Information and Communication Technology (ICT) – An Effective Tool for Nutrition Education among Young Adult Women (17-23 years) on polycystic ovarian syndrome

BY

AT.AGILANDESWARI

(16PFN001)

A Dissertation Submitted to the

Avinashilingam Institute for Home Science and Higher Education for Women,

Coimbatore -641 043

In Partial Fulfilment of the Requirement for the

DEGREE OF MASTER OF SCIENCE IN FOOD SCIENCE AND NUTRITION

APRIL, 2018

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Signature of the supervisor

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I. INTRODUCTION

Fertility is the natural human capability of producing off springs. Age and female fertility encompass women's fertility as affected by her age. A woman's fertility peaks in the early and mid twenties, often which it starts to decline being accelerated after the age of 35 years with advanced maternal age causing an increased risk of female infertility. This is popularly referred to as a women's "biological clock"

According to WHO, the reproductive age generally ranges from 15 to 45 years (Department of Health and Human service, 2013). The reproductive age group is being defined as 15 to 44 years of age while economically age group has been identified as 15 to 49 years of age. This period is also popularly known as the age and stage for fertility problems like poly cystic ovarian syndrome (PCOS).

PCOS is polycystic ovarian syndrome which is an endocrinal dysfunction. PCOS is nowadays become more common threat among the young women belonging to reproductive age group due to life style changes and genetic predisposition. Poly cystic ovarian syndrome is a chronic hormonal and metabolic disorder that presents a perplexing series of health problems such as sterility, obese, hirsutism, hair loss, depression, dark skin patches and deficient in energy and nutrients.

PCOS contributes to hormonal imbalance leading to irregular menstruation, hyperandrogenism, obesity, diabetes, cardiovascular disease and many other endocrinal disorders, even when left untreated may lead to infertility and other reproductive disorders. People who are obese are more prone to get PCOS. As grave as these symptoms are, the consequences of not dealing effectively with PCOS are even more severe, including heart disease, diabetes, reduced existence of life, and condensed lifespan .

During each menstrual cycle, follicles nurture on the ovaries. Eggs build up within those follicles, one of which will attain maturity sooner than the others and be unconfined into the fallopian tubes. This is "ovulation." The lasting follicles will suspend back into the ovary. In PCOS, the ovaries are bigger than actual size and there are a number of immature follicles that emerge in clumps, quite similar to a bunch of grapes which may also affect the fertility when left untreated.

However, when the cysts cause a hormonal imbalance, a prototype of symptoms may build up. This prototype of symptoms is called a syndrome. These symptoms are the variation between suffering from PCOS and from simply having polycystic ovaries. So we may have Poly cystic ovaries without having PCOS. While, all women who have PCOS will be having poly cystic ovaries. Polycystic Ovary Syndrome is the name given to a metabolic condition in which a woman will have polycystic ovaries, along with a certain pattern of other symptoms that reflect imbalances in reproductive and other hormones (Rodin et al. 2008).

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age. Most investigators have found that 30-50 percent of PCOS women are obese and tend to have an increased waist-hip ratio, (WHR) i.e. abdominal (visceral) obesity. Central fat excess is associated with an increase in low grade chronic inflammation and insulin resistance (IR) and with metabolic dysfunction in women with PCOS. It may also contribute to the development of glucose and lipid metabolism disorders (Deeks et al 2006).

PCOS is characterized by hyperandrogenism, ovulatory dysfunction and polycystic ovaries. The hyperandrogenism is caused by excessive ovarian and/or adrenal androgen secretion and is associated with clinical manifestation such as hirsutism, acne and male pattern and baldness. Ovulation dysfunction may include chronic anovulation and is also associated with menstrual disturbance and infertility. PCOS is characterized by a measured number of small antral follicules with arrested development and a hypertrophoid the cell layer (Diamarti, 2013).

In addition to hirsutism, irregular menstrual periods and infertility, women with PCOS display a number of metabolic abnormalities including hyperinsulinemia, insulin resistance, dyslipidemia, and obesity. All the features are components of the metabolic syndrome and women with PCOS are therefore the risk of developing Type2 diabetes, which in turn puts them in increased risk of developing CVD. This common disorder in women in reproductive age thereby associated with obesity, insulin resistance, dyslipidemia and hypertension (Kauffman, 2002).

World Health Organization highlighted those 16 million (3.4percent of women) women worldwide affected. Globally prevalence estimates of PCOS are highly variable, ranging from 2.2 percent to as high as 26 percent (Lancet, 2007).

About 5-10 percent of women worldwide suffer from PCOS, a chronic endocrinal disorder that affects metabolism and fertility. A diagnosis of PCOS

includes 2 out of 3 criteria 1) hyperandrogenism, 2) amenorrhoea or oligomenorrhoea and 3) Poly cystic ovaries (wang et al, 2012).

Because PCOS affects metabolism, it can cause distressing and unwanted symptoms such as weight gain, abdominal obesity and hirsutism. In addition to causing psychologically disturbing symptoms, PCOS increase a women's risk of developing depression (Franks et al, 2004).

An U.S Scientific report (2012) reviewed that PCOS affecting as many as 10 percent of company's female workforce. Women suffering from PCOS are at high risk of developing CVD, hypertension, altered lipoprotein profile, non insulin dependent diabetes or impaired glucose tolerance, endometrial hyperplasia, endometrial cancer, gestational diabetes or impaired glucose tolerance during pregnancy. In a community based study in the U.K, it was found that polycystic ovaries were particularly common among women of south Asian origin (52 percent) compared to the prevalence of PCOS observed in a predominately Caucasian population (22 percent). The South Asian population in general, also exhibits a higher prevalence of insulin resistance and Type 2 diabetes, which may increase long term morbidity among those with PCOS. Recent studies indicated higher insulin concentration and lower insulin sensitivity in South Asian women with PCOS compared to Caucasian women with PCOS (Kumarapeli *et al*, 2008).

In India, the prevalence is gradually increasing. In Indian express (2016), it was published that PCOS becoming "epidemic", because of lifestyle pattern that the people have adopted. Almost all foods are packed with chemicals that lead to hormonal imbalance. The actual cause of PCOS remains unclear.

According to the National Cholesterol Education Programme - Adult Treatment Panel III (NCEP-ATP III) , the prevalence of the metabolic syndrome has been reported to be between 33 percent and 46 percent in women with PCOS, compared to six percent in normal women aged 20-29 years and 15 percent in women aged 30-39 years. Furthermore the metabolic syndrome is present in 80 percent of PCOS women who are also obese (Thomson *et al*, 2011).

Recent studies have focused on fat quantity and distribution of fat in the women with PCOS increases the risk of Infertility, pregnancy loss, obesity, CVD, diabetes mellitus, obstructive sleep apnea, depression, non alcoholic fatty liver disease, endometrial hypoplasia and endometrial carcinoma and so on. Infertility occurs in 75 percent due to anovulation. Other risk been reported in different

percentage as cutaneous hyperandrogenism in the form of obesity found is 40-60 percent cases, acne in 15-25 percent, Hirsutism in 65-75 percent, alopecia in 5-50 percent cases (Azziz, 2010).

Compared to normal weight women, overweight women with PCOS were found to be increased in prevalence and have been decreased sex hormone binding globulin (SHBG) and increased fasting insulin, fasting glucose and triglycerides. Obese women have decreased biochemical markers of blood level contributed many metabolic and degenerative diseases and disorders (Ruutiainen *et al*, 2008). There is higher risk of gestational diabetes in women with PCOS. The risk is believed to be the greatest in obese women with PCOS, required ovulation induction in order to conceive. Such women should be screened for abnormal glucose tolerance in pregnancy and if appropriate, referred for antenatal management by an obstetrician with special interest in diabetes in pregnancy. A recent Meta analysis concluded that women with PCOS have significantly higher risk of pregnancy complications compared to non PCOS pregnant woman (Dokras, 2017).

By conclusion polycystic ovarian syndrome is the condition of an endocrine and metabolic heterogeneous disorder with a likely genetic origin, influenced by environmental factors including dietary and lifestyle pattern, Physical activity and sound sleep.

Life style management in PCOS needs to cover regular physical activity, disciplined medication and balanced dietary pattern Vasudo (2012), pointed out that nutritious diet, regular exercise spiritual and mental growth and development (Positive attitudes)are the prime remedies for a healthy and happy active life, free from all disease and stress. All the aspects need to have appropriate health and nutrition education and counseling. Health and nutrition education is the process that bridges the gap between health information and health practices. According to National Education Association health and nutrition education is the process of developing and providing planned learning experience in such a way as to supply information, change attitude and influence behavior (Benetoli et al, 2014). Health and nutrition education is any combination of learning experience designed to help individual and community to improve their health status, by increasing their knowledge or influencing their attitudes or implementing their plan of action (WHO, 2016)

Basically health and nutrition is a process of learning that influence the knowledge, beliefs and attitude and behavior of an individual or a community and allow them to make more intelligent decisions regarding dietary and lifestyle choices to promote health status and reduce the risk of developing chronic diet related disorders like obesity, diabetes, heart diseases and reproductive health problems (Fedorcsak et al, 2004).

In the lifecycle approach for promoting nutrition, adolescence is often seen as a crucial phase for nutrition development. Imparting nutrition education and the necessary nutritional skills in this phase can form the basis for lifelong habits. A WHO report in improvement to nutritional status of adolescence mentions recommended measures of the holistic approach towards improvement in nutritional status and also for prevention of disease condition of adolescent population.

This approach endorses Behavior Change through Communication (BCC). BCC is a multilevel tool for promoting and sustaining the desired behavior in individuals and communities by using a variety of communication channels and creating demand for information and service. Multimedia approaches that combine face- to- face and mass media are appropriate for nutrition education. The role of mass mediated entertainment education programme in focusing on observed first order camps i.e. small shifts in knowledge, attitudes and practices without any major changes in primary value system.(Adefemi, 2016)

In present modern scenario, digital technology has lead to the global revolution. The world is becoming increasingly more connected and is able to solve more and more complex societal health problems through increased collaboration and information sharing (Shaban-Nejad et al, 2011). The field of nutrition and health care providers has also begun to deploy digital tools to better understand and serve the community. Digital ‘e’, mass media like face book, Instagram, What’s app, messenger are free wares, cross platform and end to end encrypted instant messaging application for smart phones. It uses the internet to make voice calls, one to one video calls, send text messages, images, GIF, video, documents, user location, auto files, phone contacts etc, to other users using standard cellular mobile numbers.

A tailor-made, self-monitoring and intervention delivery applications performed especially in smartphones, with an emphasis on maximum simplicity, speed and convenience in their operation (Vandelanotte *et al*, 2012). What’s app, Face book

and Instagram has more users and the priority of the youngsters among the social media is found to be high (Lonescu *et al.,* 2015). It also has an option of creating our own group as well as community web pages and it is common and can be seen by all users and accesses it (Smith *et al*, 2017). It also has options for comment, share and like the post. So that they can like, share and comment on the post. So it is an effective method of imparting knowledge among huge population as well as the community (Schellevis *et al*, 2012). What's app is end to end encrypted, so it provides privacy among the users. Hence it is more interactive and helps to create rapport between the individuals.

Continuous nutrition education with digital technology is recommended as long term strategies for enhancing nutritional knowledge of mass especially vulnerable groups of population including adolescence and preventing of health problems like PCOS. Thereby, nutrition education is necessary, if the target groups of population are to become fit, productive and able to fulfill their responsibilities in the life. People who are well nourished and educated are more productive and improve their own potentials as well as their contributions to the national economy.

With these backdrops the present study was carried out, with the following objectives:

1. To elicit information related to socio economic profile, dietary and lifestyle pattern of the selected adolescent girls(17-23 years)
2. To assess the nutritional and health knowledge related to PCOS of the selected subject.
3. To develop various digital educational modules and assess the preference of education module among the selected subjects.
4. To study the effect of various nutritional educational module on nutritional knowledge of the selected subjects.

II.REVIEW OF LITERATURE

Literature pertaining to the present study on "**Information and Communication Technology (ICT) – An effective tool of nutrition education among adolescent girls (17-23 Years) with polycystic ovarian syndrome".** reviewed under the following headings.

A. Poly cystic ovarian syndrome : An overview to concern
B. Remedy for PCOS
C. PCOS and Nutrition
D. ICT- A magnificent tool on imparting nutrition and health education
E. Social media and nutrition education

A. Poly cystic ovarian syndrome: An overview to concern.

Polycystic ovary syndrome (PCOS) is one of the most common endocrine and metabolic disorders in premenopausal women. Heterogeneous by nature, PCOS is defined by a combination of signs and symptoms of androgen excess and ovarian dysfunction in the absence of other specific diagnoses. The etiology of this syndrome remains largely unknown, but mounting evidence suggested that PCOS might be a complex multigenic disorder with strong epigenetic and environmental influences, including diet and lifestyle factors. PCOS is frequently associated with abdominal adiposity, insulin resistance, obesity, metabolic disorder and cardiovascular risk factors. The diagnosis and treatment of PCOS are not complicated, requiring only the judicious application of a few well-standardized diagnostic method and appropriate therapeutic approaches addressing hyperandrogenism, the consequences of ovarian dysfunction and the associated metabolic disorder (Rodin DA *et al*, 2008).

Clinical features oligomenorrhea or dysfunctional bleeding is an early and dominant symptom of the anovulatory component of PCOS. The menstrual irregularity of the PCOS is chronic and can manifest in several different ways. Probably the most common is erratic menstruation owing to anovulation. Some women with PCOS have prolonged amenorrhea associated with endometrial atrophy and some will have regular cycles at first and experience menstrual irregularity in association with weight gain. The occurrence of oligomenorrhea may be explained by PCOS in approximately 85-90 percent of women, whereas 30-40 percent of

amenorrheic patients have been reported to have the disorder (Paradisi G *et al*, 2001).

Hyperandrogenism is the second defining characteristic of PCOS. According to a study in subjects between 14-36 years old, PCOS is a disorder with perimenarchal onset and the clinical, endocrine and ultrasound features were not changed by the age of 36 years, although patients were prone to gain weight. However, it has also been shown that hyperandrogenism partly resolves before menopause in women with PCOS and they tend to gain more regular menstrual cycles with increasing age after 40 years. A decline in follicle cohort has been reported to occur while aging. Several findings have suggested, however, that the common denominator in women with hyperandrogenic anovulation could be functional ovarian hyperandrogenism (FOH) whether or not they have typical PCOS (Solomon CG *et al*, 2009).

Clinically, the most common sign of hyperandrogenism in PCOS women is hirsutism. The range of the prevalence of hirsutism in PCOS women varies between 17 and 83 percent. Hirsutism may develop peripubertally or during adolescence or it may be absent until the third decade of life. Another common sign of hyperandrogenism is acne. Overt signs of virilization, i.e. male pattern balding, alopecia, and increased muscle mass, a deepening voice or clitoromegaly usually reflect the presence of an androgen producing tumor or ovarian hyperthecosis. There is strong evidence of a peripubertal onset of the PCOS the symptoms of which has been used as a diagnostic criteria (Deeks A *et al*, 2010)

Infertility was included in the original description of PCOS. The prevalence of infertility caused mainly by anovulation, in PCOS women varies between 35 and 94 percent . However, women with PCOS are as likely to have children as healthy women, although often after infertility treatment. Also, women with PCOS who conceive are at a higher risk of gestational diabetes mellitus. Some studies have also described an increased miscarriage rate in PCOS, the mechanism of which is poorly understood. It has been suggested that high follicular phase concentrations of LH have a deleterious effect on rates of conception and miscarriage (Kaushal *et al*, 2014).

Although the role of obesity in the development of PCOS is still not very clear, several studies have shown a modest increase in the prevalence of PCOS with increasing BMI. Though these studies suggest environmental factors such as eating habits may determine the degree of obesity in PCOS, it has been suggested that PCOS is more due to inherited than to environmental factors(Ching *et al*, 2007).

Most investigators have found that 30-50 percent of PCOS women are obese and tend to have an increased waist-hip ratio, (WHR) i.e. abdominal (visceral) obesity. Central fat excess is associated with an increase in low grade chronic inflammation and insulin resistance (IR) and with metabolic dysfunction in women with PCOS. It may also contribute to the development of glucose and lipid metabolism disorders. Of course involvement of excess visceral fat is well known in cardiovascular risks since visceral fat is a source of many cytokines (Sundararaman et al, 2013).

a. PCOS and Other metabolic Disorders

Polycystic ovary syndrome (PCOS) is diagnosed by its characteristic reproductive features. However, PCOS is also associated with metabolic abnormalities, including insulin resistance and β-cell dysfunction. The severity of these abnormalities varies according to the reproductive phenotype, with the so-called NIH or classic phenotype conferring the greatest metabolic risk. The increased risk for type 2 diabetes (T2D) is well established among affected women with the NIH phenotype (Laura, 2017).

Obesity, in particular, central obesity, plays a key role in the development of PCOS, and the majority of women with PCOS are overweight or obese. The mechanisms by which obesity influences the pathophysiology and clinical expression of PCOS are not completely understood, but obesity is, as an independent factor, associated with IR and sex steroid disturbances, which may lead to an increased risk of menstrual irregularities and hyperandrogenemia. Obesity makes it difficult to interpret the role of genetic intrinsic defects in the etiology of PCOS and it is possible that different pathogenic factors account for the development of the PCOS phenotype in lean and obese women. IR is associated with an increased risk of developing impaired glucose tolerance (IGT) or manifest Type 2 diabetes, lipid disturbances and cardiovascular diseases. Accordingly, an increased prevalence of

IGT, Type 2 diabetes and dyslipidemia has also been found in women with PCOS. The well-known obesity-associated disturbances in the glucose and insulin metabolism leading to IGT or Type 2 diabetes may however be different from those in women with PCOS, in particular, lean women with PCOS (Dasgupta and Reddy, 2008).

The total calorie intake and dietary constituents were similar, except from higher saturated fat content in diet of women. The genetic and lifestyle factors contribute to body weight differences. Food quality seems to play more active role in metabolic abnormalities and could interfere in reproductive dysfunction in PCOS directly or indirectly (Carmina *et al*, 2012).

It has also been suggested that global adiposity rather than abnormal regional fat characterize women with PCOS. However certain studies suggest that visceral fat is directly associated with subclinical CVD in PCOS women. But some studies have reported that PCOS cases and BMI/body fat mass matched control women are indistinguishable with respect to distribution of fat within visceral, abdominal subcutaneous and gluteo femoral subcutaneous depots despite significant differences in insulin resistance between these two groups (Zagar *et al*, 2015)

b. Cause of PCOS

Rapid urbanization and changes in life style in many developing countries is causing an increase in many complex diseases like PCOS, cardiovascular diseases and diabetes. On an average PCOS affects 5-10 percent of the women in reproductive age group worldwide. Prevalence of PCOS is rapidly rising among Indians also. Estimates of PCOS in migrant Indians have been estimated at 52 percent level. And about 37% among the north Indian women have been estimated to suffer from PCOS, (Anahita *et al*, 2015).

