

***The Bioactive Effect of Flaxseed on Women with
the Polycystic Ovarian Syndrome***

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Abstract

The present study aimed to investigate the effect of the active substances found in flaxseed powder on improving ovarian cysts, overcoming the symptoms and complications caused by this disease, and rebalancing the state of hormones in the body, the most important of which is the treatment of insulin resistance, lowering body weight all with the aim of desire and ambition to bring about pregnancy and childbirth in women with poly cystic ovarian syndrome (PCOS). Thirty women with PCOS, between 18 to 40 years were selected, women with PCOS were divided into 3 groups (10 woman/group) All groups were subjected to a diet low in carbohydrates and protein to reduce weight, in addition to taking the basal medications, with the exception of metformin tablets, the experiment lasted for 3 months. The results of the present study showed that ground flaxseed with the application and following of a diet low in carbohydrates and protein, all together have a significant positive effect in improving cases of polycystic ovaries, treating hormonal imbalance, regulating the occurrence of the menstrual cycle and the occurrence of pregnancy and childbearing in some women.

Introduction

Polycystic Ovary Syndrome (PCOS) is known as the most common endocrine disorder of women in reproductive ages. (***Haidari et al .,2020***)

It is a hormonal imbalance and metabolic disorder affecting about 8-13% of all women during their reproductive age. It leads to some of the major implications such as anovulation, hyperandrogenism, polycystic ovary hyperinsulinism, hirsutism, and elevated concentrations of luteinizing hormone (LH) (***Shamsi et al.,2020***).

It is a major disorder characterized by elevated levels of male hormones (androgens), menstrual irregularities ,hypertrophy ovarian Volume , acne and hirsutism. It can even cause insulin resistance, anovulation ,infertility , hyperinsulinemia and dyslipidemia in addition to risk of heart disease and type 2 of diabetes on the long run . Since PCOS is a curable disorder, it can be cured by use of natural remedies (***Haidari et al .,2020***) in recent years, increasing evidence has shown that natural plant-based products may play a role in the treatment and management of PCOS. (***Mina et al., 2020 and Lei et al., 2018***)

Flaxseed is one of the oldest crops, having been cultivated since the beginning of civilization. The Latin name of the flaxseed is *Linum usitatissimum*, which means “very useful” (***Laux, 2011***).

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Flaxseed is emerging as an important functional food ingredient because of its rich contents of α -linolenic acid (ALA, omega-3 fatty acid), lignans, and fiber. Flaxseed oil, fibers and flax lignans have potential health benefits such as in reduction of cardiovascular disease, atherosclerosis, diabetes, cancer, arthritis, osteoporosis, autoimmune and neurological disorders. Flax protein helps in the prevention and treatment of heart disease and in supporting the immune system (*Sepidarkish et al., 2019*).

Flaxseed supplementation has resulted in significant reduction in ovarian volume and number of follicles in polycystic ovaries, improvement in frequency of menstrual cycles, body weight, blood sugar and hirsutism. The positive effect of FSP could be due to its content of lignan and alpha-linolenic acid (ALA) (active compounds) which they are responsible for the reduction in testosterone, oestrogen, LH and insulin levels contributing to follicular maturation and the anti-inflammatory actions to the reduction in ovarian volume. Considering the improvement in ovarian function and menstrual cycle, Flax seed appear to be an alternative source of future drug development for PCOS (*Farzana et al., 2014*).

Therefore, the present study Possible therapeutic ability of flaxseed powder on decrease biochemical parameters especially Hyperinsulinemia, Insulin resistance, Hyperandrogenism in addition to Loss of weight and regulation of menstrual cycle and regulating ovulation hormones and estrogen, and regulating the the menstrual cycle, all with the aim of desire and ambition to bring about

pregnancy and childbirth in cases of poly cystic ovarian syndrome (PCOS) .

Chemical Analysis Of Bioactive Substances:

Chemical Composition for flaxseed and Nutrition Value.

