Effect of Lifestyle Intervention on Poly Cystic Ovary Syndrome among College Going Girls (19 to 22 Years)

By

Chinnu V Kumar

(14PFN002)

Thesis Submitted to the
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

In partial fulfillment of the requirement for the Degree of

Master of Science in Food Science and Nutrition

April, 2016

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Certified as Bonafide Research Work

S. Thilakavathy
Signature of the Guide

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Signature of the
Head of the Department

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Contents

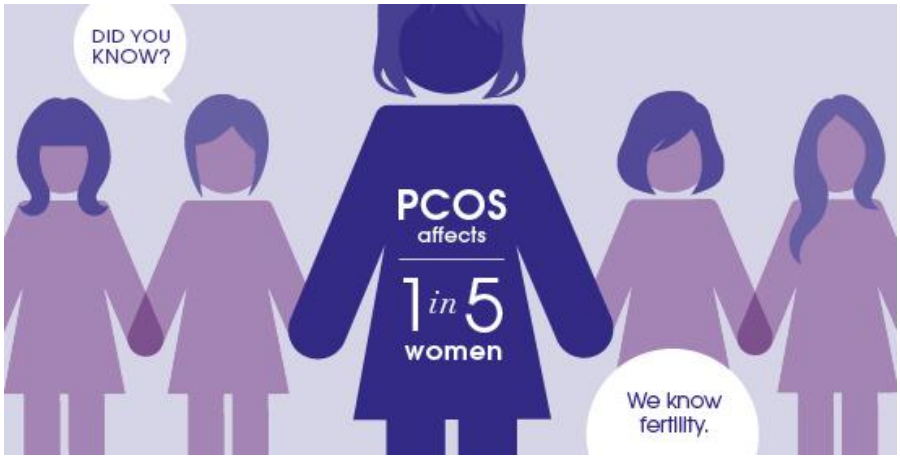
CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES



Introduction

I. INTRODUCTION

"Healthy citizens are the greatest asset any country can have"

– Winston S Churchill

Adolescence has been defined by World Health Organization (2010) as the period of life span between 10 – 19 years and the youth between 15 – 24 years. The phenomenal growth that occurs in adolescence, second only to that in the first year of life, creates increased demands for energy and nutrients. Total nutrient needs are higher during adolescence than any other time in the lifecycle. Nutrition and physical growth are integrally related; optimal nutrition is a requisite for achieving full growth potential (Story, 2001).

India is the second most populous country in the world with a total population of over 1081 million. Adolescents form a large section of population with about 22.5 per cent. Adolescents are living in diverse circumstances and have diverse health needs. Adolescents are full of energy, have significant drive and new ideas and are a positive force for a Nation and they are responsible for the future productivity provided they develop in a healthy manner (Population action International, 2005).

National population – based surveys have found that adolescents often fail to meet dietary recommendations for overall nutritional status and for specific nutrient intakes. Many adolescents receive a higher proportion of energy from fat and/or added sugar and have a lower intake of micronutrients like Vitamin A, folic acid, fiber, iron, calcium, zinc (Larson *et al.,* 2007).

Within the past two decades, the developing nations began relying on westernized diet and lifestyle and therefore it is predicted that they may see up to a six fold increase in obesity and diabetes in the next ten years especially in India, who is already the diabetic capital of the world. The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014. Almost half of all deaths attributable to high blood glucose occur before the age of 70 years. WHO projects that diabetes will be the 7th leading cause of death by 2030 (WHO, 2014).

In comparison to younger children, teens are exposed to more unhealthy food choices in their environment (Lytle *et al*., 2002). Factors influencing adolescents diets included their nutritional knowledge, friends (with whom high-fat fast foods were often consumed), government health campaigns and cooking programs on television (Walsh & Nelson, 2010). High peer pressure and craze to match the latest trends lead many adolescents to eat fast foods like Pizzas, burgars, aerated drinks, chocolates etc., which have a long term effect of obesity, hyperlipidemia, metabolic syndrome and PCOS in girls.During adolescent stage, nutritional intake and quality of diet are important to support physical health, reproductive health, prevent chronic disease and promote a healthful weight (Health Action, 2013).

In India adolescent lifestyle has undergone vast changes, with lower levels of physical activity, with a sedentary life , irregular meal time, and diet rich in fat and refined carbohydrates. Due to unhealthy eating habits and lifestyle they are more prone to diseases especially fertility related problems.

Eating right and nutritious food during adolescence provides necessary nutrients to meet physical and intellectual growth; provides adequate stores in case of illness or pregnancy and prevent onset of diseases like hypertension, obesity and osteoporosis later in life (Gowri and Surya, 2008).

Skipping of meals by teens at home is very common and the likelihood of purchasing fast food from a restaurant, vending machine or convenience store is also high. These foods which fascinate adolescents tend to be high in fat and sugar and they provide little nutritional value. More importantly, eating too much fast foods lead to weight gain and may predispose adolescent girls to PCOS and diabetes (Beresford *et al.*, 2006).

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorder prevalent among adolescent girls and adult women and has reproductive and metabolic consequences (Fauser *et al.*, 2012). PCOS is caused due to a combination of genetic and environmental factors (Kandarakis *et al.,* 2006). PCOS affects approximately 5-10% of the

female population in developed countries (Abbott *et al.*, 2005). Adolescents with PCOS are at an increased risk of developing health problems later on life. The physical signs of PCOS can be detrimental to a teenage girl's self image. Early diagnosis and treatment of PCOS in adolescence is essential to ensure healthy adulthood and restoring self esteem (Chang *et al.*, 2008).

It is challenging to make a diagnosis during the 1 – 2 years following menarche because normal pubertal changes can mimic features of PCOS (Rosenfield, 2013). In adolescents, the most common presenting clinical features of PCOS include rare menstrual periods, heavy periods, excess body and facial hair, acne, pelvic pain, conceiving problems, and patches of thick, darker, velvety skin.etc (Roeatt *et al*., 2013).

The diagnosis of PCOS in adolescents is difficult due to its overlapping symptomatology with the physiologic changes of puberty and a lack of well defined hormonal delineations (Warren, 2006). About two-third of adolescents with PCOS have clinical evidence of hirsuitism or hirsuitism equivalents (Rosenfield, 2000). Adolescents with irregular menses have higher plasma androgen levels than those who have regular cycles (Hart, 2007). Presently high androgen levels have largely become the clinical focus of PCOS (Homburg, 2009).

PCOS have a negative impact on adolescent health related quality of life (Upadayay and Maria, 2008). Hyperandrogenemia is a risk factor for Metabolic Syndrome independent of obesity and insulin resistance (Andrea *et al.*, 2006). Forty per cent of women with PCOS have problems like infertility (Teede *et al.*, 2010). Weight gain and menstrual uncertainties affect body image and lead to further stress to the individuals and the family members (Joshi, 2007).

The presence of PCOS was detected in 95 per cent of the adolescents with menstrual irregularity (Fernandes, 2005). Having metabolic syndrome from PCOS puts women/adolescent at a much higher risk of cardiovascular and other complications at a later stage in life (Duleba, 2002). The PCOS must be handled at healthy level by maintaining weight with regular exercise and eating the healthy food choices (Maria, 2006).

Obesity is known to amplify the metabolic risk factors associated with PCOS and increases the risk of metabolic syndrome, even in adolescents (Nandalika *et al.,* 2012). Furthermore, obesity can worsen undesirable cosmetic features of PCOS such as hirsuitism and acne, which decrease perceived quality of life in adolescents with PCOS (Barnard *et al.,* 2007). Adolescents with PCOS are also at increased risk of hypertension as compared to age and BMI-matched controls. Hence, weight should be maintained by adolescents, as BMI is the strongest predictor of all lifestyle diseases in this age group. (Bonny *et al*., 2012).

One to four adolescents with PCOS may have derangements in glucose metabolism independent of their BMI (Flannery *et al*., 2013). Globally, prevalence estimates of PCOS are highly variable, ranging from 2.2 per cent to as high as 26 per cent.(Azziz *et al.,* 2004). Most prevalence studies in India are in hospital set-ups and recently studies among adolescents in schools report prevalence of PCOS as nine per cent to 36 per cent (Nair *et al.,* 2012). Oral glucose tolerance test as an initial metabolic screening method is preferred, even in normal weight adolescents with PCOS (Rackow, 2013). Insulin resistance estimated to occur in at least 65 per cent of patients with PCOS independent of BMI, is thought to be a primary contributor to the underlying pathophysiology of the condition and is typically the first metabolic derangement seen in adolescents who develop PCOS (Deugarte, 2005).

The primary treatments for PCOS include diet, lifestyle, medications (Lim *et al.,* 2011). Lifestyle modifications such as weight loss and increased exercise in conjunction with a change in diet consistently reduce the risk of PCOS. This approach has been found to be comparable to or better than treatment with medication and should therefore be considered first-line treatment in managing women/adolescents with polycystic ovary syndrome (Vause *et al.,* 2010).

Diet and exercise are important measures to control PCOS. This is because young women/adolescents with PCOS have higher levels of insulin in their blood and many have trouble in maintaining a healthy weight (Julie, 2011). The combination of exercise and a healthy diet is most effective for losing and maintaining weight (Wu *et al*., 2009). Diet therapy is the most important and effective treatment for PCOS. The typical western diet (high in fat and

refined carbohydrate, low in fiber) contributes to insulin resistance and chronic disease development.

Weight loss of first five per cent, along with diet modification, can lower insulin levels, reduce hyperlipidemia, reduce androgen and luteinizing hormone levels and restore regular menstruation (Marshall, 2001). The diets rich in fruits, vegetables, complex carbohydrates and fiber lower chronic disease risk (Davy *et al*., 2003). Lifestyle modification has been determined to be beneficial in women with PCOS. A modest amount of weight loss (5% to14%) improves cardiovascular risk factors, reduces abdominal fat, blood glucose, blood lipids, serum androgens and increases menstrual cyclicity, ovulation, and fertility (Thomson *et al.,* 2011).

To prevent the development of PCOS among adolescent girls, decreasing the consumption of energy – dense foods and increasing the consumption of fruits and vegetables is an important target of nutrition interventions. The development of effective nutrition interventions requires a detailed understanding of the determinants of target eating behavior. More specifically knowledge about the determinants of developmental change in target eating behaviours during key life stages such as adolescence is required (Brug *et al.,* 2005).

Nutrition education is an effective tool to create awareness among adolescents to bring about positive results with regard to good dietary and lifestyle habits. Nutrition Education is a combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being. Nutrition education is delivered through multiple venues and involves activities at the individual, as well as the community (Jones & Bartlett, 2007).

Initial management of PCOS in adolescents should target the symptoms such as menstrual irregularity, acne and signs of androgen excess, with lifestyle modification being the primary recommended strategy (Geller, 2011). For obese adolescents with PCOS, weight reduction is often challenging and is the cornerstone of intervention for metabolic risk education primarily for improvement in insulin resistance (Reinehr, 2009).

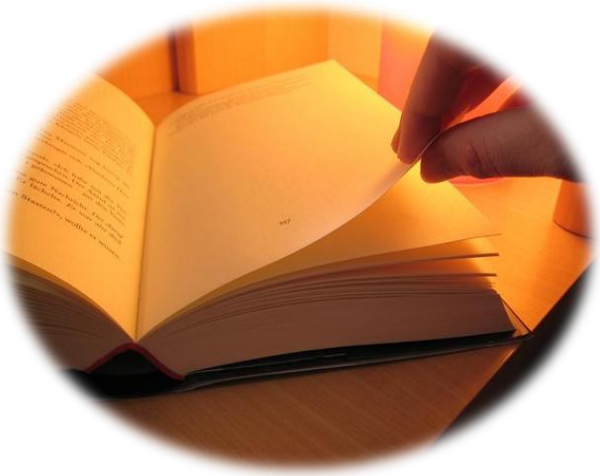
A multidisciplinary approach to weight loss (including medical, nutritional and emotional) seems to be a successful approach to at least short term weight loss in adolescents (Geier *et al.*, 2012), underscoring the importance of early diagnosis the success of these lifestyle interventions is inversely related to age (Lass *et al*., 2011).

Hence with this background the present study was planned to assess the assessment of nutritional knowledge on PCOS and food consumption pattern of adolescents and the impact of nutrition education on PCOS. The present study entitled, "Effect of lifestyle Intervention on Poly Cystic Ovary Syndrome among College Going Girls from 19 to 22 years" was planned with the following objectives.

Objectives of the Study

To

- study the socio economic background, nutritional status and dietary pattern of college going girls.
- assess the knowledge of PCOS among college going girls (19 to 22 years).
- assess the effectiveness of structured nutrition education programme on PCOS among adolescent girls.



Review of Literature

II. REVIEW OF LITERATURE

The review of literature pertaining to the present study entitled **"Effect of Lifestyle Intervention on Poly Cystic Ovary Syndrome among College Going Girls (19 to 22 Years)"** is presented under the following headings.

I. **Prevalence of Poly Cystic Ovary Syndrome**
II. **Risk Factors of Poly Cystic Ovary Syndrome**
III. **Complications of Poly Cystic Ovary Syndrome**
IV. **Management of Poly Cystic Ovary Syndrome**
    i. **Diet and PCOS**
    ii. **Exercise and PCOS**

I. PREVALENCE OF POLY CYSTIC OVARY SYNDROME

PCOS are now increasingly perceived as disorder of changed lifestyles and is a rainbow metabolic syndrome. Stein and Leventhal (1935) were the first researchers to distinguish the reproductive phenomena of what was to become known as PCOS. A polycystic ovary is defined as having 12 or more follicles (or cysts) within the 2-9 mm range under ultrasound (Balen *et al.,* 2009). Since 1935, a myriad of other symptoms have also been correlated with PCOS such as acne, male pattern balding (alopecia), hirsutism (excessive hair growth), infertility, obesity, or at least truncal fat patterning, skin tags, and high androgen hormone levels (Fauser *et al.,* 2004). Most of the symptoms associated with PCOS appear to be linked with either high androgen or insulin hormone levels (Abbott *et al.,* 2002, Kandarakis *et al.,* 2006 and Xita & Tsatsoulis, 2006).

The prevalence of PCOS varies between populations, as does the strength of the association between PCOS and insulin resistance or obesity. These differences may arise from genetic factors and from differences in lifestyle. Furthermore, cultural differences in attitudes to fertility and racial differences in hirsutism may influence presentation. PCOS prevalence amongst young women in the reproductive years is generally quoted at 5 – 10 per cent (Ehrmann, 2005). There are limited studies of PCOS in India, the observational studies by endocrinologists, gynecologists, and dermatologists relate to diverse aspects of PCOS.