Genetic studies of women with PCOS and their families may provide major insight into this common endocrine abnormality and also into many of its metabolic syndromes. Susceptibility to inheritance of PCOS seems to be equally probable from the maternal and paternal side of the family. It is estimated that a woman's risk for developing PCOS is higher if she has an affected sister, but at a lower risk if other family members are affected. Though the genetic studies have not yet determined the pattern of heredity, most of the family studies have shown a simple Mendelian

pattern of inheritance consistent with an autosomal dominant or X-linked partem of inheritance (Thomson RL *et al*, 2011).

Some studies conducted in India have been confined to clinical dimensions of PCOS. Other studies on Indians are from South Asia and emigrant Indians. In a mutational analysis of CPY1A1 and leptin as genetic determinants of hyper-androgenicity and obesity in PCOS (Maitra *et al*, 2010). The same group has shown the existence of dyslipidemia associated with cardiovascular risks and obesity in PCOS (Kalra et al., 2014).

The insulin resistance is associated with dyslipidemia in women with PCOS independent of obesity a higher prevalence of PCOS associated with type 2 diabetes. Another study has shown that South Indian women with reproductive abnormalities of PCOS have greater insulin resistance and intimal media thickness that would lead to risks of vascular diseases (Zagar *et al*,2010).

Type 2 diabetes is common among South Asians and insulin resistance is central to the pathogenesis of PCOS. Asian Indians being more resistant to insulin may exhibit higher predisposition to metabolic syndrome also at an early stage. Although, Indian population contributes greatly to the worlds total population genetic studies related to PCOS is scanty and therefore it has become imperative to explore the etiology (both environmental and genetic) in the manifestation of PCOS (Cussons AJ *et al*, 2005)

However, the problems in genetic studies are the lack of uniform criteria for diagnosis, heterogeneity of phenotypic features even within affected families and between sisters and moreover, the disorder is expressed clinically only in women during their reproductive years (Li L *et al*, 2007).

PCOS may be stated that a major challenge to gene-finding efforts in complex diseases is that each gene typically contributes modestly to disease risk. For example, most of the recently discovered genes for Type 2 diabetes mellitus affect risk by only 25- 35 percent, necessitating large sample sizes for adequate power to discover the genes. PCOS genetics is also faced with other hurdles unique to the syndrome, such as impaired fertility potentially leading to small family sizes, lack of a clear phenotype in men, and in pre pubertal and menopausal women, and

the absence of universally accepted diagnostic criteria. Although several positive results have been reported in PCOS, no gene or genes is universally accepted as important in PCOS pathogenesis though the numbers of candidate genes are steadily increasing (Maitra et al., 2014).

Despite these shortcomings, the study of familial aggregates has consistently suggested that the mode of inheritance appears to be dominant. This fact would tend to exclude many of the other rare etiologies of hyperandrogenism, such as steroidogenic enzyme deficiencies, which are autosomal recessive. Currently, PCOS is considered a polygenic trait that might result from the interaction of susceptible and protective genomic variants under the influence of environmental factors. Candidate genes cover a broad spectrum of an endless list of molecules which participate on every step of reproductive and metabolic pathways of this syndrome. The current view supports the notion that PCOS is likely to represent a complex oligogenic trait with multiple genetic defects (Gharani et al, 2007).

B. Remedy for PCOS

Goals of therapy for PCOS should include decreasing levels of free androgens in the blood, blocking androgen activity in target tissues, stabilizing the endometrium, and reducing insulin resistance. However, by decreasing testosterone, it may reduce ovarian cysts and help re-establish the delicate balance of hormones, thereby enhancing the likelihood of ovulation, without which there is no chance of becoming pregnant. At the present time there are no pharmaceutical drugs that will heal PCOS or no single pill that will cure Metabolic Syndrome. But there are ways to address Insulin Resistance, an underlying cause of these conditions as well as PCOS symptoms. It is suggested that a system that combines a realistic exercise program, nutritional guidance and a support system may help to change unhealthy lifestyle choices and lose weight (Erin k *et al,* 2015).

It is suggested that life style modification should be greater than or equal to seven percent loss in weight and maintenance with < 25 percent of the calories from fat and a total calorie intake of 1200 to 1800 calories per day. It is recommended that the patient should have more than 2 1/2 hours of moderate physical activity per week and be on a low glycemic index diet to improve insulin resistance. It is suggested that PCOS patient can consider brisk walking 3-5 times a week weight loss and

exercise have been shown to improve fertility and lowering of androgen level. Thus lifestyle modification in the treatment for PCOS might reduce the long term risk of Diabetes, heart disease and possibly endometrial cancer (Wijeyaratne et al 2006)

Studies have shown that long term use of hypocaloric diets will improve the metabolic derangements in patients with PCOS. Some have concerns about a low carbohydrate and high fat diet in PCOS due to the already abnormal lipid profiles seen in patients with PCOS. In a study published in 1992, twenty-four obese PCOS spent 6 months on a low calorie (1000 kcal), low fat diet. There was a marked improvement in their clinical parameters and lowered insulin levels. A report shows that reduction in serum testosterone levels using a similar dietary regimen. A very well designed study from Italy examined the long term effects of metformin and hypocaloric diet on PCOS (Jakubowicz and Nestter., 2014).

Metformin improved the hirsutism, menstrual function, visceral adipose tissue, and glucose stimulated insulin secretion. In a study of 128 non obese women with PCOS, with fasting insulin <15 µIU/ml, metformin did induce ovulation although requiring ~6 months to show effect. There is some evidence that "life style" modification may be an effective adjunct to our treatment of PCOS. Many patients have attempted to diet all their life with limited success. Some have even attempted gastric bypass surgery to effectively starve themselves (Nestler et al., 2014). PCOS patients have a marked reduction in the lipolytic (i.e. fat breakdown) effects of noradrenalin due to a decreased number of noradrenalin receptors on fat cells. Weight reduction has been shown to increase noradrenalin sensitivity in PCOS patients. Thus, there may be a link between the sympathetic nervous system and PCOS where exercise may help. (Ek et al., 2014)

According to World Health Organization (2017), the adolescent age group is changed till the age of 24 years. Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age. Most investigators have found that 30-50 percent of PCOS women are obese and tend to have an increased waist-hip ratio, (WHR) i.e. abdominal (visceral) obesity. Central fat excess is associated with an increase in low grade chronic inflammation and insulin resistance (IR) and with metabolic dysfunction in women with PCOS. It may also contribute to the development of glucose and lipid metabolism disorders, (Gill, 2017).

In the clinical scenario, PCOS is predictably viewed as "a young lady, probably obese, presenting with features of hirsutism, oligomenorrhea and infertility". But augmented interest in PCOS has led to the realization that it involves far more than just the reproductive system. PCOS presents an early manifestation of the metabolic syndrome with a cluster of abnormalities where the combination of insulin resistance and compensatory hyperinsulinemia predisposes individuals to develop a high plasma triglyceride and a low high-density lipoprotein cholesterol concentration, high blood pressure and coronary heart disease, (Zagar et al 2002).Therefore PCOS is sometimes defined as a Metabolic Syndrome (MetS) that includes obesity, dyslipidemia, insulin resistance, diabetes mellitus, hypertension and cardiac diseases. Furthermore, recent studies have focused on association of PCOS with malignancies like cancerous conditions of the endometrium, breast and ovary (svedsen et al, 2008).

Polycystic ovarian syndrome (PCOS) is a heterogeneous clinical entity leading to development of metabolic, endocrine and reproductive disorder. This multifaceted clinical manifestation comprises of hyper androgenism, menstrual dysfunction, infertility, pregnancy complications and an increased prevalence of obesity and abdominal obesity. PCOS enact as risk factors in development of impaired glucose tolerance and cardiovascular diseases furthermore it is a significant cause of distress to most women affected by it. The pathogenesis of PCOS is complex and not completely understood. The underlying hormonal imbalance is created by a combination of increased androgens and/or insulin. Genetic and environmental contributors to hormonal disturbances with other factors including obesity, ovarian dysfunction and hypothalamic pituitary abnormalities are contribute to the etiology of PCOS (Pitchai *et al* , 2016).

This complex disorder affect both developed as well developing countries. Its prevalence ranges from four to twelve percent in general population of women in the world of reproductive age. Although there are no systemic studies from India, the observations by endocrinologists, gynecologists, dermatologists, etc. show a significant rise in number of females with PCOS nevertheless prevalence of PCOS in Indian adolescents estimated at 9.13 percent. As PCOS incidence is on the rise in India a sense of urgency is needed in addressing this contemporary syndrome. Given the metabolic liabilities of PCOS and an increase in the adaptation of sedentary lifestyle and fast growing westernized diet culture in India this study aims

to explore perception on PCOS among women with diagnosed PCOS, awareness on life style modification, their concern regarding PCOS (Nidhi *et al*, 2011).

C. PCOS and Nutrition

Obesity targeted applications have to do both with weight-loss intervention programs as well as obesity prevention through the adoption of healthy lifestyle.

Researchers aimed to make an in-depth investigation around the pediatricians' perceptions in the use of electronic health records and decision support systems for the improvement of their nutrition and physical activity counseling. Findings depict clinicians' intention to stay focused on each patient's individual needs as well as to their own clinical experience when it comes to obesity management and counseling. However, they are in favor of implementing functional interventions, such as a decision alert that identifies obesity and is linked to targeted educational materials related to patient's age, gender, neighborhood and weight status. (Mc Donald et al., 2014)

The outcomes from nutrition and physical activity interventions, centred in adult males via web-based mode of delivery. Particularly, studies aimed at showing a significant change in adult males' dietary intake or in their body weight and Body Mass Index over the intervention period. As far as the results of the studies are concerned, effectiveness of the internet-based features of the intervention delivery was insignificant due to the heterogeneity of the study designs. Nonetheless, adult men seem to be more easily recruited in a study if they can use the internet from their worksite environment. Moreover, instant and tailored feedback, such as clear, concise and achievable in goal setting messages presented in a comical manner, in response to adult men's self-monitoring of lifestyle changes, are strongly associated with the enhancement of the effectiveness of dietary interventions for males (Taylor et al.,2012)

The determination of individual's carbohydrate intake requirements by integrating three input variables, level of physical activity, age and Body Mass Index. This multiple decision criteria application owns its fuzzy logic principles to experts' knowledge and its final goal is to enhance individual health sustenance in contemporary life conditions (Nakandala et al.,2016).

A current study among adolescent on bodyweight status, nutrient intakes, meal behaviours and physical activity levels by using a web-based, self administered survey. According to the findings, overweight and obese students consumed significantly more total fat and high calorie beverages as well as higher frequency of breakfast skipping. It is crucial for adolescents' weight status to improve their lifestyle behaviours, including school health policies (Storey et al.,2016).

A consistent, multidisciplinary semantic platform that assembles social, environmental, economical and behavioral knowledge in the domain of healthy eating and child obesity prevention is generated. Such biomedical ontology, like the Childhood Obesity Prevention [Knowledge] Enterprise (COPE), includes advanced logical reasoning services and social networking in order to develop an integrated consensus knowledge base. COPE can offer dietary recommendations based on the individual's personal profile for promoting healthy eating habits (Shaban *et al*, 2011).

At this modern nutrition scenario younger generation seek information about their health care system. A structured education program able to create awareness among the adolescent population in terms of their diet and lifestyle pattern management of health problems especially PCOS. Structured education self management programs are pragmatic and cost-effective patient-centered group educations which are underpinned by learning theories and empower patients to take control of their management and reduce their associated long term risks (Hawkes, 2013).

D. ICT- A magnificent tool on imparting nutrition and health education

ICTs have become a strong ally in strengthening individuals' healthy lifestyle, taking into account nutrition intake and physical activity levels. Nutrition applications provide the means for automatic dietary intake and energy expenditure measurements as well as personalized counseling and educational services. Behavior targeted applications should be appealing and intriguing, as they apply to many people with a variety of needs for a long period of time. Therefore, they should be efficient, accurate and functional. It is a fact that nutrition applications are by all means a cost-effective innovation by reducing the chasm between the individuals in need for constant interaction and their caregivers (Drigas et al, 2013).

The study describes the process of developing four Smart phone applications to raise young adults' motivation in the improvement of their nutrition and physical activity behaviors. The purpose of the applications was to enhance subjects' self-reflection on their physical activity and consumption of take-out foods (fast food), fruit, vegetables and sugar-sweetened drinks. The realizations of such intriguing, cost-effective, long-term health interventions, focusing on subject's self-assessment and awareness, necessitate, therefore, continuous encouragement and support in the form of personalized feedback, (Hebden et al, 2012).

Contemporary nutrition-related issues in conjunction with innovations in information and communication technologies (ICTs) are the core-elements of the present state of-the-art article. In an attempt to address to the societal needs for continuous health and nutrition perseverance and care, ICTs provide the means to the realization of effective state policies and scientific interventions. Target audience of such applications is individuals at home or at work as well as professional caregivers. In both cases, the goal of the nutrition interventions implemented should be lifestyle-oriented. In order to fulfill these goals, applications should enhance end-users' self-monitoring and self management skills. ICTs are an in adversely strong determinant factor as to the massive, immediate and low-cost deployment of nutrition-related interventions (Vance *et al*, 2008)

Nutrition applications go far beyond the boundaries of mare consumption of low-calorie foods and one-way dietary interventions. They have to do with individuals' physical and psychological health as a unity. Therefore, manual, visual or audio dietary intake entry combined with activity level recordings or total energy expenditure measurements, should both be accompanied by counseling for raising self-awareness and self-efficacy levels. In essence, individuals are trained to change their behavior by realizing their nutritional and lifestyle, less beneficiary habits. During the whole process, support and guidance are predictive factors of long-term engagement in a program. That is the reason why nutrition applications should adapt to individuals' personal profile and character for goal setting as well as for intervention evaluation purposes. Tailored feedback towards individuals has been found to raise their accountability and offer them encouragement. Thus, the more personalized the feedback the more effective the intervention (Taylor, 2012).

Effective applications should therefore be interactive in order to maintain individuals' interest as well as flexible and reusable in order to apply to as many individuals as possible at the minimum cost. Individuals' motivation is also enhanced through accessible, convenient and reliable applications, especially for multi-variable settings, such as life-long diseases and/or socially impaired target groups, who come up against a variety of everyday adversities. Professional carer's are also in need of such applications as they seek to satisfy their constant need for efficient and high-quality counseling services. In general, nutrition applications provide quality and standardization of health intervention studies in an attempt to improve all people's nutritional and lifestyle behaviors (Heldmen, 2013).

E. Social media and Nutrition Education:

Mobile nutrition systems offer the means for measuring food intake and energy expenditure as well as they provide constant communication and interaction in the form of personalized information exchange between the interested party and a professional adviser. Mobile support system encompasses a Personal Digital Assistant, which operates on self-report bases for recording food intake and physical activity as well as a Sensitization platform, which reserves students' physiological information and mobility habits. Generally speaking, self-report techniques are considered a reliable predictor of success during weight-loss treatments (Barnos et al, 2011).

A pilot-study was performed in concerning middle-aged, Australian men views on mobile phone delivered physical activity and nutrition interventions. Middle-aged men prefered tailor-made, self-monitoring and intervention delivery applications performed especially in smartphones, with an emphasis on maximum simplicity, speed and convenience in their operation (Vandelanotte *et al*, 2013).

Incorporating the personal data such as Body Mass Index, activity level and individual dietary goals will assist to provide tailored-made, health and nutrition intervention programs, which can be optimized by using a web-based interactive, self-monitoring mechanism. In tangible, efficient intervention programs own their triumph, partly to participants' knowing exactly what they have to do to achieve their health and nutrition goals and having to be liable for their own success. Continuous feedback, weekly or less frequently, rather aspiring for the participants, is

indispensable. This can be achieved only using ICT tools enables rapport among the study participant and the investigator (Lewis *et al*, 2010)

In adolescents' current bodyweight status, nutrient intakes, meal behaviours and physical activity levels by using a web-based, self administered survey. According to the findings, overweight and obese students consumed significantly more total fat and high calorie beverages as well as higher frequency of breakfast skipping. It is crucial for adolescents' weight status to improve their lifestyle behaviors, including school health policies (Storey et al, 2012). They also make clear of the fact that obesity can be combated only by both dietary restriction and increased physical exercise. Health education programs should raise the participant's interest on adopting healthy lifestyle to avoid getting fat (Shehu et al, 2010)

In six month nutrition intervention project aiming at young adults' improvement of eating behaviors, makes use of a mobile application called "CHAT" keeps a record of the food images consumed as well as invites the intervention group to perform dietary changes through tailored feedback on their food intake via a text message. In this case, nutritional messages referred to consumption of fruit, vegetable and junk food are related to age, gender and behavioral characteristics. Not only are the content, frequency and length of text message important, but also the adequate time of receiving it in order for the participants to build their self-efficacy on healthy eating habits and stated that it is a successful method of creating curiosity among the participant which promotes more involvement of the study participants and hence gives a good result (Kerr et al., 2017)

Social media is participatory, socially engaging, and reciprocal. It thus provides opportunities not only for information sharing, but also for social networking and interactive engagement (Benetoli *et al*, 2015). Social media is utilized for health communication in myriads of ways. Educating and empowering people with health information are one area where social media has found an unparalleled usefulness (Vance *et al*, 2009). Owing to the ever-increasing availability and access to social media, a growing number of people now have greater access to health information. It has become easier for players in the healthcare industry to connect and interact with their clients via social media platforms. Not only is social media being used in

searching for health information, clients now get involved directly in managing their health conditions through the media (Campbell and Craig, 2014).

Hence ICT promotes effective nutrition education and increase the attention of the sample participants and helps to deliver the content and promote proper reach to the individual. Based on these reviews the most accepted ICT tool among the young population had been chosen and executed in this study.

III.METHODOLOGY

The methodology pretaining to the study on “Information and Communication Technology (ICT) – An Effective Tool for Nutrition Education among adolescent girls (17-23 years) with polycystic ovarian syndrome” is comprised in the following segments.

Phase-1: Identification of subjects.

A. Selection of area

B. Selection of subjects

C.Formulation of tools for collection of data:

D. Conduct of the Study:

Phase-2: Assessment of Nutritional status of the selected subjects

A.Nutritional Anthropometry:

a) Height
b) Weight
c) Computation of Body Mass Index
d) Waist Hip Ratio
e) Body Fat Assessment
f) Basal metabolic rate

B. Food and Nutrient Intake

C. Clinical Examination

a) Hirsutism
b) Irregular periods
c) Obesity
d) Deepening of Voice
e) Acne
f) Hair Loss
g) Inability to lose Weight

Phase-3:Study the relationship between Anthropometry, Clinical Examination and PCOS

A. Collection of information on family trait and knowledge on PCOS
B. Collection of information related to Lifestyle pattern , Physical Activity and Dietary pattern and nutritional status.