Photo (1): Chemical composition of Flax Seed

Nutrients/bioactive compounds	Quantity/ 100 g of seed	Nutrients/bioactive compounds	Quantity/ 100 g of seed
Carbohydrates ^a	29.0 g	Biotin	6 mg
Protein	20.0 g	α -Tocopherol ^b	7 mg
Total fats	41.0 g	δ -Tocopherol ^b	10 mg
Linolenic acid	23.0 g	γ -Tocopherol ^b	552 mg
Dietary fiber	28.0 g	Calcium	236 mg
Lignans	10–2,600 mg	Copper	1 mg
Ascorbic acid	0.50 mg	Magnesium	431 mg
Thiamin	0.53 mg	Manganese	3 mg
Riboflavin	0.23 mg	Phosphorus	622 mg
Niacin	3.21 mg	Potassium	831 mg
Pyridoxin	0.61 mg	Sodium	27 mg
Pantothenic acid	0.57 mg	Zinc	4 mg
Folic acid	112 mg		

Source : Diane , 2007:Flax Counc'l of Canada

Materials and Methods

Subjects :

Flaxseed (*Linum Usitatisimum*) was obtained from the Agriculture Research Center,then it was ground .

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Methods:

Preparation of Flaxseed :

Eighteen kg of flaxseeds were purchased and milled in a local mill. They were filled in jars, each package weighed 300 g. It was distributed to patients at a rate of two packages per patient per month for 3 consecutive months.

Experimental design:

Thirty -five woman with PCOS, between 18 to 40 years were selected from the department of obstetrics /gynaecology and Radiology department, Al Qasr Al Ainy Hospital Hospital , Cairo .

Exclusion Criteria :pregnant , lactating and women with hypertension will be excluded from the samples .

Women with PCOS were divided into 3 groups (10 woman/group) All groups were subjected to a diet low in carbohydrates and protein to reduce weight, in addition to taking the basal medications, with the exception of metformin tablets,the experimant lasted for 3 months as follows:

Group (1) : control, The women had taken the basal medication in addition to metformin tablets.

Group (2) : The women had taken the basal medication exception metformin tablets .

Group (3): women were provided with flax seed powder and instructed to take orally 20 gram of flax seed powder (10g in the

morning and 10 g in the evening) with a spoon provided, in lemon juice before meals.

The used dosage were an average dosage based on the previous studies

(Farzana et al., 2014) .

Cases were followed up and communicated with their daily via mobile .

Five of the thirty-five women withdrew from the experiment due to their travel and distance from Al Qasr Al Ainy Hospital Hospital , Cairo .

Blood samples were taken from cases of polycystic ovaries before the beginning of the experiment and at the end of the experiment. The blood samples were separated and transferred to a serum for the necessary analysis .

Analysis For PCOS :

Ovulation evaluation may be broken down into types:

Hormones Tests:

These Hormonal Tests Include The Following :

Luteinizing Hormone (LH):

Luteinizing Hormone (LH) was determined according to **Sherman et al., (1976).**

Follicle Stimulating Hormone(FSH):

Follicle Stimulating Hormone(FSH)was analyzed according to **Rose et al., (2000).**

Anti-Mulirian Hormone (AMH):

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Anti-Mulirian Hormone (AMH) was estimated according to *Tobler et al.,(2015)*.

Fasting Insulin(F.Insulin):

Fasting Insulin(**F.Insulin**) was analyzed according to *Young et al.,(1972)*

Cortisol AM :

Cortisol AM was determined according to *Casals and Hanzu (2020)*

Estradiol(E₂) :

Estradiol was estimated according to *Scott et al.,(1993)*

Free Testosterone :

Free Testosterone was analyzed according to *Salameh et al.,(2010)*

Random blood sugar :

Random blood sugar was determined according to *Young et al.,(1972)*

These biochemical analysis were performed in biochemical Analysis Laboratory of El-kasr Elini Hospital .

Dietary Studies :

1- Body weight, Height and body mass index (BMI) .

Diet history including food habits was taken during an interview with patients including food likes and dislikes .

Nutrients intake :

Two types of menus were designed according to patients BMI . Daily energy and nutrients intake (e.g., protein , fat , vitamins , minerals

were calculated for all patients using food intake analysis system (FIAS) .

2-Anthropometric Measurements :

Measurements of height, weight , and body mass index .

Height was measured to the nearest 0.5 centimeter with subject standing with head , shoulder , but tocks and heels vertically aligned and bare footed.

Weight was measured to the nearest 0.1 kg with light clothing and without shoes . Body weights of all participants were recorded at the base line after 6 and 12 weeks of the following regimen .

Body mass index (BMI) was calculated according to **Mitch and Klahr,(1993)**, as the weight (kg)/height (m²). The prevalence of overweight or obesity was determined.

3- Presence of hirsutism.

4-Menstrual cycle History included age at menarche, frequency, duration and severity of menstrual flow and history of dysmenorrheal. In addition, information on history of difficulty in conception were collected (*Debra et al.,2007*).

