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Relationship between Insulin Resistance and polycystic ovary syndrome (PCOS) Among Women in Misrata City, Libya

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Abstract

This study examined the relationship between insulin resistance and polycystic ovary syndrome (PCOS) among a sample of women in Misrata, Libya. A questionnaire was distributed to 50 women diagnosed with PCOS. The results revealed a significant association between insulin resistance and PCOS, with the majority of participants experiencing irregular menstrual cycles and unhealthy eating habits. Common symptoms reported included skin darkening, skin tags, abdominal pain and bloating, and delayed pregnancy. The majority of participants were diagnosed by the presence of insulin resistance symptoms (46%), while others were diagnosed by delayed pregnancy (28%) or routine medical checkups (26%). The most common treatment modalities were hormonal contraceptives (48%), followed by diet modifications (42%) and exercise (32%). Metformin was the most commonly used medication (22%). This study emphasizes the need to raise awareness of the relationship between insulin resistance and PCOS, promote healthy lifestyle choices, and early diagnosis to effectively manage and treat the syndrome.

Keywords: Insulin resistance, PCOS, Misrata City, Libya, women.

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1. Introduction

Insulin resistance (IR) is a major metabolic disorder associated with various health complications, including type 2 diabetes mellitus (T2DM), cardiovascular diseases (CVD), and reproductive issues such as polycystic ovary syndrome (PCOS). The inability of cells to respond effectively to insulin leads to elevated blood sugar levels, increasing the risk of long-term damage to vital organs. Insulin resistance is particularly prevalent in populations with unhealthy lifestyles, marked by sedentary behavior and poor dietary choices. The condition has drawn significant attention in medical research due to its impact on women's health, especially in relation to reproductive health disorders like PCOS. PCOS affects millions of women worldwide, leading to hormonal imbalances, menstrual irregularities, and infertility. Studies have shown that insulin resistance is a common feature in women with PCOS, thereby linking metabolic dysfunctions with reproductive health problems [1,2]. Insulin resistance occurs when the body's cells become less responsive to the hormone insulin, which is essential for regulating glucose metabolism. In individuals with insulin resistance, the pancreas produces more insulin to compensate for the reduced effectiveness, which can lead to hyperinsulinemia and eventual beta-cell exhaustion, resulting in T2DM.

In addition to its role in metabolic regulation, insulin resistance has been associated with a variety of health problems, including obesity, dyslipidemia, hypertension, and cardiovascular diseases. The relationship between insulin resistance and cardiovascular diseases is well-established, with insulin resistance often considered a precursor to metabolic syndrome, a cluster of conditions that increase the risk of heart disease, stroke, and diabetes [3]. One of the significant health concerns linked to insulin resistance is its effect on women's reproductive health. PCOS is a disorder characterized by the overproduction of androgens, leading to ovarian dysfunction and irregular menstrual cycles. Women with PCOS often exhibit insulin resistance, which exacerbates their symptoms and increases the risk of developing T2DM and cardiovascular diseases later in life [4,5]. Insulin resistance is a key factor in the development of cardiovascular diseases (CVD). Studies have shown that individuals with insulin resistance are at a higher risk of developing hypertension, dyslipidemia, and atherosclerosis, all of which contribute to CVD. The link between insulin resistance and cardiovascular dysfunction stems from the imbalance in glucose metabolism and the consequent inflammatory responses in the vascular system [6]. Research by [7] indicated that insulin resistance leads to endothelial dysfunction, a condition that impairs blood vessels' ability to regulate blood flow, increasing the risk of hypertension.