C. Preknowledge Assessment on PCOS among the selected subjects.

Phase-4:Impact of Nutrition Education e-modules on Nutrition knowledge of the selected subjects:

A. Formulation of Nutrition Education e-modules to enhance the nutritional knowledge (on PCOS) of the subjects.
B. Promotion and Post Knowledge Assessment on PCOS.

Phase-5: Analysis of Interpretation Data.

Phase-1: Identification of subjects

A. Selection of area

The area selected for this study was three private ladies hostels located in the residence areas, nearer to the university campus in Coimbatore. These three ladies hostels were selected because of easy accessability and convenienvce of the investigator. Prior to actual conduct of the study, a good rapport was established among the subjects through personal interaction between the subjects and the investigator.The purposes and procedure involved in the study were explained to them. The subjects were effectively motivated through nutrition education tools.The selected subjects solicited their full cooperation for the conduct of this study.

B.Selection of subjects

Polycystic Ovarian Syndrome (PCOS) is one of the most common causes of ovulatory infertility affects 6-8 percent of young women especially in their reproductive age (Nestler, 2016). Rapid urbanization and changes in life style in many developing countries are the main causes for increasing the prevalence of many complex diseases like PCOS, cardiovascular diseases and diabetes. On an average, PCOS affects 5-10 percent of the women in reproductive age group worldwide. Prevalence of PCOS is rapidly rising among Indians also. Estimates of PCOS in migrant Indians have been estimated at 52 percent and about 37 percent among the North Indian women have been estimated to suffer from PCOS. At this modern nutrition scenario, younger generation is health conscious and seeks information about their health care system. A structured education e-module able to create awareness among the adolescent girls in terms of their diet and lifestyle pattern, management of health problems especially PCOS. Hence, a total of 100

adolescent girls belonging to the reproductive age group of 17-23 years and were living in hostels, especially mobile users were selected to this study. Purposive sampling was adopted for the selection of the subjects. The inclusion and exclusion criteria for the selection of subjects are given in the Table I.

Table I

Inclusion and Exclusion criteria for the selection of subjects

Inclusion	Exclusion
• Young women who were in the age group of 17-23 years. • Willing to participate and were cooperative. • Unmarried women • Who have smart phone access • Subjects were residing in Hostels.	• Young women with complications other than metabolic disorder. • Married and lactating women • Non cooperative • Illiterates • Young women below the age group 17years and above the age group 23 yrs. • Day scholars.

C. Formulation of tools for collection of data

A questionnaire (or form) is a group or sequence of questions designed to obtain information from the respondents. Questionnaire plays a central role in the data collection process, since it has a major impact on data quality and influence the image that the statistical agency projects to the public. Questionnaires can either be in proper or computerized format (Sandal, 2012).

Informations is needed to meet the study objectives were collected using the specially designed questionnaires. A standard printed questionnaire ensures that the entire subject's were asked, the same questions and their responses were tabulated carefully. The questionnaires also translated into the legal language. Before the questionnaires were administered for the study, it should be tested for content and length; the questions should gather the needed information and should be easily understood by both interviewers and respondents. In the pre test, a small number of

interviewers were selected in the age range of 17-23 years to revise the quality of questionnaire. On the basis of the corrections and comments from the interviewers, further modification was carried out for the effective implementation.

A well structured questionnaire was formulated to collect the background information regarding socio-economic profile, dietary pattern, nutritional and health status, medical care, mode of treatment and health and nutritional knowledge related to PCOS from the selected subject. The research design and the protocols used for the study were submitted for the Ethical clearance Approval to the Institutional Ethical committee.

D. Conduct of the Study

Survey is an activity that collects information in an organized and methodical manner about characteristics of interest from some or all units of popularly using well defined concepts, methodology and procedure and compiles the gathered information into a meaningful summary with conclusion (Sativ, 2013).

A survey was conducted using specially designed questionnaire to collect the relevant information for the study. Among 100 selected subjects with PCOS observing the clinical signs, medical history and dietary survey and further by assessing the nutritional and health status and their nutritional knowledge.

Phase-2: Assessment of Nutritional status of the selected subjects

Assessment of Nutritional status is a comprehensive evaluation of person's health status using ABCD techniques were used to assess the nutritional status of an individual. In this study the parameters used are collection data of related to family trait, pre awareness on PCOS, physical activity for dietary pattern, anthropometric measurement, and clinical examination.

a. Nutritional Anthropometry

Anthropometry is the universally applicable, inexpensive and most sensitive parameter for assessing the nutritional status of the selected subjects. It reflects both health and nutritional status and also predicts performance, health and survival of an individual . The most commonly used indicators of assessing the nutritional status are 1) Standing height 2) Body Weight 3) Computation of Body Mass Index, 4) Body Fat, 5) BMR and 6) Calculation of WHR using circumferance of Waist and Hip Ratio.

1. **Standing Height**

Height of an individual is principally a measure of selected bone tissues(Jelliffe and Jelliffe, 1989). The selected subjects in the study were allowed to stand against a wall, bare foots with heels , buttocks , sholders and back of the head touching the wall. The head was comfortably erect with the arms hanging freely at the side in a natural manner . With the help of a fibre glass measuring tape, the height of the selected 100 subjects were measured systematically and recorded carefully for further analysis.

2. **Weight**

Body weight is the most widely used, the sensitive and simplest reproducible anthropometric measurement for the evaluation of the nutritional status of the population. It is more sensitive measure of nutritional adequacy and provides a crude evaluation of overall fats and muscle stores (Bamji etal., 2014).An adult weighing 10 percent more than the standard weight is overweight and 20 percent more is obese.Table given below depicts the degree of obesity of the selected subjects.

Table II

Degree of Obesity

Percentage of Body weight excess of normal	Degree of obesity
25	Mild
50	Moderate
75	Severe
100	Very severe

*Reference :Bamji et al, 2016 suggested by (WHO , 2016) . Weight of the selected 100 subjects were recorded carefully using digital electronic weighing balance and compared subjects with the standard weight.

3. Computation of Body Mass Index:

Body Mass Index (BMI) is accepted as better estimate of body fatness and health risk than body weight . It is also called Quetlet Index . The ratio of the weight in kg/ Height in m^2 is refered as Body Mass Index and also considered as an indicator of health risk.

Table III

Presumptive diagnosis with BMI

Presumptive Diagnosis	BMI
Severe Energy Malnutrition Grade III	<16.0
Moderate Energy Malnutrition Grade II	16.0-17.0
Mild Energy Malnutrition Grade I	17.0-18.5
Normal	18.5-25.0
Over weight	>25
Grade I obesity	25.0-29.9
Grade II obesity	30-40
Grade III obesity	>40

The BMI of the selected 100 subjects were computed and used to evaluate the muscle fat mass in their body and to assess their weight for height of the selected subjects.

4. Assessment of Body Fat

Body fat serves a vital role in storing energy and protecting internal organ. A more accurate definition of overweight and obesity should be based on the total amount of body fat. The upper limit of body fat for defining obesity have been set as 25 percent for male and 30 percent for female. The study conducted at National Institute of Nutrition (2004 - 2005) confirms that Indian women have high level of body fat percent at comparatively low BMI than the value reported for the other ethnic groups and given in Table IV

Table IV

Standard Body Fat Percentage

Gender	Age	Low (–)	Normal (0)	High (+)	Very High (++)
Female	20-39	<21	21.0 - 32.9	33.0 - 38.9	≥39.0

Source: NIH / WHO guidelines for BMI, Body Fat (2000), In Ref : Gallagher et al., American Journal of Clinical Nutrition, Vol. 72, Sept. (2000)

In this study, the body fat percentage is measured using hand held body fat monitor to find out the body fat percentage of the selected subjects.

5. Computation of Basal Metabolic Rate (BMR)

Basal Metabolic Rate (BMR) is the amount of energy expended while at rest and this is the amount of calories that our body needs and uses every day to perform the involuntary functions . Thereby it varies for each person. Based on their Metabolism, it's a must to know the BMR of each person in weight loss as the rate of energy expenditure is responsible for the energy balance of the Body. The BMR is calculated using the following method for female subjects aged 18-30 years and is 14.7 ×Body weight (kg) + 496.

Hence the BMR of each person is calculated as it is related with Obesity using the Hand held body fat monitor.The BMR may be less in some people but they consume more and it will be high in some people but they consume less hence the weight gain and loss is based on the BMR of each individual.

6. Waist and Hip Circumference

Waist and Hip circumference were measured using a non strechable fibre glass tape around the waist and hip , It is the practical tool, an investigator can use to evaluate a subject's upper and lower body fat deposition before and after weight loss treatment (Bhamji., 2012) . Waist and Hip circumference of all the selected subjects (N=100) were carefully recorded and used for further computation of Waist Hip Ratio.

7. Waist Hip Ratio (WHR)

Waist Hip Ratio gives distribution of fat in the human body. The waist to hip ratio being the superior clinical measurement predicting all causes and factors for many lifestyle related diseases . A waist hip ratio greater than 1.0 in men and 0.8 in women is an indicative of android obesity and increase the risk of metabolic disorder and hormonal imbalance. The waist hip ratio is assessed by dividing the waist circumference / hip circumference using the standard formula.

Waist hip ratio (WHR) =circumference of waist / circumeference of hip = 0.8

PLATE I RECORDING HEIGHT AND WEIGHT OF THE SELECTED SUBJECTS

PLATE II – COMPUTING THE PERCENT BODY FAT, BMI AND BMR

B. Clinical examination

Clinical examination assesses the level of health of individual or population group in relation to the food, they consume . It is the simplest and practical method . When two or more clinical signs characteristic of a deficiency disease are present simultaneously , their diagnostic significance is greatly enhanced. Hirsutism, Irregular periods, obesity, deepening of voice, acne, hair loss and inability to lose weight are the commonly noticed clinical signs observed in girls having PCOS. Clinical examination with these aspects was used to assess the incidence of PCOS among the selected subjects.

PLATE III CLINICAL EXAMINATION FOR THE PREVALENCE OF PCOS

C. Dietary and Lifestyle pattern

To provide one fourth to one third of their daily caloric intake and also to find out the reason for hormonal imbalance. The choice of snacks and food in young woman population is based mainly on taste rather than nutrition, resulting in the tendency to choose, salty, high sugar or high fat foods as snacks and also as food choices among young woman (Murry and Milner 2004).

Lifestyle and Dietary pattern plays a major role in cause of metabolic disorder and has the key role in cause of PCOS lifestyle pattern such as physical activity and dietary intake were is collected using the open and close ended questionnaries .

Phase-3: Study the relationship between Anthropometry and Clinical Examination witth PCOS

The study subjects were selected purposively and they were categorized into four different groups based on these following aspects:

a. Collection of information on family trait and evaluation of pre awareness on PCOS – The information collected on their family trait helps to find out the incidence of PCOS among the selected subjects

b. Collection of information related to lifestyle pattern , physical activity and dietary pattern

- Study the relationship between lifestyle pattern, BMI and Body Fat.
- Study the relationship between physical activity, BMI and Body Fat .
- Study the relationship between dietary pattern, BMI and Body Fat .
- Preknowledge Assessment on PCOS among the study subjects.

These criterias helped to find out the relationship between cause of PCOS with the increased BMI level, Body fat as it plays a major role in etiology of PCOS and obesity. As these results helped to frame the nutrition education module for the better health and helps to have a significant improvement in their health status and their well being.

After analysing these aspects, the subjects were catagorized and considered for nutrition intervention programme on PCOS for the period of three months.

Phase-4: Impact of ICT enabled nutrition education modules on nutrition knowledge of the selected subjects

a. Formulation of e- modules for Nutrition education:

At this modern nutrition scenario, younger generation seek information about their health care system. A structured education program able to create awareness among the adolescent population in terms of their diet and lifestyle modification and management of health problems especially PCOS. Structured

education e modules used for self management programs are pragmatic and cost-effective, patient-centred group educations which are underpinned by learning theories and empower patients to take control of their management and reduce their associated long term risks (Kaufman, 2010)

Apart from dietary and physical intervention, the early budding reproductive age group needs proper guidance and awareness about this condition. Nutrition education plays a vital role in prevention and maintenance of health problems like PCOS. Information communication technologies (ICT) provide privacy on educating the individual which acts as bridge between the educator and the respondent. Hence, it acts as a best education tool to impart the knowledge. ICT enabled tools that exist and popular among the adolescent population are Facebook, Whats app, Instagram, Snap chat, YouTube, Google plus, IMO, Skype, Hike, Messenger and so on. Among these ICT tools, the most commonly using highly acceptable tools among the young women population was assessed by a pilot study. It is carried out among the study subjects with the assistance of knowledge experts and then the most acceptable tools like Face book, Whats app and Instagram were used in this study to impart nutritional knowledge among the young women population on PCOS. To find out the effect of ICT enabled education on health and nutritional knowledge PCOS among the selected subjects. This study was conducted for the period of 90 days.

The subjects were selected and catagorized into four different groups . Each group consists of 25 subjects.One group was considered as the control group which is provided only with written content in the form of leaflets and pamphlets and were self explanatory. The other three groups were the experimental groups I, II, III. Experimental group I was educated with manual method with leaflet, pamphlet, chalk and talk lectures, were followed randomly to educate the subjects. Experimental group II was educated using ICT enabled tools using whats app, face book and Instagram for the period of 90 days through information text and videos on informations related to foods, nutrition, health and health problems like PCOS and preventive measures and also physical activities were also highlightened through posting videos on zumba, yoga, aerobics, exercise, etc . Experimental group III were educated with manual existing method along with physical interventions such as physical exercise , aerobics, yoga, zumba, walking and so on.

PLATE IV- EDUCATION THROUGH FACE TO FACE LECTURE

EXPT GROUP- I

PLATE V – NUTRITION EDUCTION THROUGH LECTURE AND PHYSICAL INTERVENTION (EXPT GROUP- III)

- **What's App**

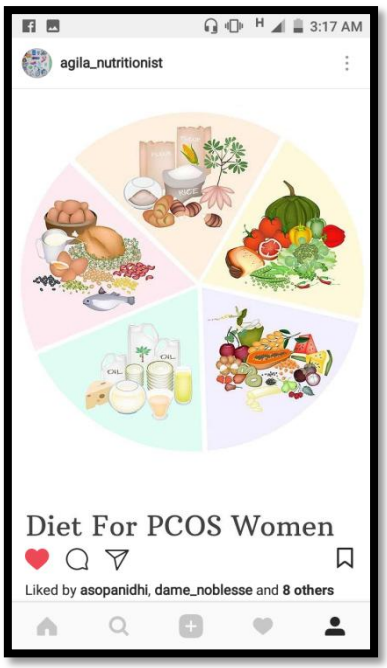
What's App and Messenger are the free software and a cross platform messaging application allows the sending of text messages and voice calls, as well as video calls, images and other media, documents, and user location. It was founded in 2009 by Brian Acton and Jan Koum, both former employees of Yahoo and had a user base of over one and a half billion .The application runs from a mobile device though it is also accessible from desktop computers; the service uses standard cellular mobile numbers. Originally users could only communicate with other users individually or in groups of individual users. In this study, a What's app group named "**Say no to PCOS**" was created on 24.12.2017 to educate the study subjects and there are 75 participants in this group and they were educated with content on PCOS for a period of three Months. As it is provided with end to end encryption and also it provides privacy among the study subjects. It was more interactive and helped to create rapport between the investigator and the selected subjects.

- **Face book**

Face book is an American online social media and social networking service company based in Menlo park, California. Its website was launched on February 4, 2004, by Mark Zuckerberg along with fellow Harvard college students and roommates. Face book may be accessed by a large device with internet connectivity. As it can be accessed in mobile as well as computers the level of acceptance and usage is high when compared to other social media. Also we have an option of creating our own group as well as web pages and it is common and can be seen by all facebook users and access it. (Smith et al, 2017). Hence, a community web page called “Healthy Ever” was created in which PCOS related posts were uploaded. This created more awareness and also in facebook there is option for comment, share and like the post. So that the selected subjects were also likes, shares and gave comments on the post. So it is a effective method of imparting knowledge among huge population as well as the community (Campbell,2010).

- **Instagram**

Instagram is a mobile, desktop and Internet-based photo-sharing application and service that allows users to share pictures and videos either publicly, or privately to pre-approved followers. The popularity of Instagram has resulted in extensive community engagement, including dedicated "trends", in which users post specific types of photos on specific days of the week with a hashtag representing a common theme. (Warren and Tom, 2016) It is similar to that of Face book and it is more easy to access hence many post related to PCOS were posted in the instagram account for the period of 3 months.



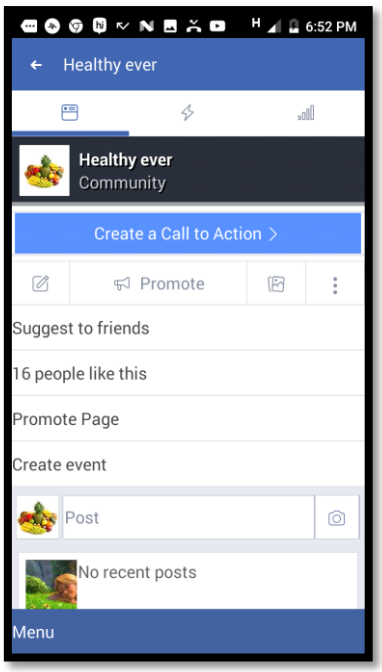


PLATE VI- EDUCATION THROUGH E-MODULE- WHAT'S APP, FACE BOOK AND INSTAGRAM (EXPT GROUP- II)

b. Promotion and post knowledge assessment

Nutritional Education for the period of 90 days on PCOS with ICT enabled manual existing methods and physical activity interventions were promoted to the study subjects by using the nutrition education modules prepared and were used to educate every day for the period of three months on the aspects related to introduction on PCOS and hormonal imbalance, signs and symptoms, prevalence, cause, etiology, Predisposing factors, genetics and PCOS, preventive measures like physical activity interventions, dietary counselling, weight loss tips, life style modification factors, interactive sessions, etc were promoted . Then the subjects were assessed with a close ended knowledge assessment questionnaire which consist of a set of 15 questions related with PCOS . This questionnaire consist of the same set of questions framed for the pre knowledge assessment and were evaluated based on Scoring method. The scors secured by the study participants were considered for assessing the effect of Nutrition education on the subjects nutritional and health knowledge of the selected subjects.

PLATE VII PRE AND POST KNOWLEDGE ASSESSMENT

PHASE-5: ANALYSIS AND INTERPRETATION OF DATA

Process of analysis and interpretation of data is carried out in a systematic manner. After the data has been collected, the investigator started for analysing the data. The analysis of data required a sample of closely related operations such as, establishment of categories tabulation and statistical influences (kothari, 2015).The collected data were properly recorded, consolidated, tabulated and analysed to conclude the study with appropriate data without any error.

