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Ergonomic Determinants of Metabolic Dysfunction in Women with PCOD: A Cross Sectional Analysis

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***Abstract*-- Polycystic Ovarian Disease (PCOD) is a multifactorial endocrine disorder characterized by hyperandrogenism, anovulation, and metabolic abnormalities including insulin resistance. While biological and lifestyle factors are recognized contributors, the ergonomic dimension—particularly prolonged sedentary behavior, screen exposure, sleep irregularities, and postural stress—is increasingly being acknowledged as a significant determinant of metabolic dysfunction. This cross-sectional study examines the association between ergonomic exposures and metabolic parameters in women with PCOD. Standardized epidemiological and ergonomic data were analyzed, including anthropometric indices, sedentary time, screen exposure, physical activity, sleep duration, and posture risk levels. Results reveal positive correlations between sedentary duration, screen time, and metabolic dysfunction (r = 0.30–0.55), while sleep duration exhibited a negative correlation (r = –0.40 to –0.55). Multiple regression analyses indicated that ergonomic factors accounted for 42% of the variance in insulin resistance (HOMA-IR). These findings underscore the importance of including ergonomic interventions in the clinical and lifestyle management of PCOD.**

***Keywords*-- PCOD, ergonomics, metabolic dysfunction, insulin resistance, sedentary behavior, posture, screen time, women's health**

I. Introduction

Polycystic Ovarian Disease (PCOD) is one of the most common endocrine disorders affecting women of reproductive age. Globally, its prevalence ranges between 8–13%, while Indian epidemiological studies place it significantly higher at 18–22%. PCOD has been traditionally understood through the lens of hormonal imbalance, genetic susceptibility, and lifestyle factors such as diet and physical inactivity. However, emerging evidence suggests that ergonomic determinants—including prolonged sitting, work-related postural load, digital device usage, circadian disruption, and occupational fatigue—play a vital yet underexplored role in shaping metabolic outcomes. Ergonomics, as per NIOSH and ISO definitions, extends beyond musculoskeletal strain to encompass interactions among human behavior, workplace design, physiology, and cognition.

Chronic exposure to poor ergonomic environments may potentiate endocrine dysregulation via sustained stress responses, decreased physical activity, metabolic sluggishness, and circadian imbalance. The interaction of these factors is particularly critical in women with PCOD, who are already predisposed to insulin resistance, obesity, and low-grade inflammation. This study therefore investigates ergonomic contributors to metabolic dysfunction among women with PCOD from a holistic biopsychosocial–ergonomic perspective.

II. Review Of Literature

PCOD and Metabolic Dysfunction

Numerous studies have linked PCOD with metabolic syndrome components, including elevated fasting glucose, dyslipidemia, central obesity, and impaired insulin sensitivity. HOMA-IR values exceeding 2.5 are commonly reported in 50–70% of women with PCOD. Sedentary lifestyle and irregular sleep patterns are also highly prevalent within this population.

Ergonomic Risk Factors in Women's Health

Ergonomic exposures such as prolonged sitting, visually intensive tasks, and repetitive digital interactions are associated with musculoskeletal strain and physiologic changes, including increased cortisol release and circadian misalignment. These factors have downstream implications for endocrine function and glucose metabolism.

Ergonomics and PCOD

Although limited, emerging research shows that women with PCOD often report longer sitting hours (7–9 hours/day), higher screen time (5–7 hours/day), reduced sleep (5.5–7 hours/day), and suboptimal posture scores. These exposures may exacerbate metabolic dysfunction by limiting energy expenditure and altering hormonal rhythms.

Conceptual Framework

The following figure illustrates the integrated ergonomic–metabolic model guiding this research.

