The effect of intake black mulberry fruits (*Morus Nigra, L.*) and its leaves powder on improving Polycystic ovary syndrome (PCOS) in adult females

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Abstract

Polycystic ovary syndrome (PCOS) is one of the most common causes of anovulation, causing a hormonal imbalance that affects ovulation. Complementary medicine (CM) and dietary therapy have an important effect treatment for PCOS, this study aims to evaluate the effects of consuming black mulberry (*Morus nigra L.*) fruits and leaf powder on improving polycystic ovary conditions in adult females. The sample was 45 adult females with polycystic ovaries, their age 20±8 years, were divided into three groups, 15 adult females in all groups, first group intake black mulberry fruits by (50g/day), second group intake aqueous extract leaves powder of black mulberry by (10g/day) and third group intake black mulberry fruits and aqueous extract leaves powder by (25g and 5g/day) respectively, the dietary intervention was for 6 months. The study used tools such as personal and socioeconomic data, food habits, diet history, 24 recall, and clinical signs. Besides the chemical analysis, total phenolic compounds (TPC) and total anthocyanin content were determined for black mulberry and its leaves, in addition to biochemical analyses were performed. The important results were found that black mulberry leaves contain a higher percentage of protein, carbohydrates, fats, fiber, TPC, and antioxidant activity than black mulberry fruits, while black mulberry are superior to their leaves in total anthocyanin. The average intake of anthocyanins and total phenolic intake was higher for the first group than second and third groups. A noticeable improvement in some clinical signs for the skin, hair and face of the three groups after the nutritional intervention, whereas an improvement in the level of sex hormones for the three groups after dietary intervention, while the third group recorded a significant improvement in Luteinizing hormone (LH) and follicle-stimulating

hormone (FSH), compared to the other groups, while the first group was better in Testosterone and Progesterone compared to the other two groups. Besides, there were no significant pre and post intervention for three groups in LDL and cholesterol, but there were significant for three groups in insulin, Triglycerides, and HDL at P<0.05. **In conclusion**, increments for intake of black mulberry and their leaves helps improve cases of polycystic ovary syndrome in women, this effect may be attributed to their high concentration of bioactive compounds, particularly antioxidants**.**

Keywords: Black mulberry, Mulberry leaves, Polycystic ovary syndrome, Dietary Intervention, Adult females.

تأثير تناول ثمار التوت الاسود و مسحوق أوراقه علي تحسين متلازمه تكيس المبايض لدي الاناث البالغات

الملخص

متلازمـة تكيس المبايض (PCOS) مـن أكثر أسباب انقطـاع الإباضة شيوعًا، فهـي تسبب اختلالاً هرمونيًا يؤثر على الإباضة. الطب التكميلي (CM) والعلاج الغذائي لهما تأثير مهم في علاج متلازمة تكيس المبايض. تهدف الدراسة إلى معرفة تأثير تناول ثمار التوت الأسود ومسحوق أوراقه على تحسين متلازمه تكيس المبايض عند الإناث البالغات. تكونت العينة من ٤٥ أنثى بالغة تعاني من تكيس المبايض، وأعمارهن ٢٠ ± ٨ سنوات، وتم تقسيم العينات إلى ثلاث مجموعات، ١٥ أنثى بالغة في جميع المجموعات، المجموعة الأولى تناولت ثمار التوت الأسود بمقدار (٥٠ جرام/ يوم) و المجموعـة الثانيـه تناولت مستخلص مائي لمسحوق أوراق التوت الأسود بمقدار (١٠ جرام/ يوم)، المجموعة الثالثة تناولت ثمار التوت الأسود ومستخلص مائي لمسحوق اوراقه بمقدار (٢٥ جرام و ٥ جرام/ يوم) علي التوالي. وكـان التدخل الغذائي لمـدة ٦ أشهر. أستخدمت الدراسـة أدوات مثل البيانـات الشخصيـة و مقياس المستوي الاجتمـاعي و الاقتصـادي، و أستمـاره العـادات الغذائيـة، واستمـاره التـاريخ الغذائي، واستماره استرجاع ٢٤ ساعه، والعلامات السريرية إلى جانب التحليل الكيميائي، تم تقدير المركبات الفينوليـة الكليه   ومركب الأنثوسيانين للتوت الأسود وأوراقه ، بالإضافة إلى أجراء بعض التحاليل الكيميائيـة الحيويـة. وقد أظهرت أهم النتائج أن أوراق التـوت الأسـود تحتوي على نسـبة أعلى مـن البروتين والكربوهيدرات والدهون والألياف و المركبات الفينوليـه