Prevalence of obesity and diabetes mellitus in most industrialized countries including India is also on the rise owing to urbanization and change in lifestyle. Most prevalence studies in India are in hospital set-ups and recently a few studies among adolescents in schools report prevalence of PCOS as 9 per cent to 36 per cent (Nair *et al.,* 2012).

Globally, prevalence estimates of PCOS are highly variable, ranging from 2.2 per cent to as high as 26 per cent. (Woods *et al.,*2004). Community-based studies using Rotterdam criteria among reproductive age group women have demonstrated varied prevalence figures in few Asian countries ranging from 2 per cent to 7.5 per cent in China to 6.3 per cent in Sri Lanka (Li *et al.,* 2012, Kumarapeli *et al*., 2008). Studies among several Caucasian populations using NIH criteria reported PCOS in the range of 5-8 per cent (Nidhi *et al.,* 2011). An Australian retrospective birth cohort study of 728 women reported a prevalence of 11.9 ± 2.4 per cent as per Rotterdam criteria, which increased to 17.8 ± 2.8 per cent when imputed data were included (March *et al.,* 2010).

Prevalence of PCOS in women between the ages of 18-25 years from Lucknow, north India, is 3.7 per cent (Harmandeep *et al*., 2012). Hirsutism is a common clinical presentation of hyperandrogenism occurring in up to 70 per cent of women with PCOS. (Fauser *et al.,*2012). Over 90 per cent of normally menstruating women with hirsutism are identified through ultrasound to have polycystic ovaries (Adams *et al*., 2000). In addition, PCOS occurs in 50 per cent of women with less severe distribution of unwanted hair growth (Souter *et al.,* 2004). Acne can also be a marker of hyperandrogenism but is less prevalent in PCOS and less specific than hirsutism. Approximately 15 per cent–30 per cent of adult women with PCOS present with acne (Wijeyaratne *et al.,* 2002). Infertility affects 40 per cent of women with PCOS. PCOS is the most common cause of anovulatory infertility. Approximately 90 per cent–95 per cent of anovulatory women presenting to infertility clinics have PCOS. (Teede *et al.* 2010).

An increased prevalence of PCOS is associated with a number of conditions. A history of weight gain often precedes the development of the clinical features of PCOS (Isikoglu *et al.,* 2007) and following a healthy lifestyle has been shown to reduce body weight,

abdominal fat, reduce testosterone, improve insulin resistance, and decrease hirsutism in women with PCOS (Moran LJ *et al.,* 2011). PCOS prevalence rates for underweight, normal-weight, overweight, mildly obese, moderately obese, and severely obese adolescents were 8.2 per cent, 9.8 per cent, 9.9 per cent, 5.2 per cent, 12.4 per cent, and 11.5 per cent, respectively (Alvarez, 2006).

Insulin resistance is present in women with PCOS independent of body mass. However, obesity in PCOS is associated with greater insulin resistance, and higher incidence of dyslipidaemia and diabetes. The incidence of diabetes and lipid disorders is higher. At least 50 per cent of adolescents with PCOS are overweight or obese (Gambineri *et al.,* 2002). Abdominal adiposity or android pattern obesity (waist-hip ratio>0.85) is also common in PCOS (Yildirim *et al*., 2003). Risk of glucose intolerance among women with PCOS patients is 5 to10 fold higher than normal, and the typical age of onset of impaired glucose tolerance or diabetes is in the third or fourth decades, earlier than in the general population (Pelusi *et al.,* 2004). In later life, the risk of developing type 2 diabetes is potentially increased seven-fold in patients who had PCOS (Wild, 2002). As in the non-PCOS population, obesity in PCOS is associated with endothelial dysfunction, decreased adiponectin and other changes in adipokines that contribute to metabolic and cardiovascular risk (Carmina, 2006).

A case-control study was conducted with 34 adolescents during the period of 2 to 4 years after menarche to assess the presence of insulin resistance as well as the incidence of PCOS in adolescents with menstrual disorders. The presence of PCOSs was detected in 95 per cent of the adolescents with menstrual irregularity (Fernandes, 2005). Dermatological effects of PCOSs can have a deleterious effect on an adolescent girl's self image and peer interaction. Weight gain and menstrual uncertainties affect body image and lead to further stress including the family members (Joshi *et al,* 2007).

More than 80 per cent of women presenting with symptoms of androgen excess have PCOS (Azziz *et al.,* 2004). Infertility affects 40 per cent of women with PCOS (Teede *et al*., 2010). PCOS is the most common cause of anovulatory infertility. Approximately

90 per cent–95 per cent of anovulatory women presenting to infertility clinics have PCOS. Women with PCOS have a normal number of primordial follicles and primary and secondary follicles are significantly increased. However, due to derangements in factors involved in normal follicular development, follicular growth becomes arrested as follicles reach a diameter of 4–8 mm, because a dominant follicle does not develop, ovulation does not ensure (Teede *et al.,* 2010). In addition, spontaneous abortion occurs more frequently in PCOS with incidences ranging from 42 per cent–73 per cent (Glueck *et al.,* 2006).

II. RISK FACTORS OF POLY CYSTIC OVARY SYNDROME

A Study conducted by Samantha *et al (*2005) opines that, PCOS's in adolescent girls has traditionally been thought of as a triad of oligomenorrhea, hirsuitism and obesity. PCOS is now recognized as a heterogeneous disorder that results in overproduction of androgens primarily from the ovary leading to anovulation and hirsuitism and is associated with insulin resistance. Treatment should be instituted early at decrease symptoms and long term sequellae of Poly cyst.

Family history of PCOS is a risk factor for PCOS. Based on the clustering of cases in families, PCOS is considered to be a heritable disorder (Franks *et al.,* 2001). An increased frequency of reproductive disorders, including PCOS, has been reported in women with epilepsy (Herzog , 2006). Using NIH criteria for diagnosis, Bilo *et al*., (2001) identified PCOS in 13 of 50 women (26 per cent) with epilepsy.

Chang *et al,* (2008) opines that adolescents with PCOS are at an increased risk of developing health problems later on life. Furthermore, the physical signs of PCOS can be detrimental to a teenage girl's self-image. Early diagnosis and treatment of PCOS in adolescent are essential in ensuring healthy adulthood and restoring self esteem. Emotional and financial strains that could have been prevented if PCOS were diagnosed in the teenagers.

Polycystic ovary syndrome is a complex, multifaceted, heterogeneous disorder that affects approximately 5 to 10 per cent of women of reproductive age. It is characterized by hyperandrogenism, polycystic ovaries, and chronic anovulation along with insulin resistance,

hyperinsulinemia, abdominal obesity, hypertension, and dyslipidemia as frequent metabolic traits, metabolic syndrome that culminate in serious long-term consequences such as type 2 diabetes mellitus, endometrial hyperplasia, and coronary artery disease. It is one of the most common causes of anovulatory infertility. However, the heterogeneous clinical features of PCOS may change throughout the life span, starting from adolescence to postmenopausal age, largely influenced by obesity and metabolic alterations, and the phenotype of women with PCOS is variable, depending on the ethnic background. The etiology of PCOS is yet to be elucidated; however, it is believed that in a woman may be genetically predisposed to developing PCOS (Allahabadia and Merchant, 2008).

Presently, high androgen levels (hyperandrogenemia) have largely become the clinical focus of PCOS (Azziz *et al.*, 2006 and Homburg, 2009). High blood level concentrations of androgenic hormones, specifically, testosterone, androstenedione, DHEA and DHEAS, as well as luteinizing hormone and insulin have received the most attention concerning the endocrine basis of the syndrome . All of these hormones play a role exacerbating excess ovarian androgen secretion (Balen *et al.,* 2009). The combination of a hyperinsulin, hyperandrogen, and an obese phenotype can increase the levels of androgens and obesity in PCOS patients (Pasquali *et al.*, 2006). Effects of elevated androgen levels may be enhanced due to a tendency of PCOS patients to have lower sex hormone binding globulin (SHBG) levels (Xita and Tsatsoulis, 2006). This overload of unbound androgenic hormones can cause detrimental, de-feminizing physical conditions such as menstrual irregularities, anovulation, hirsutism (excessive hair growth), and alopecia (male pattern balding) (Fauser *et al.*, 2004, Xita and Tsatsoulis, 2006). Beyond the hyperandrogenic state, other mechanisms, such as oxidative- nitrosative stress or Vitamin D deficiency might also have key roles in the pathogenesis of PCO and its consequences. These parameters are also involved in the development of preeclampsia. (Tang *et al.*,2006).

At present, based on the most recent meta-analysis, (Barry *et al.,* 2014) women with PCOS of all ages seem to be at an increased risk of endometrial cancer. In particular, the risk of endometrial cancer may be even higher in the premenopausal subgroup of women with PCOS, while overall the risk of ovarian and breast cancer was not significantly increased.

III. COMPLICATIONS OF POLY CYSTIC OVARY SYNDROME

A study on the effects of PCOS on health related quality of life revealed that the health risks associated with PCOS include infertility, diabetes, metabolic syndrome and endometrial cancer. A significant body of evidence consistently demonstrates that PCOS has a negative impact on women's health related quality of life (Krishna and Trent, 2008).

PCOS has historically been defined as a syndrome related to ovulatory infertility. Today, especially with the introduction of the new diagnostic criteria (Korhonen *et al*., 2003), the focus has shifted to reproductive problems, also including the obstetrics complications. From a pathogenetic point of view, the increased incidence of pregnancy complications in women with PCOS can be the result of several factors, such as PCOS features, infertility treatments, multiple pregnancies, obesity, insulin resistance and metabolic dysfunction, inflammation, and placental alterations (Palomba *et al. ,* 2010).

Infertility was one of the main symptoms originally attributed to the PCOS (March WA, 2010). Subsequent epidemiologic evidences suggested that PCOS is the most common cause of ovulatory disorder and oligo anovulation is related with increased risk for infertility. In a large population of 1,741 women affected by PCOS, primary infertility was reported in 50 per cent of women, while secondary infertility was reported in 25 per cent of women (Hull MG, 2003)

Boomsma *et al.,* (2008) opines that the gestational diabetes mellitus (GDM) is the most commonly described pregnancy complication in women with PCOS with a threefold risk and an absolute risk of 6 per cent–15 per cent. Two recent prospective studies by Chiossi *et al.,* and Wilde *et al*., (2014) confirmed an increased incidence of GDM of up to 14.7 per cent and 22 per cent in women with PCOS.

Toulis *et al.,* (2011) stated that women with PCOS present an increased prevalence of classic risk factors for cardiovascular disease (CVD) such as hypertension, dyslipidemia, diabetes, and obesity and non classic risk factors such as C-reactive protein (CRP), homocysteine, and tumor necrosis factor-α . PCOS at any age is characterized by greater odds

for elevated CVD risk markers and these elevated makers can occur without obesity but are magnified with obesity (Fauser *et al.,* 2012).

PCOS is an independent risk factor for the development of Type 2 Diabetes Mellitus .Legro *et al.,* (2005) and Norman *et al.,* (2001) estimated that, those affected, T2DM occurs within 2–3 years and exceed 50 per cent within 10 years.

Bates GW (2013) and Cascella *et al.,* (2008) opine that the greatest health implications of PCOS are associated with excess weight and abdominal circumference because a greater visceral adiposity is associated with a greater insulin resistance which is considered one of the most important metabolic pathogenetic key of the syndrome.

In addition to well-known cardiovascular and metabolic impairments, patients with PCOS present an increased risk for psychological disorders and reduced quality-of-life (QoL) compared to healthy women (Dokras *et al.,* 2011).

In 2004, a worldwide case-control study of patients from 52 countries was published, the INTERHEART study, (Yusuf *et al.,* 2004) found nine potentially modifiable risk factors, accounted for over 94 per cent of the population-attributable risk of a first myocardial infarction in women; the nine factors included smoking, hypertension, dyslipidemia, diabetes, visceral obesity, psycho-social factors, decreased consumption of fruits and vegetables, regular consumption of alcohol, and regular physical activity. The majority of these occur in the PCOS woman. It is estimated that the prevalence of each risk factor is approximately double for women with PCOS when compared with controls, while it is 1.5 times higher in BMI-matched studies beginning in adolescence and it is found in every decade (Fauser, 2012).

IV. MANAGEMENT OF POLYCYSTIC OVARY SYNDROME

Sheehan (2004) quotes that the management strategy of PCOS can be broken down into three categories: 1) correction of oligo-/ anovulation or irregular menses in association with infertility, 2) controlling symptoms of hyperandrogenism, and 3) management of the lifelong effects of insulin resistance. This can be a difficult task due to the varying symptoms and

emphasis placed on each symptom by individual women, in addition to the many treatment options available with lack of standardization.

A study by Rofey *et al., (*2007) stated that the symptoms of PCOS commonly occur during or soon after the onset of puberty, which may preclude early recognition of the disorder, because the clinical expression of gonadal activation with pubertal development may bear close resemblance to that of PCOS. The single most important finding is that of progressive hirsuitism. Efforts to minimize the clinical findings of PCOS in young adolescent girls depend on early diagnosis and timely suppression of excess ovarian androgen production.

A study was conducted by Dana *et al*., (2004) on cognitive behavioral therapy for physical and emotional disturbances in adolescents with PCOS to evaluate the feasibility and effectiveness of an enhanced cognitive behavioral therapy, primary and secondary control enhancement training for physical and emotional disturbances in adolescents with PCOS. In an open trial, 12 adolescents with PCOS, obesity and depression underwent eight week sessions and three family based sessions of training and family psycho education the results include, a significant decrease in weight across the eight sessions and also depressive symptoms decreased.

Women diagnosed with PCOS during adolescence are also at increased risk later in life for cardiovascular and metabolic disease. Early treatment may prevent disease progression (Chen *et al.,* 2008)

i. Diet and PCOS

A recent 12-month study of 96 women with PCOS compared the effect of an allow-GI diet and menstrual regularity revealed that the insulin sensitivity was significantly improved and they also exhibited an increase in menstrual regularity (Marsh *et al*., 2010). No significant differences were observed between low-carbohydrate and high carbohydrate diets on fasting insulin levels, or insulin sensitivity on PCOS as assessed by Homeostatic Model Assessment (HOMA) (Brinkworth *et al.,* 2004). However, a lower post prandial insulin response was reported in subjects consuming a low-carbohydrate diet (Farnsworth *et al.,* 2003).