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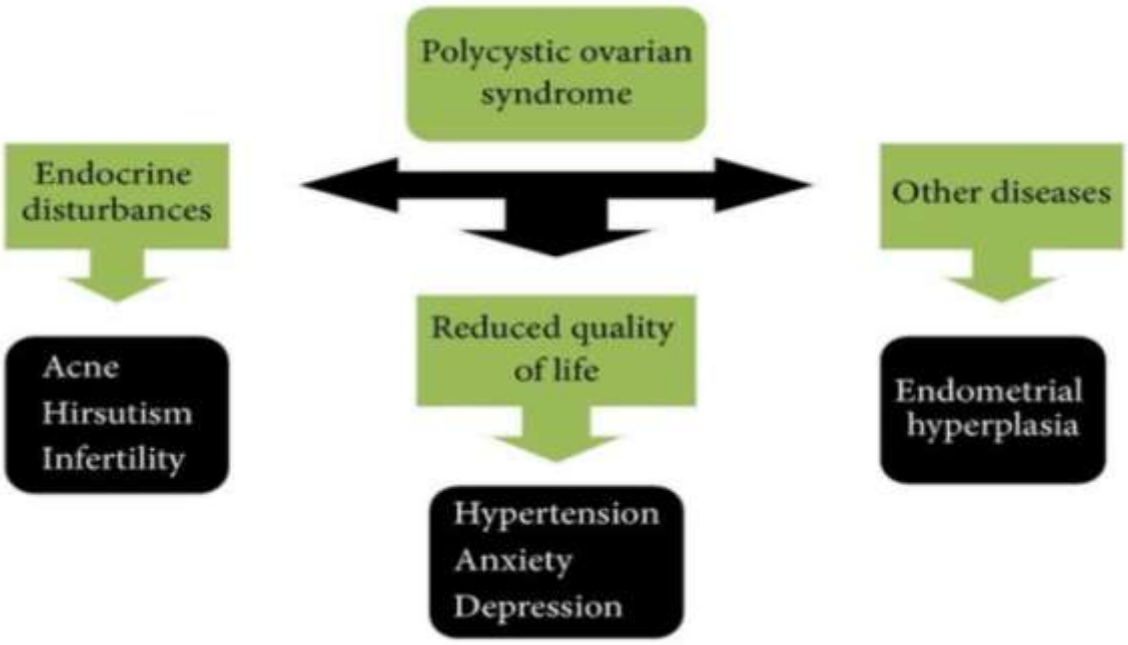

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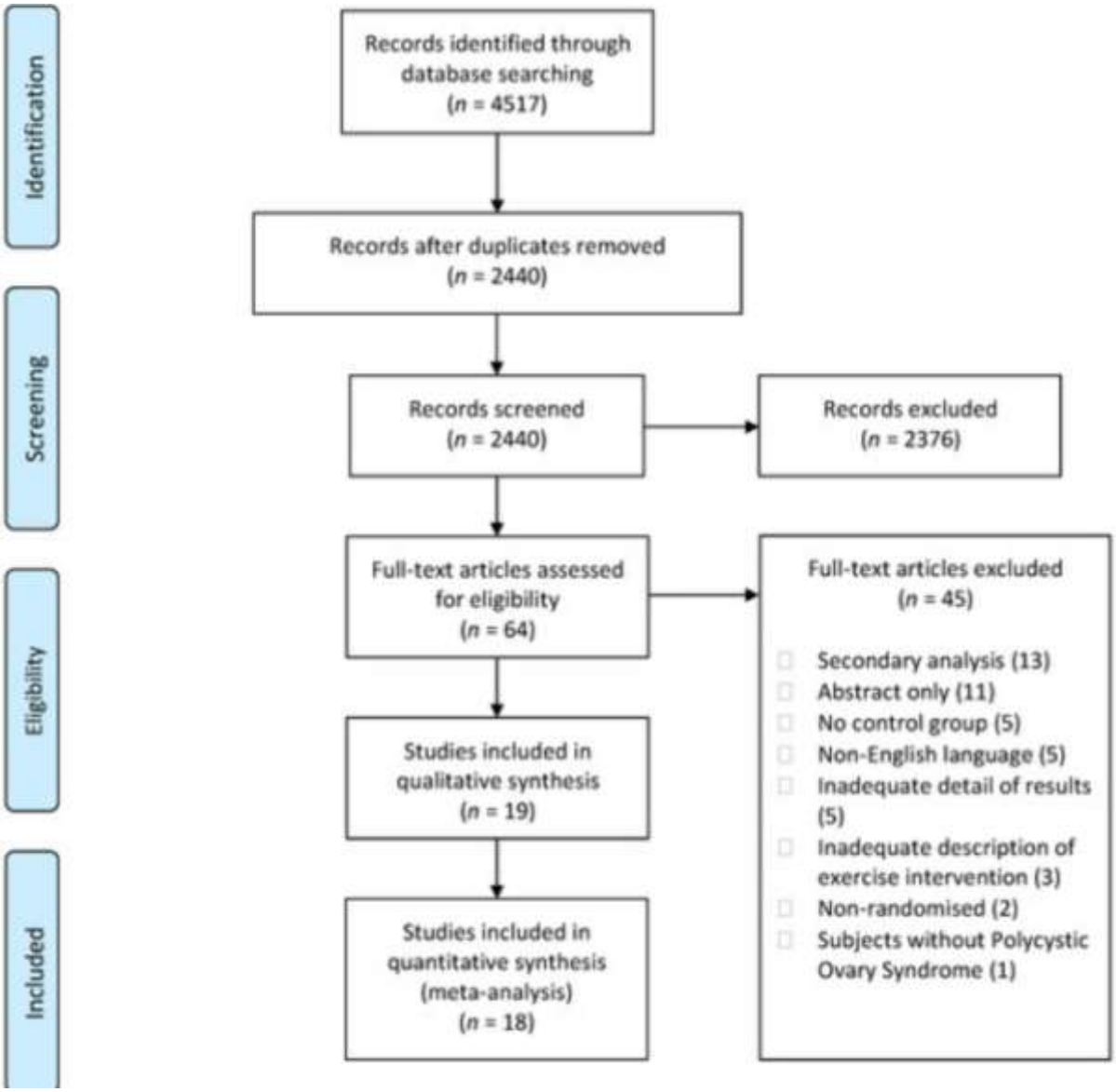