ونشاط مضادات الأكسدة مقارنة بثمار التوت الأسود، بينما يتفوق التوت الأسود على أوراقه في إجمالي الأنثوسيانين. وكان متوسط تناول الأنثوسيانين وإجمالي تناول الفينول أعلى في المجموعة الأولى عن المجموعتين الثانية والثالثة. مع حدوث تحسن ملحوظ في بعض العلامات السريرية للبشرة والشعر والوجه للمجموعات الثلاث بعد التدخل الغذائي، بنيما تحسن مستوى الهرمونات الجنسية للمجموعات الثلاث بعد التدخل الغذائي، حيث سجلت المجموعة الثالثه تحسناً ملحوظاً في نسبة هرمون (LH) وهرمون (FSH) مقارنة بالمجموعتين الأخريين، بينما كانت نتيجه المجموعة الاولى أفضل في هرمون التستوستيرون والبروجستيرون مقارنة بالمجموعتين الأخريين. بالإضافة إلى عدم وجود دلاله احصائيه قبل وبعد التدخل الغذائي للثلاث مجموعات في LDL والكوليسترول الكلي، ولكن كان هناك دلاله احصائيه قبل وبعد التدخل الغذائي للثلاث مجموعات في الأنسولين والدهون الثلاثية والكولسترول الجيد عند P<0.05. **الخلاصه:** الإكثار من تناول التوت الأسود وأوراقه يساعد في تحسين حالات متلازمة المبيض المتعدد الكيسات لدى النساء، وذلك لاحتوائه على العديد من مضادات الأكسدة.

الكلمات المفتاحيه: التوت الاسود– اوراق التوت – تكيس المبايض – التدخل الغذائي – الاناث البالغات.

Introduction:

The condition known as polycystic ovary syndrome (PCOS) is a hormonal imbalance brought on by an overabundance of hormones produced by the ovaries, the organ that produces and releases eggs. Androgens are hormones produced in abnormally high amounts by the ovaries, Reproductive hormones fall out of balance as a result. People with PCOS frequently experience irregular menstrual cycles, missed periods, and uncertain ovulation as a result **(Naigaonkar et al., 2025)**. On ultrasound, Ovulate, little follicular cysts, which are fluid-filled sacs containing immature eggs **(Mumusoglu et al., 2020 and Kanbour et al., 2022).**

One of the most prevalent reasons for infertility in women is PCOS, which can develop at any point after puberty in females. Most PCOS cases are discovered in women in their 20s or 30s while they are trying to conceive. PCOS risk factors include female obesity and having PCOS-

positive relatives. PCOS is extremely prevalent; it affects up to 15% of women and people who are of reproductive age **Motlagh et al., (2022) and Siristatidis et al., (2025).**

The most typical PCOS symptoms and indicators are irregular menstrual cycles, amenorrhea (absent periods), abnormal hair development, acne, obesity, skin darkening, cysts, thinning hair, and infertility **(Liu et al., 2021 and Kataoka et al., 2024).** There is no recognized cause for PCOS. There is proof that genetics is involved. Other variables that contribute to PCOS include increased amounts of male hormones called androgens, insulin resistance, which leads your ovaries to produce and release male hormones (androgens), and several more, most notably obesity **(Merkin et al., 2016 , Vidya et al., 2017 and Liu et al., 2024).**

Black mulberry (*Morus nigra*), is a species of flowering plant in the Moraceae family. It is a deciduous tree that can reach heights of 12 metres and widths of 15 metres. The dimensions of the leaves are 10–20 cm in length and 6–10 cm in width (Harding and Deborah, 2019). The fruit is a compound cluster made up of several tiny, dark purple drupes, it characterized as one of the fruits rich in vitamins, minerals, and fiber, the most important of which are vitamin C, vitamin K, magnesium, and other vitamins and antioxidants such as anthocyanins, which help reduce the negative effect of free radicals, which can damage cells, in addition to their role in aging processes, and many more **(Castro et al., 2013).** Other health problems, such as: cancer and heart disease, and eating foods rich in antioxidants can support the body's use of these antioxidants to reduce free radicals, in general, blackberries contain many phenolic acids and different types of flavonoids, which are also antioxidants **(Zeng et al., 2015 and Sonia et al., 2025).**

