makeup. Ovarian follicle growth and ovulation rates are largely regulated by metabolic pathways associated to nutrition. Supplementing the diet may help to get over PCOS issues such an underdeveloped oocyte, insulin resistance, hyperandrogenism, and oxidative stress.



NAC: N-acetyl-L-cysteine; LA (linolenic acid); polycystic ovarian syndrome (PCOS)

Figure 1. Effect of dietary supplements, including vitamins, minerals, vitamin-like compounds, and others, on the pathophysiology of PCOS

The most effective method of restoring normal ovulation and menstruation in the management of PCOS includes lifestyle modifications, successful weight reduction, low-carbohydrate diet and sustained regular physical activity. Weight reduction even 5-10 % weight loss can provide significant health benefits including reducing metabolic abnormalities, insulin resistance, glycaemic abnormalities by improving insulin sensitivity.

PCOS treatment must be customized to the phenotypic and personal preferences of each patient, including their desire to become pregnant. A crucial factor is also one's psychological health. Lifestyle change through food and exercise is the most recommended treatment for fertility and metabolic syndrome in PCOS with pharmaceutical therapy coming as the next. *(Ramanand et al .,2013).*

Reducing insulin resistance, enhancing fertility, treating hirsutism or acne, restoring normal menstruation, and preventing endometrial hyperplasia and endometrial cancer are all goals of medical treatment for PCOS.To ensure regular endometrial shedding and reinstate menstrual regularity, cyclical progesterone, such as Duphaston dydrogesterone 10 mg two times a day for seven days and recommended every two months should be repeated .The Oral contraceptive pill (OCP) is also reinforce menstrual cyclicity, with the added advantage of improving androgenic symptoms and contraception (Lua et al., 2018). Metformin can also be given as a concurrent medicine as it is beneficial in improving menstrual cyclicity and also improves resistance of our body to insulin further aiding weight loss. Statins can be prescribed for dyslipidaemia unless there is no plan to conceive. Sleeve gastrectomy may be effective for morbid obese patients to reduce weight improve metabolic outcome. Insulin resistance regulates hyper secretion of luteinising hormone (LH) and ovarian androgens. Drugs with anti-androgen effects include flutamide and spironolactone which can reduce hirsutism. It hinders the effect of testosterone at the level of the androgen receptor. OCPs inactivates LH secretion. The oral contraceptive pills containing cyproterone acetate is a progesterone with anti-androgen properties that blocks the action of ovarian androgen production and reduce hirsutism and acne. The principle treatment to promote ovulation is clomiphene citrate and used mostly in the anovulatory phase. For fertility management clomiphene citrate or letrozole is used as an effective strategy effective for fertility treatment by inducing ovulation. During the initial phase ultrasonography monitoring of follicle development and dose titration is essential. Myoinoitol and other bioactive compounds are useful for management of symptoms of PCOS which include reduced resistance to insulin, low testosterone and abnormal hair growth (Conway et al, 2014).

The link between PCOS and mental health status has studied widely and it is the need of the hour to note this aspect. Women with Polycystic ovaries have triple time more chance of anxiety and depression when compared to healthy women without PCOS (Barry, 2021). Higher levels of the hormone testosterone causing growth of facial hair in male pattern, acne, thinning or loss of scalp hair, oiliness of skin, and psychological problems like irritability, aggressive behaviour and depression. High testosterone level alters the receptors of oestrogen and also affecting the stimulation of Neurotransmitters Gama Amino Butyric acid (GABA) and Serotonin by making the changes in the respective genes controlling the stimulation of these neurotransmitters thereby increasing anxiety level. The first step to proper management of the mental symptoms associated with PCOS includes early mental screening and the assessment of their mental health (Al Hussain, 2020). PCOS patients with menstrual irregularities have been linked to higher rates of depression. Apart from medical care psychological support should be given for mentally stressed subjects. Psychological counselling is found to be beneficial for mood swings (Adebisi, 2021).

The first line management should focus on modified regime following a balanced diet and regular physical activity. Both the interventions are successful in minimizing depression for better quality of life. Daily physical activity improves body image and reduces the metabolic and reproductive features of PCOS, similarly and group exercise has impact better mental health outcomes as it creates a supportive environment and creates a great way to have a form of accountability care and support . Daily exercise of 30-40 minutes, yoga and meditation leads to release of endorphins (happy hormones) which leads to mood uplifting and sense of well-being (Banting 2014). Progressive muscle relaxation (PMR) developed by Edmund Jacobson is a technique for reducing stress and anxiety. Body muscle tension accompanies anxiety. Muscle relaxation is a great way to reduce anxiety .The muscle tension can be reduced by learning how to relax the muscular tension (Varvogli, 2011)