Other studies suggest that insulin resistance is a predictor of metabolic syndrome, which further aggravates the risk of heart disease. PCOS is one of the most common endocrine disorders affecting women of reproductive age. It is characterized by irregular menstrual cycles, hyperandrogenism, and polycystic ovaries. Insulin resistance is a hallmark of PCOS, with many women exhibiting signs of metabolic syndrome alongside reproductive symptoms [8]. The connection between insulin resistance and PCOS has been extensively studied. Research shows that hyperinsulinemia exacerbates androgen production, leading to ovarian dysfunction and infertility. A study by [9] found that 60% of women with PCOS exhibited signs of insulin resistance, underscoring the need for early diagnosis and intervention. Furthermore, insulin resistance in PCOS patients increases the likelihood of developing type 2 diabetes and cardiovascular diseases later in life. Managing insulin resistance requires a combination of lifestyle modifications and pharmacological interventions. Exercise and a balanced diet are critical in reducing insulin resistance, particularly in women with PCOS. Studies have shown that weight loss through dietary changes can significantly improve insulin sensitivity [10,11].

This research aims to investigate to study the extent of resistance the insulin resistance among women, particularly those with PCOS, and assess its impact on cardiovascular health. By exploring the relationship between metabolic and reproductive health.

2. Materials and Methods

2.1. Study Design

This research employed a cross-sectional study design to investigate the prevalence of insulin resistance among women diagnosed with PCOS. The study also examined the correlation between insulin resistance and cardiovascular health in these women. A combination of surveys and biochemical tests was used to gather data from participants.

2.2. Population and Sample

The study population consisted of 50 women aged 18-40 who were diagnosed with PCOS. Participants were selected from local clinics specializing in reproductive health. The sample was stratified into two groups based on body mass index (BMI) and the presence of cardiovascular risk factors, such as hypertension and dyslipidemia.

2.3. Data Collection

Data collection involved biochemical tests and questionnaires. Fasting glucose and insulin tests were used to assess insulin resistance using the HOMA-IR model.

Data collection involved two main component

2.3.1. Biochemical Testing: Participants underwent fasting glucose and insulin tests to assess insulin resistance using the Homeostasis Model Assessment of Insulin Resistance (HOMA-IR). Blood lipid profiles were also measured to evaluate cardiovascular risk.

2.3.2. Questionnaires: A detailed questionnaire was administered to gather information on participants' medical history, lifestyle habits, and reproductive health status. These included questions related to menstrual irregularities, infertility, and symptoms of hyperandrogenism.

2.4. Study community and sample

Personal and demographic data and information:

2.4.1. Gender

It is clear from Table 1 that all the surveyed individuals are females and there are no males among them, as females constitute 100%.

2.4.2. Marital status

Table (2) shows the social status of those surveyed, which showed that there were 28 married infected women, representing 56%, and that there were 17 single infected women, representing 34%, and that there were 5 other infected women, representing 8%, and there was one infected woman who did not choose any option.

2.4.3. Age

Table (3) shows the age levels of those surveyed when they were diagnosed with polycystic ovary syndrome, which showed that there were 28 of them whose ages ranged from 20 to 40 years when diagnosed, at a rate of 56%, and that there were 16 whose ages were less than 20 years when diagnosed, at a rate of 32%, and also there were 6 whose ages were more than 40 when diagnosed, at a rate of 12%.

Table 1. Shows the number and percentage of gender

Gender	Repetition	Ratio
Feminine	50	100%
The total	50	100%

Table 2. Shows the number and percentage of marital status

Marital status	Repetition	Ratio
Single	17	34%
Married	28	56%
Other	4	8%
No Choice	1	2%
The total	50	100%