Increased consumption of unsaturated fatty acids has been reported to improve insulin sensitivity in healthy obese and type 2 diabetic subjects (Vessby *et al.,* 2001). However, the beneficial effects of the fat quality on insulin sensitivity were observed in individuals with less than 37 per cent of total energy intake as fat (Uusitupa *et al.,* 2001). A recent investigation by Kasim *et al.,* (2004) focused on a diet supplemented in poly unsaturated fatty acids (PUFA). It is found that PUFA is associated with positive health benefits.

Consumption of trans fats – unsaturated fats which, because of internal resonance in the molecule between double bonds, behave like unsaturated fats – has been recently linked with increased risk of an ovulatory infertility (Diets that are either low in fat or low in carbohydrate almost inevitably deliver an increased proportion of calorie intake as protein. Although it has been controversial, recent evidence suggests that higher intake of protein improves the glucose and insulin responses to a glucose load (King *et al.,* 2009). Fish oil supplements may have a therapeutic role in PCOS treatment, especially for women with Coronary Heart Disease, hypertriglyceridemia, and/or depression (Gainie *et al.,* 2011)

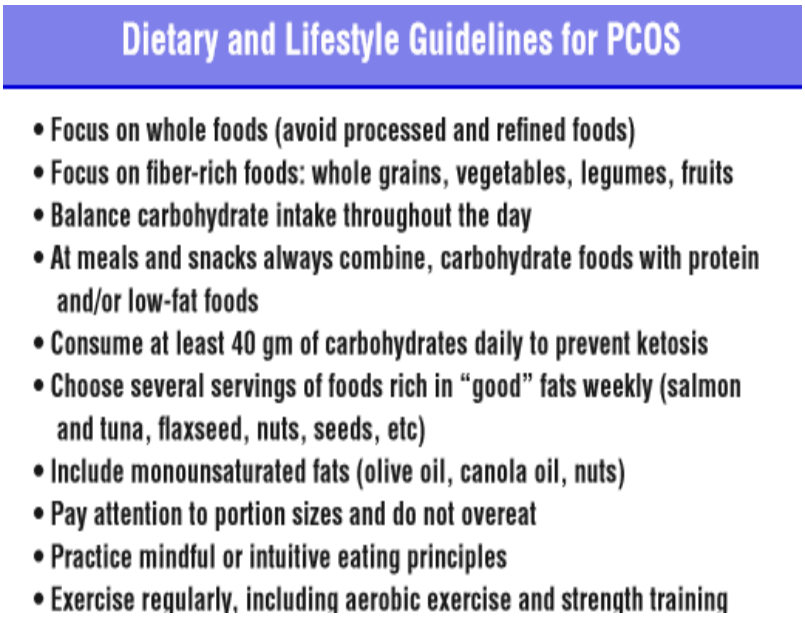
Marshall (2001) opines that the findings are ambiguous regarding the supplemental use of flaxseed, glucoman- nan, guar gum, vitamin E, chromium, magnesium, and the botanical saw palmetto for PCOS that it has health benefits.

Jenkin *et al., (*2002) stated that the women with PCOS should follow a balanced diet that is calorie-controlled, high in fiber, low in refined carbohydrates, with emphasis given to low GI index foods, low in saturated and trans fats, and high in omega-3 and omega-9 fatty acids .The dietary advices represent the main components of the lifestyle changes, in particular for obese women, but the dietary composition seems to influence the metabolic improvements of the PCOS women to a lesser extent when compared to the weight loss. In fact, a 5 per cent–10 per cent weight loss is considered clinically significant and able to reduce metabolic syndrome prevalence in general population (Moran *et al*., 2009).

Currently, despite the limitations of the existing evidences, lifestyle changes, aiming at sustained weight loss, should be recommended as first-line treatment in overweight/obese

PCOS adolescents, given the limited health risks, the low costs, and the modest benefits with other interventions. Future prospective requires longer and larger trials to draw stronger conclusions about the effects of lifestyle modifications on PCOS outcomes, to determine optimal weight loss for all these clinical improvements, and to establish the possible effects also in lean PCOS patients (Domecq *et al.*, 2013).

The first line of treatment is diet and weight loss. It is more effective to get women to focus on what to eat (whole grains, fruits, vegetables, foods rich in omega-3 fatty acids), rather than on what not to eat. The goal is to replace positive habits with negative habits over time. The chart below lists general dietary guide- lines for women with PCOS as given by Mckittrick (2001).



ii. Exercise and PCOS

Studies by Jakicic *et al.*, (2003) showed that 60 - 75 minutes of moderate-to-high intensity of physical activity promotes a greater long term (12-18 months) weight loss compared with the conventional recommendation for optimum health. Increasing muscle strength and mass with weight training has been neglected as a means of improving function and body composition until recently. The high metabolic rate of muscle means that muscle mass is an important determinant of resting energy expenditure and resistance training is now regarded as a

highly acceptable way to opt influence weight, body composition, and insulin sensitivity (Borg *et al*., 2002).

Lifestyle intervention improves body composition, hyperandrogenism (high male hormones and clinical effects) and insulin resistance in women with PCOS (Moran *et al.*,2011). Lifestyle change, including hypocaloric diet and physical exercise, is considered a cornerstone of the management of women with PCOS presenting with obesity, particularly the abdominal phenotype (Conway *et al.,* 2014).so it is generally recommended as a first-line approach for obese PCOS women (Legro *et al.,* 2013).However, there are few randomized controlled trials that support this recommendation. A Cochrane review about the lifestyle's impact on PCOS women supports the benefits of lifestyle treatment in PCOS patients. In particular, when compared to minimal treatment (consisting of unstructured minimal dietary, exercise or behavioral advice), lifestyle intervention is able to improve anthropometric markers, such as weight and fat distribution, total testosterone levels, fasting, and OGTT insulin concentrations. However, it does not reduce free androgen index that is considered a real marker of hyperandrogenism; it neither shows effects on OGTT glucose, fasting glucose levels, or lipid profile, compared to controls (Moran, 2011).

Methodology

III. METHODOLOGY

The methodology followed for the present study entitled **"Effect of Lifestyle Intervention on Poly cystic Ovary Syndrome among College Going Girls (19 to 22 years)"** is presented under the following headings.

- **A. Selection of Area**
- **B. Selection of Subjects**
- **C. Formulation of Interview Schedule and Conduct of Survey**
  - **i. Obtaining Ethical Clearance of the Study**
- **D. Assessment of Nutritional Status**
  - **i. Anthropometric Measurement of the Selected Subjects**
  - **ii. Dietary Survey**
- **E. Formulation of Questionnaire to Assess Nutritional Knowledge**
- **F. Imparting Nutrition Education to the selected Adolescent Girls.**
- **G. Analysis and Interpretation of the Data**

A. SELECTION OF AREA

The area selected for the study was Coimbatore city. As of 2010 survey data, Coimbatore district is home to 7 universities, 78 engineering colleges, 3 medical colleges, 35 polytechnic colleges, 2 dental colleges, more than 150 Arts and Science colleges, and with large number of schools located in and around Coimbatore. Since it is a hub of education it was chosen for selecting the samples for survey and nutrition education was quite easy. Also the investigator was familiar with the people and resources, easy accessibility to the subjects and co-operation of the subjects made this place conducive for conducting the study.

B. SELECTION OF SUBJECTS

Adolescence is the period of transition from childhood to adulthood and is crucial in the life of human beings. They need nutritional care to promote and to maintain their health status. Also PCOS affect 5-10 per cent of women of reproductive age and therefore it is necessary to create awareness about the effects of PCO's and the complications arising due to this. Therefore samples

were selected among the college going girls in the age group of 19 – 22 years, as creating awareness about PCOS is very essential as they are the pillars of the next generation of our country.

Sampling is simply the process of learning about the population on the basis of a sample drawn from it (Gupta, 2004). Under this method a small group of the universe is taken as the representative of the whole mass and the results are drawn. It is a method to make social investigation practicable and easy (Kothari, 2011).

The adolescent subjects in the age group of 19 to 22 years were selected for survey by simple random sampling technique. Simple random sampling is a sampling technique which means a selection where each and every item of the population has an equal chance of being selected in the sample (Gupta, 2004). Three hundred girls in the age group of 19-22 years were selected randomly and interviewed during the survey. An inclusion criteria for survey includes girls belonging to 19 to 22 years of age group and the girls who are available and willing to participate in the study. The exclusion criteria include adolescent girls who do not belong to this age group and those who are not willing to participate in the study.

C. FORMULATION OF INTERVIEW SCHEDULE AND CONDUCT OF SURVEY

An interview schedule is the list of questions that helps to collect data from the field. This is generally filled by the researcher or the interviewer herself (Gupta, 2007). The purpose of interview schedule is that, accurate information can be collected and it is free from bias (Kothari, 2011).

Interview method was chosen due to its convenience, comprehensiveness and possibility of obtaining genuine information for collection of data. Hence interview method was selected using an interview schedule.

With an Interview schedule the background information relating to age, education, type of family, income of the family, anthropometric assessment, dietary pattern, frequency of food intake, lifestyle pattern, and medical history related to menarche was collected with the help of the interview schedule. The schedule used for the study is presented in Appendix I. Hence the interview method was used on 300 subjects of adolescent girls selected from the various colleges of Coimbatore.

i. Obtaining Ethical Clearance of the Study

The application form explaining the design and the protocols used in the research study was subjected to the Institutional Ethical Committee and Ethical clearance (AUW/IHEC/FSN-15-16/XMT-10) was obtained (Appendix II).

D. ASSESSMENT OF NUTRITIONAL STATUS

Assessment of the nutritional status of the community is one of the first steps in the formulation of public health strategy to combat nutritional problems. Nutritional status of an individual is assessed by using medical, nutrition, anthropometric measurement and dietary pattern. Nutritional anthropometry is a measurement of human body at different age's levels of nutritional status. It is based on the concept that an appropriate measurement should reflect any morphological variation occurring due to significant functional physiological change (Bamji, 2009).

i. Anthropometric Measurement of the Selected Subjects

Anthropometry deals with physical measurement that provides an indirect assessment of body composition, growth and development. It also indicates the changes in an individual's nutritional status. This is considered to be the most sensitive parameter for assessing the nutritional status (NIN, 2011). Anthropometric measurements are physical measurements of the body such as height and weight, hip circumference and waist circumference. The assessment of growth includes the evaluation of height, weight as well as allowing for the correction of those parameters of age. Assessment of nutritional status is based on body components relating to previous measurements and relating to values to normal standard values (Insel *et al.,* 2010).

The most commonly used anthropometric measurements to determine nutritional status are,

a. Measurement of height
b. Measurement of weight
c. Body Mass Index(BMI)
d. Waist circumference
e. Hip circumference
f. Waist Hip Ratio (WHR)

a. Measurement of Height

The height of an individual is principally a measure of skeletal, body tissues, leg, pelvis, spine and skull. Height is the simplest and quickest one to measure and the easiest to produce, provide simultaneously maximum information concerning a number of nutritional problems. The height is measured with a vertical measuring rod. The subject should stand erect on a leveled surface without shoes, looking straight with heels together and toes apart. An average three successive measurements is taken as the final measurement (Bamji, 2009) (Plate I).

b. Measurement of Weight

Body weight is the most widely used and the simplest method for assessing the nutritional status of people. It indicates the body mass and it is composite of all body constituents like water, minerals, fat, protein, bone etc., (Bamji, 2009).

Body weight is an important anthropometric measurement in use. Use of level-actuated balance with 100gm is recommended. The weighing scale should be placed on a firm and flat ground and zero error has to be adjusted. The subject is made to stand on the platform of the balance without footwear and with minimal clothing and weight should be taken by the investigator (NIN, 2011) (Plate I).

c. Body Mass Index (BMI)

Body mass index, a mathematical formula that correlates with body fat is expressed as weight in kilograms divided by height in meter square (Mahan,2008).After the cessation of linear growth around the age of 21 years, weight for height indicates muscle fat mass in the adult body. Therefore BMI provides a reasonable indication of the nutritional status of adults. The BMI has good correlation with fatness. It may also be used as indicator of health risk(Bamji et al.,2009). The BMI was calculated by using the Quatlet's index for all the selected adolescents.

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

The BMI values of the adolescents were categorized according to nutritional status based on BMI as suggested by WHO (2010).

BMI (Kg/m^2)	Classification
< 18.5	Underweight
18.5 – 22.9	Normal
23.0 – 24.9	Overweight
> 25	Obese

d. Waist circumference

Waist circumference is measured using fibre reinforced plastic tape. The tape should pass mid way between these lower rib margin and iliac crest. Adult man with waist circumference ≥ 102cms and adult women with ≥ 88cms are considered having abdominal obesity (Bamji,2009).The waist circumference is obtained by measuring the distance around the smallest area below the rib cage and above umbilicus (belly button) with the use of non stretchable measuring tape. Waist circumference measurements assess abdominal fat content (Mahan, 2008) (Plate II).

e. Hip Circumference

Hip circumference is measured with tape passing over maximum protuberance on buttocks (Bamji,2009).Place the tape horizontally over the buttocks and measure the circumference at the point yielding the maximum circumference in centimeters upto the nearest millimeter (NIN, 2011) .

f. Waist Hip Ratio (WHR)

Waist hip ratio is used as a measurement of obesity, especially abdominal obesity, which in turn is a possible indicator of other more serious health conditions. The standard waist hip ratios (WHR) of 0.85 and greater have a risk of health problems in women (WHO, 2006).The predominant distribution of fat in an obese pattern whether in the upper part or the lower part of the body may determine the disease pattern. Waist hip ratio (WHR) is defined as the waist circumference divided by the hip circumference (Lutz *et al*., 2007). The waist hip ratio of selected adolescents were calculated using the following formula,

$$WHR = \frac{\text{Waist circumference (cm)}}{\text{Hip Circumference (cm)}}$$

The individual Height, Weight, Body mass index, Waist-Hip ratio is presented in Appendix III.

ii. Dietary Survey

Diet is a vital determinant of health and nutritional status of an individual. Diet survey was conducted in adolescents to collect information on their food consumption pattern. The details on the dietary practice like food frequency pattern, type of diet taken, consumption of sugar, fast foods and habit of skipping meals were collected with the help of questionnaire.

E. FORMULATION OF QUESTIONNAIRE TO ASSESS NUTRITIONAL KNOWLEDGE

A questionnaire was designed to elicit the information regarding knowledge on PCOS among adolescents, Questionnaire included questions on PCOS and other aspects related to the PCOS like- the meaning of PCO, causes of PCOS among adolescent girls, complications of PCOS and also high and low glycemic index foods. Questionnaire also had questions on the types of foods and its effect on obesity, health and PCO, foods to be avoided and included during PCOS and finally its management strategy was included. Overall 20 questions were used for assessing the knowledge level and is presented in Appendix IV. Each question answered with correct answer was equivalent to one point. Wrong answers did not receive scores. The scores varied from 1 to 20.