RESEARCH DESIGN

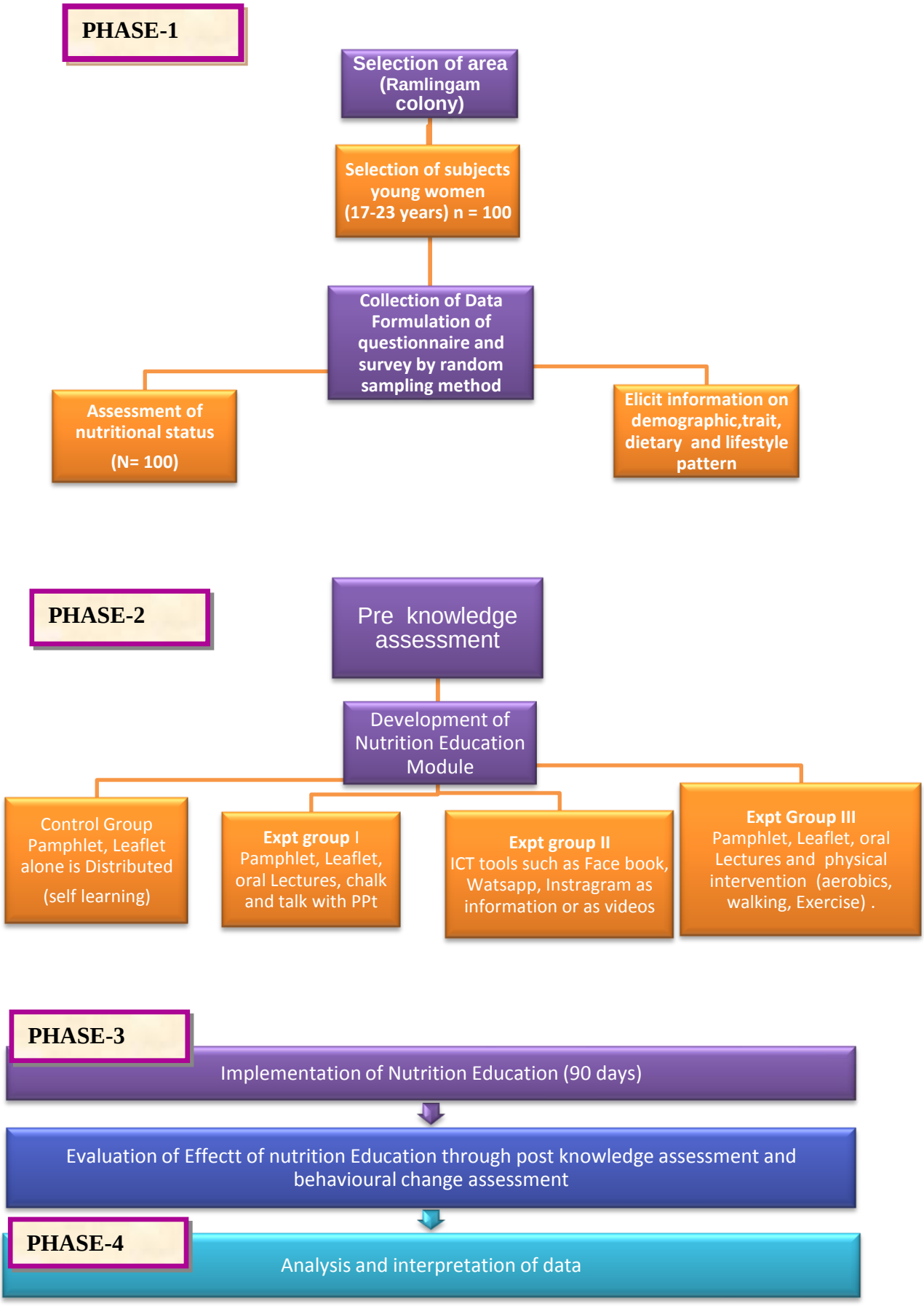


Figure I

IV. RESULTS AND DISCUSSION

The results pertaining to the present study on "**Information and Communication Technology (ICT) – An Effective Tool for Nutrition Education among adolescent girls (17-23 years) with polycystic ovarian syndrome**" are presented and discussed under the following headings.

A. Background information of the selected subjects.
B. Assessment of nutritional status of the selected subjects.
C. Collection of family trait and assessment of pre awareness about PCOS among the selected subjects.
D. Dietary and lifestyle pattern of the selected subjects.
E. Pre and post knowledge assessment of the selected subjects.
F. Effect of nutrition education e-modules in nutritional knowledge of the selected subjects.
G. Evaluating the best method for imparting nutrition education modules used.

A. Background information of the selected subjects

Health and nutritional status of an individual or family is promoted by a favorable socio economic status of the family and also the individuals lifestyle pattern changes based on their income. Hence, it is essential to include in the current study. A total of 100 subjects were selected for the present study. Health and nutritional knowledge of the selected subjects belonged to the age group of 17-23 years were collected.

The demographic profile regarding the age, sex, educational qualification, occupation, family income, dietary and lifestyle pattern i.e. physical activity of the selected subjects were collected and depicted in the following pages.

TABLE V

Demographic profile of the selected subjects

Demographic profile	Number	Percent
Age Range (years)		
17-19 yrs	39	39
20-23 yrs	61	61
Educational Qualification		
Under graduates	77	77
Post graduates	33	33
Monthly Income of the family		
Low income 2101-4500	1	1
Middle income 4501 to 7500	28	28
High income group>7500	71	71

***HUDCO Income classification (2003)**

i) Age of the subjects

Out of 100 selected subjects, 61 percent of the selected subjects belonged to the age group of 20-23 years and 39 percent of them belonged to the age group of 17-19 years. All the selected subjects were stayed in the hostel for their educational purposes.

ii) Educational Qualification

Among the 100 selected subjects 77 percent were under graduates and 23 percent were post graduates.

iii) Economic status of the family

According to HUDCO Income classification, (2003) it is cleared that majority i.e. 71percent of the selected subjects belonged to the high income group and their income was more than Rs. 7500.Twenty eight percent of the selected subjects belonged to the middle income group who had their income between Rs. 4501 to Rs. 7500 and only one percent belonged to the low income group and had the income

range of Rs. 2101 to Rs. 4500 and none of the selected subjects belonged to the very low income group i.e. below poverty line.

B. Assessment of nutritional status of the selected the selected subjects.

Anthropometry is the universally applicable, inexpensive and most sensitive parameters for assessing the nutritional status of the selected subjects. It reflects both health and nutritional status and also predicts performance, health and survival of an individual . The most commonly used indicators of the nutritional status are i) Standing height ii) Body Weight iii) Computation of Body Mass Index, Body Fat, BMR iv) Calculation of WHR using circumferance of Waist Hip Ratio and recorded the values of the above mentioned parameters and are given in Table II

TABLE VI - Anthropometric Assessment

Age Group	Values	HEIGHT (cm)	WEIGHT (kg)	BMI	WHR	BODY FAT %	BMR
17-23 years	Mean Value ± SD	157.33± 6.24	51.6 ± 9.63	21.05 ± 3.93	0.74 ± 0.077	26.98 ± 7.02	1267.79 ± 200
	Standard Values	155	50	18.5-24.9	0.80	18-29	1231(Ref value)
	Difference	+ 2.33	+ 1.6	Normal	-0.6	Normal	Normal

Among the selected subjects generally the mean difference for height is +2.33, Weight is +1.6 and for waist hip ratio is -0.6. The results revealed that majority of the selected subjects had ideal weight for height and most of the subjects had BMI, Body fat and BMR in the normal range in average.

i) Body mass index (BMI)

Body Mass Index (BMI) is the basically accepted parameters to estimate the body fat and health risk according to the range of BMI values and the mean BMI values are depicted in Figure I.

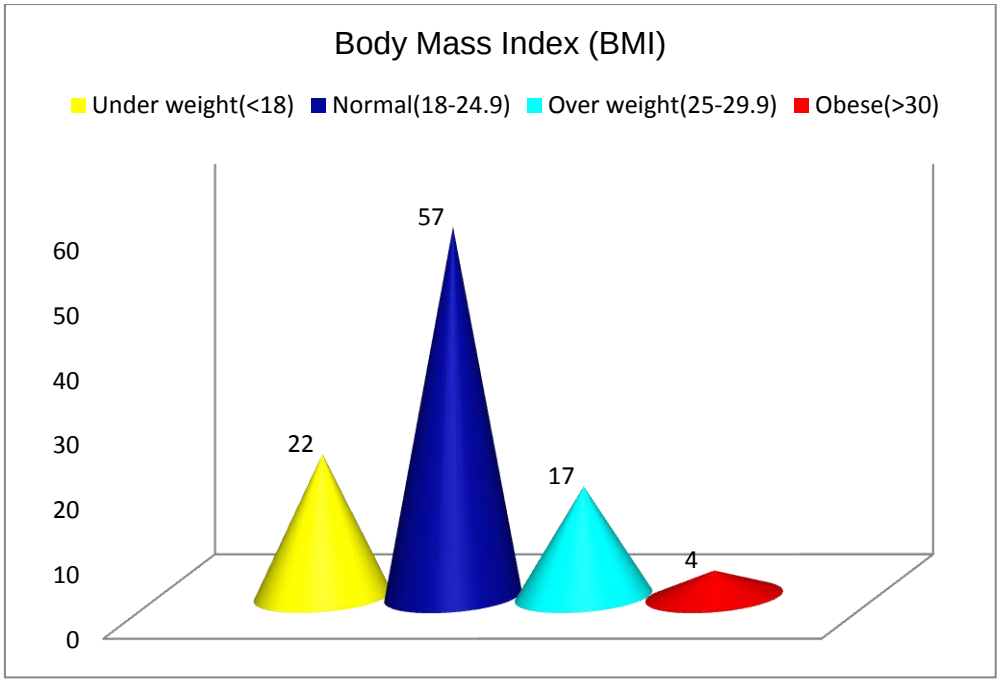


Figure II- BMI (N=100)

BMI helps to catagorize grades of obesity. Among the subjects, 22 percent of them were underweight, 57 percent were normal, 17 percent of them were over weight and four percent of them were obese.

ii) Body Fat percentage

A more accurate definition of overweight and obesity is based on the total amount of body fat. The upper limit of body fat for defining obesity have been set as 28 percent for male and 33 percent for female. A study conducted at National Institute of Nutrition (2004-2005) confirmed that Indian women had high level of body fat percent at comparatively low BMI which means the person with higher muscle mass may also had high BMI that did not belonged to the obese category . Hence, the body fat estimationdepicting the body fat percent present in our body which is the accurate higher indices for incidence of obesity.

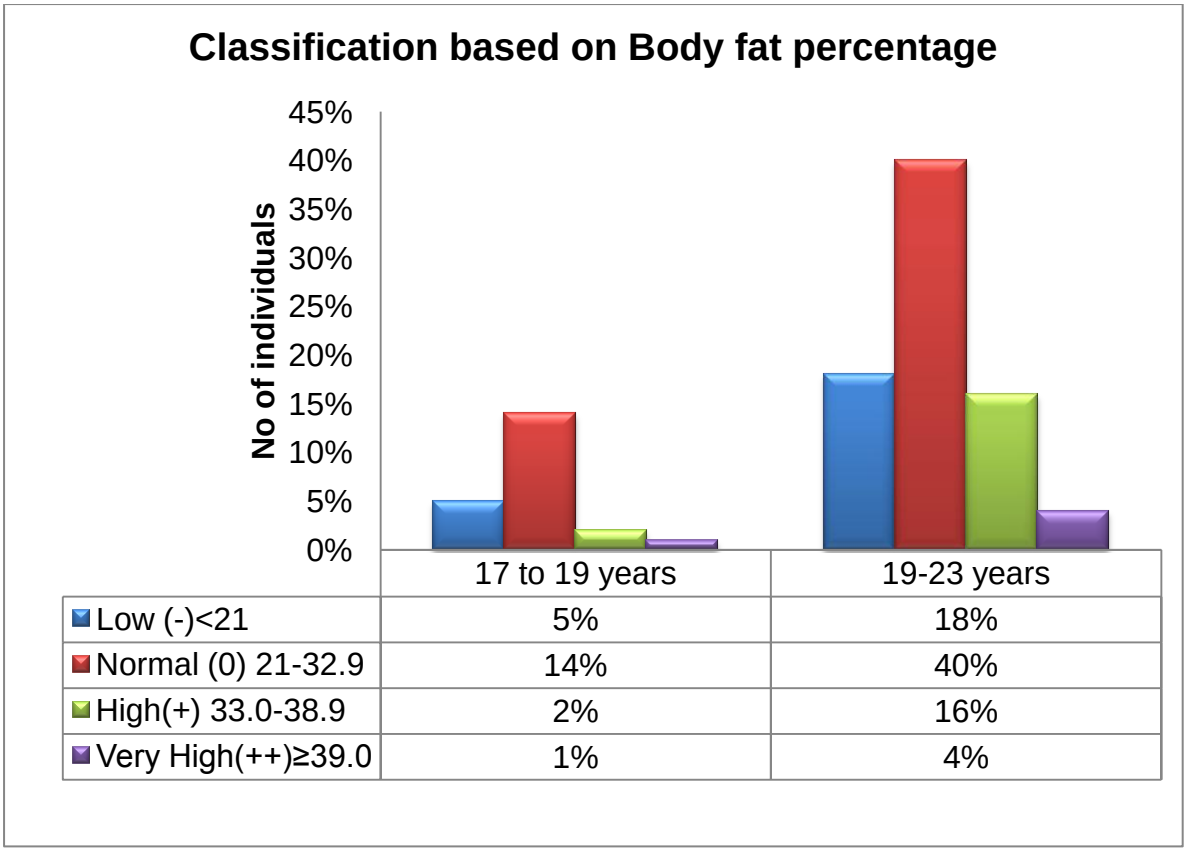


Figure III- Body Fat percentage (N=100)

The selected subjects were categorized into two types based on their age group. One is 17-19 years and another is 19-23 years. Among the selected subjects belonged to the age group of 17-19 years five percent have low body fat who belongs to the category of underweight, 14 percent have normal body fat, two percent have high body fat who comes under the category of overweight and one percent had very high body fat who were under the category of obesity.

Among the selected subjects belonged to the age group of 19-23 years 18 percent had low body fat who belonged to the category of underweight, 40 percent had normal body fat, 16 percent have high body fat who were under the category of overweight and four percent had very high body fat who lies under the category of obesity.

iii) Waist Hip Ratio (WHR)

Waist Hip Ratio gives distribution of fat in the Human Body. The Waist to Hip Ratio being the superior clinical measurement predicting all cause and factor for many lifestyle related diseases, It is measured to categorize the subjects based on

their body weight as waist hip ratio is the major indices to find out the prevalence of android obesity.

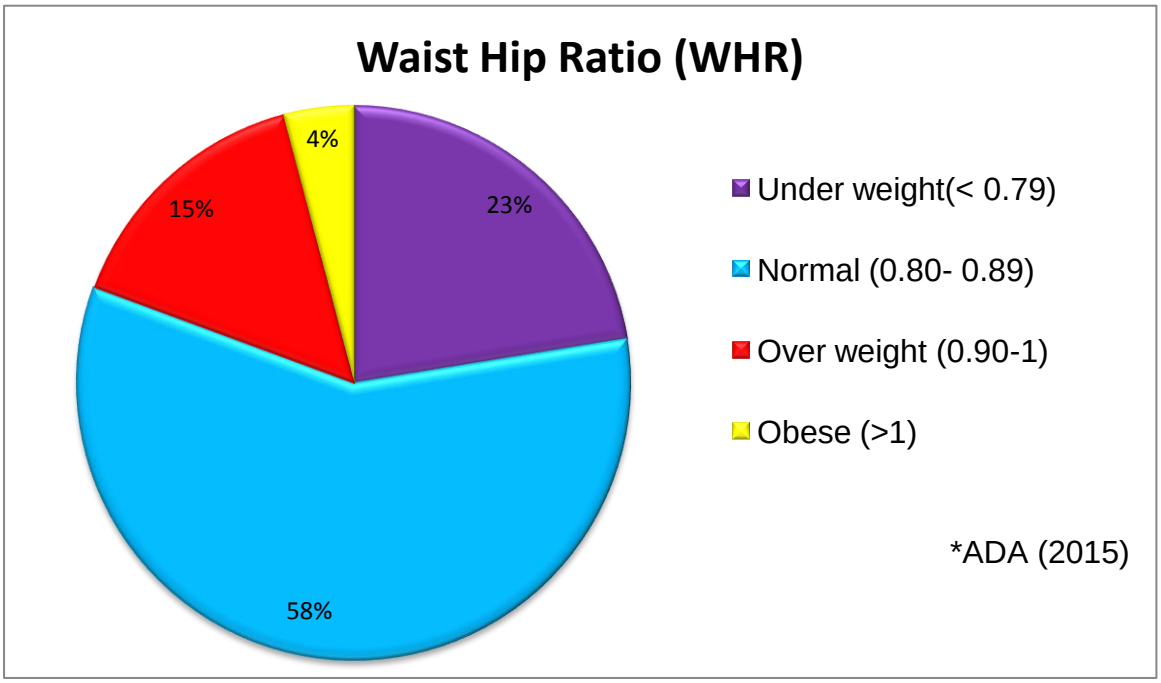


Figure IV – Waist Hip Ratio (WHR)

Among the selected 100 subjects majority of 58 percent of the selected subjects had the normal WHR, 23 percent were under weight, 15 percent were overweight and four percent were obese.

i) Clinical Examination

Clinical Examination assess level of health of an individual or a population group in relation to the food, they consume . It is the simplest and practical method . When two or more clinical signs of a deficiency disease are present simultaneously , their diagnostic significance is greatly enhanced. Hirsutism, irregular periods, obesity, deepening of voice, acne, hair Loss, inability to lose weight are the common clinical signs observed in people having PCOS. Clinical examination with these signs and symptoms has been used to assess the prevalence rate of the subjects having the menstrual problem of PCOS and prevalence or experience of these health problems. Symptoms were recorded and are given in the following Tables.