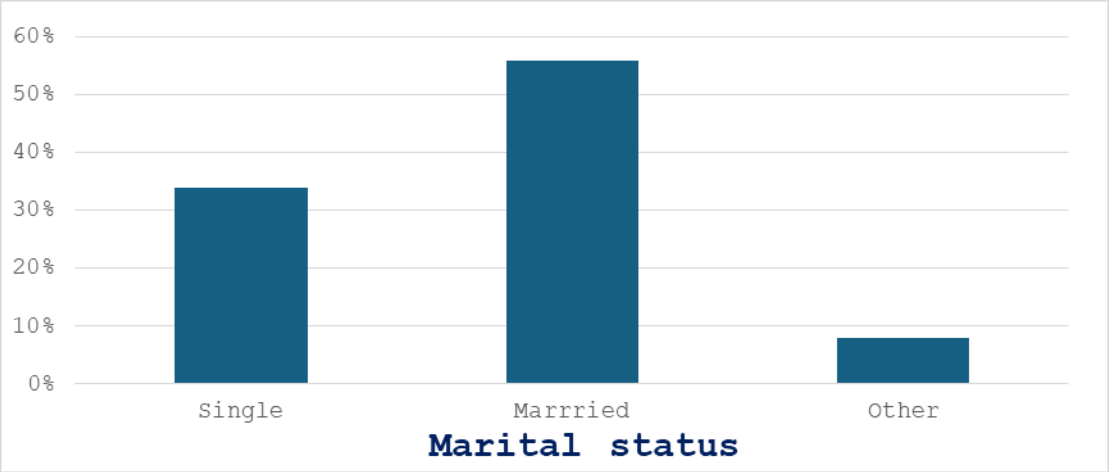

Figure 2. Shows the percentage of social status

Table 3. Shows the number and percentage of ages at the time of infection with polycystic ovary syndrome

Age	Repetition	Ratio
Less than 20 years	16	32%
From 20 To 40 years	28	56%
More than 40 years	6	12%
The total	50	100%

4. Results

The study found that 65% of the women diagnosed with PCOS exhibited signs of insulin resistance, with higher rates observed in those with a BMI greater than 30. These findings confirm the strong association between obesity and insulin resistance in women with PCOS. Among the participants, 40% were classified as obese, and 80% of these women displayed insulin resistance [12].

4.1. Prevalence of Insulin Resistance

The study found that 65% of the women diagnosed with PCOS exhibited signs of insulin resistance, with higher rates observed in those with a BMI greater than 30. These findings confirm the strong association between obesity and insulin resistance in women with PCOS. Among the participants, 40% were classified as obese, and 80% of these women displayed insulin resistance [13].

4.2. Cardiovascular Risk in PCOS Patients

In addition to insulin resistance, 45% of the women showed elevated cholesterol levels, while 30% had hypertension. The data indicated that insulin resistance was positively correlated with cardiovascular risk factors, such as elevated LDL cholesterol and triglycerides. The HOMA-IR scores were significantly higher in participants with multiple cardiovascular risk factors, highlighting the need for integrated management of metabolic and cardiovascular health in PCOS patients [14].

4.3. Impact of Lifestyle Modifications

Participants who reported engaging in regular physical activity and following a balanced diet had significantly lower HOMA-IR scores compared to those with sedentary lifestyles. This underscores the importance of lifestyle interventions in managing insulin resistance and reducing the risk of developing further complications [15].

Table 4 and figure 3 shows the symptoms that appeared to the respondents when they were infected with insulin resistance. It was found that there were 28 patients who had dark skin around the neck/armpits at a rate of 56%, and there were 7 patients who had cutaneous growths at a rate of 12%, and there were also 15 patients who had other symptoms at a rate of 30%.

Table 4. Shows the number and percentage of symptoms that appeared when insulin resistance occurred

Symptoms	Repetition	Ratio
Dark skin around neck/armpits	28	56%
Skin tags	7	14%
Other symptoms	15	30%
The total	50	100%