F. IMPARTING NUTRITION EDUCATION TO THE SELECTED SUBJECTS

Nutrition Education is any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being. Nutrition education is delivered through multiple venues and involves activities at the individual, as well at the community level (Jones & Bartlett, 2007).

Nutrition education is any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition related behaviours conductive to health and well being. Well-designed and effectively implemented nutrition education can motivate those participating to change dietary behaviors and provide them with the knowledge and skills to make healthy food choices in the context of their lifestyles and economic resources. Effective nutrition education and promotion includes multiple components: 1)skill building to facilitate positive behavior change;

2) environmental and policy changes to make the healthy choice the easy choice, and 3) integrated initiatives and social marketing to build community and social support (Martin and Oakley,2008).

Nutrition education is an effective tool when used properly on any target group and for a specific condition, can bring about positive results (World Health Report,1998).Initial knowledge on PCOS, attitude towards the proper nutrition and health for PCOS, eating habits, knowledge concerning about the facts of PCOS were assessed through an interview schedule covering all facts (Appendix IV).

Nutrition education was imparted to selected 50 college going girls who were willing to attend the nutrition education. Nutrition education was imparted with the help of educational aids like Pamphlet, PowerPoint's,Lectures etc., Pamphlets were prepared comprising of all the information and also visual presentation in English was done with PPT with necessary explanation and distributed among the adolescent girls (Plates III & IV).

The effectiveness of the nutrition education about PCOS knowledge of the girls on PCOS were evaluated using the same questionnaire which was used for getting the initial knowledge and the results obtained were consolidated using scores. Comparison of initial and final scores was used to evaluate the impact of the nutrition education programme (PPT in Appendix V and Pamphlet for nutrition education in Plate V and Appendix VI).

G. Analysis and Interpretation of the Data

The data collected were organized to obtain the desired results and interpreted scientifically (Gupta, 2007). The collected data was consolidated, tabulated and analyzed to see the knowledge and the impact of nutrition education on PCOS of selected subjects.

PLATE I

MEASUREMENT OF HEIGHT AND WEIGHT

PLATE II
MEASUREMENT OF WAIST

PLATE III

IMPARTING NUTRITION EDUCATION

PLATE IV

DISTRIBUTION OF PAMPHLETS

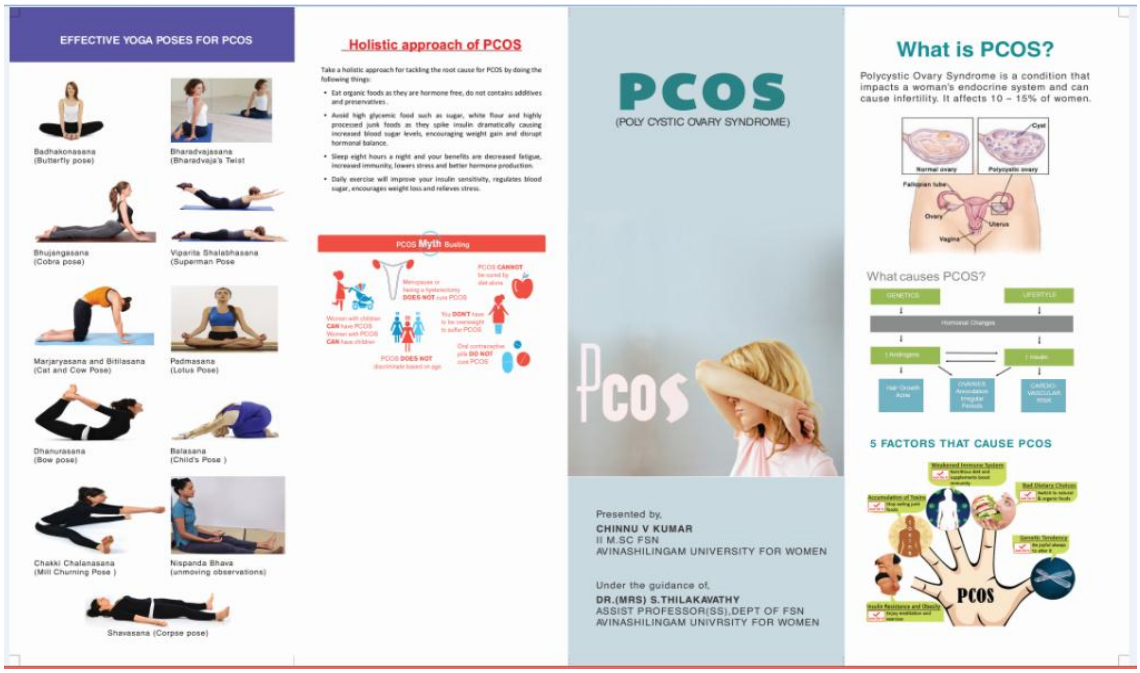
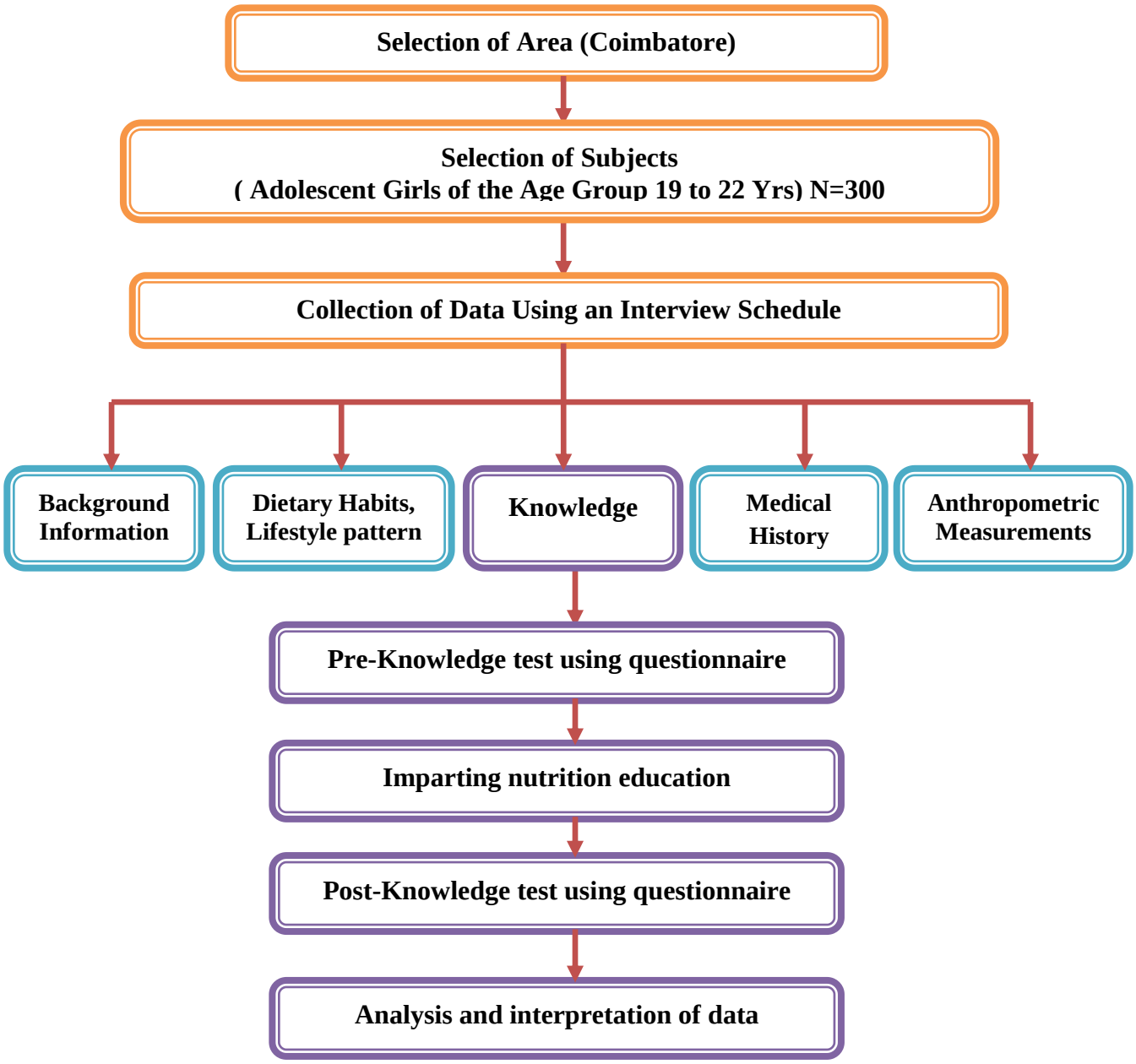


PLATE V
NUTRITION EDUCATION MATERIAL (PAMPHLET)

RESEARCH DESIGN



Results and Discussion

IV. RESULTS AND DISCUSSION

The results of the present study titled, **"Effect of Lifestyle Intervention on Polycystic Ovary Syndrome among College Going Girls (19 to 22 years)"**, are presented and discussed under the following headings:

A. Socio economic background of the selected college going girls

B. Dietary pattern and Lifestyle of the college going girls

C. Medical History of college going girls

D. Nutritional status of college going girls

E. Assessment of nutritional knowledge on PCOS and impact of nutrition education

A. SOCIO ECONOMIC BACKGROUND OF COLLEGE GOING GIRLS

The details pertaining to the socio economic background of college going girls are discussed as follows

1. Age of the college going girls

Table 1 presents the categorization of girls according to their age

TABLE I

AGE OF THE COLLEGE GOING GIRLS (N=300)

Age(years)	Number	Per cent
19	70	23.3
20	105	35
21	67	22.3
22	58	19.3
Total	**300**	**100**

Among the 300 girls selected for the study, 23.3 per cent belonged to the age of 19 years, majority of (ie) 35 percent belonged to the age of 20 years, 22.3 and 19.3 per cent were in the age group of 21 and 22 years respectively. Thus the age of the selected girls were between 19- 22 years.

2. Educational status of the college going girls

Table II represents data on the educational status of the selected girls.

TABLE II

EDUCATIONAL STATUS OF THE SELECTED COLLEGE GOING GIRLS

Educational status	Number	Per cent
UG (Undergraduate)	218	72.7
PG(Postgraduate)	82	27.3
TOTAL	**300**	**100**

Out of the selected girls, majority of them (ie) 72.7 per cent of them were in their undergraduate course, while 27.3 per cent of the girls were doing their post graduation studies

3. Monthly Income of the family

Monthly income of the selected girls family is presented in Table III

TABLE III

INCOME OF THE FAMILY

Income of the family in Rupees	Number	Per cent
5000-10,000	92	30.7
10,001-15,000	96	32
15,001-20,000	56	18.7
Above 20,000	56	18.7
Total	**300**	**100**

Out of the selected girls 30.7 per cent belonged to the family with an income of Rs. 5000-10,000, while 32 per cent girls family had an income between Rs. 10,000-15,000 and 18.7 per cent of girls belonged to the higher income category of Rs.15,001 – 20,000 and above Rs.20,000 respectively

B. DIETARY PATTERN AND LIFESTYLE OF COLLEGE GOING GIRLS

Details regarding the dietary pattern of the selected college going girls are discussed under the following headings.

1. Type of diet consumed

The type of diet consumed by the girls is presented in Table IV.

TABLE IV

TYPE OF DIET CONSUMED

Type of diet	Number	Per cent
Vegetarian	40	13.3
Non Vegetarian	260	86.7
TOTAL	**300**	**100**

Information on the general type of diet consumption pattern from Table IV revealed that 86.7 per cent of them preferred non vegetarian diet and only 13.3 per cent preferred vegetarian diet. The data reveal that non-vegetarian food is the most preferred food among the youngsters. A study by Croll *et al* (2001) opines that non-vegetarian foods tend to be viewed as adolescent foods which are preferred for consuming rather than vegetarian foods.

2. Commonly consumed Non vegetarian foods

The commonly consumed non vegetarian foods by the selected college going girls are presented in Table V.

TABLE V

COMMONLY CONSUMED NON VEGETARIAN FOODS

Food Item	Number	Per cent
Fish	25	8.3
Chicken	102	34
Mutton	4	1.3
All the non-vegetarian foods(including egg)	129	43
TOTAL	**260**	**86.6**

Table V revealed that majority of them (ie) 43 per cent of college going girls preferred to consume fish, mutton, chicken, egg etc and 8.3 per cent preferred only fish to eat while 34 per cent of them preferred chicken and only 1.3 per cent preferred mutton in their non vegetarian diet.

3. Frequency of consumption of Non Vegetarian foods

Frequency of consumption of non vegetarian foods by the college going girls is presented in Table VI.

TABLE VI

FREQUENCY OF CONSUMPTION OF NON VEGETARIAN FOODS

Frequency	Number	Per cent
Daily	3	1
Weekly	161	53.7
Thrice in a Week	38	12.7
Monthly	35	11.7
Rarely	23	7.7

The data in the Table revealed that out of the students who are consuming non vegetarian foods, only one per cent consume non vegetarian food daily,most percentage of the girls (ie) about 53.7 per cent consumed weekly once, 12.7 per cent consumed thrice a week and 11.7 per cent of college going girls consumed monthly once, while 7.7 per cent of girls consumed non vegetarian foods rarely.This data shows that more number of girls prefer to eat non vegetarian foods as their meal at least once in a week regularly.

4. Meal pattern of the selected girls

Meal pattern of the selected college going girls is given in Table VII.

TABLE VII

MEAL PATTERN OF THE SELECTED COLLEGE GOING GIRLS

Number of meals	Number	Per cent
2 meals	36	12
3 meals	217	72.3
4 meals	47	15.7
TOTAL	**300**	**100**
Skipping meal pattern	**Number**	**Per cent**
Yes	168	56
No	132	44
Total	**300**	**100**
If Yes, the meals skipped		
Breakfast	122	40.7
Lunch	24	8
Dinner	22	7.3

Out of 300 girls selected, majority of girls (ie), 72.3 per cent followed a three meal pattern, while 12 per cent followed a two meal pattern and 15.7 per cent followed a four meal pattern every day.

This data reveals that majority of them had good dietary habit by eating three meals a day without skipping any meal. The girls who followed two meal pattern mostly skipped breakfast due to one or other reasons like travelling long distance to reach college, overworked etc.