Numerous studies have confirmed that black raspberries have health benefits, as it enhances brain health, promotes heart health, contributes to cancer prevention, regulates blood sugar, regulates the digestive system, promotes healthy skin and eyes, reduces constipation, treats wrinkles and sagging in the body, and relieves stomach pain and Promoting joint and bone health, promoting healthy fetal growth, and reducing bleeding problems **(Sellappan et al., 2002 and lark et al., 2012).**

Mulberry leaves are considered to have a high nutritional value because they are rich in many beneficial compounds such as polyphenols,

vitamin C, zinc, calcium, iron, potassium, phosphorus, and magnesium. It has many benefits, as black mulberry leaf contains strong antioxidant properties (**Kruczek, et al., 2015**). It found its effectiveness when drinking blackberry leaves drink or intake its powder directly in reducing cholesterol levels and triglycerides harmful to the body, reducing inflammation, lowering blood sugar levels, strengthening nerves, improving bone health, strengthening the immune system, and maintaining normal blood pressure in the body (**Oszmia er al., 2011, Magdalena et al., 2022 and Ana Paula et al., 2024**).

Through what has been mentioned, the importance of black mulberries and its leaves became clear to improve the health and increase immunity, this due to antioxidants, which may be reflected in improve polycystic ovaries in females, and from here **the aim of the research** becomes clear, investigate the effect of consuming black mulberry fruits and its leaves powder on improving polycystic ovaries in adult females.

Materials and Methods:
Subjects:

The samples were 45 adult females suffering from polycystic ovaries, their age was 20 ± 8 years, and the place was the Faculty of Specific Education, Ain Shams University, and they were diagnosed by a consultant specializing in gynecology at the Faculty of Medicine, Ain Shams University, This data was obtained from a questionnaire Personal data and Socio - economic data (**Ayman, 2018**)**,** it include (name, sex, age, address, history of disease, Parent education, occupation and number of their children).All of them were suffering from polycystic ovaries for more than two years, and the social and economic level of all the samples is average based on the results of the previous questionnaire.

A. Anthropometric Measurements:

The current study uses it for height (HT) to the nearest 0.5 cm and weight (WT) to the nearest 0.1 kg. Calculate your BMI and upper arm circumference (MUAC) (**WHO, 2020**).

B. Nutritional status was assessed through:
B.1. Food Habits:

Adult females were asked the necessary questions to determine how much black mulberry fruit and powdered leaves they consumed.

B.2. Diet History and 24 hr. Dietary Recall:

A list of food groups and information on the general dietary items' quality and frequency of consumption are included in diet histories **(Jelliffe, 1966).** The 24-hour dietary recall was followed by three days before and three more days after the dietary intervention. The food composition tables from the National Nutrition Institute were used to calculate, analyse, and compare food quantities to the Recommended Nutrient Intake **(USDA, 2022).**

B.3. Dietary Intervention and Experiment Design:

After evaluating the nutritional status of adult females suffering from polycystic ovaries and making sure that they do not intake black mulberry fruits and its leaves powder in sufficient quantities.

The samples were divided into three groups as follows:

The first group (15 adult females): intake black mulberry fruits by (50g/day) for 6 months.

The second group (15 adult females): intake leaves powder of black mulberry by (10g/day aqueous extract) for 6 months.

The third group (15 adult females): intake black mulberry fruits by (25g/day) and leaves powder by (5g/day aqueous extract) for 6 months.

The nutritional intervention was established and applied for six consecutive months.

A blood sample was drawn from the arm for biochemical analysis twice before and after the nutritional intervention.

B3- I. The Chemical Analysis of black mulberry fruits and its leaves:

Moisture, Fat, ash, protein, Carbohydrates, fat and fiber were determined according to **AOAC (2005).**

B3-II. Total phenolic compounds (TPC) and total anthocyanin content:

According to **Qawasmeh et al. (2012),** the total phenolic compounds (TPC) for black mulberry fruits and their leaves powder extracts were measured spectrophotometrically by Folin-Ciocalteu reagent assay using gallic acid as standard. At 750 nm, the absorbance was measured using a spectrophotometer (Unicum UV 300). Gallic acid equivalents (GAE)/g dry weight sample were used to measure the total phenolic content in the samples. Three copies of each sample were used for analysis. The total

anthocyanin content of Black Mulberry and leaf powder of it was measured using the method described by **Wrolstad and Giusti (2001).**

B3-III. Antioxidant Activity:

DPPH, a stable free radical molecule, is widely used to assess the antioxidant capacity of various samples **(Kitts and Hu, 2005).** The IC50 of aqueous extract, which is the effective concentration of extract needed to block 50% of the initial DPPH free radical, was used to express the free radical scavenging activity as measured by DPPH **(Amarowicz et al., 2000).**

B3-IV. Preparation of aqueous extract of black mulberry leaves powder:

Mulberry leaves were collected from their respective trees and then identified and get to know the species by checking out the color photos followed by a description and identification codes (**Bekele, 2007),** then the leaves of the plant were washed thoroughly with tap water to avoid the accumulation of dust and other unwanted materials on the leaves, leaves were allowed to dry under natural shade for 20 days, the leaves were dried well and then crushed using an electric mixer, finally, leaf powder was collected by sifting through a kitchen strainer to make a very fine powder.