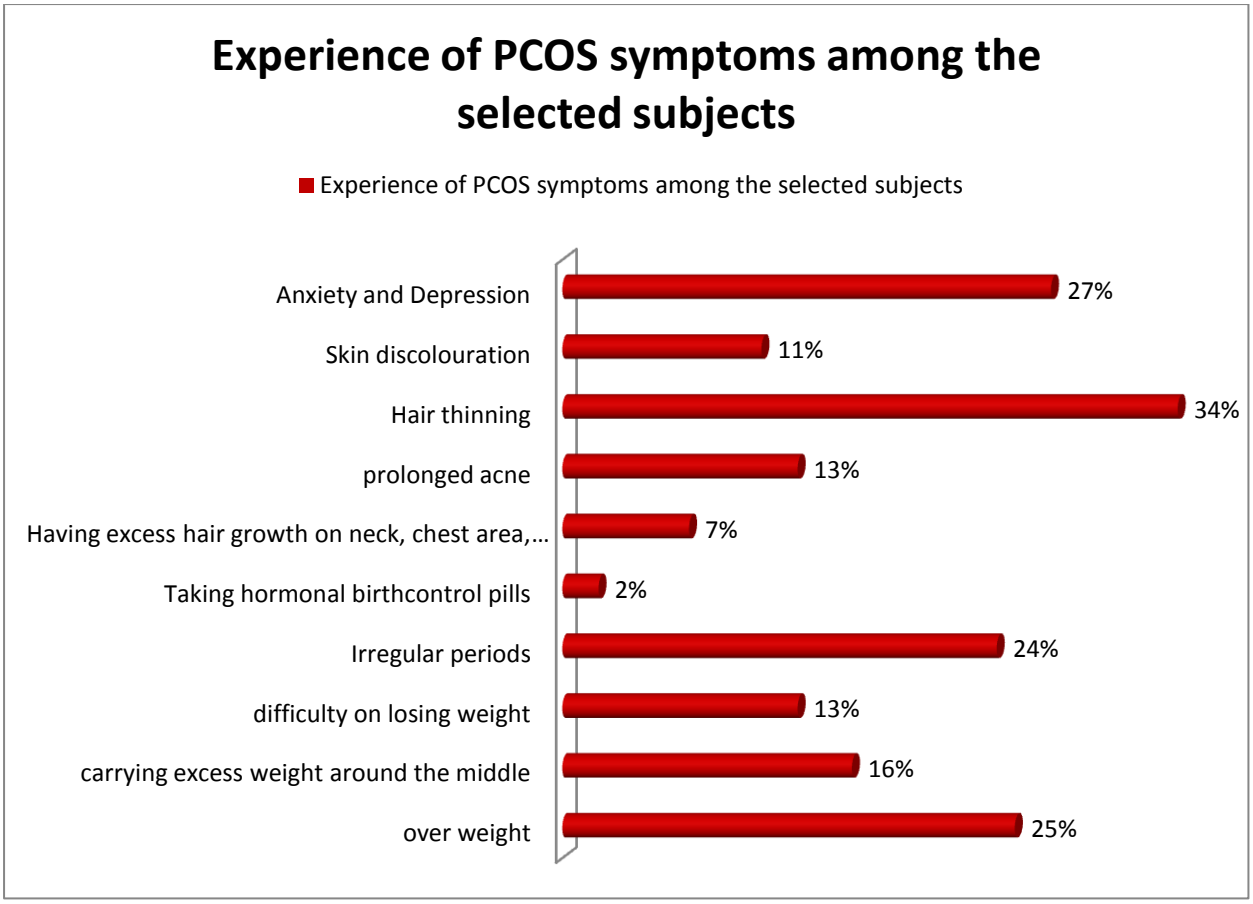


Figure VI- Experience rate of PCOS

Among the selected subjects, the incidence of experience of PCOS ranged in an average of 17.2 percent and the symptom that is found to be more common among the selected subjects had hair thinning (34 percent). Next was anxiety and depression i.e. 27 percent. Over weight is 25 percent and irregular menstruation is 24 percent. These are the common problems that are related with PCOS but while coming to the specific symptoms 16 percent are carrying excess weight around their middle, 13 percent had difficulty in losing weight, 13 percent had prolonged acne, 11 percent had skin discolouration, seven percent had excessive hair growth on neck, chest area and other area in the body (hirsutism), two percent consumed birth control pills. It had mean ± SD of 0.17 ± 0.10 and these indices showed that the experience rate of PCOS among the selected subjects was quiet high.

C. Evaluation of Family trait and assessment of pre awareness about PCOS.

i) Family trait Inventory

A total of 100 subjects selected and their traits were assessed using with close ended questionnaire.

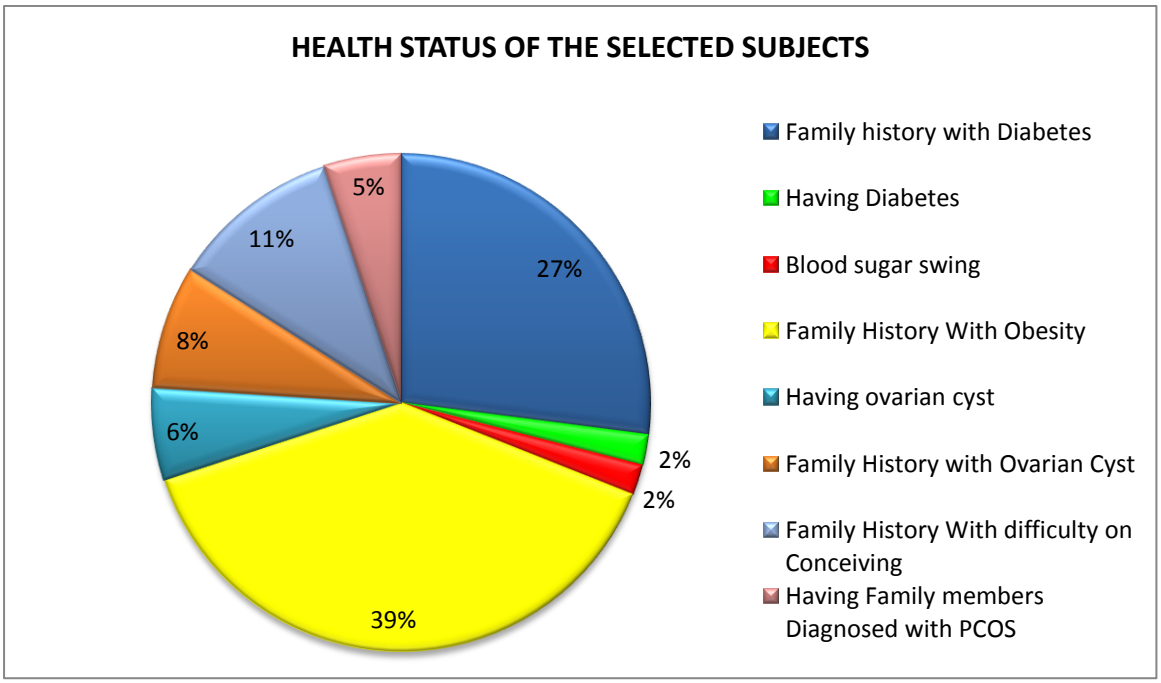


Figure VI- Family trait and health status

According to the family history of the selected subjects majority of (39 percent) the subjects had the family history with obesity, Next comes the diabetes with 27 percent of the family history, 11 percent of the selected subjects found that their family history had the problem of difficulty in conceiving, eight percent of the subjects family women were detected with ovarian cyst and five percent of their family members is diagnosed with PCOS.

While coming to the subject's health status two percent of the selected subjects had diabetes and blood sugar swing. Also six percent of the selected subjects were detected with ovarian cysts.

Source of pre awareness on PCOS before Nutrition education intervention

Table III shows the source of the pre awareness on PCOS, before nutrition education intervention.

Table VIII

Source of pre awareness on PCOS before education intervention

Knowledge on PCOS	Number	Percentage
Family members	5	5.8
Friends	24	27.9
Books / Magazines	24	27.9
Social Media	18	20.9
Mass Media	10	11.63
Any other(Studies/ conference/ lectures, etc)	5	5.8
Total	86	100

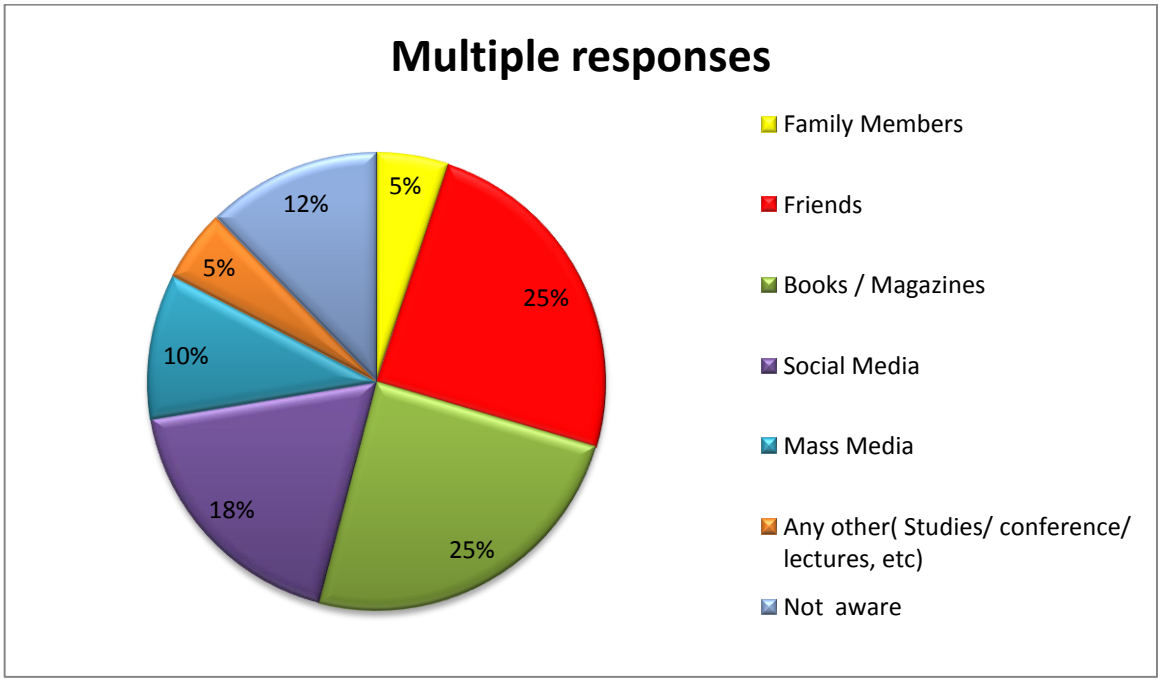


Figure VII - Precentage of pre awareness and its source

Among the selected subjects cent percent, 86 percent of the subjects were aware / heard about PCOS before intervention. Each of the subjects awared of PCOS through different modes and among them majorty of (27.9 percent) the selected subjects heard about PCOS through their friends, books and magazines.

Then 21 percent of them were aware of PCOS through social media, 11.63 percent through mass media and 5.8 percent through family members, studies, conference and lectures.

D. Dietary habits, Nutritional status and lifestyle pattern of the selected subjects

As the lifestyle and dietary pattern play a major role in cause of metabolic disorder, lifestyle pattern such as physical activity, dietary intake and their dietary pattern needed to assess using the open and close ended questionnaries . It helped to find out their health status and the key cause of the lifestyle disorders that existed and this data showed the interrelationship between their health problems and their lifestyle and dietary habits. Having this, as the basis nutrition education modules were prepared to find out their effect on nutritional knowledge of the selected subjects.

a. Dietary pattern of the selected subjects

Table VIII – Food consumption pattern

Type of food consumption pattern	Number	Percentage
Vegetarian	14	14%
Non-vegetarian	84	84%
Ova-vegetarian	1	1%
Lacto-vegetarian	1	1%
Total	100	100%

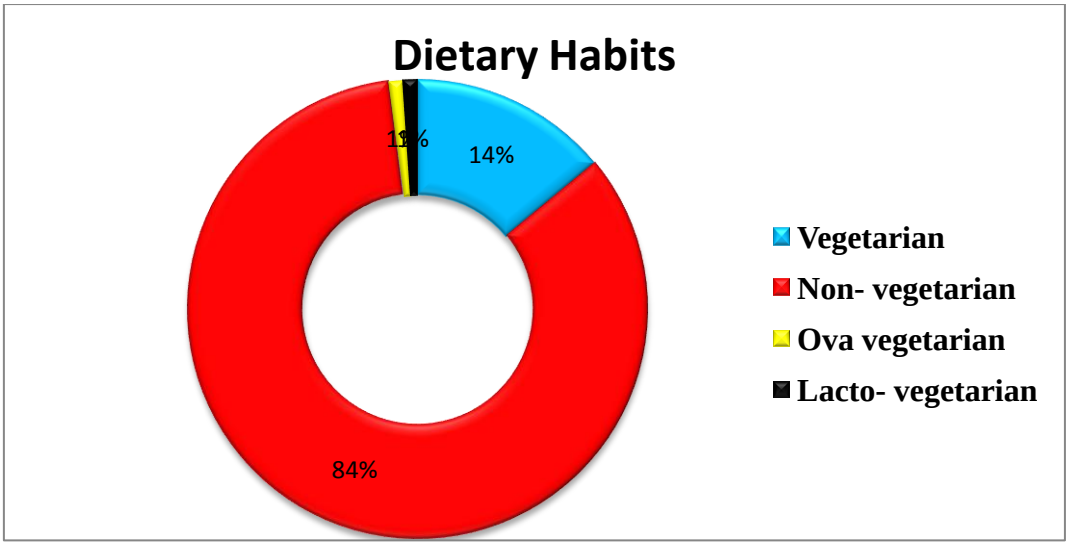


Figure VIII- Dietary Habits of the selected subjects

Among the selected subjects majority (84 percent) of them were non vegetarians, 14 percent were vegetarians, one percent was ova vegetarian and one percent was lacto vegetarian.

b) Meal pattern of the selected subjects

Table IV and the figure IX shows the meal pattern of the selected subjects.

Figure IX- Frequency of Meal pattern

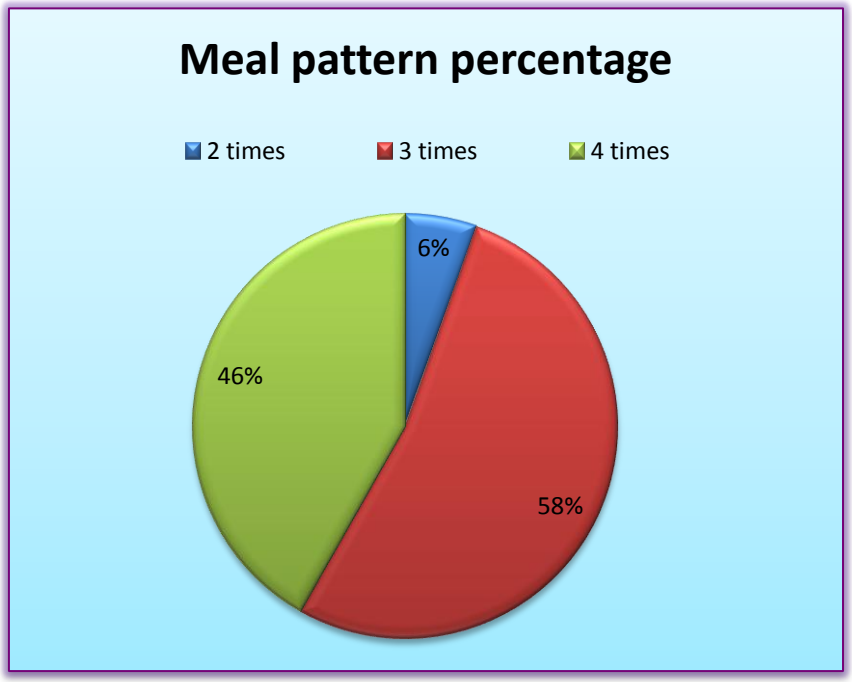


Table IX

Frequency of meal consumption percentage

Meal pattern of the adolescent girls	Number	Percentage
2	6	6
3	58	58
4	46	46
Total	100	100

The frequency of consumption of meals per day by the selected subjects revealed that majority (58%) of them had the habit of having three meals per day, 46 percent of them had the habit of having four meals per day and very less of two percent of them had the habit of two meals per day.

c. Meal skipping pattern

Skipping of meals is the most common practices of the young adult women to maintain their body weight and figure and shape. To some extent they expressed that skipping is mainly due to poor availability, lack of time and so on.

Table X

Meal skipping pattern

Meal skipping pattern	Number	Percent
Yes	51	51
No	49	49
Total	100	100
Breakfast	29	57
Breakfast and dinner	2	4
Lunch	13	25
Dinner	7	14
Total	51	51

Reason for meal skipping		
Fasting/ health status	22	43.13
Not hungry	4	7.84
Not good food	8	15.7
Not tasty food	7	13.73
Time constraint	8	15.7
Simply	2	3.92
Total	51	100
Frequency of skipping meal		
Daily	3	6
Frequently	14	27
Occasionally	34	67
Total	51	100

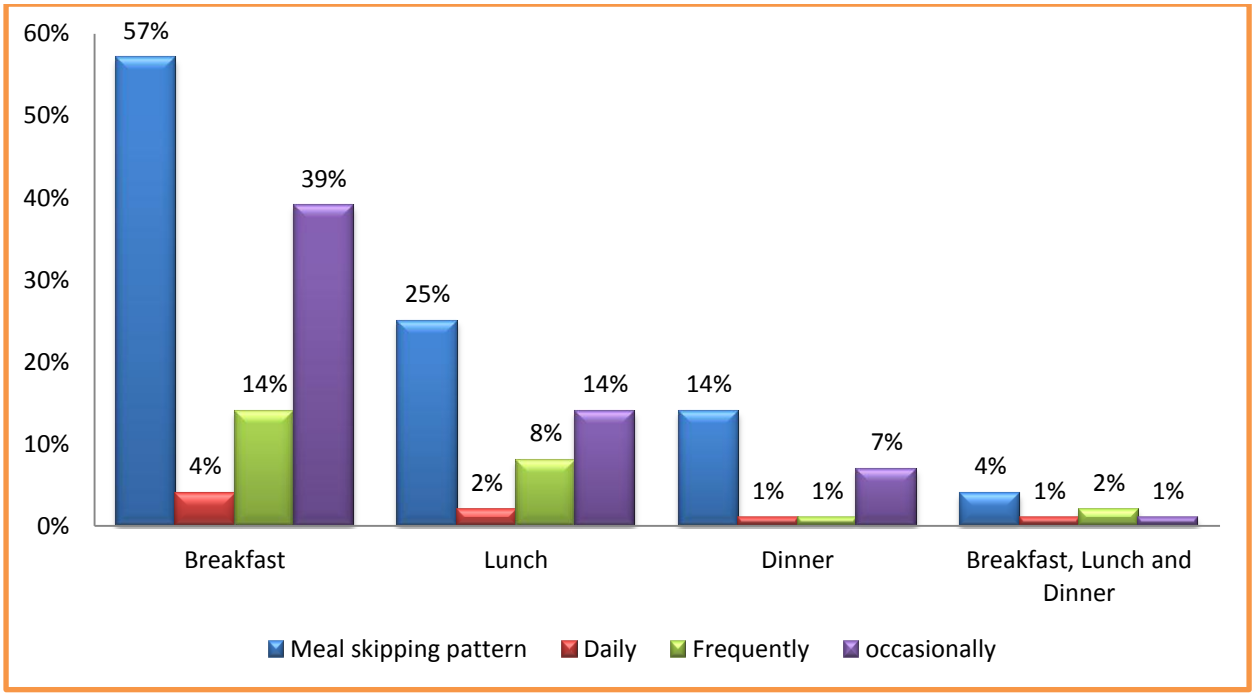


Figure X – Meal skipping pattern of the selected subjects

Among the selected subjects 57 percent of them used to skip breakfast, 25 percent skipped lunch and 14 percent skipped their dinner and four percent of them skipped meal for considering various reasons.