As far as dietary habits are concerned, women with PCOS mostly have higher appetite, and consume more compact high calorie, high glycaemic index (GI) foods, a trend in higher consumption in total fat, saturated fat, have inadequate fibre intake and have a poor quality of life (Larsson, (2016) and Douglas et al, 2006).It is imperative that reduction in body weight and better hormonal balance can prevent of metabolic disorders and can attain better health in PCOS (Moran, 2011). Lifestyle modification programmes focuses on management of behaviour, dietary habits and physical activity level, which in future will be helpful in controlling degenerative diseases such as metabolic syndrome,

cardiac diseases, Type 2 diabetes mellitus and also improves fertility outcome (Douglas et al, 2006). Losing just 5 to 10 percent of body weight is helpful in regulating the menstrual cycle. A modest weight loss within short span of time can improve some of the endocrine abnormalities associated with PCOS. Pharmacological treatment considered as a useful adjunct to lifestyle interventions, and drug treatments targeted to improve insulin sensitivity. Specific aspects of PCOS such as irregular cycles, fertility issues and hirsutism should be treated with medications and through proper nutrition support. (Marsh. 2005).

Calorie intake plays the crucial role in scheduling dietary management. Controlling the calorie intake is essential as some studies explaining the effects of caloric restriction either by modified combination of macronutrients or by increasing the energy expenditure. Combined approaches are effective as the combination of the two to get multiple health outcomes and changes biochemical indices. Irrespective of the dietary pattern, a deficit of 350-1000kcal per day helps in considerable body fat and weight loss and improves menstrual cycle and insulin sensitivity (Marzouk, 2015).Protein intake improves satiety and may help in decreasing abdominal fat. Frequent eating habits will lead to higher intakes of carbohydrate, fibre, and a range of micronutrients. Less frequent intake causes higher intakes of lipids , more cholesterol, Na+ levels and high protein ,while very little micronutrient intake was observed among those who skip meals regularly especially breakfast. Improvement in abdominal fat and sensitivity to insulin is seen even without a weight change (Farshchi, 2007).

Increased intake of fat is associated with decreased oxidation of carbs while no obvious variation in lipid oxidation leading to fat deposition and increased lipogenesis (Vessby 2007). DASH diet pattern with fat restriction to less than 25 percent reported significant reduction in body weight and body composition .Impaired insulin sensitivity is associated with higher fat intake ,particularly in obese individuals(Foroozanfard ,2017).The fat content in the diet should be less than 30 percent with less than ten percent saturated fat , around 18 percent Mono unsaturated fatty acid (MUFA) the diet, helps in reducing fasting insulin ,acute response of insulin to carbohydrates. It has been reported some beneficial health effects of PUFAS, especially of omega 3 fatty acid from marine sources has anti-inflammatory effects (Perelman, 2017). Postprandial thermogenesis and satiety level can be improved by a higher protein intake encompassing tremendous positive health benefits, including preservation of lean body mass and reducing abdominal fat and improves the response of the muscles to exercise. The calories contributed by protein should be 20 percent, while during short term diets

tailor-made to reduce weight and improve glucose tolerance can be advised increased protein intake (Bray 2012).

Papavasiliou *et al.* (2017) stated that the best method to to decrease the glycaemic load of the diet is by reducing refined carbohydrates by following an isocaloric diet concentrating high protein and intake of Mono unsaturated fat (MUFA) or by consuming foods of lower Glycaemic Index. MUFA and protein containing diet has been shown to improve insulin sensitivity, decrease sugar levels post-prandially, lowering TG values and upsurge HDL-cholesterol. Diet specifying less carbs are restricted in simple carbohydrate diets that are helpful in aiding weight loss usually recommend for six months period. The main idea while planning such kind of a diet plan is to deliver fewer calories than are being used (i.e., they are hypo caloric). They appear to be safe for short-term use and, indeed, improve cardiovascular risk profile. Distribution of carbohydrates may be a vital component for regulating metabolism of Carbohydrate. It is good to consume the major share of carbohydrates at afternoon, and next best option is delivery of carbohydrates in diet equally throughout the day, and to restrict breakfast with high content of simple carbohydrate.

Frequent eating habit can lead to high intake of carbohydrates, fibre and variety of micronutrient, vitamins and minerals. Less frequent eating habit may increase the intake of fat, total cholesterol, Na+, and protein. Those who skip breakfast will have a lower micronutrient intake (Kerver, 2006).Compared to irregular eating at intervals of two weeks, decreased energy intake and higher insulin sensitivity were seen among obese women who had a a regular meal frequency and higher postprandial energy expenditure. Regular consumption of breakfast was highly connected to lower calorie uptake and better insulin utilization (Farshchi, 2005).Disordered eating or avoidance of breakfast if continued for long could lead to weight gain and obesity (Chapelot et al.2006).The timing of food intake can affect metabolism and insulin secretion. The glycaemic levels after food is controlled by circadian rhythm and that its misalignment can cause intolerance to glucose .Decreased Resting-Energy Expenditure was connected to late eating habits and which can further contribute to decreased fasting oxidation of carbohydrate, blunted free cortisol levels and decreased specific dynamic action of food Oike (2014) and Bandin (2015).