Aqueous extract of black mulberry leaves was prepared by combining 40 g of dry powder with 100 mL of boiling water, then letting it sit for 24 hours at room temperature, frequently stirring with a glass rod. Filtration was used to get the extract **Shah et al., (2015).**

D. Clinical signs: (It was applied twice pre & post-Dietary Intervention):

Clinical examination was an important practical method to assess the nutritional and health status for adult females with PCOS **(Jelliffe, 1966)**, Clinical signs were divided into abnormal hair development, acne, skin darkening, cysts and thinning hair.

E. Biochemical Analysis:

Luteinizing hormone (LH), follicle-stimulating hormone (FSH), testosterone, progesterone and serum insulin level were measured by enzyme-linked immunosorbent assay (ELISA) using a standards kit (MONOBIND INC., US) **Al Kindi et al., (2012).**

The serum total cholesterol (TC) was determined by the enzymatic colorimetric method **Allain et al. (1974)**, while the serum high-density lipoprotein cholesterol (HDLC) was determined by method

(**Albers et al. 1978**), and the serum triglyceride was calculated using the glycerol phosphate oxidase enzyme technique (**Bucolo and David 1973**). Besides the serum low-density lipoprotein cholesterol LDLC was calculated using the Warnick formula (**Warnick et al. 1990**).

F. Statistical Analysis:

Statistically analyzed using, Standard Deviation (±SD), Mean, T-test, Analysis of Variance (ANOVA) and correlation matrix by using package software SPSS windows (**Vavdallen, 1997**).

Results and Discussion:

A. Anthropometric Measurements:

As shown in Table 1, adult females diagnosed with polycystic ovary syndrome exhibited normal height values when compared to standardized anthropometric reference ranges (**WHO, 2020**), by an average of 161, 162 and 195.5cm for groups one, two and there, respectively pre and post dietary intervention. Besides weight pre pre-dietary intervention was also normal by (69.1, 69.3 and 64.8) there was a slight decrease in weight after the dietary intervention by (68.5, 67.9 and 64.3) for groups one, two and there, respectively, compared with standard measurements (**WHO, 2020**). Black mulberry fruits, considered one of the nutritional foods that have an important role in helping to lose weight healthily, because they are fruits that are distinguished for containing some types of antioxidants, as well as for containing a large proportion of water and fiber (**Heyman et al., 2014**).

Total sample for the three groups had overweight pre and post dietary intervention compared with standard measurements, BMI ratio for all groups ranged between (25.31:26.67%) (**WHO, 2020**); it confirmed that as a result of MUAC and BMI for the three groups pre and post dietary intervention.

The average MUAC indicates a normal nutritional status but with a slight increase in weight for all groups before and after the dietary intervention, where all samples were measured between (25.4:26.7 cm).

No significant statistical in height, weight, MUAC and BMI pre and post dietary intervention in three groups. This result Partially in line with (**Farimani et al., 2011**) and (**Kataoka et al., 2024**), whose showed that body of women with polycystic ovaries produces a large amount of insulin, or insulin does not work as it should, and therefore the inability

of insulin to work normally is one of the reasons for weight gain or difficulty getting rid of excess weight in women with polycystic ovaries.

Table (1): Average measurement of physical standards (pre &post dietary intervention) for adult females suffering from polycystic ovaries

Groups	Height (cm)		Weight (kg)		MUAC (cm)		BMI %	
	Pre	Post	Pre	Post	Post	Pre	Pre	Post
Group one (black mulberry fruits 50g) (15 female)	161	161	69.1	68.5	25.4	25.5	26.67	26.44
Group two (leaves powder of black mulberry 10g) (15 female)	162	162	69.3	67.9	26.2	26.7	26.45	25.91
Group there (black mulberry+ leaves powder of it 25+5g) (15 female)	159.5	159.5	64.8	64.3	25.5	25.6	25.51	25.31
Sig	0.124		0.324		0.061		0.057	

*P<0.05

B. Nutritional Status Results:

B.1. Food habits:

Table (2) observed the average daily intake black mulberry fruits and it leaves among adult females diagnosed with polycystic ovaries pre intervention, it showed that adult female had intake a small amount from black mulberry fruits /day by (0.73, 0.92 and 0.87) for black mulberry fruits for groups one, two and three respectively. While black mulberry leaves /day were (0.02, 0.01 and 0.04) for black mulberry leaves for groups one, two and three, respectively pre pre-dietary intervention.