A healthy diet to reduce weight provided for cases of polycystic ovary syndrome Regimen diets low in carbohydrates and protein presented to women with polycystic ovarian syndrome PCOS :

Provided 1500 k.calories :

(40% Carbohydrate , 20% protein and 40% fats)

The diet is divided into three meals per day (Breakfast , Lunch and Dinner)

Breakfast :

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100 g Grilled cauliflower cooked in the oven, 5 spoons of baba ghanouj salad and 100 g Cucumber slices.

or

100g Grilled falafel in the oven, 5 spoons (100g) cooked fava beans
And a green salad plate (20g onions + 50g coriander + 50g lettuce + 50g
Cucumber + 20g tomatoes + 1 tps olive oil)

or

100g of lentils soup , 60g boiled egg and a green salad plate (30g
onions + 50g coriander + 50g lettuce + 50g Cucumber + 20g tomatoes + 1
tps olive oil) .

or

100 g Koshari dish without rice, vermicelli and pasta , 60g boiled egg
And a green salad plate (20g onions + 50g coriander + 50g lettuce + 50g
Cucumber + 20g tomatoes + 1 tps olive oil) .

Between Each Meal :

Intermittent fasting which you drink warm unsweetened drinks.

Warm drinks:

Big cup of 200ml (Cinnamon with cloves or ginger with lemon or sage
with marjoram or fennel anise) .

Twenty minutes before lunch :

100g apple or 100g orange or 100g five strawberries .

Lunch :

150g fish grilled or cooked in the oven, preferably (mackerel - tuna - catfish - tilapia) , A plate of green salad and 60g three spoons of rice or grits .

Or

Vegetable soup plate (50g cabbage leaf – 50g celery – 50g green coriander - - 100g zucchini – 100g green beans) 150 g 1/4 chicken, and green salad plate .

Or

280g stuffed dish of vine leaves or cabbage or Stuffed assorted vegetables(zucchini, eggplant, bell pepper and green pepper) stuffed with(100g leafy vegetables ,50g onions ,100g minced chicken meat,30g sunflower oil) and 100g Yogurt salad with cucumber, green coriander, garlic and pickled olives .

Or

250 g dish of lentil soup with carrots and zucchini (mashed), 60g a boiled local , baladi egg and a green salad dish .

Dinner:

60g (3tps) of raw sesame or Pumpkin seeds and pulp or Sunflower seeds and pulp or almonds or walnuts with a dish of green salad with 1 tps olive oil .

A day of detox:

It is done at a rate of three times every week, after every two days of eating the previous meals.

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At Detox Day the following is addressed:

Vegetable soup two times a day and green juice (watercress, lettuce, green coriander, cucumber, mint and anise) and previous warm drinks without sugar .

Statistical analysis:

The obtained data were statistically analyzed using SPSS-PC statistical package software and the type of test is ANOVA followed by Duncale at 0.05 significant (**SAS , 2004**).

Results and Discussion

Nutritional Studies

Body Mass Index(BMI):

Results in table (1) indicated that a total of 35 woman with polycystic ovarian syndrome(PCOS) were included in the final analysis, there were married , women with PCOS who treated with oral dietary supplement of 20 g of flaxseed powder / day had the lowest mean body mass index ,this is agreement with (**Mohammadi-Sartang et al.,2018**) then followed by women who have been on a diet low in carbohydrates and protein compared to the control group at post treatment , the differences between the groups were significant and this was in agreement with(**Yuan et al and Wong et al., 2016**) .

Also, results revealed that PCOS womens who were subjected to only drug administration had the highest mean body

mass index and lowest weight loss . The decrease of body mass index (weight loss)was attributed to the active constituent of flaxseed such as adietary fiber lignan and essential fatty acid omega-3 ,phenolic compounds and vitamins which play an important role in decrease of insulin resistance ,consequently ,an increase in fat metabolism and its burn in the body leads to weight loss and decrease of body mass index .These results are agreement with (*Yari et al.,2021*)

Biochemical Analysis

1. Follicular Stimulating Hormone (FSH) , Leutinizing Hormone (LH) and Anti-Mulirian Hormone (AMH):

Analysis presented in table(2) illustrated that almost of treated groups induced increase of follicular stimulating hormone (FSH) compared to the control group ,and the control group induced the greatest increase in (FSH) was obtained by supplementation with flaxseed powder then followed by Women who have been on a diet low in carbohydrates and protein,the differences between groups were significant and these results were agreed with (*Mehrabani et al.,2012*) .