A tailor-made calorie restricted diet including high quality proteins and low GL (Glycaemic load) in considerably increased insulin sensitivity (Mehrabani, 2012). Resolution of many fundamental symptoms of PCOS occur with a mild to moderate weight loss of around five to fifteen percent (Moran 2017). An appreciable amount of

carbohydrate restriction can reduce the fasting insulin concentrations which later on may improve reproductive and endocrine outcomes. A daily calorie deficit of at least 200 kcal will prevent weight gain and promote weight loss in the long run. The advised levels of calorie deficit is 500 kcal, 1,000kcal per day, that will be helpful in reducing a minimum of 5 kg per week to 1 kg per week (Douglas, 2006).

Lower intake of micro nutrients especially folate, vitamin B12, vitamin D, calcium, iodine, iron, and selenium seen among a higher proportion of women in pregnancy and lactating periods (Schaefer, 2019). Micronutrient deficiency is also commonly seen among PCOS individuals starting from adolescent years which are connected to various metabolic alterations in the body. Zinc levels plays an important role in the development of insulin resistance. Low intake of zinc may lead to poor stimulation of insulin receptor tyrosine kinase in individuals with PCOS .Zinc deficiency is also associated with abnormal lipid profiles (Beletate, 2007).A positive correlation exists between Insulin resistance and elevated Homocystine levels. Folate , Pyridoxine and Cobalamine have effective part in Homocystine regulation and control in PCOS individuals (Loverro2002 and Badawy 2007). Low levels of magnesium in the blood and high Ca/Mg ratios is seen among women with PCOS due to IR. Low serum levels of vitamin D in the blood or inadequacy is clearly associated with android obesity, IR, decreases the chance of fertility and excessive hair growth , whereas serum 25-hydroxy Cholecalciferol is very essential for reproductive success following ovulation induction.

It is clear that nutrition related metabolic pathways are functioning to regulate the ovarian follicle growth and promoting ovulation rates. Most studies focuses on the macronutrient constituent of the food, proofs are coming into prominence that micronutrients are also playing essential role for effective management of PCOS. Therefore, nutritional supplementation including micronutrients are beneficial to overcome complications of PCOS such as undeveloped oocyte, Insulin Resistance, hyperandrogenism, reduction of body fat. Alternative medicine including Naturopathy Treatment are implemented widely to get the beneficial effect of phytonutrients in reducing severity of PCOS symptoms and its endocrine, cardio metabolic, complications and regularisation of menstruation. Pal et.al, (2011) found that 3 months supplementation with vitamin D and Calcium can reduce androgens through a direct effect on the pathways of steroidogenesis in the adrenal and ovarian axis. When flaxseed containing lignanas and ω-3 fatty acid helps in down regulating testosterone production and improves lipid profile. Myo inositol supplementation for PCOS women improve the body's ability to spontaneously ovulate, helps in proper utilisation of insulin also lowers systolic

BP, LH/FSH ratio, lowers testosterone and prolactin in blood. Supplementation of 220 mg zinc sulphate administration per day for eight weeks among PCOS had beneficial effects on fasting blood sugar, fasting insulin, triglyceride levels and improving resistance of the body to insulin (Foroozanfard, 2015) and Selenium 200mg/day for eight weeks reported to have additional benefit of reducing VLDL levels without affecting lipid profile. Another study found that 200 mg/day chromium supplementation for eight weeks among PCOS had favourable effects on fasting insulin, IR and insulin sensitivity. (Jamilian *et al.,* 2015). Moreover, 5 mg/day folate supplementation for eight weeks among PCOS had beneficial effect on inflammatory factors and biomarkers of oxidative stress (Bahmani,2014).

Nutrition and health education is an important part of providing nutrition services that bridges the gap between information on Nutrition and health information and practices. Lifestyle modification including dietary pattern with suitable Nutrition and health education empowers people with the knowledge and skills to make healthy food choices by adopting a healthy lifestyle pattern including dietary pattern. A Judicious line of attack to modification of lifestyle in this syndrome will help the multidisciplinary team to involve with the patient, and help care givers and patient to manage this disorder in a sensible manner. Diet is one of the most important and modifiable lifestyle determinants of human health. In studies there have been correlations made between vitamin, mineral deficiencies and symptoms of PCOS. Inadequate dietary intake of micronutrients and low consumption of micronutrient supplements were evident in several studies. New techniques are providing opportunities for developing scientific as well as indigenous dietary supplements. This dietary intervention with proper nutrition education is expected to enhance nutritional and health status and to relieve the metabolic, hormonal and physiological symptoms related to PCOS among young women of reproductive age. Nutritional supplement in the form of micronutrient rich seed powder is thought to enhance the reproductive environment by helping body fat reduction restore micronutrients firming the antioxidant protection system, with the clinical benefits of improving hyperandrogenism embryo quality, reducing the conception time and increasing the pregnancy rate.