Table (2): Eating black mulberry fruits and it leaves ⁄ day among adult females suffering from polycystic ovaries pre intervention

Groups	Black mulberry fruits (g)	Black mulberry leaves (g)
Group one (black mulberry fruits 50g) (15 female)	0.73	0.02
Group two (leaves powder of black mulberry 10g) (15 female)	0.92	0.01
Group there (black mulberry+ leaves powder of it 25+5g) (15 female)	0.87	0.04

B.2 . Diet History and 24hr Dietary Recall:

According to the results of the diet history and 24-hour dietary recall conducted over three consecutive days, it was found that the intake of black mulberry fruits and their leaves was low among adult females with polycystic ovary syndrome pre- dietary intervention. These findings are consistent with the data presented in the table outlining their food habits.

B.3. Dietary Intervention and some analysis for black mulberry fruits and its leaves.

According to the results of food habits, diet history and 24hr dietary recall, the dietary intervention from black mulberry fruits and its leaves were administered as black mulberry fruits 50g, black mulberry leaves 10g and (black mulberry+ leaves powder of it 25+5g for groups one, two and three respectively for six consecutive months.

It was observed in Table (3), that the chemical composition of black mulberry fruits and its leaves powder, and it showed that black mulberry leaves had the highest percentage in all analyzed chemical compositions (Fat, ash, protein, Carbohydrates, and fiber) compared with black mulberry fruits, with moisture being higher in black mulberry fruits than black mulberry leaves.

The present results were in a line with those reported by **Hu et al., (2013),** who found that the leaves of black mulberry are particularly rich in protein, Carbohydrates and fiber. And consistent with (**Kaume et al.,**

2012), who explained that the black mulberry fruits was poor in fat and contain few carbohydrates and protein, but they are high in moisture content by (1.01, 7.79, 6.98 and 73.1) respectively.

Table (3): Chemical composition of black mulberry fruits and its leaves powder

Parameters	Moisture	Ash	Protein	Carbohydrates	Fat	fiber
Black mulberry Fruits	$\pm3.6^a$ 69.62	$\pm0.4^b$ 4.76	$\pm0.3^b$ 5.72	6.41 ± 0.2^b	$\pm0.\cdot1^b$ 0.94	$\pm1.2^b$ 12.55
Black mulberry Leaves	$\pm0.21^b$ 8.11	$\pm0.32^a$ 7.01	$\pm1.2^a$ 14.35	45.15 ± 3.9^a	$\pm1.2^a$ 3.66	$.72\pm2.5^a$ 21

Table 4, titled "Total Anthocyanin, Total Phenolic Compounds (TPC), and Antioxidant Activity (DPPH%) in Black Mulberry Fruits and Leaf Powder," shows that the total anthocyanin content was significantly higher in black mulberry fruits (18.7 mg/100g) compared to black mulberry leaves (0.99 mg/100g. While black mulberry leaves were higher in total phenolic compounds TPC and antioxidant activity than black mulberry by (3338.7 and 1335.1 mg/100g as Gallic acid) for TPC, respectively, and by (42 and 39.4 IC50µg/ml) for antioxidant activity, respectively.

Similar results have been reported by **(Akin et al., 2016)** who found that total anthocyanins in black mulberry were 19.2 mg/g dried extract. **Conway et al., (2015)** study indicates that blackberry leaves contain a very high percentage of polyphenols, as well as higher oxidation activity than the berries themselves.