Concerning leutinizing hormone (LH) and antimullerian hormone (AMH), data analysis revealed that almost of treated groups induced decrease in (LH and AMH)compared to the control group .The greatest decrease in (LH and AMH) was obtained by supplementation with flaxseed powder compared to the other tested groups , this decrease was significant and this was agreed with

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(*Farzana et al.,2014*). The women who consumed ground flaxseed, four of them became pregnant, just as the menstrual cycle was regular for the majority of the women of this group, then followed by women who have been on a diet low in carbohydrates and protein compared to the control group and two of them became pregnant and the menstrual cycle was regular for the majority of them while the group that lost weight ,loss two of them became pregnant and had regular ,the menstrual cycle when most of them. Whereas, women in the group that took metformin did not get pregnant, with irregular menstruation.

An increase of (FSH) and the decrease of (LH and AMH) by almost of treated groups may be attributed to the good effects of flaxseed powder and red beets which they contain antioxidant properties and essential fatty acids such as omega -3 ,especially at flaxseed powder and low carbohydrate and low protein diet , all of these factors each to other resulted in hypoinsulinemia and an increase of the receptors sensitivity of the body cells to insulin hormone ,consequently ,hypoandrogenism ,increase of (FSH) hormone and decrease of (LH and AMH) hormones .These results was agreed with (*Vickova et al.,2018*) .

**3. Fasting Insulin Hormone (F.Insulin), Cortisol , Estradiol (E2),
Free Testosterone (F.Testosterone) and Glucose :**

Data presented in table (3a and 3b) illustrated that almost of treated groups induced decrease of glucose level ,insulin hormone and decrease of cortisol AM at post treatment compared to pre treatment and the differences between groups were significant These results were agreed with(**Haidari et al., 2020**) .

The greatest decrease of glucose level and insulin hormone were obtained by supplementation with flaxseed powder then followed by the group of women who have been on a diet low in carbohydrates and protein. These results were agreed with(**Haidari et al., 2020**) and these may be attributed bioactive substances such as oil, essential fatty acid especially omega -3, protein, dietary fiber, lignansand phenolic compounds, vitamins (A, C, F and E) and mineral (P, Mg, K, Na, Fe, Cu,Mn and Zn) (**Jheimbach and Port Royal ,2009**).

These essential fatty acids especially are very popular because of their antihyperglycaemic effects, Potential efficacy of omega-3 on carbohydrate metabolism and glucose homeostasis may offer unique treatment modalities for various aspects of type 2 diabetes(**Andrica et al., 2015**). **Sidika et al.,2016** found that the novel possibility that dietary PUFA may alter glucose indirectly, secondary to its effects on the aromatic aminoacids (AA) metabolism. Alternatively, alterations in AA metabolism can be the consequence of the PUFA-induced changes in insulin sensitivity ,consequently ,reduction in blood glucose level . The reduction in blood glucose stimulated the release of cortisol as a counter

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regulatory mechanism (*Olumese and Oboh, 2016*). The correlation studies revealed a weak relationship between glucose and cortisol. Cortisol, a stress hormone has been reported to increase gluconeogenesis, decrease peripheral glucose utilization and increase the availability of fuel substances by the mobilization of glucose, free fatty acids, and amino acids from endogenous stores. The results from this study showed that cortisol correlated positively with insulin (*Olumese and Oboh, 2016*).

Concerning estrogen hormone and free testosterone hormone, the analysis revealed that almost of supplemented groups induced increase of estrogen hormone level compared to the control group and decrease of free testosterone level at post treatment compared to pretreatment.

The greatest decrease of free testosterone and increase of estrogen level was obtained by supplementation with flaxseed powder then followed by women who only underwent a low-protein, low-carbohydrate diet with the medication compared to the control group, the differences between groups were significant and these results were agreed with (*Kuranova et al., 2020*).

The positive effect of flaxseed powder (FSP) could be due to reduction in testosterone, estrogen, LH and insulin levels contributing to follicular maturation and the anti-inflammatory actions to the reduction in ovarian volume (*Farzana et al., 2014 and Kuranova et al., 2020*).