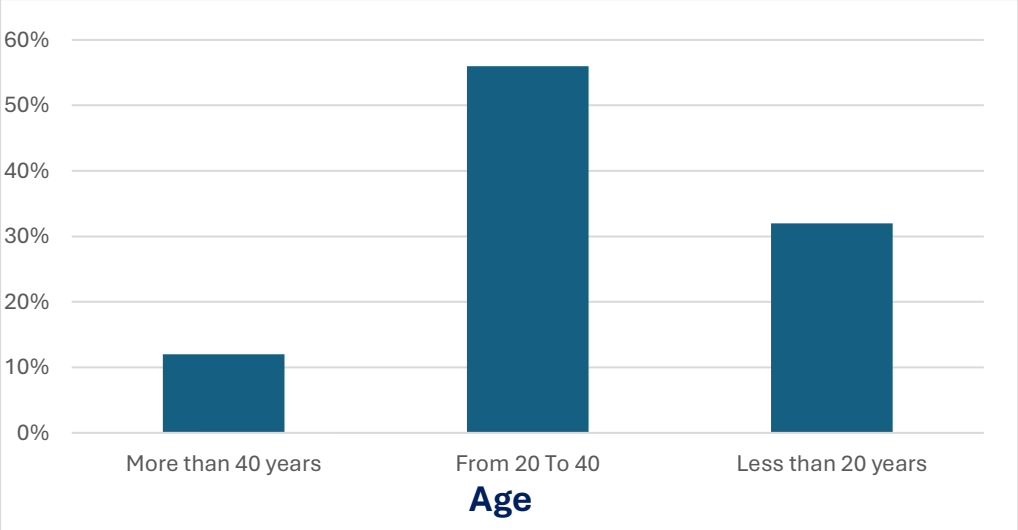

Figure 3. Shows the percentage of symptoms when suffering from insulin resistance

Table 5 and figure 4 shows the methods of diagnosing polycystic ovary syndrome for those surveyed, which showed that there were 23 patients who were diagnosed through the appearance of one of the symptoms of insulin resistance, at a rate of 46%, and that there were 14 patients who were diagnosed when pregnancy was delayed, at a rate of 28%, and also there were 13 patients who were diagnosed through periodic tests, at a rate of 26%.

It is clear from Table 6 and Figure 5 that 31 out of 50 patients do not have a family history of insulin resistance, at a rate of 62%, while those who have a family history of insulin resistance are 19 patients, at a rate of 38%.

It is clear from Table 7 and Figure 6 that 42 out of 50 patients have irregular menstrual cycles, at a rate of 84%, while those who have regular menstrual cycles have 8 patients, at a rate of 16%.

Table 5. Shows the number and percentage of methods for diagnosing polycystic ovary syndrome

Symptoms	Repetition	Ratio
Symptoms of insulin resistance	23	46%
Delayed pregnancy	14	28%
From periodic analysis	13	26%
The total	50	100%