However four percent of the selected subjects skipped their breakfast daily, 14 percent frequently and 39 percent occasionally skipped their meals. While coming to lunch two percent of the subjects skipped daily, eight percent frequently and 14 percent occasionally and dinner is one percent of the subject skipped daily, one percent frequently and seven percent occasionally and skipping meals for entire day was one percent of the subject skipped daily, two percent frequently and one percent occasionally.

Habit of eating out

To provide one fourth to one third of their daily caloric intake and also to find out the reason for hormonal imbalance. The choice of snacks and food in young woman population is based mainly on taste rather than nutrition, resulting in the tendency to choose, salty, high sugar or high fat foods as snacks and also as food choices among young woman. (Murry and Milner 2004).The food choice, type of food they consume, preference and place they consume more is noted and shown in the table listed below

Table XI

Habit of eating outside

Response to the habit of eating out	Number	Percentage (%)
Yes	75	75
No	25	25
Total	100	100

Preference & Consumption of Food			
Food type	Yes (percent)	No (percent)	Total percent (%)
Fast foods	83	17	100
Fried foods	89	11	100
Milk and Milk products	74	26	100
Vegetables	73	27	100
Fruits	25	75	100
Green leafy vegetables	21	79	100

Among the selected subjects 75 percent consumed food from outside and 25 percent do not consume food outside. While coming to the eating habits and preference most of the selected subjects preferred to have foods such as 89 percent prefer to have fried foods more, followed by 83 percent prefer fast foods, 74 percent consumes milk and milk products on the other hand 26 percent do not consume milk and milk products, 73 percent will consume vegetables and 27 percent do not consume vegetables, 25 percent consume fruits and 75 percent do not consume fruits. 21 percent consume green leafy vegetables and 79 percent do not consume green leafy vegetables. With this discussion we can observe that the food consumption and preference is high in fast foods and fried foods as they are staying in hostels they have faulty eating habits more than healthy eating as due to accessibility, taste and variety. Most of them reported that the accessibility and acceptability of healthy foods in hostel is less due to taste and quality, they prefer to have fast foods and fried foods outside.

Soft drink consumption pattern

Table VI shows the soft drinks consumption pattern of the selected subjects

Table XII

Soft drinks consumption

Response to soft drink consumption	Number(100)	Percentage
Yes	27	27
No	73	73
Total	100	100
Frequency of soft drink consumption		
Daily	4	14.8
Frequently	2	7.4
Occasionally	21	77.8
Total	27	100

Among the selected subjects 27 percent had the habit of consuming soft drinks and 73 percent did not have the habit of consuming soft drinks. Among the 27 percent of the subjects, 15 percent had the habit of consuming soft drinks daily, nearly eight percent consumed frequently and 78 percent consumed occasionally.

Water consumption pattern

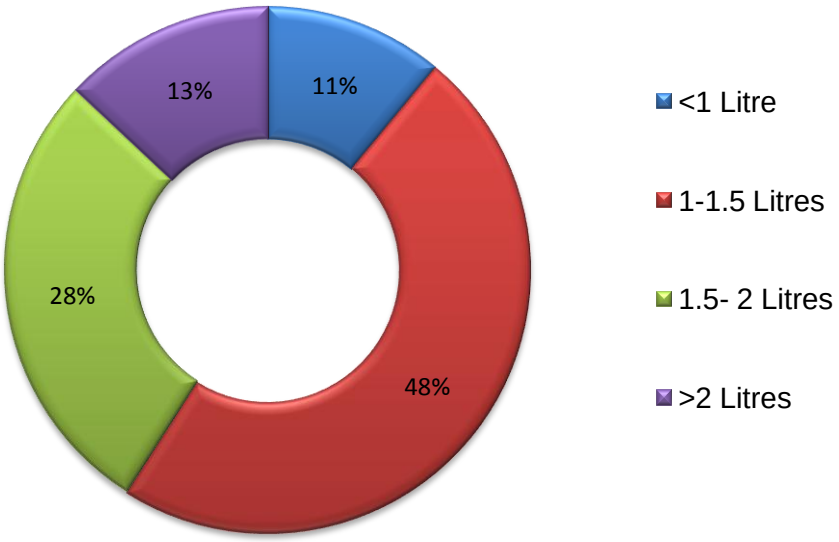
Water is the vital source of the body and it helps to perform the certain functions in the body. It also helps to maintain the body temperature, fluid balance and other functions. Hence water consumption is a must and it also helps to eliminate the body waste through sweat and urine and it is considered as an important factor which is related with PCOS. One of the most important problems of PCOS is elevated temperature of the body. Excessive consumption of water helps to reduce/ avoid the discomfortability of the body due to high temperature. A young woman should consume an average of 2 litres of daily to be hydrated. Hence the water consumption level of the subjects is recorded and their outcomes are shown below in the figure and the table. Water consumption pattern of the selected subjects is given in the table and figure

Table XIII

Water consumption pattern

Quantity of water consumption	Number of sample participants	Percentage (%)
<1 Litre	11	11
1-1.5 Litres	48	48
1.5- 2 Litres	28	28
>2 Litres	13	13

Figure X – Water Consumption percentage



The consumption amount of water is majority of 48 percent of the selected subjects had 1 to1.5 litres of water, 28 percent had 1.5 to 2 litres of water daily, 13 percent consume more than two litres of water and 11 percent consume less than one litre of water. Hence it is found that most of the subjects consumed water less than two litres but they have an average consumption of 1-1.5 litres of water daily.

b. Life style pattern

Table XIV

Mode of transport to the Academic Institutions

Mode of transport	Number	Percentage
Auto	1	1%
Bus	4	4%
Car	1	1%
2Cycle	4	4%
Two wheeler	16	16%
Train	0	0%
Walk	74	74%
Total	100	100%

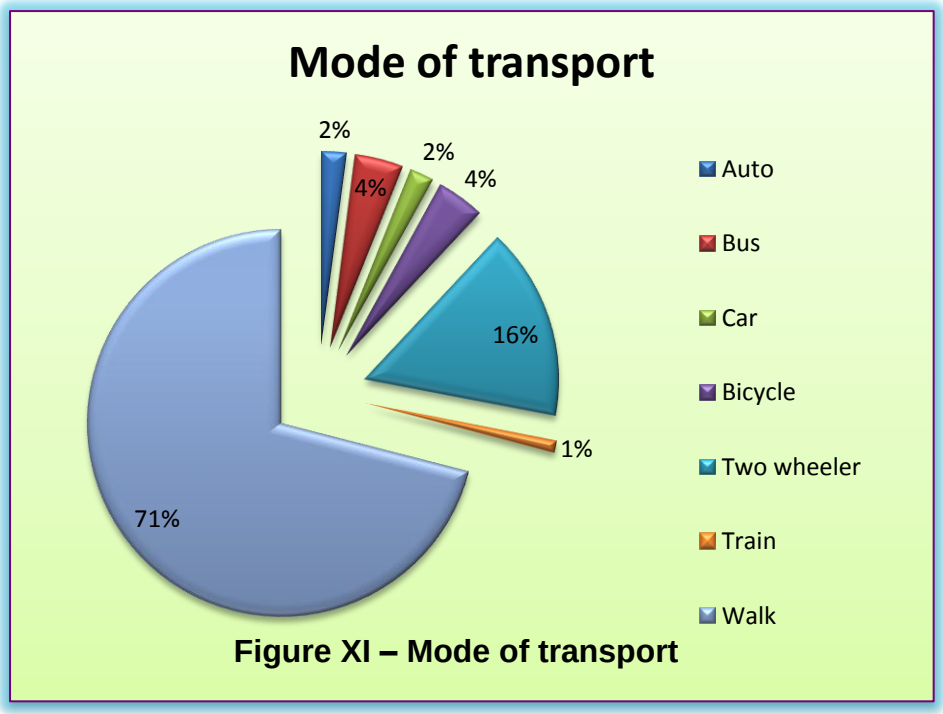


Figure XI – Mode of transport

Among the selected subjects majority of (71 percent) of them came to their educational institution by walk, 16 percent by two wheelers, four percent by bus or bicycle, two percent by car or auto and one percent by train. By this we can observed that majority of them travelled by walk. This is considered as the good practice of physical activities and helps to reduce the body weight and problem of overweight and PCOS.

Physical Activity

Intensity of physical activity is considered as the main factor to maintain body fit and active. This also considered for “go – green practices” and prevent or postpone the occurrence of disease condition

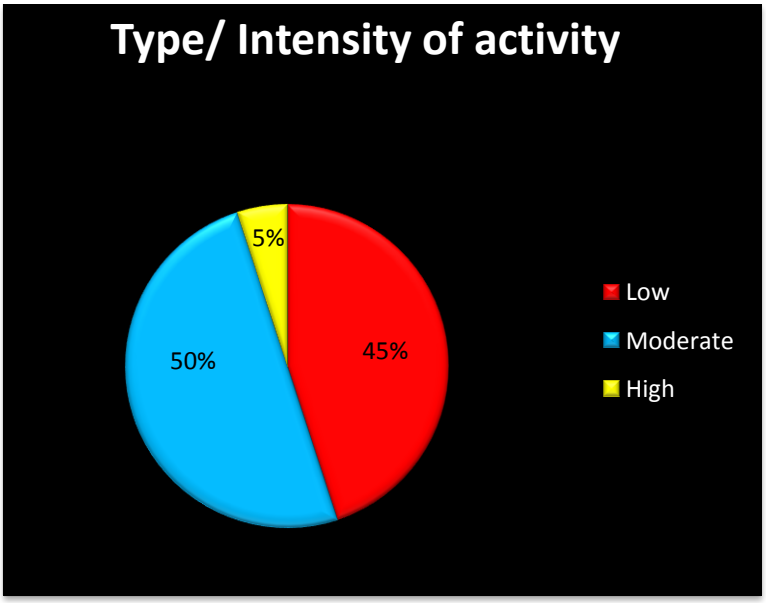


Figure XII -Type and intensity of the physical activity

Table XV

Type and intensity of physical activity done before and after education

physical Activity	Percent	Frequency and duration of the exercise		Mean difference (M)
		Before education (Mean ± SD)	After education (Mean ± SD)	
Aerobics	10	2.22 ± 1.99	3.66 ±1.52	+1.44
Yoga/ stretching	20	3.01 ± 1.42	5.11 ± 1.39	+2.10
Walking/ jogging/ cycling	75	5.68 ± 0.53	6.1 ± 0.48	+0.42
Heavy exercise(gyming)	3	0.77 ± 0.86	0.86 ± 0.83	+0.09
Strength training	2	0.48 ± 0.76	0.62 ± 0.80	+0.14

Among the selected subjects 10 percent of them did aerobics, 20 percent adopted yoga practices, majority i.e. 75 percent did walking, jogging and cycling, three percent of them did heavy exercise and the least of two percent undergone muscle strengthening training. All did not perform exercise and here it is compared that their frequency and duration of doing exercise and their standard deviation and the mean value is found. Results observed after the education that the mean value is

increased 1.44 on doing aerobics, 2.10 on Yoga and stretching exercise, the involvement on walking, jogging and cycling is increased to 0.42, 0.09 increased in performing heavy exercise and even in muscle strengthening training and there is an increase of 0.14. Hence, it is found out that the nutrition education given through various education methods such as what's app, Face book and instagram, also the lectures and physical activity intervention had greater impact on the behavioral change of among the selected subjects.

E. Pre and post knowledge assessment

After the nutrition education was given to the subjects, the knowledge assessment is done with the same pre knowledge assessment questionnaire and evaluated the knowledge gained by them. Then comparison on finding the effective method for giving Nutrition Education is assessed by data analysis using't' Test – (Test of significance)**.**

i) Effect of Nutrition Education using 'e' modules

E -modules such as what's app, Face book and Instagram were used as ICT tools for imparting Nutrition education to the selected young women for the period of three months and their knowledge was assessed with the close ended questionnaires. These data are analyzed by using statistical analysis mean, standard deviation, correlation and t - test were considered to find out the effect of nutrition education on the nutritional knowledge of the selected subjects given to them. They were as follows. Table XIII highlights the effect of nutrition education with different types of 'e' modules.

Table XVI

Effect of Nutrition Education with 'e' modules

Effect of Nutrition Education with 'e' modules				
PCOS	Mean	N	Std. Deviation	Std. Error Mean
Pre knowledge Asssessment	11.2300	100	2.09788	.20979
Post knowledge Assessment	13.3200	100	1.59469	.15947

In the pre knowledge assessment the subjects score has the mean ± SD of 11.2 ± 2.09 and in post knowledge assessment the subjects score has the mean ± SD of 13.2 ± 1.59. The research data revealed that there was increase in knowledge of the selected subjects after the nutrition education through different types of 'e'-modules. The following table shows the statistical correlation and t - test (test of significance) between pre and post knowledge assessment.

Table XVII

Statistical analysis of correlation and test of significance on pre and post knowledge assessment

Paired Samples Test									
PCOS (N=100)	Paired Differences					Correlation	T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pre knowledge – post knowledge	- 2.090	1.54459	.1545	- 2.3965	-1.7835	0.681	-13.531	99	.000

The calculated value has the test of significance (t- value) which is less than 0.05 and has it has 0.000 test of significance and is one percent significant. Hence it is concluded that the value obtained is highly significant. So nutrition education imparted is more effective and useful to enhance the nutritional knowledge of the selected subjects. It has a higher impact and has drastically increased the nutritional knowledge of the selected subjects on PCOS.

F. Effect of Nutrition education with e-modules

At this modern nutrition scenario younger generation seek information about their health care system. A structured education programs are able to create awareness among the selected adolescent population in terms of their diet and

lifestyle pattern management of health problems especially PCOS. Structured education self management programs are pragmatic and cost-effective patient-centered group educations which are underpinned by learning theories and empower patients to take control of their management and reduce their associated long term risks.

ICT provides privacy on educating the individual who acts as bridge between educator and the respondent. Hence it acts as a best education tool to impart the knowledge. The most acceptable tools are Face book, what's app and Instagram and were used in this study to impart nutritional knowledge among the selected young women subjects on PCOS. The effect of ICT equipped education on PCOS among selected subjects (young adult women) was conducted and it is preceded with incorporating the subsequent procedures.

Table XVIII

Different methods of nutritional interventions

Type of Group	Number of Subjects	Method of Intervention
Control Group	25	Pamphlet, Leaflet alone is Distributed (self learning)
Experimental group I	25	Pamphlet, Leaflet, oral Lectures, chalk and talk with Power point presentation.
Experimental group II	25	ICT tools such as Face book, What`s app, Instragram as information or as videos
Experimental group III	25	Pamphlet, Leaflet, oral Lectures and physical intervention (aerobics, walking, Exercise).

G. Rating and ranking for ICT tools used in nutritional education

Using different educational 'e' modules like whats app, face book, Instagram for the period of 90 days for the formulated information text or videos on informations and also physical interventions were also given through posting videos on Zumba, Yoga, Aerobics, Exercise, etc . Experimental group III was educated with

manual existing method along with physical interventions such as Physical exercise , Aerobics, yoga, Zumba, Walking,etc.Evaluation of the nutritional education methods is discussed in terms of 5- Like extremely, 4- Very good, 3- Good, 2- Fair, 1- Poor

Table XIX

Rating and ranking for ICT tools used in nutritional education

Criteria	Rating/ Ranking				
	ICT Tools used in Nutrition Education			Manual Existing Methods	Manual Existing method with Physical intervention
	What's app	Face book	Instagram		
Design	4.58±0.57	4.59 ±0.53	4.63±0.60	4.67 ± 0.55	4.67 ± 0.51
Accessibility	4.62±0.59	4.44 ±0.62	4.57±0.57	4.49± 0.58	4.59 ± 0.55
Quality of content	4.77± 0.47	4.64 ±0.52	4.63±0.60	4.61± 0.58	4.64± 0.56
Participant satisfaction	4.59± 0.59	4.6 ± 0.55	4.55±0.61	4.62 ± 0.51	4.55 ± 0.61
Understandability	4.72± 0.47	4.59 ±0.55	4.7± 0.48	4.59 ± 0.57	4.64± 0.52
Overall Rating	4.7± 0.50	4.61± 0.53	4.66±0.53	4.68 ± 0.47	4.67 ± 0.49

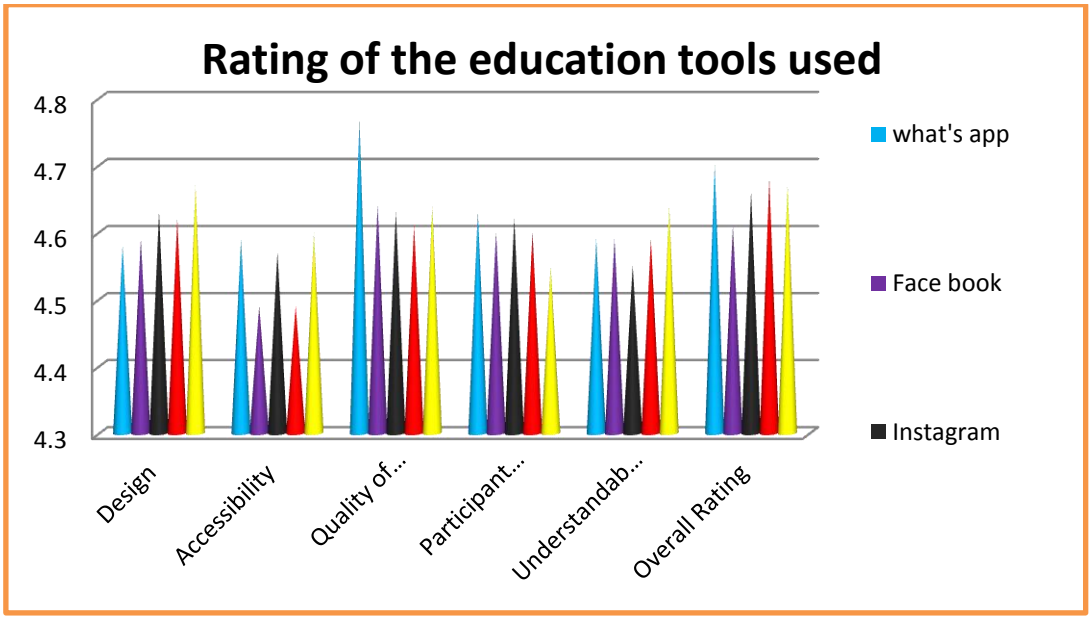


Figure XIV - Rating of nutrition education tools used

i) The best method for nutrition education was evaluated and found out that education through what's app was found to be the best method. And also the overall rating of what's app is found to be high i.e. 4.7 ± 0.50.Hence it is considered to be the best education tool among the different 'e' module tools used.

ii) On evaluating the design of the module, the acceptability of the design was high in manual education method along with physical intervention, accessibility is considered to be high in using what's app. There is a positive feedback that the quality of content was highly appreciable and easy to follow and considered to be satisfied in what's app and understandability is comfortable in manual existing method with physical intervention.

iii) And also the overall rating of what's app is found to be high i.e. 4.7 ± 0.50.Hence it is considered to be the best education tool and can be used for promoting nutritional and health status of an individual especially young generation.