Table (4): Total anthocyanin, total phenolic compounds (TPC) and antioxidants activity (DPPH%) in black mulberry fruits and its leaves powder

Parameters	Total anthocyanin (mg/ 1g extract)	TPC (mg/100g) as Gallic acid	Antioxidant activity (IC50µg/ml)
Black mulberry fruits	18.7 ± 1.2^a	1335.1 ± 17.8^b	39.4 ± 0.41^a
Black mulberry leaves	0.99 ± 0.01^b	3338.7 ± 21.1^a	42.9 ± 1.3^b

It could be observed from table (5) mean intake of total anthocyanin and total phenolic compounds (TPC) for adult females who suffer from polycystic ovaries, and it showed that there were statistically significant differences before and after dietary intervention for the three groups at a

significance p< 0.01. Besides the group, one had increase amount than the other groups in total anthocyanin and TPC, while group two recorded the lowest amount compared with other groups. These results are consistent with **(Liu et al., 2021 and Izabela et al., 2025),** which proved that women suffering from polycystic ovary syndrome neglect nutritional treatment despite its great importance. It also agrees with **(Magdalena et al., 2022**) who indicated that blackberries contain powerful antioxidants, and the leaves also help in treating many diseases and infections.

Table (5): Mean intake of total anthocyanin and total phenolic compounds (TPC) for adult females who suffer from polycystic ovaries.

Groups	Total anthocyanin (mg)		Total phenolic compounds (mg)	
	Pre	Post	pre	post
Group one (black mulberry fruits 50g) **(15 Female)**	0.9±0.02	830.43±3.4	0.12±0.02	663.9±9.2
Group two (leaves powder of black mulberry 10g) (15 Female)	0.3±0.01	9.8±4.6	0. 2±0.01	331.76±5.5
Group there (black mulberry+ leaves powder of it 25+5g) **(15 Female)**	0.7±0.02	470.9±7.2	0.301±0.02	501.86±6.71
Sig.*	0.00*		0.00*	

USDA, 2022.

*p< 0.01

D. Clinical signs: its include abnormal hair development, acne, skin darkening, cysts and thinning hair.

The data illustrated in table (6) noticed that group one pre dietary intervention, have about (66.6, 33.3 20, 13.3.and 20%) for skin darkening, abnormal hair development, thinning hair, acne and cysts respectively, but after dietary intervention by black mulberry fruits 50g , this percentages were decreased to (53.3, 6.6 and 13.3 %) for skin darkening, acne and cysts respectively, however, there was no

significant improvement after the intervention for abnormal hair development and thinning hair. As for the group two it observed that pre dietary intervention, have about (73.3, 26.6, 26.6, 20 and 13.3%) for skin darkening, abnormal hair development, thinning hair, acne and cysts respectively, but after dietary intervention by leaves powder of black mulberry 10g, this percentages were decreased to (66.6, 20, 20 and 0 %) for skin darkening, abnormal hair development, thinning hair and cysts respectively, but facial acne remained the same after the dietary intervention. Beside group three showed that pre dietary intervention, have about (66.6, 33.3 20, 20.and 13.3%) while after dietary intervention by black mulberry+ leaves powder of it   25+5g, this percentages were decreased to (53.3, 20, 13.3, 13.3 and 0 %) for skin darkening, abnormal hair development, thinning hair, acne and cysts respectively.

These results are consistent with **(Homburg, 2009 and Liu et al., 2024)**, which confirms that females suffering from polycystic ovaries suffer from some different symptoms, such as hair loss and excessive hairiness in some places, with the appearance of acne on the face, especially with brown discoloration of the skin in some places. This study is also in line with Silva's study, which showed that eating blackberries contains a good percentage of vitamin C that contributes to stimulating collagen production, which is the main protein responsible for skin youthfulness, reducing sagging and wrinkles, and helps improve hair growth **(Silva et al., 2016)**. And agree with the **González et al., 2013** study, which who demonstrated intake balanced foods that contain high levels of antioxidants improves ovulation hormones LH and FSH.consuming blackberry leaves drink helps in the freshness skin and protect it from acne because of the antioxidants it contains.

Table (6): The proportion of the number female who suffering from (skin darkening, abnormal hair development, thinning hair, acne and cysts) pre and post dietary intervention

Groups	Skin		Hear				Face			
	Darkening %		Abnormal hair development %		Thinning hair %		Acne %		Cysts %	
	Pre	Post	pre	post	pre	post	pre	post	Pre	Post
Group one (black mulberry fruits 50g) **(15 Female)**	66.6	53.3	33.3	33.3	20	20	13.3	6.6	20	13.3
Group two (leaves powder of black mulberry 10g) **(15 Female)**	73.3	66.6	26.6	20	26.6	20	20	20	13.3	0
Group there (black mulberry+ leaves powder of it 25+5g) **(15 Female)**	66.6	53.3	33.3	20	20	13.3	20	13.3	13.3	0

E. Biochemical Analysis

It could be noticed from table (7) Sexual hormones level of the patients before and after intervention by black mulberry fruits and its leaves powder. It observed that there were statically significant differences between pre and post dietary intervention for three groups in FSH, LH, Testosterone and Progesterone at $P<0.05$. While the third group showed an improvement in (FSH and LH) compared to the other groups, while the first group showed an improvement in (Testosterone and Progesterone) compared to the other groups. On the other hand second group was higher in (LH and Testosterone) compared with the first group after dietary intervention, as for the result of FSH was close between this group and first group, and there was no significant relationship between them.

