

***The Bioactive Effect of Red Beetroot on Women
with the Polycystic Ovarian Syndrome(PCOS)***

Shaimaa SH. Matar

*Nutri. & Food Sci. Dept., Faculty of Home Economics, Helwan
University, Egypt*

Ahmed A. Farrag

*Nutri. & Food Sci. Dept., Faculty of Home Economics, Helwan
University, Egypt*

Samar M. Hafez

*Pharmacology Dept. Faculty of Veterinary Medicine, Cairo
University, Egypt*

Radwa M. Fahmy

*Obstetrics and Gynecology. Dept., Faculty of Medicine (Kasr
Alainy), Cairo University, Egypt*

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

Abstract

The present study aimed to investigate the effect of the active substances found in dried ground red beets 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 red beets 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

Red beetroot (*Beta vulgaris*ssp. *vulgaris* L.) is a herbaceous biennial (flowering in the second year of growth) or, rarely, perennial plant up to 120 cm (up to 200 cm in second year) in height, but cultivated forms are mostly biennial. The roots of the cultivated forms are dark red, white, or yellow, and moderately to strongly swollen and fleshy or brown, fibrous, sometimes swollen and woody in the wild subspecies (**Ceclu and Nistor, 2020**).

Beetroot is rich in several other bioactive compounds that may provide health benefits, particularly for disorders characterised by chronic inflammation. Also, recent research has provided compelling evidence that beetroot ingestion offers beneficial physiological effects that may translate to improved clinical outcomes for several pathologies, such as hypertension, atherosclerosis, type 2 diabetes and dementia (**Gilchrist et al., 2013**). Red beetroot has anti-glycaemic effect could be attributed to one of the many antioxidant compounds contained in beetroot particularly alpha-lipoic acid, which improves insulin sensitivity (**Megan, 2016**). Also, betanin the bioactive compound of redbeetroot caused low ovarian cysts with a high incidence of ovarian primary, antral, graafian follicles and corpus luteum. The plasma glucose, cholesterol, LDL and LH levels were found to be diminished the cases of PCOS whereas plasma HDL and FSH levels were increased (**Montazeri et al., 2018**).

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

Betanin exhibits an antioxidant activity that is ten times higher than tocopherol. Betalains, especially betacyanins, play an important role in human health because of their pharmacological activities as an antioxidant, anti-cancer, antiinflammatory, hepatoprotective (**Georgiev et al.,2010**), anti-lipidemic and antimicrobial agent. They inhibit cervical ovarian and bladder cancer cells in vitro, and can also inhibit the proliferation of cells in human tumors(**Neha et al.,2018**).

Therefore,the present study Possible therapeutic ability of red beetroot 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 Composition Of Raw And Dried Redbeetroot Per 100/gm :

		Raw	Dried
Water	g	87.58	11
Energy	kcal	43	63
Protein,	g	1.61	1.61
Total fats	g	0.17	0.17
Carbohydrate	g	9.56	9.56
Fiber	g	2.8	2.8
Sugars	g	6.76	8.2
Calcium	mg	16	16
Iron,	mg	0.8	0.8
Magnesium	mg	23	23
Phosphorus	mg	40	40
Potassium	mg	325	325
Sodium,	mg	78	81
Zinc,	mg	0.35	0.35
Vitamin C,	mg	4.9	2.1
Thiamin,	mg	0.031	0.026
Riboflavin,	mg	0.04	0.04
Niacin,	mg	0.334	0.334
Folate,	µg	109	89
Total phenolic		255	238
Total flavonoid		260	262

(Mirmiran et al.,2020)

Bioactive Substances Of Red Beetroot :

Bioactive substances of red beetroot .

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

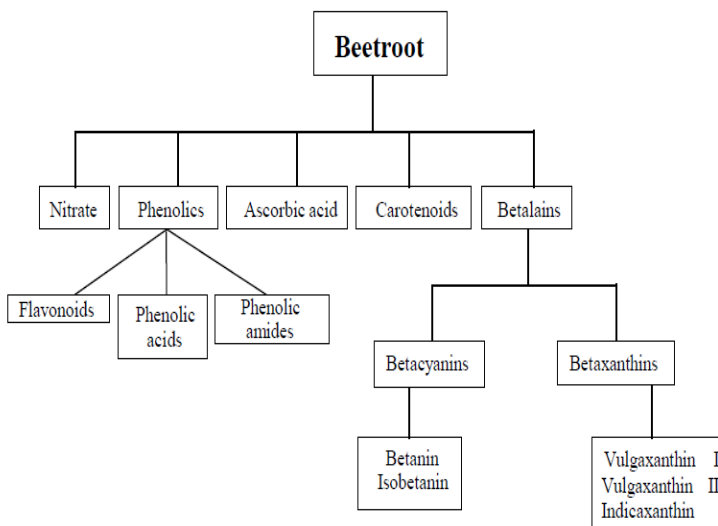


Photo (1):