Nutrition education should be practical and easily adaptable to food. Nutrition and health related knowledge generally needed for all walks of life and it becomes part of the community. Lack of knowledge is the prime cause for prevailing health problems in the society. The use of ICT enabled nutrition education has more impact on the gain of knowledge in all age groups and especially in adolescent population and can be used effectively as a tool in promoting health status and preventing health problem, especially related to diet and lifestyle pattern of an individual hence there is a need to use ICT enabled multimedia in 'e' module package for creating nutrition and health awareness and knowledge as a part of the curriculum in the educational Institutions.

V. SUMMARY AND CONCLUSION

Polycystic ovarian syndrome is an endocrinal dysfunction which is nowadays became common among the young women belonging to reproductive age group due to life style changes and genetic predisposition. It also leads to infertility and many other reproductive disorders. Lack of physical activity and outdoor sports, along with the faulty eating habits and lifestyle changes like prolonged use of digital gadgets, skipping meals, skipping sleep and many other faulty practices leads to hormonal imbalance and obesity. Apart from dietary and lifestyle modification, the early budding reproductive age group needs proper guidance and awareness about this reproductive health problem. In this current modern nutrition scenario the young generation commonly uses the digital gadgets for most of their accessibility and use of ICT enabled tools in educating the individuals helps to provide personalized nutrition. Hence, ICT enabled tools provide privacy on educating the individuals, which acts as bridge between the educator and the respondent, also acts as the best education tool to impart the knowledge in short time among large population. With these views, the current study is designed and conducted with these following objectives.

1. To elicit information related to socio economic profile, dietary and lifestyle pattern of the selected young women (17-23 years)
2. To assess the nutritional and health knowledge related to PCOS of the selected subject.
3. To develop various digital educational modules and assess the preference of education module among the selected subjects.
4. To study the effect of various nutritional educational module on nutritional knowledge of the selected subjects.

A. Background information of the sample participants.

- Health and nutritional status of an individual or family is promoted by a favorable socio economic, dietary and lifestyle pattern of an individual. Hence it is essential to include it in the current study. A total of 100 subjects in the

age group f 17-23 years and health and nutritional knowledge of the selected subjects were recorded.

- Out of 100 selected subjects, 61 percent of them belonged to the age group of 20-23 years and 39 percent of them were in the age group of 17-19 years.
- Among the selected 100 subjects 77 percent of them were under graduates and 33 percent of them were post graduates and all of the selected subjects were in hostels.
- According to HUDCO Income classification, (2003) it is cleared that majority of (71percent) of the selected subjects belonged to the high income group and their income is more than Rs. 7500. Almost 28 percent of the selected subjects belonged to the Middle income group who had the income between Rs. 4501 to Rs. 7500 and only one percent of the sample participants belong to the low income group who has the income of Rs. 2101 to Rs. 4500 and none of the participants belonged to the very low income group.

B. Assessment of anthropometric and clinical status of the selected subjects

- Among the selected subjects 100 the mean difference for height is +2.33, Weight is +1.6 and for waist hip ratio is -0.6. Majority of selected subjects had their ideal weight for height and most of the subjects had BMI, Body fat and BMR in the normal range .

i) Body Mass Index (BMI)

- Body Mass Index (BMI) is accepted as better estimate of body fatness and health risk than body weight . Among the selected subjects 22 percent were underweight, 57 percent were normal, 17 percent of them were over weight and four percent of them were obese.

ii) Body Fat percentage

- A more accurate definition of overweight and obesity should be based on the total amount of body fat. The upper limit of body fat for defining obesity have been set as 28% for male and 33% for female.
- The selected subjects were categorized into two types, based on their age group. One is 17-19 years and another is 19-23 years. Among the subjects

belonged to the age group of 17-19 years five percent had low body fat who belonged to the category of underweight, 14 percent had normal body fat, two percent had high body fat who were under the category of overweight and one percent had very high body fat and were under the category of obesity.

- Among the selected subjects belonged to the age group of 19-23 years 18 percent had low body fat and belonged to the category of underweight. Forty percent have normal body fat, 16 percent had high body fat and were under the category of overweight and four percent had very high body fat and were under the category of obesity.
- Among the selected subjects, majority of (58 percent) of them had the normal WHR, 23 percent were under weight, 15 percent were overweight and four percent were obese.
- Clinical Examination was used to assess the incidence of on PCOS . Among the study population, the incidence of Prevalence of PCOS ranges in an average of 17.2 percent and the symptom that is found to be more common among the participants is Hair thinning, its incidence is 34 percent next is anxiety and depression (27 percent), over weight was 25 percent and irregular menstruation was common among 24 percent of the selected subjects.
- These are the common problems that are related with PCOS but while coming to the specific symptoms 16 percent are carrying excess weight around their middle, 13 percent have difficulty in losing weight, 13 percent have prolonged acne, 11 percent have skin discolouration, 7 percent have excessive hair growth on neck, chest area and other area in the body (hirsutism), two percent consume birth control pills.
- It has mean ± SD of 0.17 ± 0.10 and these indices shows that the prevalence rate of PCOS among the subjects is quiet high.

C. Evaluation of Family trait and assessment of pre awareness about PCOS among the young women population.

There are totally 100 subjects selected and their traits were assessed with providing them with a close ended questionnaire.

- According to the family history of the selected subjects majority (39 percent) of the participants had the family history with obesity. Next comes, the diabetes with 27 percent of the family history, 11 percent of the participants family women find difficulty in conceiving, eight percent of the selected subjects family women are detected with ovarian cyst and five percent of their family members was diagnosed with PCOS.
- While coming to the sample participant's health status two percent of the selected subjects had the complications of diabetes and blood sugar swing. Also six percent of the selected subjects were detected with ovarian cyst.
- Among the 100 percent of the sample participants, 86 percent of the selected subjects were aware of or heard about PCOS before nutrition education intervention. Each of the subjects got aware of PCOS through different modes nearly 30 percent of the subjects had heard about PCOS through friends, books and magazines. Twenty one percent of them had been aware of PCOS through social media, 12 percent through mass media and 5.8 percent through family members, studies, conference and lectures.

D. Dietary habits and lifestyle pattern of the selected subjects

As the lifestyle and dietary pattern plays a major role in cause of metabolic disorder and has the key role in occurence of PCOS, their lifestyle pattern such as physical activity and dietary intake and their lifestyle and dietary pattern was collected using the open and close ended questionnaries . It helped to find out their health status and it provide the key cause of the lifestyle disorder that exist and this data showed the interrelationship between their health problem and their lifestyle and dietary habit.

- Among the selected subjects the majority (84 percent) of them were non vegetarians, 14 percent were vegetarians, one percent was ova vegetarian and one percent was lacto vegetarian.
- The frequency of consumption of meals per day by the selected subjects revealed that majority (58%) of them had the habit of having 3 meals per day, 46 percent of them have the habit four meals per day and very less of two percent of them had the habit of having 2 meals per day.

- Among the subjects selected, 57 percent used to skip breakfast, 25 percent skipped lunch and 14 percent skipped dinner and rest of them did not skip any part of the meal.
- However four percent of the selected subject skipped their breakfast daily, 14 percent frequently and 39 percent occasionally. While coming to lunch two percent of the subject skipped daily, eight percent frequently and 14 percent occasionally and dinner was one percent of the subject skipped daily, one percent frequently and seven percent occasionally and skipped meals for the whole day by very merge percent of the selected subjects.
- The food choice, type of food they consume, preference and place they consume more is noted and their outcomes are, among the selected subjects 75 percent consumed foods from outside and 25 percent do not consume any food outside.
- While coming to the eating habits and preference of eating among the selected subjects, a majority of (89 percent) the selected subjects preferred to have fried foods more, followed by 83 percent prefer fast foods, 74 percent consumed milk and milk products on the other hand 26 percent did not consume milk and milk products, 73 percent will consume vegetables and 27 percent did not consume vegetables, 25 percent consumed fruits and 75 percent did not consume fruits, 21 percent consumed green leafy vegetables and 79 percent did not consume green leafy vegetables in their dietary pattern.
- Among the selected subjects 27 percent had the habit of consuming soft drinks and 73 percent did not have the habit of consuming soft drinks. Among the 27 percent of the selected subjects, 15 percent had the habit of consuming soft drinks daily, nearly eight percent consumed frequently and 78 percent consumed occasionally.
- Water consumption level of the selected subjects is recorded and majority of (48 percent) the selected subjects consumed nearly 1-1.5 litres of water, 28 percent consumed nearly 1.5- 2 litres of water daily, 13 percent consumed more than two litres of water and 11 percent consume less than one litre of water. Hence it is found that most of the selected subjects consume water less than two litres but they have an average consumption of 1-1.5 litres of

water daily. Consumption of water is considered as the best remedial measure to prevent the complication of raising the body temperature of the subjects with PCOS.

- Among the selected subjects majority of (71 percent) them used to come by walk to their educational institution, 16 percent by two wheeler, four percent by bus and bicycle, two percent by car and auto and one percent by train. This data is considered to be favorable for go green concept of the present scenario.
- Among the selected subjects 10 percent used to do aerobics, 20 percent yoga, majority i.e. 75 percent used to go for walking, jogging and cycling, 3 percent adopted their heavy exercise and two percent undergone muscle strengthening training.
- By this result it is observed that the mean value is increased 1.44 on doing aerobics, 2.10 on Yoga and stretching exercise, the involvement on walking, jogging and cycling is increased to 0.42, 0.09 increase in performing heavy exercise and even in strength training there is increase of 0.14.
- Hence it is find out that the nutrition education given through various education methods such as what's app, Face book and instagram, also the lectures and physical activity intervention has greater impact on the behavioral change of among the selected subjects.

E. Pre and post knowledge assessment

- After the nutrition education was given to the selected subjects, the knowledge assessment is done with the same pre knowledge assessment questionnaire and evaluated the knowledge gained by them. Then comparison on finding the effective method for giving Nutrition Education is assessed by data analysis using't' Test – Test of significance**.**

i) Effect of Nutrition Education with 'e' modules

- In the pre knowledge assessment the subjects score has the mean ± SD of 11.2 ± 2.09 and in post knowledge assessment the subjects score has the mean ± SD of 13.2 ± 1.59. Hence the table shows that there is increase in knowledge of the subjects after the Nutrition education through 'e'- modules

- Since the calculated value has the test of significance (t- value) is less than 0.05 and has it has 0.000 test of significance and is 1percent significant, hence it is concluded that the value obtained is highly significant. So the nutrition education imparted is more effective and useful. It has a higher impact and has drastically increased the knowledge of the subjects on PCOS.

F. Imparting and assessing the effect of nutrition education with e-modules

- At this modern nutrition scenario younger generation seek information about their health care system. A structured education program able to create awareness among the adolescent population in terms of their diet and lifestyle pattern management of health problems especially PCOS.
- Structured education self management programs are pragmatic and cost-effective patient-centered group educations which are underpinned by learning theories and empower patients to take control of their management and reduce their associated long term risks.
- ICT provides privacy on educating the individual which acts as bridge between Educator and the respondent hence it acts as a best education tool to impart the knowledge. The most acceptable tools like Face book, What's app and Instagram were used in this study to impart nutritional knowledge among the young women population on PCOS.
- Among the adolescent population this study was conducted.

G. Evaluating the best method for imparting nutrition education among the modules used.

- The subjects were selected and catagorized into 4 different groups . Each group consists of 25 participants.One is the control group which is provided only with leaflets and pamphlets no education is given, the rest of 75 are the experimental group.
- Experimental group I is educated with manual existing method with leaflet, pamphlet, oral lectures were given to them randomly.
- Experimental group II is educated using ICT as tool i.e, through whats app, face book, Instagram for the period of 90 days through information text or

videos on informations and also physical interventions were also given through posting videos on Zumba, Yoga, Aerobics, Exercise, etc .

- Experimental group III were educated with manual existing method along with physical interventions such as Physical exercise , Aerobics, yoga, Zumba, Walking,etc.

H. Evaluation of the nutrition education methods

- From the table and the graph the best method for giving nutrition education is evaluated. From the 5 different education tools used it is found that education through what's app is found to be the best method. And also the overall rating of the what's app is found to be high i.e. 4.7 ± 0.50.Hence it is considered to be the best education tool among the tools used.
- On evaluating the design of the module the acceptability of the design was high in manual education method along with physical intervention, accessibility is considered to be high in using what's app. There is higher positive feedback that the quality of content was high in What's app , the participant satisfaction is high in what's app and understandability is high in manual existing method with physical intervention.
- And also the overall rating of what's app is found to be high i.e. 4.7 ± 0.50.Hence it is considered to be the best education tool among the tools used and overall rating is high among ICT tools when compared to two other methods.
- Hence it is proven that use of Information Communication Technology (ICT) has great impact on knowledge and behavioral change among the younger generation.

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age. Most investigators have found that 30-50% of PCOS women are obese and tend to have an increased waist-hip ratio, (WHR) i.e. abdominal (visceral) obesity. In this study a structured education program is designed and interpreted to promote and create awareness among young population about this dreadful disorder and using these methods we were able to successfully guide and educate the young population in terms of their diet and lifestyle pattern management of health problems especially PCOS.

Information communication technology (ICT) enabled nutrition and health education method is also pragmatic and cost-effective patient-centered group educations which are underpinned by learning theories and empowered the subjects to take control of their management and reduce their associated long term risks. Thus it is concluded that use of ICT tools for educating the young population is a best and most acceptable method among younger generation.

RECOMMENDATIONS

Based on the findings of the present study, following recommendations are emerged.

- While the consumption includes most of the desired items the pattern suggests that the frequency of intake of fast foods is more desired and needs to be abridged
- .The meal skipping is also found to be high among the subjects and prevalence of under nutrition is also found to be high due to meal skipping and lack of guidance.
- Hence the follow up of the current 90 days of nutrition education gave an enormous result in change in their behavior and knowledge. So nutrition education in other aspects also can be given using ICT enabled tools.

LIMITATIONS

- Biochemical parameters related to PCOS is not done in this study. Hence only knowledge and Behavioral change is observed in this study.
- Only random sampling method is used in this study. Purposive sampling may be done to have higher impact in the outcome and will be more useful.

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APPENDIX I

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) – AN EFFECTIVE TOOL FOR NUTRITION EDUCATION AMONG ADOLESCENT GIRLS (17-23 YEARS) WITH POLYCYSTIC OVARIAN SYNDROME

1. Name of the investigator:
2. Name of the participant:
3. Age: Gender: F/M
4. Address:
5. Monthly income:
6. Staying in : hostel / Day scholar
7. Contact No:

Primary data:

I. Anthropometric assessment:

1. Height (Cms): 2. Weight (kg): 3. BMI:

4. Waist hip ratio: 5. Body fat:

Secondary data:

II. Clinical signs:

1. Hirsutism ☐ Yes ☐ No 2. Irregular periods ☐ Yes ☐ No

3. Obesity ☐ Yes ☐ No 4. Acne ☐ Yes ☐ No 5.Deepening voice ☐ Yes ☐ No

Trait inventory Questions:

1. Are you, over your ideal weight ☐ Yes ☐ No
2. Are you carrying excess weight around your middle? ☐ Yes ☐ No
3. Are you experiencing difficulty in losing weight? ☐ Yes ☐ No
4. Do you have irregular periods? ☐ Yes ☐ No
5. Are you taking hormonal birth control to bring on a period? ☐ Yes ☐ No

6. Do you have excess hair growth on your neck, chest area chin, above the lip or abdominal region? ☐ Yes ☐ No

7. Do you have prolonged acne? ☐ Yes ☐ No

8. Is the head thinning? ☐ Yes ☐ No

9. Is your skin discolored in certain areas in your body? ☐ Yes ☐ No

10. Do you experience anxiety and depression? ☐ Yes ☐ No

11. Do you have a family history of diabetes? ☐ Yes ☐ No

12. Do you have diabetes? ☐ Yes ☐ No

13. Do you have blood sugar swings (Hyper / Hypoglycemia)? ☐ Yes ☐ No

14. Do you have family members who are obese or overweight? ☐ Yes ☐ No

15. Have you ever had ovarian cysts? ☐ Yes ☐ No

16. Has anyone of your family ever had ovarian cysts? ☐ Yes ☐ No

17. Do any of your female family members have/ had difficulty in Conceiving? ☐ Yes ☐ No

18. Do you have female family members diagnosed with PCOS? ☐ Yes ☐ No

19. Have you ever heard about PCOS before anywhere? ☐ Yes ☐ No

If yes, (by which source):

a) Family members b) Friends c) Books/ Magazines d) social media

e) Mass media f) any other (please specify)

20. Are you interested to know about PCOS? ☐ Yes ☐ No

If yes, by what method?

a) Lectures b) Social media(face book/ watsapp/snap chat) c) Instagram d) lecture with physical intervention

Secondary data:

I. Life style pattern:

Physical activity:

Activity	Type/ Intensity (low-moderate - high)	Days per week	Duration(Minutes)
Aerobics			
Yoga/ stretching			
Walking/ jogging/ cycling			
Heavy exercise(gyming)			
Strength training			

II. Dietary pattern:

1. Dietary habits: Vegetarian/ Non vegetarian/ Ova vegetarian/ Lacto vegetarian

2. Do you skip meals? ☐ Yes ☐ No

If yes,

(i) a)Daily b) frequently c) occasionally

(ii) Type of meals skipped: a) breakfast b) lunch c) Dinner

3. Do you take fast foods? ☐ Yes ☐ No

If yes, a) Daily b) frequently c) occasionally

4. Do you take fried foods? ☐ Yes ☐ No

If yes, a) Daily b) frequently c) occasionally

5. Do you eat milk and milk products daily? ☐ Yes ☐ No

If yes how much?

a) 0-1 portion b) 2-3 portions c) 4or more portions

If no why?