From the table it was found that majority per cent of girls,(ie) 56 per cent skip their meals, and 44 per cent girls did not skip any meals and had the habit of taking food regularly at least minimum quantity of food.

Out of the girls who skipped meals, about 40.7 per cent of the girls was skipping breakfast, eight per cent of them skipping lunch and 7.3 per cent were skipping dinner.

In the present situation, college going girls have developed the habit of skipping meals either due to time taken for travelling or due to their studies or dislike for the food provided in the home or hostel.

5. Frequency of consumption of Fast foods

The frequency of consumption of fast foods by college going girls is presented in Table VIII.

TABLE VIII

FREQUENCY OF CONSUMPTION OF FAST FOODS

Frequency	Number	Per cent
Daily	5	1.7
Once in a week	152	50.7
Twice in a week	60	20
Rarely	83	27.7
Total	**300**	**100**

From the table regarding the frequency of consumption of fast foods it was shown that majority of girls (ie).50.7 per cent consume fast foods only once in a week and 20 per cent preferred to consume it twice in a week, while 27.7 per cent consume fast foods very rarely and only 1.7 per cent of girls consumed fast foods regularly.

6. Type of fast foods preferred to consume by selected girls

The type of fast foods preferred by the college going girls is presented in Table IX.

TABLE IX

FAST FOODS CONSUMED

Fast food variety	Number	Per cent
Burgar	26	8.7
Pizza	15	5
Sandwich	21	7
KFC	3	1
Parotta	111	37
French Fries	25	8.3
All the above	99	33
Total	**300**	**100**

From the data, out of the 300 college going girls majority per cent of girls, ie about 37 per cent preferred parotta to eat when compared with other fast food items, while 8.7 per cent of girls liked burgar to consume, five per cent preferred pizza for consuming, while only a very few girls preferred KFC for consuming and 8.3 per cent chose French fries as their preference and about 33 per cent of girls preferred all these items for consuming.

Out of this data it was revealed that most number of girls consumed parotta. Parotta prepared from refined wheat flour is only calorie dense and lacking in other micronutrients and fibre and hence not good and it will leads to health problem and obesity, a cause for PCOS.

7. Lifestyle pattern of college going girls

The details pertaining to the lifestyle pattern of college going girls are discussed as follows.

Adolescent life style has undergone vast changes , with lower levels of physical activity, with a sedentary life , irregular meal time, and diet rich in fat and refined carbohydrates. Due to unhealthy eating habits and lifestyle they are more prone to diseases especially fertility related problems (Beresford *et al,* 2006).

1. **Exercising pattern**

The habit of exercising of selected college going girls is presented in Table X.

TABLE X

HABIT OF EXERCISING

Habit of exercising	Number	Per cent
Yes	128	42.7
No	172	57.3
Total	**300**	**100**
If yes,type of exercise		
Walking	80	62.5
Cycling	6	2
Yoga	34	11.3
Others	8	2.7

The data in the table revealed that about 57.3 per cent (ie) the majority of girls do not have the habit of exercising, while 42.7 per cent of selected girls had the habit of exercising.

Out of the students who had the habit of exercising, 62.5 per cent girls had the habit of walking as an exercise, and two per cent girls were cycling,and 11.3 per cent of girls practiced yoga and the others practiced other type of exercises like gym,aerobics etc.

2. Hours of Daily sleep

The daily sleeping hours of the college going students is represented in Table XI.

TABLE XI

DAILY SLEEPING HOURS

Sleeping hours	Number	Per cent
5-6 hours	127	42.3
7-8 hours	173	57.7
Total	**300**	**100**

From the table it was revealed that 57.7 per cent of girls had the habit of sleeping for about 7-8 hours and 42.3 per cent of the students sleep for about 5-6 hours.

From the data it is clear that majority of girls followed the correct sleeping hours which is a sign for good health with less stress.

3. Feeling of stress

Out of the 300 college going girls it was found that 50 per cent of girls were stressed often and the remaining were not stressed unnecessarily.

Under stress, the body responds by increasing hormone production, including production of cortisol and adrenaline, the “fight or flight” hormones. Cortisol can encourage weight gain, irregular periods, acne, excess body hair, high blood pressure, and diabetes – exacerbating PCOS symptoms (Harris, 2000).

C. MEDICAL HISTORY OF COLLEGE GOING GIRLS

The medical history of the 300 selected college going girls is presented as follows.

1. Age of Menarche

Table XII presents menarche age of 300 college going girls.

TABLE XII

AGE OF MENARCHE

Age	Number	Per cent
11	65	21.7
12	70	23.3
13	105	35
14	60	20
Total	**300**	**100**

Out of the 300 girls 35 per cent of the girls had menarche at the age of 13 and 23.3 per cent of girls had menarche at the age of 12 ,while 21.7 per cent of girls age of meanarche was at 11 years while 20 per cent of girls had menarche in their 14^{th} year.

2. Problems during menarche

The problems faced by the college going girls during their menses period is presented in Table XIII.

TABLE XIII

PROBLEMS FACED DURING MENARCHE

Problems	Yes		No		Rarely	
	No.	Per cent	No.	Per cent	No.	Per cent
Back pain	150	50.0	111	37.0	39	13.0
Excessive bleeding	58	19.3	191	63.7	51	17.0
Head ache	80	26.7	192	64.0	28	9.3
Irregualr periods	139	46.3	123	41.0	38	12.7
Stomach Pain	192	64.0	67	22.3	41	13.7
Tiredness	194	64.7	75	25.0	31	10.3
Physical discomfort	114	38.0	131	43.7	55	18.3
Vomiting sensation	43	14.3	226	75.3	31	10.3

❖ **Multiple Response**

From the table it was revealed that all the girls suffered from one or other health problems and some of them had multiple problems like back pain, irregular periods and tiredness.

Fifty per cent of the girls had back pain during every menses period, 13 per cent of the girls had the pain occasionally, and 37 per cent of girls did not have back pain. Sixty four per cent, 64.7 per cent, 46.3 per cent and 38 per cent of the girls suffered from stomach pain, tiredness, irregular periods and physical discomfort respectively. A minimum of 19.3 and 14.3 per cent of the girls had problem due to excessive bleeding and vomiting sensation respectively.

From the data, it is clear that the adolescent girls undergo one or other type of suffering during menarche either because of their dietary habits or lifestyle changes.

D. NUTRITIONAL STATUS OF COLLEGE GOING GIRLS

The nutritional status of the college going girls was assessed by anthropometric measurements.

Assessment of the nutritional status of the community is one of the first steps in the formulation of public health strategy to combat nutritional problems. Nutritional status of an individual is assessed by using medical, nutrition, anthropometric measurement and dietary pattern. Nutritional anthropometry is a measurement of human body at different age's levels of nutritional status. It is based on the concept that an appropriate measurement should reflect any morphological variation occurring due to significant functional physiological change (Bamji, 2009).

1. Anthropometric measurement

Anthropometric measurements are physical measurements of the body such as height and weight, hip circumference and waist circumference. The assessment of growth includes the evaluation of height, weight as well as allowing for the correction of those parameters of age. Assessment of nutritional status based on body components relating to previous measurements and relating to values to normal standards (Insel *et al.*, 2010).

a. Mean height and weight of college going girls

Table XIV presents the distribution of college going girls according to height and weight classification. The individual height and weight of the selected girls is presented in Appendix III.

TABLE XIV

HEIGHT AND WEIGHT OF THE SELECTED COLLEGE GOING GIRLS

Details	Number	Per cent
Height(cm)		
<145	14	14.7
146-150	30	10
151-155	82	27.3
156-160	98	32.7
>160	76	25.3
Weight(kg)		
<40	14	4.7
41-50	118	39.3
51-60	102	34
61-70	49	16.3
>70	17	5.7

Table XIV indicates that 14.7 per cent of the girls were less than 145 cmof height. Ten per cent of selected girls were between 146-150 cm height, 27.3 and 32.7 per cent of the girls were between 151-155 cm and 156-160 cm of height respectively, while 25.3 per cent of the girls were tall with a height of above 160 cm.

With regard to weight, 4.7 per cent of the girls were underweight and their body weight was less than 40 kg. While 39.3 per cent of girls were in the range of 41-50 kg,a little above underweight,34 per cent of the girl's body weight was in the range of 51-60 kg,16.3 per cent were in the weight range of 61-70 kg and 5.7 per cent weighed more than 70 kg.

b. Body Mass Index(BMI)

Table XV and Figure 1 represents the Body mass index of the selected subjects

TABLE XV
BODY MASS INDEX

BMI Classification		Number	Per cent
<18.5	Underweight	59	19.7
18.5-22.5	Normal	104	34.7
23.0-24.9	Overweight	93	31.0
>25	Obese	44	14.7

WHO (2009)

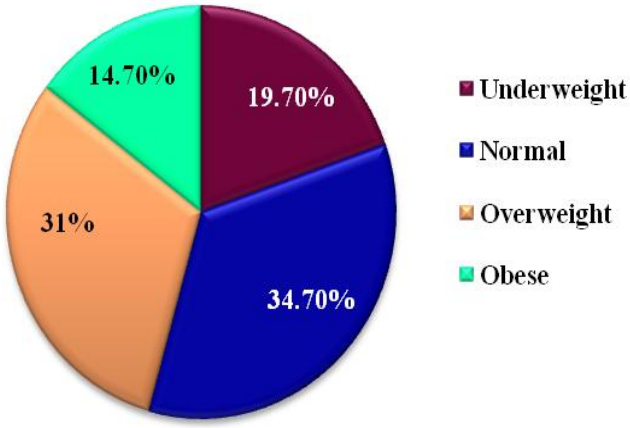


FIGURE 1

BMI OF THE SELECTED GIRLS

Out of the selected subjects 34.7 per cent of the girls had normal height and weight hence their BMI was also within the normal range as the data on height and weight indicated,19.7 per cent of the girls had a BMI of less than 18.5 and they were underweight. The remaining students (ie) 31 per cent and 14.7 per cent had BMI range of 23.0-24.9 and greater than 25 respectively and they were categorized as overweight and obese. The data reveals that only 34.7 per cent of the subjects were in the normal range and the others were either underweight or overweight.

c. Waist-hip ratio

Table XVI and Figure 2 shows the waist-hip ratio of the selected subjects.

TABLE XVI
WAIST-HIP RATIO

Waist hip ratio	Health risk	Number	Per cent
<0.80	Low risk	106	35.3
0.81-0.85	Moderate Risk	100	33.3
>0.85	High risk	94	31.3

(WHO 2009)

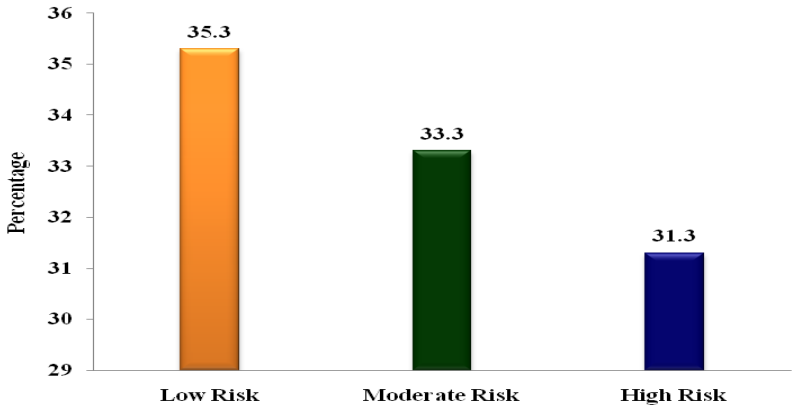


FIGURE 2

WHR OF THE SELECTED GIRLS

The data shows that about 35.3 per cent of the girls had waist hip ratio values within the low risk range and 33.3 per cent of them had WHR of moderate risk, while 31.3 per cent of them were in a high risk range. This data is in accordance with the data in Table XVI which indicated that around 45 per cent were overweight and obese.Hence WHR is also in high risk category for 31.3 per cent of the girls.

E. ASSESSMENT OF NUTRITIONAL KNOWLEDGE ON PCOS OF COLLEGE GOING GIRLS

Nutrition education was imparted to the selected 50 girls.Before giving education their initial knowledge about PCOS was assessed using the questionnaire. The score was analyzed with a maximum mark of 20. Assessment of nutritional knowledge of college going girls is presented in Table XVII and Figure 3.

According to Contento (2011), the role of nutrition education is to target audience with new information about nutrition, with the assumption that this information will lead to changes in knowledge, which in turn will result in improved dietary behavior or practices.

TABLE XVII

ASSESSMENT OF NUTRITIONAL KNOWLEDGE

Nutritional Knowledge Scores	Before Education		After Education	
	No.	Per cent	No.	Per cent
Low (0-8 marks)	38	76	6	12
Middle (9-14 marks)	9	18	8	16
High (15-20 marks)	3	6	36	72

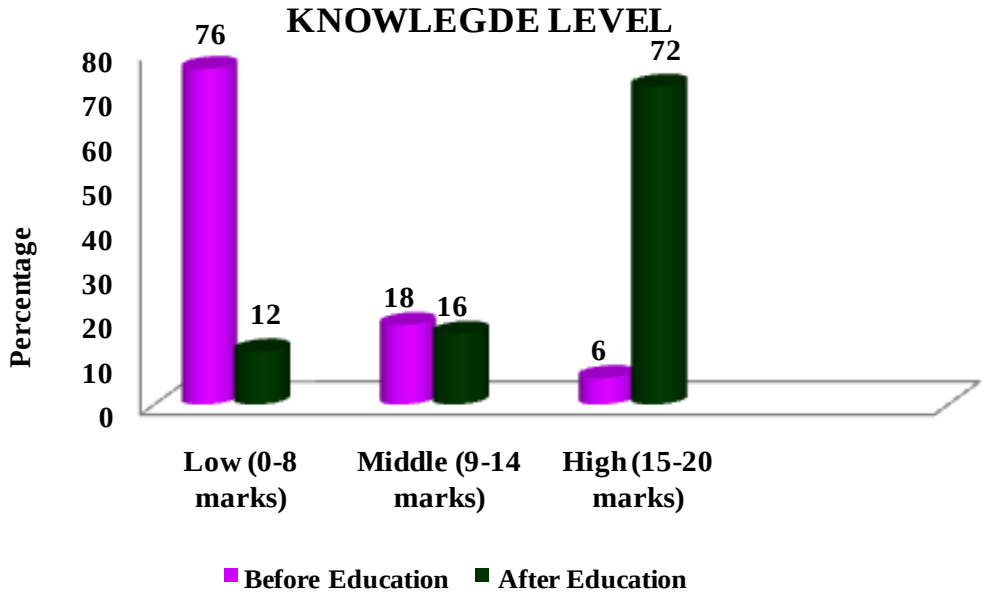


FIGURE 3

IMPACT OF NUTRITION EDUCATION ON SELECTED GIRLS

All the 50 selected girls knowledge was assessed before education and also after education based on scores. Before imparting education 76 per cent, 18 per cent and six per cent of girls scored marks in the level of low, middle and high with 0-8 marks, 9-14 marks and 15-20 marks respectively and after education the percentage of the girls who scored high marks was increased to 72 per cent from six per cent, while the girls who scored less marks (76 Per cent) was decreased to 12 per cent (Figure 3).