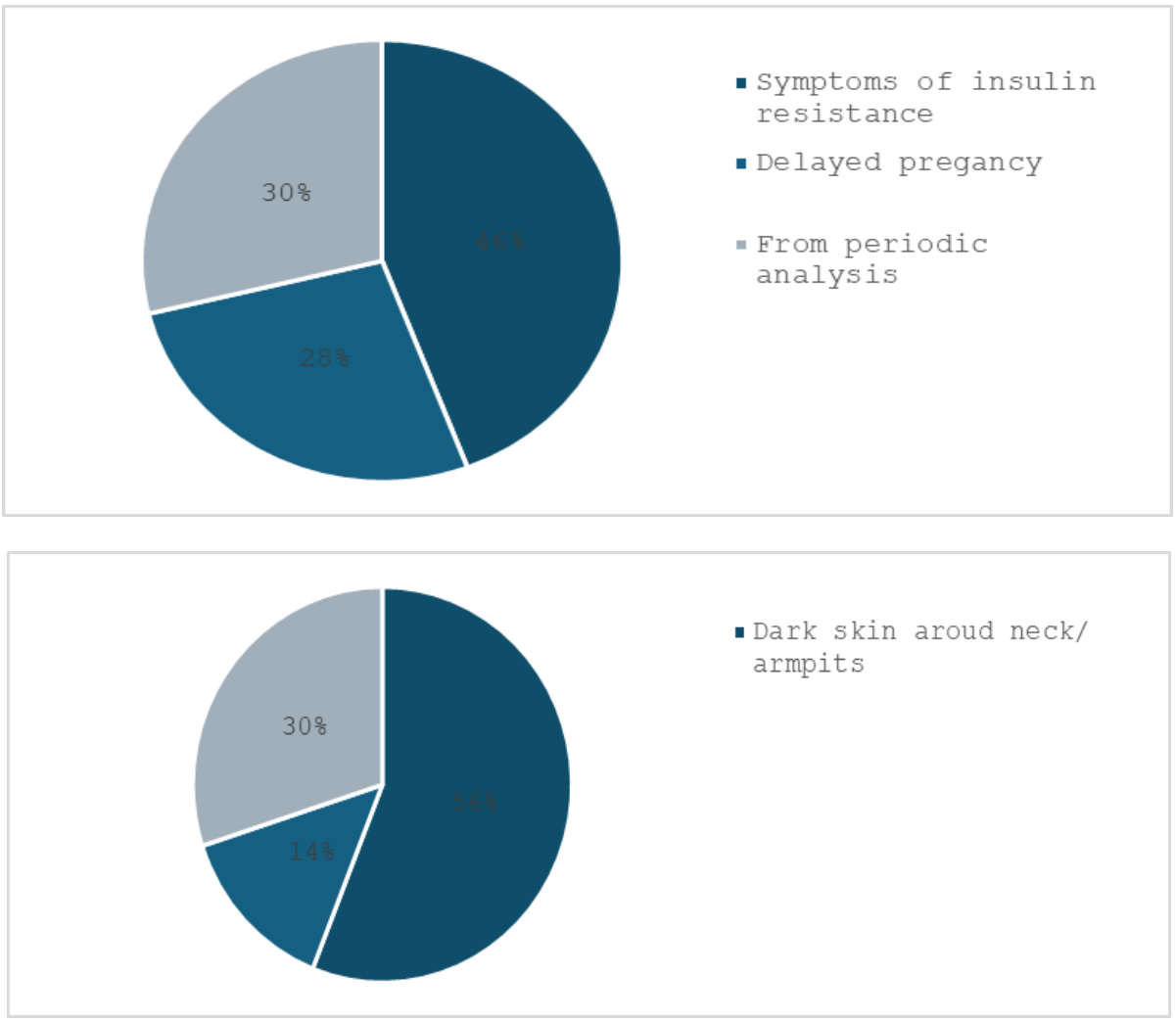

Figure 4. Shows the percentage of methods for diagnosing polycystic ovary syndrome

Table 6. Shows the family history of insulin resistance

	Repetition	Ratio
He has a family history of insulin resistance	19	38%
He has no family history of insulin resistance	31	62%
The total	50	100%