The jeopardy of PCOS in reproductive age group is very intrusive which exposes symptoms such as infertility, dysmenorrhoea, obesity, cardio vascular diseases, diabetes mellitus, and other psychosocial abnormalities. The necessity for efficacious method is in the leading edge reduce these health risks. Till date the researchers emphasis on the macronutrient components of the diet and solid evidences supported the use of dietary interventions including balance of macronutrient in the management of

PCOS. Evidence from several studies revealed micronutrients are also important. Large longitudinal observational studies concluded that multiple micro nutrient supplementation improved PCOS symptoms including betterment of pregnancy rates. In this context the current study is relevant as it focuses on incorporating the relevant micronutrient rich grains and seeds into a nutritional supplement powder to intervene on the selected PCOS population to compare the effect on nutritional supplement administered and non-administered subjects. The supplementation has been decided considering the lacunae in the micronutrient intake of the selected group of subjects in their daily diet.

The study has taken up with the specific objectives of assessing the efficiency of dietary intervention strategies on signs and symptoms of PCOS among the selected group of Reproductive age women

- Find out the prevalence of PCOS among women in the reproductive age (20-45 years)
- Identification of women having PCOS for collection of data related to socio economic profile, dietary and lifestyle pattern, nutritional, reproductive, and health status
- Assessment of nutritional status and nutritional knowledge of the selected women
- Formulation and evaluation of micro nutrient rich health mix supplement powder and nutrition and health education modules for nutrition interventions and
- Impact of nutrition interventions on nutritional status nutrition knowledge on the polycystic ovarian syndrome symptoms among the selected women of reproductive age (20-45 years)

Novelty of the study

Administration of micro nutrients and its effect on metabolic and hormonal profile were already studied. To find out a combination of micronutrients can impart for the reduction in biochemical and clinical profile of hyperandrogenism is a novel approach.

Outcome of the study

1. Maintain the anthropometric measurements such as weight, BMI, Body fat and Waist Hip ratio suitable.
2. Reduction in the Biochemical estimation, clinical symptoms and metabolic parameters in terms of testosterone levels, hirsutism, acne and insulin resistance respectively
3. Regularise the menstrual cycle and
4. Minimise the complications and consequences of PCOS

"Hypothesis of the study"

I H0-There is no significant difference in the metabolic and clinical symptoms of PCOS women between the Experimental group I, Experimental group II and Control group before and after the Nutrition interventions

H1-There is significant difference in the metabolic and clinical symptoms of PCOS women between the Experimental group I, Experimental group II and Control group before and after the Nutrition interventions

II H0-No significant difference is observed in the biochemical values of PCOS subjects between the study groups before and after the Nutrition interventions

H2- Significant difference is observed in the biochemical values of PCOS women between the study groups before and after the Nutrition interventions

III H0- Menstrual cycle regularity has shown no significant difference between the nutrition supplementation group, Nutrition Education group and Control group before and after the Nutrition interventions

Ha- Menstrual cycle regularity has shown significant difference between the nutrition supplementation group,Nutrition Education group and Control group before and after the Nutrition interventions

Strength of the study

Ready to eat powdered nutrient dense health mix using low cost and locally available seasonal food ingredients were used for the dietary intervention. The study focused on the effectiveness of the indigenous micronutrient rich nutritional supplement powder over the common medical management and standard nutrition education in minimizing or preventing the symptoms of PCOS, including regularising menstrual cycle, thereby ovulation and also minimising the consequences of PCOS.

Limitation of the Study

- Intervention period may be extended to six months
- Larger sample size may be studied
- This study did not investigate the biochemical profile of micronutrients, which could be correlated with the symptoms of PCOS and also for prevention of PCOS

Scope of the study

1. The extent of the signs and symptoms of PCOS experienced by women especially in reproductive age will pave the way to know about or explore methods for prevention of this type of reproductive health issues and promotion of reproductive health status.

2. Creating awareness related to the importance of optimum health and reproductive health issues are the need of the hour, since reproductive health issues are emerging very rapidly in this modern era.
3. Diet based approach with suitable physical activities and healthy lifestyle pattern are considered as the sustainable measures for the effective management of PCOS to promote and preserve the optimum health.