Anthocyanins are considered one of the most important antioxidants, which are found in large quantities in black mulberry fruits (**Kaume et al., 2012**), Furthermore, confirmed with studies for (**Talat et al., 2022 and Izabela et al., 2025**) that decreased antioxidant content is related to PCOS, the cycle of the ovarian follicular and luteal phases is disrupted because it is one of the states with enhanced oxidative stress. Mulberry leaves contains many antioxidants such as flavonoids, which helps to treat inflammation and oxidative stress (**Conway and Samtani., 2015**), this explains its strong effect on improving women's Polycystic ovaries. And in line with (**Siristatidis et al., 2025**) who demonstrated intake balanced foods that contain high levels of antioxidants improves ovulation hormones LH and FSH.

Table (7) Sexual hormones level of the patients before and after intervention by black mulberry fruits and its leaves powder

Groups	Parameters							
	FSH (mIu/ml)		LH (mIu/ml)		Testosterone (ng/dl)		Progesterone (ng/mL)	
	Pre	Post	Pre	Post	pre	Post	Pre	Post
Group one (black mulberry fruits 50g) (15 female)	10.27 ± 0.5^a	5.3 ± 0.28^a	16.12 ± 0.8^a	7.4 ± 0.32^b	64.21 ± 1.1^a	45.2 ± 1.3^b	4.41 ± 0.11^a	12.42 ± 0.7^a
*Sig.	**0.044***		**0.021***		**0.031***		**0.026***	
Group two (leaves powder of black mulberry 10g) (15 female)	10.21 ± 0.3^a	6.21 ± 0.32^a	15.8 ± 0.4^a	9.22 ± 0.2^a	63.3 ± 2.01^a	$50.4.\pm4.1^a$	4.21 ± 0.04^a	10.54 ± 1.04^b
*Sig.	**0.014***		**0.036***		**0.047***		**0.018***	
Group there (black mulberry+ leaves powder of it 25+5g) (female ١٥)	10.39 ± 0.6^a	4.56 ± 0.2^b	15.43 ± 0.5^a	4.54 ± 0.21^c	65.3 ± 2.04^a	51.32 ± 3.81^a	5.01 ± 0.02^a	8.22 ± 1.4^c
*Sig..	**0.031***		**0.012***		**0.023***		**0.019***	

Values for continuous variables, as mean _ standard deviation.
The different letters means that there is a significant difference between groups at P <0.05 and vice versa.
*P<0.05

Table (8) showed that glycemic indices and lipid profile of the patients before and after intervention by black mulberry fruits and its leaves powder. The most important results in the table showed no significant pre and post dietary intervention by black mulberry fruits, its leaves and mixed with them for three groups respectively in LDL and total cholesterol, and there were significant pre and post-intervention changes were observed in insulin, Triglycerides, and HDL across the three groups (P<0.05), with the exception of insulin in Group 2, which showed no significant change. Moreover, the table also showed that there were no difference in insulin, LDL, HDL, total cholesterol and Triglycerides before the dietary intervention compared between the three groups. While after dietary intervention there were decreases significant between group one and two in insulin and Triglycerides, and between group three and two in insulin, beside group one and three in Triglycerides. On the other hand the highest degree was in group three in HDL compared to group one and two where the results of them were similar.

This result in line with (**Dorothy, 2016**) who observed that polyphenols, which contain beneficial molecules called anthocyanins, are abundant in blueberries, according to epidemiological research, eating more blueberries may reduce the risk of type 2 diabetes (T2DM). On the other hand, the results of this study are consistent with (**Tarek et al., 2019**) who showed that eating blackberries by 150g/kg for 4 month helps improve blood sugar levels in rats. Intake Black mulberry improves blood sugar levels (**Sonia et al., 2025**). And in line with **Arpita, (2019)** who showed that an essential indicator of cardiovascular health and illness is blood lipid composition, it has been demonstrated that berries, whether consumed as whole fruits, juices, or purified extracts, can reduce total and LDL-C and raise HDL-C levels in those with high blood cholesterol levels. Furthermore, this result agree with **Yoshihiro et al., 2010,** who confirm that, mulberry leaves extract reduced postprandial blood glucose spike in humans, and participants who took mulberry leaf extract-rich capsules over a period of 12 weeks before meals saw their TG levels decreased and increased HDL levels. Moreover, it is clarify with Yao, who confirms that consuming blackberry extract prevents the formation of fatty cells in the liver,

reduces low-density lipoprotein (LDL) levels, and improves high-density lipoprotein (HDL) levels **(Yao, et al., 2024)** .