4. Thyroid Stimulating Hormone (TSH), Triiodothyronine (T3) and Thyroxine (T4) :

Results in table (4a) and table (4b) showed that almost of treated groups induced increase within normal range (TSH) hormone, (T3) and (T4) at post treatment compared to pre treatment between groups especially control group and the differences between groups were significant. The greatest increase of TSH, T3 and T4 hormones were obtained by supplementation with flaxseed powder then followed by women who have been low carbohydrate low protein diet compared to the control group, this was agreed with **(Faris et al., 2020)**.

The greatest decrease of TSH, T3 and T4 was obtained by control group. The increase induced in TSH, T3 and T4 hormones in all treated groups may be attributed to their antioxidant properties of their bioactive constituents. In addition, the decrease in TSH, T3 and T4 may be interpreted as adverse metformin medication impact on thyroid gland. Since, adding flaxseed, intermittent fasting and low carbohydrate low protein diet caused a significant decrease of testosterone, increased estradiol concentration, also each of growth hormone and TSH hormones increased significantly **(Chiofalo et al., 2017)**.

As decrease in genomic DNA concentration with flaxseed supplementation may be due to one of the mechanisms by which phytoestrogens may influence reproductive physiology that involve inhibition of enzymes essential for DNA replication. These results are agreement with **(Yousif, 2019)**.

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In conclusion, the results of the present study showed that flaxseed powder improved body mass index (BMI), follicular stimulating hormone (FSH), Leutinizing Hormone (LH) , anti-mulirian hormone (AMH), insulin hormone, cortisol, estradiol(E₂) , free testosterone, glucose, and thyroid gland hormones in women who have been on alow carbohydrate low protein diet . The flaxseed powder have given better results in improving the cases of polycystic ovaries, achieving a balance in hormones and producing pregnancy and childbearing compared to the rest of the experiment groups.

Table (1) : Effect of Flaxseed and Diet Regimen between all Groups (pre and post) on Body Mass Index(Weight Loss) .

Group		BMI			
Pre	Control	36.1	±	.22	a
	Diet	36.0	±	.21	a
	F.seed	35.0	±	.21	b
Post	Control	31.4	±	.25	a
	Diet	28.5	±	.23	b
	F.seed	24.2	±	.23	d

Data expressed as mean ± SD, significant differences at P < 0.05
No significant differences between the values had the same letter in each column .

Table (2) : Effect of Flaxseed and Diet Regimen between all Groups (pre and post) on Ovulation Hormones , Follicular

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Stimulating Hormone (FSH) , Leutinizing Hormone (LH)
and Anti-Mulirian Hormone (AMH).

Group		FSH	LH	AMH
Pre	Control	4.1 ± .16 ^a	8.1 ± .18 ^a	6.1 ± .23 ^a
	Diet	4.2 ± .18 ^a	8.1 ± .20 ^a	6.0 ± .25 ^a
	F.seed	4.0 ± .12 ^a	5.2 ± .23 ^c	4.2 ± .24 ^b
Post	Control	5.0 ± .21 ^d	5.7 ± .23 ^a	3.3 ± .16 ^a
	Diet	7.0 ± .22 ^c	4.0 ± .20 ^b	3.0 ± .21 ^b
	F.seed	9.0 ± .20 ^a	2.5 ± .19 ^c	2.6 ± .21 ^d

Data expressed as mean ± SD, significant differences at P < 0.05
No significant differences between the values had the same letter in each column .

Table (3a) : Effect of Flaxseed and Diet Regimen between all Groups (pre and post) on Fasting Insulin Hormone(F.Insulin), Cortisol and Estradiol (E2).

Group		F.Insulin MIU/mL	Cortisol AM µg/dL	E2 Pg/mL
Pre	Control	29.0 ± .20 ^a	22.1 ± .18 ^b	87.1 ± .21 ^b
	Diet	29.0 ± .20 ^a	24.0 ± .24 ^c	86.1 ± .19 ^c
	F.seed	29.0 ± .17 ^a	25.0 ± .21 ^a	90.1 ± .20 ^a
Post	Control	19.9 ± .21 ^a	14.9 ± .19 ^a	174.9 ± .16 ^c
	Diet	15.9 ± .21 ^b	14.0 ± .20 ^b	223.7 ± .22 ^b
	F.seed	11.5 ± .23 ^c	12.0 ± .25 ^c	230.1 ± .19 ^a

Data expressed as mean ± SD, significant differences at P < 0.05
No significant differences between the values had the same letter in each column .

Table (3b) : Effect of Flaxseed and Diet Regimen between all Groups (pre and post) on Free Testosterone (F.Testosterone) and Glucose .