Bioactive substances of red beetroot according to (*Ninfali and Angelino,2013., Georgiev et al.,2010 and Kujala et al.,2002*)

Materials and Methods

Red beetroot (*Beta vulgaris*) was obtained from the Agriculture Research Center and it was dried then it was ground .

Preparation of Red Beetroot :

One hundred and twenty kg of red beets were purchased from the Agriculture Research Center and they were soaked, washed well and cleaned, then they were cut into thin slices such as

crunchy potato chips, then they were dried in the Solar Energy Center at the National

Research Center in Dokki, Cairo, and they were packed in jars, one package weighing 300 gm, and it was distributed to patients at a rate One package for each patient every 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 experiment 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 red beetroot powder and instructed to take orally 10 gram of red beetroot powder (5 gm in the morning and 5 gm in the evening) with a spoon provided, in Lemon juice before meals (*Gilchrist et al.,2013*) .

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

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):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 ,(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 :

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

1-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

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

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 :

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, 5spoons (100g) cooked fava beans And agreen salad plate(20g onions+50g coriander +50g lettuce+50g Cucumber+20g tomatoes +1 tps olive oil)

or

Egyptian J. of Nutrition Vol. XXXVI No. 3 (2021)

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

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

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 adish 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.

At Detox Day the following is addressed:

Vegetable soup two twice aday 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 30 women with polycystic ovarian syndrome(PCOS) were included in the final analysis,there were married ,women with PCOS who treated with oral dietary supplement of (10 g redbeets)powder / day had the lowest mean body mass index then followed by women treated with only low carbohydrate,protein diet and women with diet regime compared to women who were subjected to only drug administration (the control group) had the highest mean body mass index and lowest weight loss,the differences between the groups were significant at post treatment and this was in agreement with (***Yari et al.,2021***).

The decrease of body mass index (weight loss)was attributed to the active constituent of redbeet powder such as adietary fiber ,phenolic compounds many antioxidant compounds contained in beetroot particularly alpha-lipoic acid, which improves insulin sensitivity (***Megan, 2016***). Also, betanin the bioactive compound of red beetroot caused low ovarian cysts and low plasma glucose, cholesterol, LDL (***Montazeri et al., 2018***) . and

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

vitamins especially B-Vitamins which play an important role in so many chemical reactions in the body including hormone regulation, fat and sugar metabolism, and other functions that help the body maintain homeostasis (*Thatcher, 2000*), also they 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 , the differences were significant between groups especially at post treatment ,and the group induced the greatest increase in (FSH) was obtained by supplementation with red beetroot powder then followed by the group only treated with low carbohydrate low protein diet compared to the control group ,the differences were significant and this was in agreement with (*Megan, 2016*) .

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 red beetroot powder compared to the other

tested groups and this decrease were significant . The women who consumed red beetroot powder , two of them became pregnant, just as the menstrual cycle was regular for the majority of the women of this group, then followed by the women who only treated with low carbohydrate low protein diet , two of them became pregnant and the menstrual cycle was regular for the majority 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 red beetroot powder and low carbohydrate low protein diet which they contain antioxidant properties compounds contained in beetroot particularly alpha-lipoic acid, which improves insulin sensitivity and these results were in agreement with (**Megan, 2016**). Also, betanin the bioactive compound of redbeetroot caused low ovarian cysts with a high incidence of ovarian primary, antral, graafian follicles and corpus luteum. The plasma glucose, was found to be diminished the cases of PCOS whereas FSH levels were increased .

Betanin exhibits an antioxidant activity that is ten times higher than tocopherol. Betalains, especially betacyanins, play an important role in human health and , 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 and these results were agreed with(**Montazeri et al., 2018**) .

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

Data presented in two 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 .