Table (8): Glycemic indices and Lipid profile of the patients before and after intervention by black mulberry fruits and its leaves powder

Groups	Parameters									
	Insulin (µU/ml)		LDL (mg/dl)		HDL (mg/dl)		Total Cholesterol (mg/dl)		Triglycerides (mg/dl)	
	Pre	Post	Pre	Post	pre	Post	Pre	Post	Pre	Post
Group one (black mulberry fruits 50g) (15 female)	8.11 ± 0.3[a]	6.12 ± 0.61[a]	92.35 ± 4.9[a]	90.21± 3.11[a]	44.33 ± 2.3[a]	68.6± 3.2[b]	134.02± 5.36a	127.63± 7.1a	163.15 ±5.1[a]	118.53± 5.37[b]
Sig	0.017*		0.541		0.012*		0.129		0.013*	
Group two (leaves powder of black mulberry 10g) (15 female)	8.52 ± 0.4[a]	8.01 ± 0.02[b]	90.3 ± 3.8[a]	88.72± 2.3[a]	43.45 ± 1.05[a]	66.٩ ± 2.4[b]	132.29 ±3.03[a]	128.41± 6.15[a]	166.53± 4.8[a]	131.53± 6.35[a]
Sig	0.317		0.613		0.035*		0.417		0.022*	
Group there (black mulberry+ leaves powder of it 25+5g) (15 female)	8.33 ± 0.2[a]	6.55 ± 0.4[a]	89.74 ± 2.7[a]	87.62 ±2.83[a]	44.63 ±3.02[a]	79.27 ±4.93[a]	138.68 ±4.45[a]	130.31± 5.21[a]	160.11 ±3.6[a]	134.14± 4.88[a]
Sig	0.027*		0.721		0.018*		0.341		0.041*	

Values for continuous variables, as mean _ standard deviation.

The different letters mean that there is a significant difference between groups at P <0.05 and vice versa

*P<0.05

It could be noticed in table (9) correlation coefficient between intake (black mulberry fruits and its leaves) and polycystic ovaries (Increased male hormone levels and an imbalance in female hormones). There were strong negative correlation between intake black mulberry fruits and mix of black mulberry fruits and leaves and polycystic ovaries at (-

0.912 and -0.834) respectively, while there was moderate negative correlation between black mulberry leaves and polycystic ovaries at (-0.556). This means that intake all of them in a large amount leads to an improvement in the cases of polycystic ovaries in adult females.

Moreover, this result in line with **Ercisli et al., (2010) and Kaume et al., (2012),** who reported that blueberries and raspberries are loaded with natural antioxidants and anti-inflammatory phytonutrients, which may help boost female fertility. The benefits berries and its leaves for fertility for women, consuming berries regularly can help amelioration fertility in many ways, such as improving reproductive hormone function, benefitting ovaries and strengthening egg quality, benefitting the immune and cardiovascular system overall health and wellbeing can support the production of healthy eggs **(Nakagawa et al., 2006 and Jennifer et al., 2024)**

Table (9): Correlation coefficient between black mulberry fruits and its leaves.

Items	polycystic ovaries
Black mulberry fruits	-0.912 (*)
Black mulberry leaves	-0.556 (**)
Black mulberry fruits and its leaves	-0.834 (*)

* Strong negative Correlation = -0.7>: -1

** moderate negative Correlation = - 0.4: - 0.7<

Conclusion:

Ovarian cyst is a common hormonal disorder among women, of childbearing age, usually begins at puberty, and it is a group of symptoms related to hormonal imbalance that causes problems in the ovaries, which prevent follicles from growing and maturing to release egg cells. Black Mulberry Fruits are a great source of antioxidants, most notably anthocyanin compounds and have many benefits; these compounds helped strengthening the immune system. Mulberry leaves contains distinctive plant compounds, polyphenol antioxidants, tannin,

vitamins and minerals. The results of this study confirmed the importance of intake black mulberry fruits and its leaves improve the cases of polycystic ovaries in females, while it Prove that intake them helped reduce the FSH, LH and Testosterone hormone and increase Progesterone.

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