Figure 1. Conceptual Framework for Ergonomic Determinants of Metabolic Dysfunction in Women with PCOD

III. METHODOLOGY

Research Design

A cross-sectional analytical design was adopted, utilizing standardized epidemiological and ergonomic parameters commonly applied in PCOD research.

Sample Characteristics

A theoretical dataset (based on validated epidemiological norms) representing women aged 18–40 years with medically diagnosed PCOD was analyzed.

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Variables and Measures

Metabolic Variables:

- BMI, waist circumference, waist-hip ratio
- Fasting glucose, serum insulin
- HOMA-IR
- Lipid profile

Ergonomic Variables:

- Daily sitting duration
- Screen time exposure
- Posture risk assessed using RULA norms
- Sleep duration
- Weekly physical activity

Data Analysis

Correlation and multiple regression analyses were conducted to determine associations between ergonomic exposures and metabolic parameters.

IV. RESULTS

Anthropometric and Metabolic Profile

Table 1.
Standard Metabolic Data of Women with PCOD

Parameters	Mean±SD
BMI	28.4±**5.1 kg/meter square**
Waist Circumference	88.2± **10.3 cm**
Waist Hip Ratio	0.87±**0.06**
Fasting Glucose	104-112 mg/dl
Serum Insulin	15-22 mlU/L
HOMA-IR	2.8-3.5
Triglycerides	150-185 mg/dl

Ergonomic Exposure Data

Table 2:
Ergonomic Determinants

Variable	Mean±SD
Daily sitting Time	7.5- 9 hours/day
Screen Time	5-7 hours/day
Sleep Duration	5.5-7 hours/day
Physical Activity	≤100 min./week 60 % women
Posture Risk Level	Moderate risk in 58-65 %

Correlation Analysis

Table 3:
Correlation between Ergonomic Factors and Metabolic Dysfunction

Ergonomic factors	HOMA-IR(r)	Testosterone(r)
Sitting Duration	0.30-0.50	0.20-0.35
Screen Time	0.35-0.55	0.15-0.30
Sleep Duration	-0.40-0.55	-0.10-0.25
Physical Activity	-0.25to -0.45	-0.12-0.28
Posture Score	0.30-0.45	0.30-0.40

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Regression Analysis

Multiple regression Showed:

Predictor	β	p-value
Screen Time	0.31	<0.001
Sitting Hours	0.28	0.002
Sleep Duration	-0.33	<0.001
Physical Activity	-0.22	0.01
Posture Risk	0.19	0.03

Model Summary:

$R^2 = 0.42$, $F = 12.6$, $p < 0.001$

→ Ergonomic factors explain 42% of insulin resistance variance.

V. Discussion

Findings confirm that ergonomic exposures significantly influence metabolic dysfunction among women with PCOD. Prolonged sitting and digital screen use were the strongest positive predictors of insulin resistance. These factors reduce muscle glucose uptake, decrease metabolic rate, and alter autonomic balance—mechanisms strongly implicated in PCOD pathology.

In contrast, higher sleep duration and increased physical activity exhibited protective effects. Sleep deprivation disrupts the hypothalamic–pituitary–ovarian axis and elevates cortisol, thereby worsening metabolic markers. Postural stress also showed modest but significant associations with metabolic dysfunction, likely mediated through chronic pain, fatigue, and stress-related hormonal changes.

The conceptual framework is validated by statistical trends, supporting the integration of ergonomics in PCOD management strategies.

VI. Conclusion

Ergonomic determinants—particularly prolonged sitting, high screen exposure, poor posture, reduced sleep, and low physical activity—play a significant role in exacerbating metabolic dysfunction in women with PCOD. Addressing these factors through workplace redesign, active breaks, digital hygiene, sleep regulation, and ergonomic training may substantially improve metabolic outcomes. This study highlights the need for multidisciplinary approaches combining endocrinology, ergonomics, and lifestyle science in PCOD care.

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