The greatest decrease of glucose level , insulin hormone and cortisol hormone at post treatment were obtained by supplementation with redbeetroot powder then followed by diet group(women who only underwent a low-protein, low-carbohydrate meal) compared to the control group and this decrease was significant , these results are agreement with (*Haidari et al., 2020*) and these may be attributed to bioactive compounds of plant species have shown that increasing levels of anthocyanins, flavonoids (*Farid et al.,2015*).These polyphenols are very popular because of their antihyperglycaemic effects, safety and non side-effects. Potential efficacy of polyphenols on carbohydrate metabolism and glucose homeostasis may offer unique treatment modalities for various aspects of type 2 diabetes(*Andrica et al., 2015*). These includes inhibition of α -amylase and α -glucosidase, increase in paraoxonase 1 (PON1) activity, modification of intracellular signal transduction which is a major mechanism of reducing blood glucose by foods (*Uchida-Maruki et al.,2015*).The reduction in blood glucose stimulated the release of cortisol as a counter 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.

The hypoglycaemic activity of beetroot juice as clearly established by this study may not be dependent on insulin secretion. The possible mechanisms could include inhibition of carbohydrate digestion and glucose absorption in the intestine, and the modulation of glucose release from the liver. (*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 and decrease of free testosterone level at post treatment compared to the control group .

The greatest decrease at post treatment of free testosterone and increase of estrogen level were obtained by supplementation with redbeets then followed by women who only underwent a low-protein, low-carbohydrate meal compared to the control group and these differences were significant ,these results were in agreement with (*Haidari et al., 2020*) .

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

Data presented in table (4) illustrated that the greatest increase of TSH, T3 and T4 hormones were obtained by

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

supplementation with redbeets then followed by low carbohydrate ,low protein meal compared to the control group ,the differences at post treatment between experimental groups were significant . 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 since,adding redbeets and low carbohydrate low protein meal caused a significant decrease of testosterone, increased estradiol concentration, also each of growth hormone and TSH hormones increased significantly , As decrease in genomic DNA concentration with redbeets supplementation may due to one of the mechanisms by which phytoestrogens may influence reproductive physiology that involve in inhibition of enzymes essential for DNA replication.These results are agreement with **(Yousif ,2019)** .

Also these results were agreement with **(Zhang et al., 2019)**.They found that low carbohydrate low protein meal treatment in women with PCOS has significantly improved BMI, lipid levels (TC,and LDL-C), HOMA-IR, FSH, SHBG and thyroid gland functions ,and this result was agreement with**(Diana, 2017)** ,the results support the hypothesis that an increased intake of foods high in nitrate over 250 g carrots or beetroot 250 g/day is a risk factor for the *de novo* development of hypothyroidism .The decrease in TSH,T3 and T4 in the control group may be interpreted as adverse metformin medication impact on thyroid gland **(Yousif , 2019)**.

In conclusion, the results of the present study showed that ground red beets 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 ground red beets 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 Red Beetroot 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
	R.Beet	36.0	±	.17	a
Post	Control	31.4	±	.25	a
	Diet	28.5	±	.23	b
	R.Beet	26.8	±	.24	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 (2) :Effect of Red Beetroot and Diet Regimen between all Groups (pre and post) on Ovulation Hormones , Follicular 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
	R.Beet	4.1	± .18 ^a	7.6	± .13 ^b	4.4	± .15 ^b

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

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
	R.Beet	7.6 ± .23 ^b	4.0 ± .16 ^b	2.4 ± .12 ^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 (3a) :Effect of Red Beetroot 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
	R.Beet	27.9 ± .19 ^b	25.0 ± .14 ^a	79.0 ± .23 ^d
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
	R.Beet	8.7 ± .19 ^d	9.7 ± .12 ^d	150.9 ± .17 ^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 (3b) :Effect of Red Beetroot and Diet Regimen between all Groups (pre and post) on Free Testosterone (F.Testosterone) and Glucose .

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

Egyptian J. of Nutrition Vol. XXXVI No. 3 (2021)

	R.Beet	22.0	±	.17	^b	118.0	±	.24	^c
Post	Control	19.9	±	.20	^a	105.0	±	.16	^a
	Diet	12.3	±	.23	^b	92.9	±	.16	^b
	R.Beet	5.0	±	.16	^d	86.0	±	.20	^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 (4) :Effect of Red Beetroot 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
	R.Beet	1.1 ± .16 ^d	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}
	R.Beet	3.9 ± .17 ^a	3.6 ± .22 ^a	1.6 ± .22 ^{ba}

Data expressed as mean ± SD, significant differences at P < 0.05

No significant differences between the values had the same letter in each column .

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

References

Andrica, F., Serban, M.C., Timar, R.,(2015) :

Polyphenols-rich natural products for treatment of diabetes.
Curr Med chem.; 22(1):14-22

Casals G, Hanzu FA.(2020):

Cortisol Measurements in Cushing's Syndrome:
Immunoassay or Mass Spectrometry? Ann Lab
Med.;40(4):285-296.