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Group		F.Testosterone Pg/mL			Glucose mg/dL		
Pre	Control	26.0	± .20	a	124.0	± .19	a
	Diet	26.1	± .23	a	120.0	± .18	b
	F.seed	22.0	± .23	b	120.0	± .18	b
Post	Control	19.9	± .20	a	105.0	± .16	a
	Diet	12.3	± .23	b	92.9	± .16	b
	F.seed	7.3	± .20	c	91.1	± .21	c

Data expressed as mean ± SD, significant differences at P < 0.05
No significant differences between the values had the same letter in each column .

Table (4) : Effect Of Flaxseed And Diet Regimen Between All Groups
(pre and post) On Thyroid Gland Analysis (Thyroid
Stimulating Hormone(TSH), Triiodothyronine (T3) and
Thyroxine(T4) .

Group		TSH µIU/mL			T3 Pg/mL			T4 ng/dL		
Pre	Control	2.6	± .15	a	2.2	± .24	ba	1.1	± .22	ba
	Diet	2.4	± .10	b	2.3	± .16	a	1.2	± .22	a
	F.seed	1.3	± .21	c	2.0	± .20	c	.8	± .24	b
Post	Control	2.8	± .19	d	2.7	± .20	d	1.3	± .16	d
	Diet	3.1	± .16	c	3.0	± .17	c	1.5	± .15	ca
	F.seed	3.3	± .20	b	3.2	± .22	b	1.7	± .21	a

Data expressed as mean ± SD, significant differences at P < 0.05
No significant differences between the values had the same letter in each column .

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**التأثير الحيوى لبذر الكتان على النساء المصابات بمتلازمة
تكيس المبايض**

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الملخص العربى

استهدفت الدراسة الحالية معرفة تأثير المواد الفعالة الموجودة في بذر الكتان المطحون على تحسين حالات النساء المصابات بمتلازمة تكيس المبايض (PCOS) ، أى متلازمة خلل الهرمونات الذى يترتب عليه خلل فى عملية التمثيل الغذائى وخلل فى حرق الدهون و حدوث الالتهابات بالجسم وتأخر الحمل وعدم انتظام الدورة الشهرية ، والتغلب على الأعراض والمضاعفات التي يسببها هذا المرض ، وإعادة التوازن إلى حالة الهرمونات في الجسم ، وأهمها علاج مقاومة الأنسولين وخفض وزن الجسم بهدف تحقيق الحمل والإنجاب عند هؤلاء النساء.

تم اختيار خمسة وثلاثون امرأة مصابة بمتلازمة تكيس المبايض ، تتراوح أعمارهن بين ١٨ إلى ٤٠ عامًا ، وتم تقسيم النساء المصابات بمتلازمة تكيس المبايض إلى ٣ مجموعات (١٠ نساء / مجموعة). استمرت التجربة لمدة ٣ أشهر خضعت المجموعات الثلاث إلى اتباع نظام غذائى منخفض النشويات والبروتين مع تطبيق صيام متقطع بجانب تناول الأدوية الطبية جميعها ما عدا عقار الميتفورمين باستثناء المجموعة الأولى فقط (المجموعة الضابطة) هى المجموعة الوحيدة فقط التي تناولت أقراص الميتفورمين ضمن العلاج الدوائى . وقد أظهرت نتائج الدراسة الحالية أن تناول ٢٠ جم من بذر الكتان المطحون مع تطبيق واتباع نظام غذائى منخفض النشويات والبروتينات لهما تأثير إيجابى كبير فى تحسين حالات تكيس المبايض ، وعلاج خلل الهرمونات ، وتنظيم حدوث الدورة الشهرية. وقد حدثت بعض حالات الحمل والإنجاب للمرة الأولى عند بعض النساء بنسبة أعلى وأفضل من باقى المجموعات جميعها وكان له أفضل الأثر فى علاج بعض هذه الحالات بعد العديد من المحاولات الطبية السابقة التي كانت قد استمرت ستة أعوام دون جدوى .

الكلمات المفتاحية: متلازمة تكيس المبايض (PCOS) ، بذر الكتان والخصوبة ، مقاومة الإنسولين والتكيس ، السمنة ، الكورتيزول والتكيس ، هرمونات الغدة الدرقية والتكيس ، مؤشر كتلة الجسم (BMI) ، الهرمونات المسؤولة عن التبويض ، سكر الدم العشوائى.