From this data it was shown that the nutrition education was successful and it had an impact on the knowledge and dietary recommendations to be followed for PCOS.

Summary and Conclusion

V. SUMMARY AND CONCLUSION

The study entitled **"Effect of Lifestyle Intervention on Poly Cystic Ovary Syndrome among College Going Girls (19 to 22 years)"** is summarized as follows;

Adolescence has been defined by World Health Organization (2010) as the period of life span between 10 – 19 years and the youth between 15 – 24 years. Adolescence is a time of many transitions in terms of physical growth, physchological development and emotional maturity. This phase is characterized by exceptionally rapid rate of growth. Total nutrient needs are higher during adolescence than any other time in the lifecycle. Nutrition and physical growth are integrally related; optimal nutrition is a requisite for achieving full growth potential. Nutrition during adolescence comprises the second and last growth spurt period and adolescents are susceptible to develop faulty eating behavior leading to malnutrition.

Nutrition education is an integral way to impart knowledge to the public and it plays an important role in developing health and nutrition for a better living. Nutrition Education is a combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behaviors conducive to health and well-being.

A total of 300 adolescent girls were selected from various colleges in Coimbatore city. An interview schedule was formulated and data regarding socio economic background, dietary pattern, lifestyle pattern and medical history were collected from the selected college going girls. The socio economic status was evaluated using an interview schedule. Anthropometric parameters namely height, weight, waist circumference and hip circumference were determined using standard procedures, from which indices such as BMI and waist hip ratio were calculated.

Nutrition education was given regarding proper nutrition and health for college going girls and impact was recorded through knowledge questionnaire. Initial knowledge on PCOS, attitude towards the proper nutrition and health for PCOS, eating habits, knowledge concerning about the facts of PCOS were assessed through an interview schedule covering all facts.

Salient findings of the study:

The salient findings of the study is as follows;

- Among the 300 girls selected for the study, 23.3 per cent belonged to the age of 19 years, majority of (ie) 35 per cent belonged to the age of 20 years, 22.3 and 19.3 per cent were in the age group of 21 and 22 years respectively.
- Out of the selected girls, a majority of them ie, 72.7 per cent of them were in their undergraduate course, while 27.3 per cent of the girls were doing their post graduation studies. 30.7 per cent belonged to the family with an income of Rs. 5000-10,000, while 32 per cent girls family had an income between Rs. 10,000-15,000 and 18.7 per cent of girls belonged to the higher income category of Rs.15,001 – 20,000 and above Rs.20,000 respectively.
- Eighty six per cent of them preferred non vegetarian diet and only 13.3 per cent preferred vegetarian diet.
- Forty three per cent of college going girls preferred to consume fish, mutton, chicken, egg and 8.3 per cent preferred only fish while 34 per cent of them preferred chicken and only 1.3 per cent preferred mutton in their non vegetarian diet.
- Out of the students who are consuming non vegetarian foods,only one per cent consume non vegetarian food daily, majority of the girls ie, about 53.7 per cent consumed weekly once, 12.7 per cent consumed thrice in a week and 11.7 per cent consumed monthly once while 7.7 per cent consumed non vegetarian foods rarely.
- Out of 300 girls selected, majority of girls ie, 72.3 per cent followed a three meal pattern,while 12 per cent followed a two meal pattern and 15.7 per cent followed a four meal pattern every day.
- Majority of, (ie) 56 per cent skip their meals, and 44 per cent girls did not skip any meals and had the habit of taking food regularly atleast minimum quantity of food.
- Out of the girls who skipped meals, about 40.7 per cent of the girls was skipping breakfast, eight per cent of them skipping lunch and 7.3 per cent were skipping dinner.
- Regarding the frequency of consumption of fast foods it was shown that majority of girls (ie).50.7 per cent consume fast foods only once in a week and 20 per cent preferred to

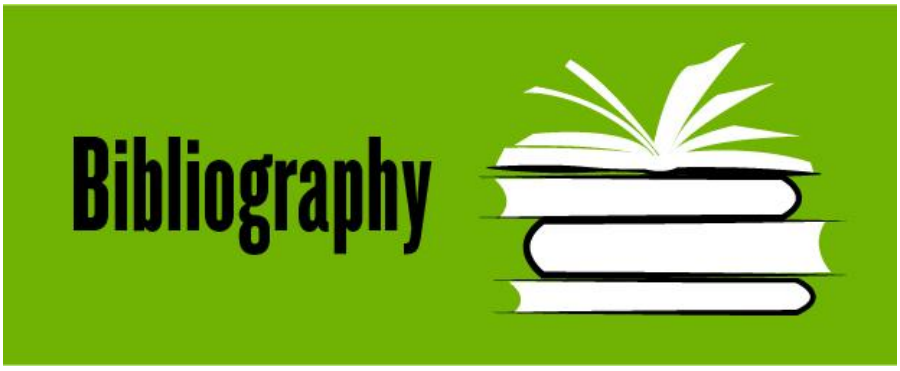
consume it twice in a week, while 27.7 per cent consume fast foods very rarely and only 1.7 per cent of girls consumed fast foods regularly.

- Out of the 300 college going girls, about 37 per cent preferred parotta to eat when compared with other fast food items, while 8.7 per cent of girls liked burgar, five per cent preferred pizza, while only a very few girls preferred KFC and 8.3 per cent chose French fries as their preference and about 33 per cent of girls preferred all these items for consuming.
- About 57.3 per cent (ie) the majority of girls do not have the habit of exercising, while 42.7 per cent of selected girls had the habit of exercising.
- Out of the students who had the habit of exercising, 62.5 per cent girls had the habit of walking as an exercise, and two per cent girls were cycling,and 11.3 per cent of girls practiced yoga and the others practiced other type of exercises like gym,aerobics etc.
- About 57.7 per cent of girls had the habit of sleeping for about 7-8 hours and 42.3 per cent of the students sleep for about 5-6 hours.
- Out of the 300 college going girls it was found that 50 per cent of girls were stressed often and the remaining were not stressed unnecessarily.
- Out of the girls 35 per cent of the girls had menarche at the age of 13 and 23.3 per cent of girls had menarche at the age of 12 ,while 21.7 per cent of girls age of meanarche was at 11 years while 20 per cent of girls had menarche in their 14^{th} year.
- Fifty per cent of the girls had back pain during every menses period, 13 per cent of the girls had the pain occasionally, and 37 per cent of girls did not have back pain. Sixty four per cent, 64.7 per cent, 46.3 per cent and 38 per cent of the girls suffered from stomach pain, tiredness, irregular periods and physical discomfort respectively. A minimum of 19.3 and 14.3 per cent of the girls had problem due to excessive bleeding and vomiting sensation respectively.
- About 14.7 per cent of the girls were less than 145 cm of height. Ten per cent of selected girls were between 146-150 cm height, 27.3 and 32.7 per cent of the girls were between 151-155 cm and 156-160 cm of height respectively, while 25.3 per cent of the girls were tall with a height of above 160 cm.

- With regard to weight, 4.7 per cent of the girls were underweight and their body weight was less than 40 kg. While 39.3 per cent of girls were in the range of 41-50 kg,a little above underweight,34 per cent of the girl's body weight was in the range of 51-60 kg,16.3 per cent were in the weight range of 61-70 kg and 5.7 per cent weighed more than 70 kg.
- Out of the selected subjects 34.7 per cent of the girls had normal height and weight hence their BMI was also within the normal range,19.7 per cent of the girls had a BMI of less than 18.5 and they were underweight.The remaining students (ie) 31 per cent and 14.7 per cent had BMI range of 23.0-24.9 and greater than 25 respectively and they were categorized as overweight and obese.
- About 35.3 per cent of the girls had waist hip ratio values within the low risk range and 33.3 per cent of them had WHR of moderate risk, while 31.3 per cent of them were in a high risk range.
- Before imparting education 76 per cent, 18 per cent and six per cent of girls scored marks in the level of low, middle and high with 0-8 marks, 9-14 marks and 15-20 marks respectively and after education the percentage of the girls who scored high marks was increased to 72 per cent from six percent while the girls who scored less marks (76 Per cent) was decreased to 12 per cent.

CONCLUSION

Nutrition education has an impact on nutritional knowledge of the target group. The salient finding of the study revealed that, in the present situation, dietary habits and lifestyle of the college going girls have changed and they have developed the habit of skipping meals .The youngsters mostly preferred junk foods for consumption The faulty dietary habits of the young students with deficient intake of nutrients leads to nutritional problems and also lack of exercise cause PCOS. Impact of nutrition education programme helps to improve nutritional knowledge and food intake pattern and better lifestyle practices on PCOS among adolescents.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Appendices

APPENDIX 1

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON THE DIETARY PATTERN AND LIFESTYLE FROM COLLEGE GOING GIRLS.(19 TO 22 YEARS)

I .PERSONAL PROFILE

1. Name of the investigator :
2. Name of the interviewer :
3. Address of the interviewer :
4. Age :
5. Educational qualification :
6. Monthly income

   ☐ 5000-10000 ☐ 10000-15000 ☐ 15000-20000 ☐ Above 20000

II. DIETARY PATTERN

1. Are you a,

   ☐ Vegetarian ☐ Non-vegetarian ☐ Ova-Vegetarian

2. If you are a non vegetarian, what are the foods commonly consumed

   ☐ Egg ☐ Fish ☐ Chicken ☐ Mutton ☐ Others

3. How frequently do you consume non veg foods?

   ☐ Daily ☐ Weekly ☐ Thrice in a week ☐ Monthly ☐ Rarely

4. Daily meal pattern?

   ☐ 2 meals ☐ 3 meals ☐ 4 meals ☐ More than 4 meals

5. Do you have the habit of skipping meals?

   ☐ Yes ☐ No

   If yes, ☐ Breakfast ☐ Lunch ☐ Dinner

6. How often do you consume fast food?

   ☐ Daily ☐ Once in a week ☐ Twice in a week ☐ Rarely

7. What type of fast foods do you prefer to consume?

☐ Burger ☐ Pizza ☐ Sandwich ☐ Kentucky fried chicken

☐ Porotta ☐ French fries ☐ All the above

III . LIFESTYLE PATTERN

1. Do you have the habit of exercising regularly?

☐ Yes ☐ No

If yes, type of exercise,

☐ Walking ☐ Cycling ☐ Swimming ☐ Yoga ☐ Others

2. How many hours do you sleep daily?

☐ 5-6 hrs ☐ 7-8 hrs ☐ Less than 5 hrs ☐ More than 8 hrs

3. Do you feel too much stress?

☐ Yes ☐ No

4. How often you face stress situations?

☐ Always ☐ Rarely ☐ Sometimes ☐ Mostly

IV. MEDICAL HISTORY

1. Age at menarche :
2. Problems during menarche

S.No.	Problems	Yes	No	Rarely
1	Back pain			
2	Excessive bleeding			
3	Head ache			
4	Irregular periods			
5	Stomach pain			
6	Tiredness			
7	Physical discomfort			
8	Vomiting sensation			

V. ANTHROPOMETRIC MEASUREMENTS

1. Height (cm) :
2. Weight (kg) :
3. BMI :
4. Waist :
5. Hip :
6. Waist to Hip Ratio:

APPENDIX II
ETHICAL CLEARANCE

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam
Institute for Home Science and Higher Education for Women
University
(Estd. u/s 3 of UGC Act 1956)

11th March 2016

To
Ms. Chinnu V Kumar
Department of Food Science and Nutrition
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Madam,

Ref : Your proposal No. IHEC/15-16/FSN/10 entitled "Knowledge and the impact of nutrition education on poly cystic ovary syndrome among college going girls (19 to 22 years)" submitted for approval of the IHEC

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No. IHEC/15-16/FSN/10 entitled "Knowledge and the impact of nutrition education on poly cystic ovary syndrome among college going girls (19 to 22 years)" submitted by you. The Approval number for the same is AUW/IHEC/FSN-15-16/XMT-10.

We wish you all the best in your research endeavours.