Ceclu. L and Nistor. O.Viorela .,(2020):

Red Beetroot: Composition and Health Effects - A Review
Nutritional Medicine and Diet Care. J Nutri Med Diet Care,
6:043 ,Chemical Studies 6: 3190-3194.

**Debra, A. ,Nowak, RN., BSNa, Denise ,C., Snyder, MS., RDa, Ann
J. Brown, MD., MHSb., Demark-Wahnefried, W.,(2007):**

The Effect of Flaxseed Supplementation on Hormonal Levels
Associated with Polycystic Ovarian Syndrome: A Case Study.,

NIH Public Access, *Curr Top Nutraceutical Res.*; 5(4): 177–181

Diana V Artene,.(2017):

Beetroot juice increases the risk of thyroid nodules and hypothyroidism in breast cancer patients. *J Nutr Food, Sci*, 7:1

Farid, H.E.A., EL-Sayed, S.M., Abozid ,M.M.,(2015):

Pumpkin and Sunflower Seeds Attenuate Hyperglycemia and Protect Liver in Alloxan-Induced Diabetic Rats. *Research Journal of Pharma-ceutical, Biological and Chemical Sciences*; 6(5): 1269-1279

Georgiev, V.G.; Weber, J.; Kneschke, E.M.; Denev, P.N.; Bley, T.; Pavlov, A.I.(2010):

Antioxidant activity and phenolic content of betalain extracts from intact plants and hairy root cultures of the red beetroot *Beta vulgaris* cv. Detroit dark red. *Plant Foods Hum. Nutr.*, 65, 105–111.

Gilchrist, M.; Winyard, P.G.; Fulford, J.; Anning, C.; Shore, A.C.; Benjamin, N.,(2013):

Dietary nitrate supplementation improves reaction time in type 2 diabetes: Development and application of a novel nitrate-depleted beetroot juice placebo. *Nitric Oxide*, 40, 67–74.

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

**Haidari,F., Banaei-Jahromi,N., Zakerkish,M., and Ahmadi, K.,
(2020):**

The effects of flaxseed supplementation on metabolic status
in women with polycysticovary syndrome: a randomized open-
labeled controlled clinical trial . *Nutrition Journal* 19:8

**Kujala, T.S.; Vienola, M.S.; Klika, K.D.; Loponen, J.M.; Pihlaja, K.(
2002):**

Betalain and phenolic compositions of four beetroot (*Beta
vulgaris*) cultivars. *Eur. Food. Res. Technol.*, 214, 505–510.

Megan, W., (2016):

Beetroot: health benefits, nutritional information. *Medical
News Today*.

**Mirmiran. P., Houshialsadat .Z., Gaeini .Z., Bahadoran. Z and
Azizi. F.,(2020):**

Functional properties of beetroot (*Beta vulgaris*) in
management of cardio-metabolic diseases., *Nutrition &
Metabolism* , 17:3

Mitch ,W.E. and Klahr ,S.(1993):

Nutritional requirements of hemodialysis patients ,*Nutrition
and the kidney* 2^{ed} .chap8,pp.,189-94

Montazeri .H., Safavi . M., Ebrahim-Habibi .H., Yaghmaei . P.,(2018):

The effects of betanin of beetroot in polycystic ovary syndrome induced rat .Journal of Medicinal Plants 17(68):74-81

Neha P, Jain SK, Jain NK, Jain HK, Mittal HK (2018) :

Chemical and functional properties of Beetroot (*Beta vulgaris* L.) for product development: A review. International Journal of

Ninfali, P.; Angelino, D.(2013):

Nutritional and functional potential of *Beta vulgaris cicla* and *rubra*. *Fitoterapia*, 89, 188–199.

Olumese ,F.E and Oboh HA.,(2016):

Effects of Daily Intake of Beetroot Juice on Blood Glucose and Hormones in Young Healthy Subjects . Nig. Qt J. Hosp. Med. Vol. 26(2)

Rose MP, Gaines Das RE, Balen AH.(2000):

Definition and measurement of follicle stimulating hormone. Endocr Rev. Feb;21(1):5–22.

Salameh W.A., Redor-Goldman M.M., Clarke N.J., Reitz R.E., Caulfield M.P. (2010):

Validation of a total testosterone assay using high-turbulence liquid chromatography tandem mass spectrometry: total and free testosterone reference ranges. *Steroids*.;75:169–175.