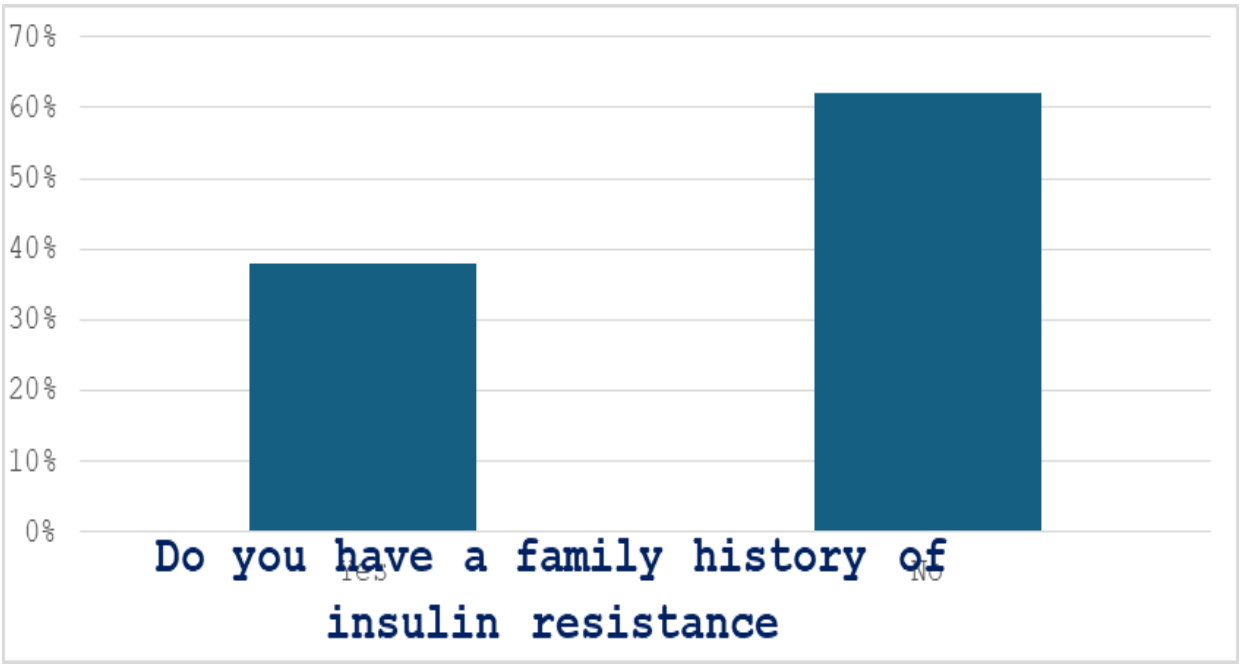

Figure 5. Family history of insulin resistance

Table 7. Shows irregular menstrual cycle

	Repetition	Ratio
Irregular menstrual cycle	42	84%
Regular menstrual cycle	8	16%
The total	50	100%