Regards,
11/3/16
Dr.P.R.Padma
Member Secretary

Institutional Human Ethics Committee

APPENDIX III

ANTHROPOMETRIC VALUES OF SELECTED SUBJECTS

Sl. No	Height	Weight	Body mass index	Waist hip ratio
1	159	56	22.0	0.86
2	157	60	24.3	0.78
3	162	47	17.9	0.70
4	150	47	20.9	0.75
5	163	47	17.7	0.81
6	145	57	27.1	0.73
7	159	80	31.6	0.72
8	158	55	22.0	0.77
9	158	42	16.8	0.70
10	155	45	18.7	0.74
11	157	52	21.1	0.71
12	163	50	18.8	0.74
13	155	54	22.5	0.72
14	160	45	17.6	0.72
15	152	48	20.8	0.67
16	149	41	18.5	0.72
17	157	47	19.9	0.67
18	153	57	24.3	0.81
19	160	56	21.9	0.76
20	155	39	16.2	0.69
21	154	43	18.1	0.72
22	154	47	19.8	0.65
23	153	60	25.6	0.77
24	171	55	18.8	0.69
25	167	52	18.6	0.74
26	156	65	26.7	0.75
27	146	62	29.1	0.91
28	154	43	18.1	0.53
29	154	67	28.3	0.80
30	156	65	26.7	0.90
31	152	47	20.3	0.74
32	156	60	24.7	0.69
33	137	61	32.5	0.78
34	158	85	34.0	0.80
35	159	63	24.9	0.91
36	155	49	20.4	0.92
37	149	49	22.1	0.86
38	149	55	24.8	0.98
39	157	60	24.3	0.81
40	170	54	18.7	0.91
41	165	62	22.8	0.89

42	161	43	16.8	0.84
43	144	42	20.3	0.89
44	167	50	17.9	0.88
45	158	55	22.0	0.94
46	158	46	18.4	0.90
47	156	55	22.7	0.88
48	172	72	24.3	0.76
49	163	54	20.3	0.89
50	154	65	27.4	0.84
51	155	36	15.0	0.83
52	150	43	19.1	0.85
53	165	55	20.2	0.86
54	158	48	19.2	0.80
55	152	54	23.4	0.84
56	161	41	15.8	0.82
57	162	50	19.1	0.79
58	159	41	16.2	0.89
59	161	55	21.2	0.92
60	156	51	21.2	0.73
61	163	43	16.2	0.83
62	157	60	24.3	0.78
63	162	47	17.9	0.70
64	150	47	20.9	0.75
65	163	47	17.7	0.81
66	145	57	27.1	0.73
67	159	80	31.6	0.72
68	158	55	22.0	0.77
69	158	42	16.8	0.70
70	155	45	18.7	0.74
71	157	52	21.1	0.71
72	163	50	18.8	0.74
73	155	54	22.5	0.72
74	155	45	18.7	0.74
75	157	52	21.1	0.71
76	163	50	18.8	0.74
77	155	54	22.5	0.72
78	160	45	17.6	0.72
79	152	48	20.8	0.67
80	149	41	18.5	0.72
81	157	47	19.9	0.67
82	153	57	24.3	0.81
83	160	56	21.9	0.76
84	155	39	16.2	0.69
85	154	43	18.1	0.72
86	154	47	19.8	0.65

87	153	60	25.6	0.77
88	171	55	18.8	0.69
89	167	52	18.6	0.74
90	156	65	26.7	0.75
91	146	62	29.1	0.91
92	154	43	18.1	0.53
93	154	67	28.3	0.80
94	156	65	26.7	0.90
95	152	47	20.3	0.74
96	156	60	24.7	0.69
97	137	61	32.5	0.78
98	158	85	34.0	0.80
99	159	63	24.9	0.91
100	155	49	20.4	0.92
101	155	45	18.7	0.74
102	157	52	21.1	0.71
103	163	50	18.8	0.74
104	155	54	22.5	0.72
105	155	45	18.7	0.74
106	157	52	21.1	0.71
107	163	50	18.8	0.74
108	155	54	22.5	0.72
109	160	45	17.6	0.72
110	152	48	20.8	0.67
111	149	41	18.5	0.72
112	157	47	19.9	0.67
113	153	57	24.3	0.81
114	160	56	21.9	0.76
115	155	39	16.2	0.69
116	154	43	18.1	0.72
117	154	47	19.8	0.65
118	153	60	25.6	0.77
119	171	55	18.8	0.69
120	167	52	18.6	0.74
121	156	65	26.7	0.75
123	146	62	29.1	0.91
124	154	43	18.1	0.53
125	154	67	28.3	0.80
126	156	65	26.7	0.90
127	152	47	20.3	0.74
128	156	60	24.7	0.69
129	137	61	32.5	0.78
130	158	85	34.0	0.80
131	159	63	24.9	0.91
132	155	49	20.4	0.92

133	149	41	18.5	0.72
134	157	47	19.9	0.67
135	153	57	24.3	0.81
136	160	56	21.9	0.76
137	155	39	16.2	0.69
138	154	43	18.1	0.72
139	154	47	19.8	0.65
140	153	60	25.6	0.77
141	171	55	18.8	0.69
142	167	52	18.6	0.74
143	156	65	26.7	0.75
144	146	62	29.1	0.91
145	154	43	18.1	0.53
146	154	67	28.3	0.80
147	156	65	26.7	0.90
148	152	47	20.3	0.74
149	156	60	24.7	0.69
150	137	61	32.5	0.78
151	159	56	22.0	0.86
152	157	60	24.3	0.78
153	162	47	17.9	0.70
154	150	47	20.9	0.75
155	163	47	17.7	0.81
156	145	57	27.1	0.73
157	159	80	31.6	0.72
158	158	55	22.0	0.77
159	158	42	16.8	0.70
160	155	45	18.7	0.74
161	157	52	21.1	0.71
162	163	50	18.8	0.74
163	155	54	22.5	0.72
164	160	45	17.6	0.72
165	152	48	20.8	0.67
166	149	41	18.5	0.72
167	157	47	19.9	0.67
168	153	57	24.3	0.81
169	160	56	21.9	0.76
170	155	39	16.2	0.69
171	154	43	18.1	0.72
172	154	47	19.8	0.65
173	153	60	25.6	0.77
174	171	55	18.8	0.69
175	167	52	18.6	0.74
176	156	65	26.7	0.75
177	146	62	29.1	0.91

178	154	43	18.1	0.53
179	154	67	28.3	0.80
180	156	65	26.7	0.90
181	152	47	20.3	0.74
182	156	60	24.7	0.69
183	137	61	32.5	0.78
184	158	85	34.0	0.80
185	159	63	24.9	0.91
186	155	49	20.4	0.92
187	149	49	22.1	0.86
188	149	55	24.8	0.98
189	157	60	24.3	0.81
190	170	54	18.7	0.91
191	165	62	22.8	0.89
192	161	43	16.8	0.84
193	144	42	20.3	0.89
194	167	50	17.9	0.88
195	158	55	22.0	0.94
196	158	46	18.4	0.90
197	156	55	22.7	0.88
198	172	72	24.3	0.76
199	163	54	20.3	0.89
200	154	65	27.4	0.84
201	155	36	15.0	0.83
202	150	43	19.1	0.85
203	165	55	20.2	0.86
204	158	48	19.2	0.80
205	152	54	23.4	0.84
206	161	41	15.8	0.82
207	162	50	19.1	0.79
208	159	41	16.2	0.89
209	161	55	21.2	0.92
210	156	51	21.2	0.73
211	163	43	16.2	0.83
212	157	60	24.3	0.78
213	162	47	17.9	0.70
214	150	47	20.9	0.75
215	163	47	17.7	0.81
216	145	57	27.1	0.73
217	159	80	31.6	0.72
218	158	55	22.0	0.77
219	158	42	16.8	0.70
220	155	45	18.7	0.74
221	157	52	21.1	0.71
222	163	50	18.8	0.74

223	155	54	22.5	0.72
224	155	45	18.7	0.74
225	157	52	21.1	0.71
226	163	50	18.8	0.74
227	155	54	22.5	0.72
228	160	45	17.6	0.72
229	152	48	20.8	0.67
230	149	41	18.5	0.72
231	157	47	19.9	0.67
232	153	57	24.3	0.81
233	160	56	21.9	0.76
234	155	39	16.2	0.69
235	154	43	18.1	0.72
236	154	47	19.8	0.65
237	153	60	25.6	0.77
238	171	55	18.8	0.69
239	167	52	18.6	0.74
240	156	65	26.7	0.75
241	146	62	29.1	0.91
242	154	43	18.1	0.53
243	154	67	28.3	0.80
245	156	65	26.7	0.90
246	152	47	20.3	0.74
247	156	60	24.7	0.69
248	137	61	32.5	0.78
249	158	85	34.0	0.80
250	159	63	24.9	0.91
251	155	49	20.4	0.92
252	155	45	18.7	0.74
253	157	52	21.1	0.71
254	163	50	18.8	0.74
255	155	54	22.5	0.72
256	155	45	18.7	0.74
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259	155	54	22.5	0.72
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269	153	60	25.6	0.77
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297	156	65	26.7	0.90
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300	137	61	32.5	0.78

APPENDIX IV

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON THE NUTRITIONAL KNOWLEDGE ON POLY CYSTIC OVARY SYNDROME FROM COLLEGE GOING GIRLS(19 TO 22 YEARS)

KNOWLEDGE ON PCOS

1. Have you heard about PCOS?

   ☐ Yes ☐ No

2. Do you know the causes of PCOS?

   ☐ Yes ☐ No

3. Out of the following give the common cause of PCOS?

   ☐ Hormonal imbalance ☐ Increased vaginal bleeding ☐ Obesity

   ☐ Genetics ☐ Over - production of androgen ☐ Excess insulin

   ☐ All the above

4. Identify from the below the common symptoms of PCOS?

   ☐ Excess hair growth on all parts of the body ☐Irregular periods ☐ Pimples

   ☐ Decrease in breast size ☐ Weight gain ☐ Pelvic pain

   ☐ Anxiety or depression ☐ Infertility ☐ All the above

5. What are the complications of PCOS in later year?

   ☐ Type 2 diabetes ☐ High BP ☐ Infertility ☐ Sleep apnea

   ☐ Depression ☐ Abnormal uterine bleeding ☐ All the above

6. Have you heard about metabolic syndrome?

   ☐ Yes ☐ No

7. What are the diseases coming under metabolic syndrome?

☐ Increase in blood pressure ☐ High blood sugar level

☐ Excess body fat around the waist ☐ Heart disease ☐ All the above

8. What are the foods to be included in metabolic syndrome?

☐ Vegetables ☐ Fruits ☐ Whole grains ☐ Peas and beans

☐ Cheese ☐ Meats ☐ Leafy vegetables ☐ All the above

9. What are the foods to be avoided in metabolic syndrome?

☐ Fat rich foods ☐ Cheese and butter ☐ Meat

☐ Dairy products ☐ All the above

10. Do you know about glycemic index?

☐ Yes ☐ No

11. Whether glycemic index has any role in PCOS?

☐ Yes ☐ No

12. In the case of PCOS, what type of GI foods should be given?

☐ High glycemic index foods ☐ Low glycemic index foods

13. Whether low glycemic index foods have any impact in PCOS?

☐ Yes ☐ No

14. Give reasons for selecting low glycemic index foods?

☐ Increase in blood sugar ☐ Hormonal balance ☐ Decrease in blood sugar

15. From the options given below, identify the low glycemic index foods,

☐ Potato ☐ Soy ☐ Onion ☐ Rice

16. Foods which cause PCOS are,

☐ Sweetened juices ☐ baked products ☐ Fried items

☐ Potato ☐ Fast food ☐ All the above

17. Foods to be included during PCOS,

☐ Fruits ☐ Vegetable ☐ Leafy vegetables

☐ Whole grain products ☐ Water ☐All the above

18. Have you undergone or still undergoing any treatment related to PCOS?

☐ Yes ☐ No

19. If yes, what type of treatment?

☐ Ayurveda ☐ Allopathic ☐ Surgery ☐ Lifestyle changes

20. What are the treatments available for PCOS?

☐Lifestyle changes ☐ Medications ☐ Surgery

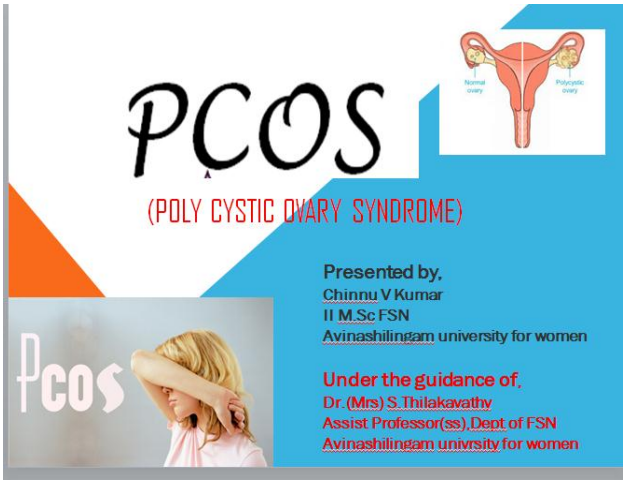
☐ Dietary changes ☐ All the above

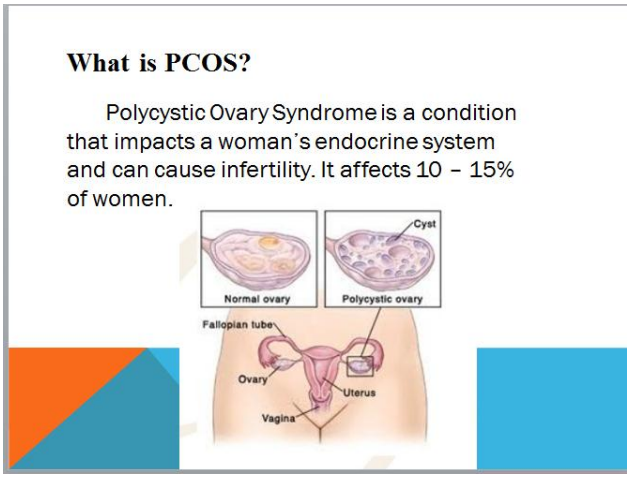
21. How PCOS can be prevented?

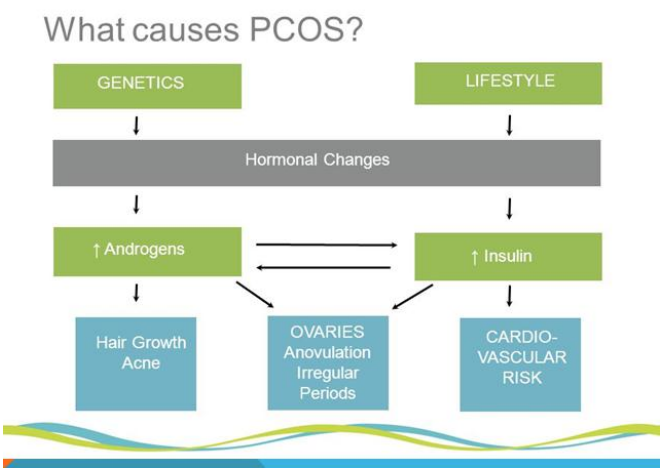
☐ Healthy eating ☐ Regular Exercise ☐ Early diagnosis ☐ All the above