**Shaimaa SH. Matar , Ahmed A. Farrag, Samar M. Hafez
and Radwa M. Fahmy**

**Scott RT Jr, Illions EH, Kost ER, Dellinger C, Hofmann GE, Navot
D.(1993):**

Evaluation of the significance of the estradiol response during
the clomiphene citrate challenge test. *Fertil Steril*;60(2):242–6.

Sherman BM, West JH, Korenman SG. (1976):

The menopausal transition: analysis of LH, FSH, estradiol,
and progesterone concentrations during menstrual cycles of
older women. *J Clin Endocrinol Metab.*;42:629–36.

Thatcher .S ., (2000):

PCOS: TheHidden Epidemic. Perspective Press. Indianapolis.

**Tobler KJ, Shoham G, Christianson MS, Zhao Y, Leong M,
Shoham Z.(2015):**

Use of anti-Müllerian hormone for testing ovarian reserve: a
survey of 796 infertility clinics worldwide.*J Assist Reprod
Genet.*;32(10):1441–1448.

Uchida-Maruki, H., Inagaki, H., Ito, R., Kurita I, Sai M,Ito, T.,(2015) :

Piceatannol Lowers the Blood Glucose Level in Diabetic Mice.
Biol. Pharm. Bull.; 38: 629–633

**Yari,z.,Naser-Nakhaee,z.,Shahrbabak,E.K.,Cheraghpour,M.,Heda
yati,M. etal.,(2021):**

Combination therapy of flaxseed and hesperidin enhances the
effectiveness of lifestyle modification in cardiovascular risk

Egyptian J. of Nutrition Vol. XXXVI No. 3 (2021)

control in prediabetes: a randomized controlled trial
,Diabetology & Metabolic Syndrome, 13(1)

Young.D.S., (1972):

Clin.Chem.18(10).

Yousif, A. N., (2019):

Effect of Flaxseed on some hormonal profile and genomic DNA concentration in Karadi lambs. International Conference on Agricultural Sciences .IOP Conf. Series: Earth and Environmental Science ,388 ,012035

Zhang ., Yang Zheng , Yanan Guo , and Zhiwen Lai.,(2019) :

Review Article,The Effect of Low Carbohydrate Diet on Polycystic Ovary Syndrome:A Meta-Analysis of Randomized Controlled Trials Chongqing Medical University, No.1,Medical College Road,Yuzhong District, Chongqing International Journal of Endocrinology.

SAS., (2004):

Statistical analysis system ,SAS users Guide :statics,SAS intitute Inc,Editors,Cary,N.C.

**التأثير الحيوى للبنجر الأحمر على النساء المصابات بمتلازمة
تكيس المبايض**

شيماء شعبان مطر

قسم التغذية وعلوم الأطعمة – كلية الاقتصاد المنزلى – جامعة حلوان

أحمد عوض فراج

قسم التغذية وعلوم الأطعمة – كلية الاقتصاد المنزلى – جامعة حلوان

سمر منير حافظ

قسم الصيدلة – كلية الطب البيطرى – جامعة القاهرة

رضوى محمد فهمى

قسم النساء والتوليد – كلية طب القصر العينى – جامعة القاهرة

الملخص

استهدفت الدراسة الحالية معرفة تأثير المواد الفعالة الموجودة في البنجر الأحمر المجفف 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 وحدوث الالتهابات بالجسم وتأخر الحمل وعدم انتظام الدورة الشهرية ، والتغلب على الأعراض والمضاعفات التى يسببها هذا

المرض ، وإعادة التوازن إلى حالة الهرمونات في الجسم ، وأهمها علاج مقاومة الإنسولين 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 غذائي منخفض النشويات والبروتين مع تطبيق صيام متقطع بجانب تناول الأدوية الطبية جميعها ما عدا عقار الميتفورمين باستثناء المجموعة الأولى فقط (المجموعة الضابطة) هي المجموعة الوحيدة فقط التي تناولت أقراص الميتفورمين ضمن العلاج الدوائي . وقد أظهرت نتائج الدراسة الحالية أن البنجر الأحمر المطحون مع تطبيق واتباع نظام غذائي منخفض النشويات والبروتينات لهما تأثير إيجابي كبير في تحسين حالات تكيس المبايض ، وعلاج خلل الهرمونات ، وتنظيم حدوث الدورة الشهرية. وقد حدثت بعض حالات الحمل والإنجاب للمرة الأولى عند بعض النساء بعد العديد من المحاولات الطبية السابقة التي كانت قد استمرت ستة أعوام دون جدوى .