6. Do you eat vegetables every day? ☐ Yes ☐ No

If yes, a) <100g b) 100- 200 g c) >200g

7. Do you eat fruits daily? ☐ Yes ☐ No

If yes, a) <100g b) 100- 200 g c) >200g

8. Do you eat greens daily? ☐ Yes ☐ No

If yes, a) <100g b) 100- 200 g c) >200g

9. Do you have carbonated beverages? ☐ Yes ☐ No

a) If yes, Daily b) frequently c) occasionally

10. How much water will you have daily?

a) <1 litre b) 1-1.5 litres c) 1.5- 2 litres d) > 2 litres

11. Do you have non vegetarian foods? ☐ Yes ☐ No

a) If yes, Daily b) weekly once c) weekly twice d) > twice

12. Do you use saturated oils in cooking (vanaspathi / ghee)? ☐ Yes ☐ No

If yes how much/ month? _____

Pre knowledge assessment

1. What is polycystic ovarian syndrome?

a)Irregular menstrual cycle b) Hormonal imbalance c) Inability to conceive

d) All the above

2. Polycystic ovarian syndrome is a

a) Endocrinal dysfunction b) Health problems c) Disease d) None of the above

3. It is caused because of

a) Hormonal imbalance b) Environmental change c) climatic changes d) Depression

4. It occurs

a) Before Menarche b) After Menarche c) During reproductive age d) After Menopause

5. It occurs through

a) Genetic predisposition b) Environmental pollution c) Life style modification d) Both a&c

6. Symptoms of PCOS

a) Physical b) Mental c) Social d) All the above

7. What shows that you have PCOS?

a) Acne b) Excess hair growth c) Inability to lose weight d) All the above

8. In severe condition it may a) Affects the regular activity b) Leads to infertility

c) Not affect the regular activity d) do not know

9. Common measures to overcome PCOS condition a) Dietary modification & physical activity

b) Iron supplementation c) Calcium supplementation d) All the above

10. In PCOS there is tendency to have more

a) Junk foods b) Milk c) Water d) Sour foods

11. How does PCOS affect women while pregnant?

a) Miscarriage b) Gestational diabetes c) Premature delivery d) all the above

12. How does PCOS can be treated? a) Birth control pills b) Life style modification only

c) Exercise & dietary modification d) None of the above

13. What should be done to prevent hormonal imbalance

a) Physical activity b) Consuming foods rich in Vitamin E c) Weight loss b) None of the above

14. PCOS is induced / aggravated by

a) Stress b) Smoking c) Alcohol d) All the above

15. Now have you understand about PCOS? ☐ Yes ☐ No

APPENDIX II

AVINASHILINGAM INSTITUE OF HOMESCIENCE AND HIGHER EDUCATION FOR WOMEN

Department of Food science and Nutrition

TITLE: Information and Communication Technologies (ICT) – An Effective Tool for Nutrition Education among young adult women (17-23 Years) on Polycystic Ovarian Syndrome

I. Post knowledge assessment

1. What is polycystic ovarian syndrome?
a)Irregular menstrual cycle b) Hormonal imbalance c) Inability to conceive d) All the above

2. Polycystic ovarian syndrome is a
a) Endocrinal dysfunction b) Health problems c) Disease d) None of the above

3. It is caused because of
a) Hormonal imbalance b) Environmental change c) climatic changes d) Depression

4. It occurs
a) Before Menarche b) After Menarche c) During reproductive age d) After Menopause

5. It occurs through
a) Genetic predisposition b) Environmental pollution c) Life style modification d) Both a&c

6. Symptoms of PCOS a) Physical b) Mental c) Social d) All the above

7. What shows that you have PCOS?
a) Acne b) Excess hair growth c) Inability to lose weight d) All the above

8. In severe condition it may a) Affects the regular activity b) Leads to infertility
c) Not affect the regular activity d) do not know

9. Common measures to overcome PCOS condition a) Dietary modification & physical activity b) Iron supplementation c) Calcium supplementation d) All the above

10. In PCOS there is tendency to have more
a) Junk foods b) Milk c) Water d) Sour foods

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a) Miscarriage b) Gestational diabetes c) Premature delivery d) all the above

12. How does PCOS can be treated? a) Birth control pills b) Life style modification only c) Exercise & dietary modification d) None of the above

13. What should be done to prevent hormonal imbalance a) Physical activity b) Consuming foods rich in Vitamin E c) Weight loss b) None of the above

14. PCOS is induced / aggravated by
a) Stress b) Smoking c) Alcohol d) All the above

15. Now have you understand about PCOS? ☐ Yes ☐ No

II. Evaluation of the Nutrition Education through ICT Tools: (5- Like extremely, 4- Very good, 3- Good, 2- Fair, 1- Poor)

Criteria (Whats app)	Rating/ Ranking				
	5	4	3	2	1
Design					
Accessibility					
Quality of content					
Participant satisfaction					
Understandability					
Overall Rating					

Criteria (Face Book)	Rating/ Ranking				
	5	4	3	2	1
Design					
Accessibility					
Quality of content					
Participant satisfaction					
Understandability					
Overall Rating					

Criteria (Instagram)	Rating/ Ranking				
	5	4	3	2	1
Design					
Accessibility					
Quality of content					
Participant satisfaction					
Understandability					
Overall Rating					

Criteria (Manual Existing Methods)	Rating/ Ranking				
	5	4	3	2	1
Design					
Accessibility					
Quality of content					
Participant satisfaction					
Understandability					
Overall Rating					

Criteria (Manual Existing method with Physical intervention)	Rating/ Ranking				
	5	4	3	2	1
Design					
Accessibility					
Quality of content					
Participant satisfaction					
Understandability					
Overall Rating					

Remarks:

APPENDIX III

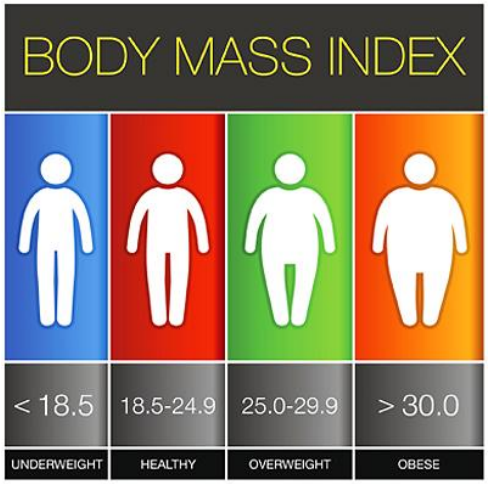
SMALL CHANGES CAN MAKE A LARGE DIFFERENCE

30 days to "a get a good result"

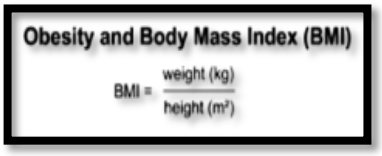
Set a weight goal: A weight goal needs to be reasonable. If you want to lose weight, start with a goal of 5–10% of your current weight.

Track your weight: Check & enter your weight at least once a week same time of day with the same amount of clothing, and on the same scale and track progress over time.

Stick to the measuring tape: When it comes to shedding body fat, the scale is not always your friend. If your waist size is greater than 80cms (for women) and greater than 90cms (for men), it indicates that you are at an increased risk of metabolic complications such as diabetes and cardiovascular risks.



Learn your BMI - BMI is a measure of your weight compared to your height. BMI can help adults determine whether they are at a healthy weight.



Avoid inactivity- Every bit counts, and doing something is better than doing nothing! Do a little more each time. Once you feel comfortable, do it more often. Then you can trade activities at a moderate level for vigorous ones that take more effort. You can do moderate and vigorous activities in the same week. Use a pedometer to keep track of your steps.

Tip6: Keep track of what you are eating- Studies show that tracking all your meals, snacks, and drinks can help weight loss. Keeping track will give you an idea of your eating patterns. It also can help you see areas where you are doing well and areas where you could improve.

Drink at least 8 cups (64 ounces) of water per day. Water doesn't just flush all the toxins out of your body, but it makes you feel better and healthier.

Get adequate sleep each night (7-9 hours). Studies show that poor sleep is one of the strongest risk factors for obesity, being linked to an 89% increased risk of obesity in children, and 55% in adults.

Drink water before you start eating: Research has shown that drinking two glasses water before eating causes people to consume fewer calories.

Find a friend. Getting support is a huge part of successfully losing weight. A weight loss buddy will help you stay motivated and give you company along the way.

Fruit juice isn't as healthy as most people think either. Juice actually has a lot of sugar in it as well. If you are craving a glass of juice, drink fresh fruit juice instead of juice that has artificial flavors and coloring. It is even better if you can provide sugar which adds to the calories. Instead of drink fruit juice, eat more fruit. Fruit provides your body with much needed fiber as well as vitamins.

Exercise for epinephrine: Known as a fight or flight hormone, epinephrine drives the burning of fat and its release for energy in the body. Epinephrine can also aid in appetite suppression. Exercise is the best way to turn on epinephrine release in your body, interval training in particular cranks up epinephrine.

Watch what you drink! Drinking sugary drinks has been associated with obesity. Water is the best thirst quencher but if you really want a fizzy drink try unsweetened fruit juice or tender coconut water.

Balance your insulin: If you're overweight, there's a good chance that you're experiencing some level of insulin imbalance, resulting in excess glucose, or sugar, in your system

Set meal times and stick to them. Try to have your meals at specific times and eat them at that time. An eating pattern will help you to control what you eat and when you eat it.

Get a handle on the sweet tooth. This doesn't mean you can't have your sweets; just don't eat them as a meal. Always remember that these sweets end up adding to an area that you don't want them to add to. Don't deprive yourself either though, because then you'll eat twice as many as you should.

Take it easy on the salt and try to cut what you use in half. Salt is one of the main causes of obesity.

Chew your food at least 8 to 12 times. This adds saliva to the food that digests the sugar. When food isn't eaten properly and is just swallowed, you fill your stomach with food that isn't ready to be digested and it then does not yield the health benefits that you need.

Cut down your cortisol: Stress and cortisol go hand in hand, and cortisol and belly fat go hand in hand. Anytime you're faced with a stressful situation, your body pumps out cortisol to meet the challenge. Cortisol encourages your body to hold on to visceral fat— that spare tire around your waist— and it also drives you toward sweet and salty foods to quell the tension you feel.

Too Much Leptin Swells Your Appetite. With leptin, that means your brain starts to miss the signal that you're full. You continue to eat, and you keep gaining weight. Limit your fruit to no more than 3-4 servings and refined carbs to keep your leptin levels in check.

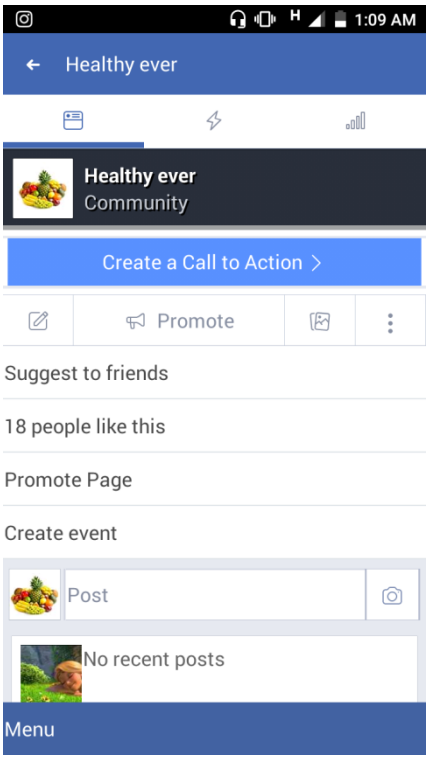
Leptin is your helpful sidekick on the weight loss journey; you want no shortage of this hormone if your goal is to drop a pant size or two. Eat a diet rich in omega-3 fatty acids and boost your intake of foods that contain Eicosapentaenoic acid (EPA), which has been shown to stimulate the production of leptin.

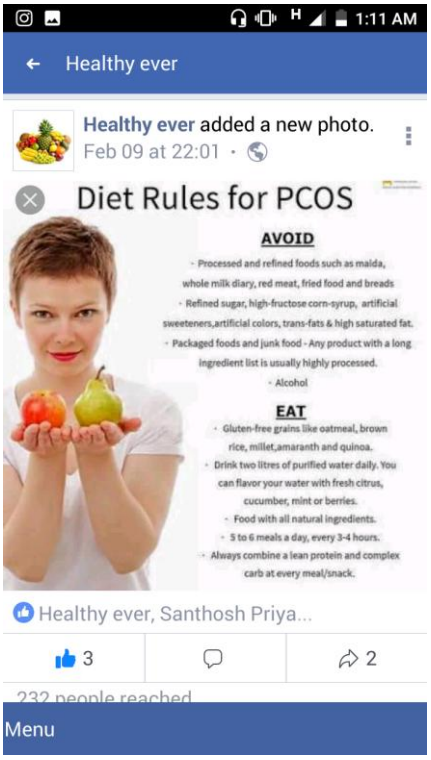
Estrogen Expands Your Fat Cells: estrogen actually helps keep you lean, when estrogen gets thrown off, though, it turns you into a weight-gain machine. Eating less fiber drives up our estrogen. Boost your fibre in your meal.

Feed your hunger hormone, ghrelin: A high protein meal lowers ghrelin levels significantly more than meals high in fat and carbohydrates. So, focus on a high-protein breakfast, such as casein and whey-free protein shakes, and veggie omelettes.

The fat burner! Adiponectin is literally the hormone that tells your body to burn fat for fuel. It's like your body's fat burning torch. Increase your adiponectin by eating magnesium rich foods like pumpkin seeds, green leafy vegetables like spinach. Try intermittent fasting to improve your adiponectin levels.

APPENDIX IV


1:09 AM
Healthy ever
Healthy ever
Community
Create a Call to Action
Promote
Suggest to friends
18 people like this
Promote Page
Create event
Post
No recent posts
Menu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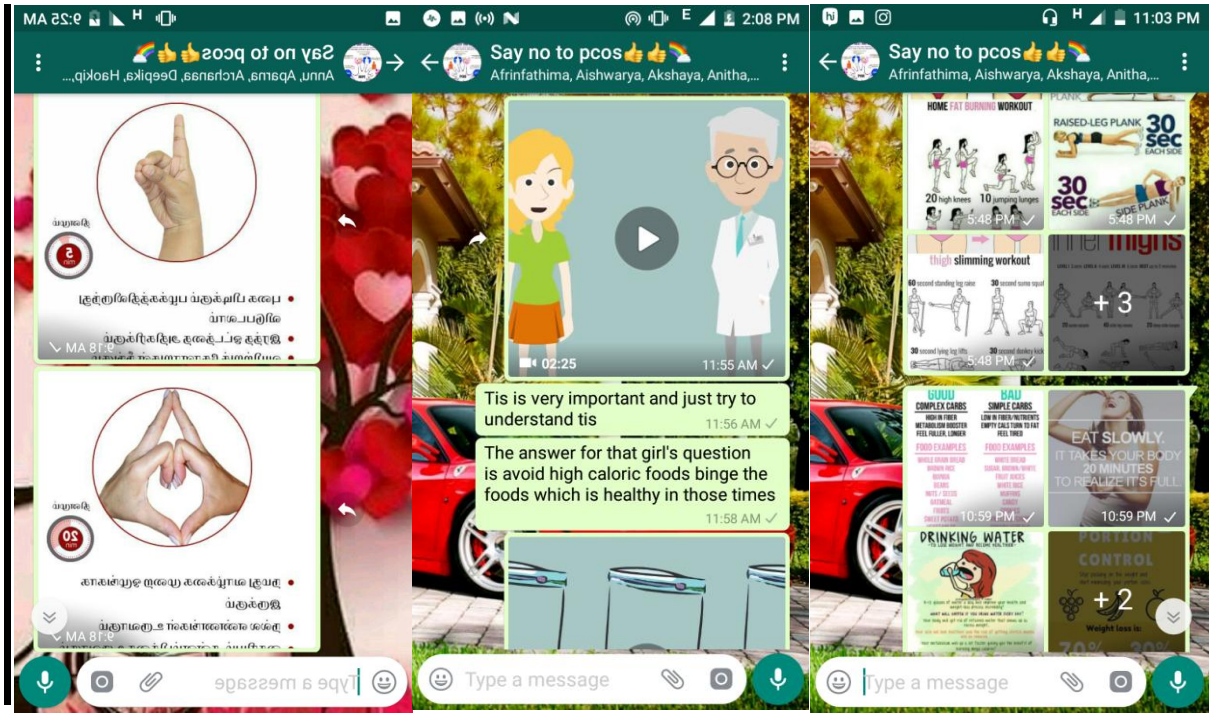
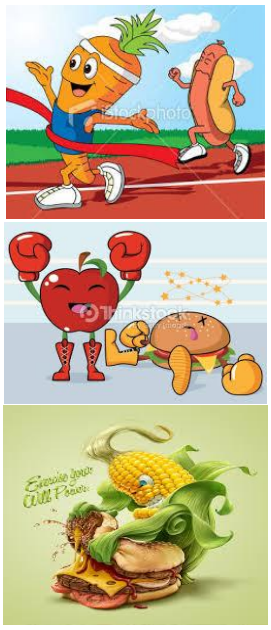
Healthy ever
Healthy ever added a new photo.
Feb 09 at 22:01
Diet Rules for PCOS
AVOID
Processed and refined foods such as malda, whole milk diary, red meat, fried food and breads
Refined sugar, high-fructose corn-syrup, artificial sweeteners,artificial colors, trans-fats & high saturated fat.
Packaged foods and junk food - Any product with a long ingredient list is usually highly processed.
Alcohol
EAT
Gluten-free grains like oatmeal, brown rice, millet,amaranth and quinoa.
Drink two litres of purified water daily. You can flavor your water with fresh citrus, cucumber, mint or berries.
Food with all natural ingredients.
5 to 6 meals a day, every 3-4 hours.
Always combine a lean protein and complex carb at every meal/snack.
Healthy ever, Santhosh Priya...
3
2
Menu


3:19 AM
agila_nutritionist
That Cause PCOS
Avoid or minimize them
High GI foods
Causes: Affects your blood sugar levels
Dairy products
Causes: Allergic reactions digestion problems
Caffeine
Causes: Increase estrogen levels and effects fertility
White sugar
Causes: Increase in sugar levels
Hydrogenated oils
Causes: Raises bad cholesterol and lowers good cholesterol
White flour and white rice
Causes: Affects digestive system and suppress immunity system
Alcohol
Causes: Worsens metabolism of sugar
Gluten grains
Causes: Digestive problems
Red meat
Liked by asopanidhi, sweet96swe and 15 others
agila_nutritionist Pcos is a hormonal syndrome which is caused due to hormonal imbalance in female which leads to great risk like metabolic disorders and affects reproductive health
FEBRUARY 8


6:04 PM
Instagram
agila_nutritionist
CELERY
BEETS
BROCCOLI
BLUEBERRIES
SALMON
WALNUTS
CHIA SEEDS
TURMERIC
GINGER
PINEAPPLES
LEAFY GREEN VEGETABLES



Factors which help in preventionof obesity



APPENDIX V

APPENDIX VI