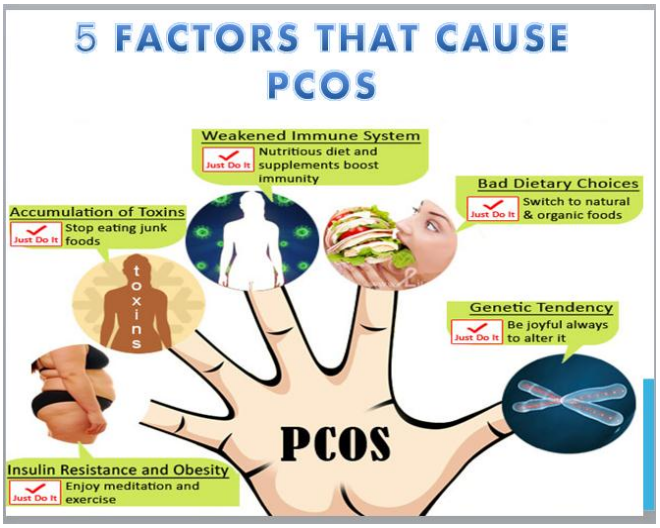
APPENDIX V

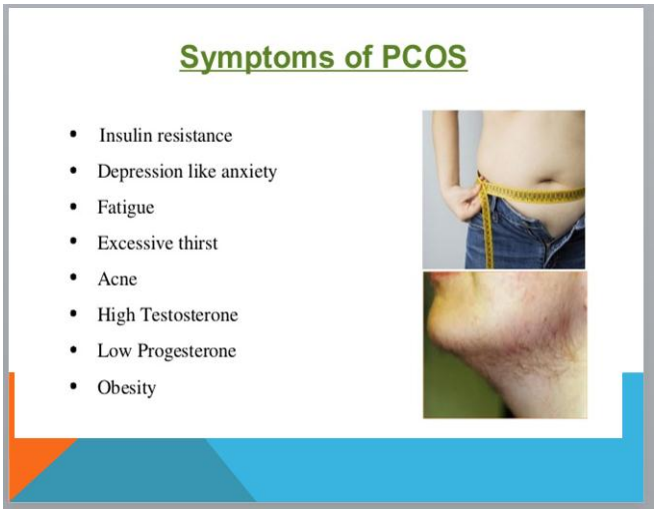
POWERPOINT PRESENTATION

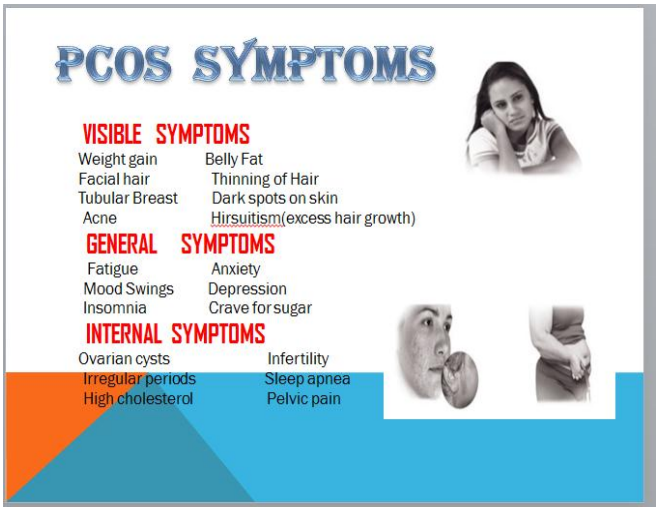




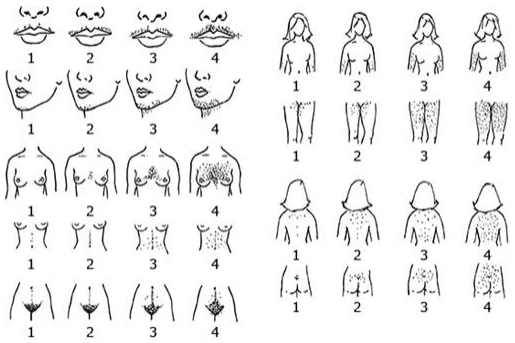








HIRSUITISM



COMPLICATIONS

- PCOS may leads to following health problems.

Diabetes

High blood pressure

Heart disease

Infertility

A thickening of the endometrium.

Summary of presentations and Consequences of PCOD in adolescents

The Most Common Endocrine disorder in women

Symptoms may Include chronically irregular and / or Absent or delayed periods

Symptoms may include facial hair , central obesity and acne

P C O D

Let untreated it may lead to Heart Disease

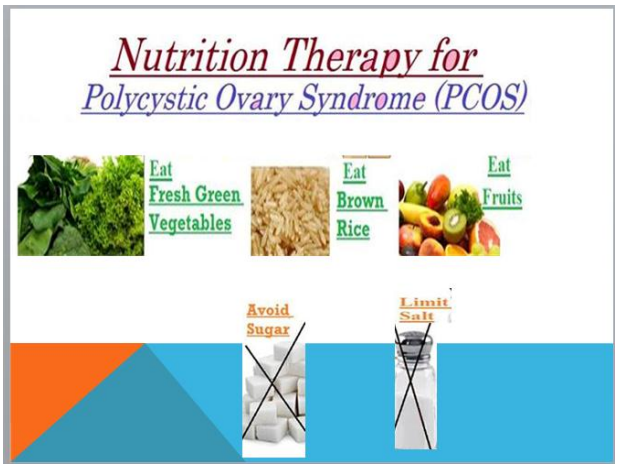
Left untreated, it may lead to Uterine cancer

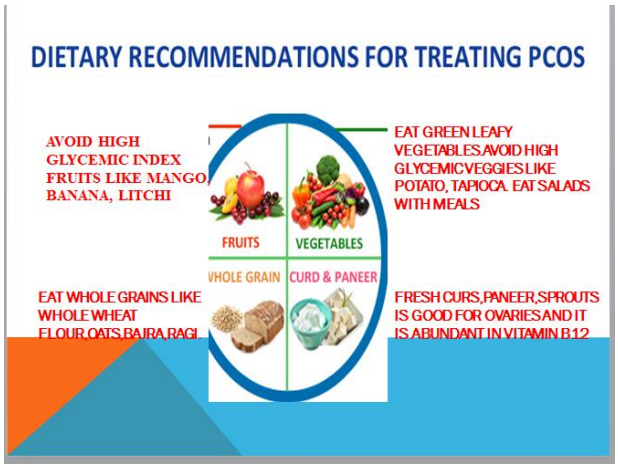
Leading cause of Infertility

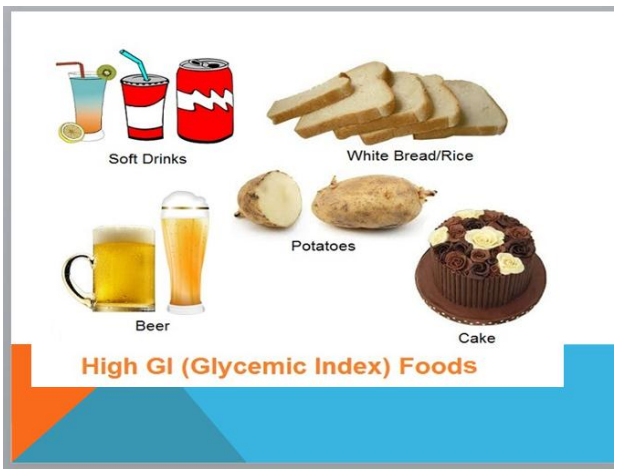
MANAGEMENT

PROTOCOLS OF MANAGEMENT IN ADOLESCENTS

- Counselling for weight reduction and life style modification.
- Carbohydrate and fat restricted diet.
- Diet restriction and exercise is the treatment for overweight.
- Low glycemic index diet upto 85% will improve menstrual cycle regularity.

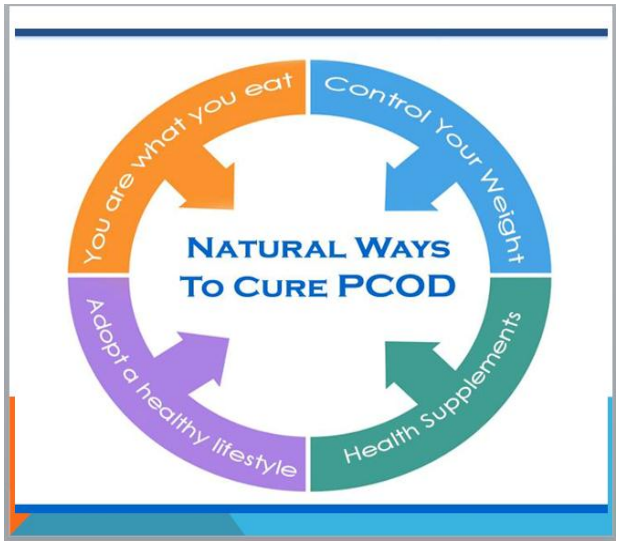

Nutrition Therapy for
Polycystic Ovary Syndrome (PCOS)
Eat Fresh Green Vegetables
Eat Brown Rice
Eat Fruits
Avoid Sugar
Limit Salt


DIETARY RECOMMENDATIONS FOR TREATING PCOS
AVOID HIGH GLYCEMIC INDEX FRUITS LIKE MANGO, BANANA, LITCHI
EAT GREEN LEAFY VEGETABLES AVOID HIGH GLYCEMIC VEGGIES LIKE POTATO, TAPIOCA. EAT SALADS WITH MEALS
FRUITS
VEGETABLES
WHOLE GRAIN
CURD & PANEER
EAT WHOLE GRAINS LIKE WHOLE WHEAT FLOUR,OATS,BAJRA,RAGI
FRESH CURS,PANEER,SPROUTS IS GOOD FOR OVARIES AND IT IS ABUNDANT IN VITAMIN B12


Soft Drinks
White Bread/Rice
Potatoes
Beer
Cake
High GI (Glycemic Index) Foods


7 FOODS THAT CURE PCOS
Brown Rice
Raw Nuts
Sprouts
Wheatgrass
Broccoli
Garlic
Onions
01
02
03
04
05
06
07


HOME REMEDIES FOR
Polycystic Ovary Syndrome (PCOS)
Cinnamon
1. Add 1 teaspoon of cinnamon powder to a glass of hot water.
2. Drink it daily a few months or until you are satisfied with the results.
Flaxseed
1. Mix 1 or 2 tablespoons of freshly ground flaxseeds in a glass of water.
2. Drink it daily for a few months or until you are satisfied with the results.
OTHER REMEDIES
Spearmint Tea
Apple Cider Vinegar
Fenugreek
Saw Palmetto
Fish Oil
Licorice


You are what you eat
Control Your Weight
NATURAL WAYS TO CURE PCOD
Adopt a healthy lifestyle
Health Supplements

Diet for PCOS

- Focus on protein and fresh vegetables
- Eat low GI foods.
- Eat natural based foods like egg, fresh fruits.
- Eat foods, which are having enough fiber.
- Avoid more sugary and carbohydrate foods.
- More weightage should be given fresh fruits and fresh vegetables.
- Foods such as lentils and chickpeas should be taken as it reduces estrogen levels.
- Foods such as nuts, seeds and olive oil should be encouraged as they contain essential fatty acid.
- Use apple cider vinegar.

EFFECTIVE YOGA POSES FOR PCOS

Badhakonasana (Butterfly pose)

Bharadvajasana (Bharadvaja's Twist)

Bhujangasana (Cobra pose)

Viparita Shalabhasana (Superman Pose)

Marjaryasana and Bitilasana (Cat and Cow Pose)

Padmasana (Lotus Pose)

Dhanurasana (Bow pose)

Balasana (Child's Pose)

Chakki Chalanasana (Mill Churning Pose)

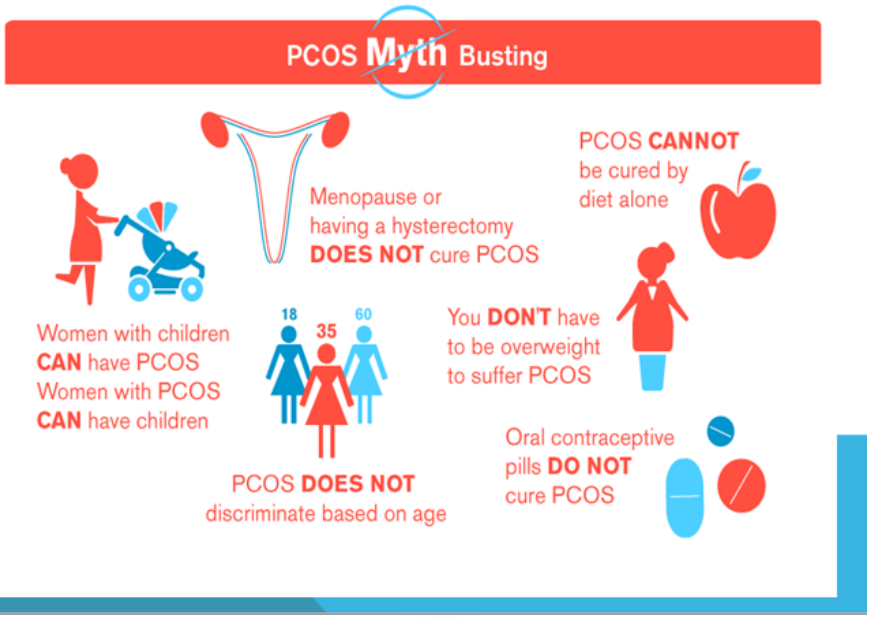
Nispanda Bhava (unmoving observations)

Shavasana (Corpse pose)

Holistic approach of PCOS

Take a holistic approach for tackling the root cause for PCOS by doing the following things:

- Eat organic foods as they are hormone free, do not contains additives and preservatives .
- Avoid high glycemic food such as sugar, white flour and highly processed junk foods as they spike insulin dramatically causing increased blood sugar levels, encouraging weight gain and disrupt hormonal balance.
- Sleep eight hours a night and your benefits are decreased fatigue, increased immunity, lowers stress and better hormone production.
- Daily exercise will improve your insulin sensitivity, regulates blood sugar, encourages weight loss and relieves stress.



APPENDIX VI

PAMPHLET FOR NUTRITION EDUCATION

SYMPTOMS OF PCOS

- Insulin resistance
- Depression like anxiety
- Fatigue
- Excessive thirst
- Acne
- High Testosterone
- Low Progesterone
- Obesity

PCOS SYMPTOMS

VISIBLE SYMPTOMS

Weight gain	Belly Fat
Facial hair	Thinning of Hair
Tubular Breast	Dark spots on skin
Acne	Hirsuitism(excess hair growth)

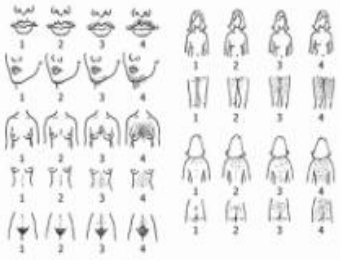
GENERAL SYMPTOMS

Fatigue	Anxiety
Mood Swings	Depression
Insomnia	Crave for sugar

INTERNAL SYMPTOMS

Ovarian cysts	Infertility
Irregular periods	Sleep apnea
High cholesterol	Pelvic pain

HIRSUITISM



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EAT WHOLE GRAINS LIKE WHOLE WHEAT FLOUR,OATS,BAJRA,RAGI.

FRESCURS,PANEER, SPROUTS IS GOOD FOR OVARIES AND IT IS ABUNDANT IN VITAMIN B12

High GI (Glycemic Index) Foods

9 FOODS THAT CAUSE PCOS

7 FOODS THAT CURE PCOS

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