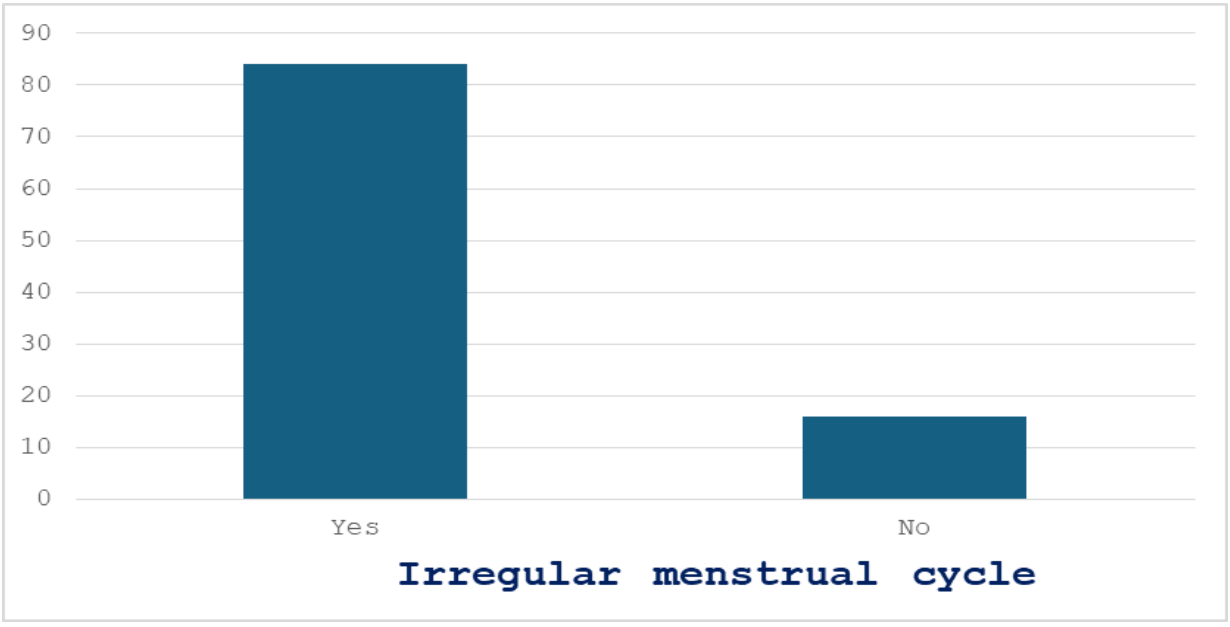

Figure 6. Shows irregular menstrual cycle

5. Discussion

The findings of this study underscore the significant relationship between insulin resistance and both reproductive and cardiovascular health in women diagnosed with PCOS. The high prevalence of insulin resistance among participants, particularly those with a higher BMI, is consistent with existing literature, reinforcing the association between obesity and metabolic dysfunction in women with PCOS. These findings highlight the need for early diagnosis and intervention to manage insulin resistance and prevent long-term complications [1,15].

5.1. Insulin Resistance and PCOS

As shown in previous studies, insulin resistance exacerbates the symptoms of PCOS, including menstrual irregularities, hyperandrogenism, and infertility. Hyperinsulinemia, caused by insulin resistance, stimulates the ovaries to produce more androgens, further disrupting normal ovarian function. This vicious cycle underscores the complexity of managing PCOS, where metabolic and reproductive issues are deeply intertwined [16]. Women with insulin resistance and PCOS are also at an increased risk of developing type 2 diabetes, particularly as they age. The presence of insulin resistance in this population signals the need for preventive strategies, including lifestyle interventions and pharmacological treatment to improve insulin sensitivity [8].

5.2. Cardiovascular Risks

In addition to its impact on reproductive health, insulin resistance significantly increases the risk of cardiovascular disease in women with PCOS. The study demonstrated a clear correlation between high HOMA-IR scores and elevated cardiovascular risk factors such as hypertension, dyslipidemia, and elevated cholesterol levels. These results align with prior research indicating that insulin resistance is a strong predictor of cardiovascular events in women, especially those with additional risk factors like obesity [17,18]. Given the increased cardiovascular risks associated with insulin resistance, integrated care that addresses both metabolic and cardiovascular health is critical for women with PCOS. Strategies such as regular monitoring of blood lipids and glucose levels, combined with targeted interventions, are essential to reduce the likelihood of long-term cardiovascular complications [13].

5.3. Management Strategies

The study highlighted the effectiveness of lifestyle modifications, including regular physical activity and a balanced diet, in reducing insulin resistance. Participants who engaged in consistent exercise and followed a low-calorie diet showed significantly lower HOMA-IR scores, suggesting that lifestyle interventions can play a key role in managing insulin resistance and mitigating cardiovascular risks [19]. Pharmacological treatments, such as metformin, remain important for managing insulin resistance in women with PCOS. However, the findings indicate that a comprehensive approach that combines medication with lifestyle changes offers the best outcomes for reducing insulin resistance and improving both metabolic and reproductive health [16].

6. Conclusions

Insulin resistance plays a pivotal role in the development of both reproductive and cardiovascular health complications in women diagnosed with PCOS. This study confirmed the high prevalence of insulin resistance among women with PCOS and demonstrated its strong correlation with cardiovascular risk factors, particularly in those with obesity [20]. The findings highlight the need for early diagnosis and integrated management of insulin resistance to prevent long-term complications such as type 2 diabetes and cardiovascular disease. Lifestyle interventions, including physical activity and dietary modifications, are essential for reducing insulin resistance, while pharmacological treatments such as metformin can provide additional support [2, 7]. Future research should focus on developing personalized treatment plans that address both metabolic and reproductive health, especially for women with PCOS and insulin resistance. Preventive strategies, combined with regular monitoring of cardiovascular risk factors, can improve health outcomes and reduce the burden of complications associated with insulin resistance [15].

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