Metabolomic insights into PCOS: the role of BMI

MASSACHUSETTS GENERAL HOSPITAL
OBSTETRICS & GYNECOLOGY

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Background

PCOS affects ~4-18% of reproductive-age women. It is characterized by hyperandrogenism and insulin resistance along with other metabolic disturbances. Clustering analyses have described distinct PCOS phenotypes introducing reproductive and metabolic subtypes mapping to lean and non-lean PCOS. This differentiation is important because the long-term health consequences and the cardiometabolic risk profile of PCOS patients vary by phenotype.

Objective

To delineate the metabolomic profile in lean and non-lean PCOS patients.

Materials & Methods

Data: Samples, metabolomic data, and health information were obtained from the Mass General Brigham Biobank.

Metabolomic data: serum levels of amino acids, apolipoproteins, cholesterol, cholesteryl esters, fatty acids, fluid balance, glycolysis related metabolites, inflammation, ketone bodies, phospholipids, and triglycerides

Population: Premenopausal patients with available BMI and metabolomics information

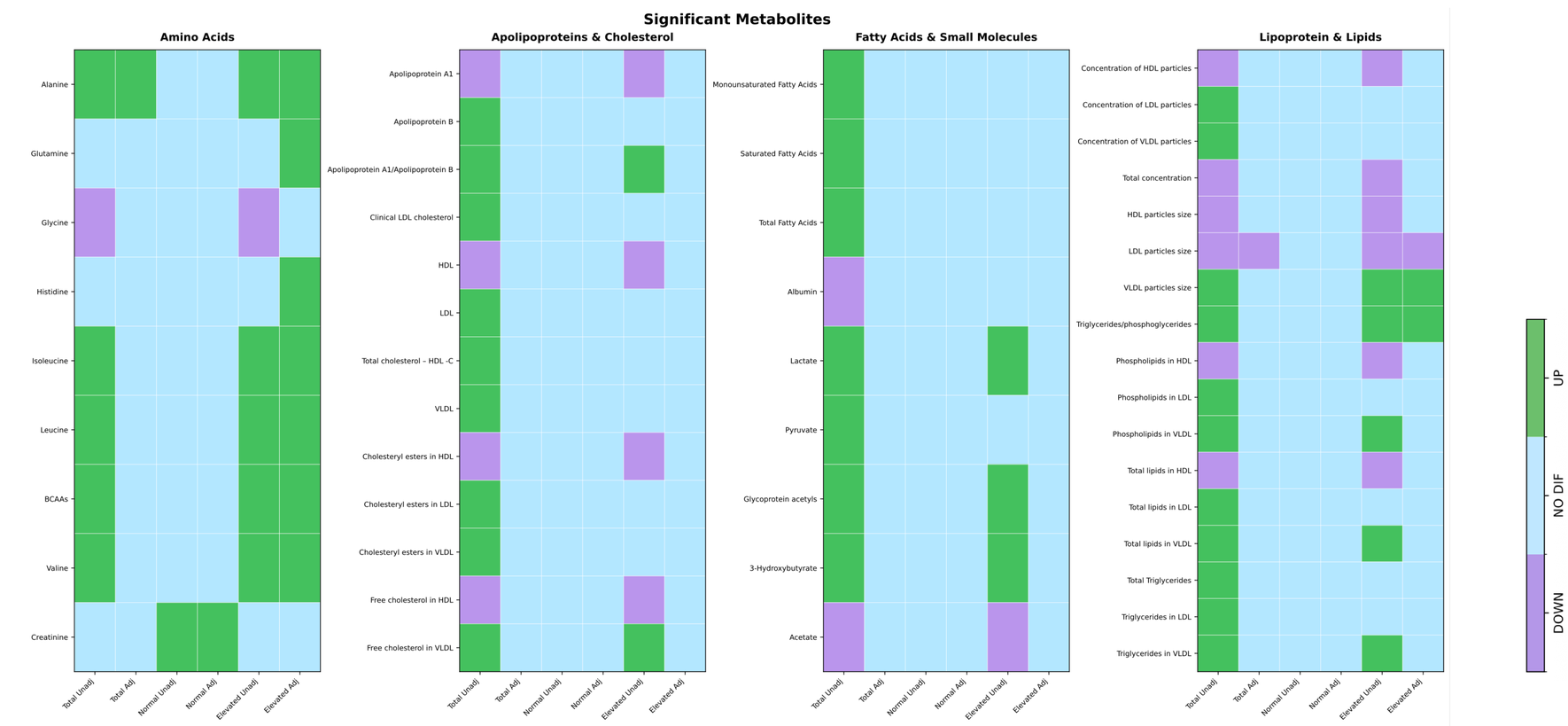
Groups: PCOS patients (n=403) were compared with non-PCOS controls (n=4,365)

Outcome measures: differences in metabolomic parameters
Sub-analysis: normal BMI & elevated BMI sub-populations

Statistics: Linear regression models controlling for potential confounders including age, exercise, BMI

Table 1. Demographic characteristics

	Total population			Normal BMI (<25 kg/m²)			Elevated BMI (≥25 kg/m²)		
	Non-PCOS (n=4,365)	PCOS (n=403)	p-value	Non-PCOS (n=2,277)	PCOS (n=132)	p-value	Non-PCOS (n=2,088)	PCOS (n=271)	p-value
Age	35.4 (9.8)	33.7 (8.4)	<0.001	33.7 (9.8)	32.2 (7.6)	0.034	37.2 (9.5)	34.4 (8.6)	**<0.001**
BMI	26.6 (6.9)	30.7 (8.7)	<0.001	21.8 (1.9)	22.1 (1.9)	0.064	31.8 (6.6)	34.8 (7.6)	**<0.001**
Exercise hrs/wk	4.0 (4.1)	3.6 (3.7)	0.099	4.5 (4.3)	4.4 (3.9)	0.669	3.3 (3.8)	3.2 (3.5)	0.679
Race, n (%)									
White	3,609 (82.7%)	302 (74.9%)	<0.001	1,935 (85.0%)	108 (81.8%)	0.473	1,674 (80.2%)	194 (71.6%)	**<0.001**
Black	212 (4.9%)	22 (5.5%)		44 (1.9%)	3 (2.3%)		168 (8.0%)	19 (7.0%)	
Asian	201 (4.6%)	22 (5.5%)		151 (6.6%)	8 (6.1%)		50 (2.4%)	14 (5.2%)	
Other	341 (7.8%)	57 (14.1%)		146 (6.4%)	13 (9.8%)		195 (9.3%)	44 (16.2%)	
Education, n (%)									
< college degree	801 (18.4%)	81 (20.1%)	0.383	358 (15.7%)	9 (6.9%)	0.006	443 (21.2%)	72 (26.6%)	**0.046**
≥ College degree	3,558 (81.6%)	321 (79.9%)		1,916 (84.3%)	122 (93.1%)		1,642 (78.8%)	199 (73.4%)	



Conclusions

Metabolomic signatures of PCOS differ by BMI phenotype. Only minimal metabolic disturbances were noted in normal BMI PCOS patients compared to non-PCOS. These findings support phenotypic risk stratification and may inform individualized metabolic screening and counselling in women with PCOS

Acknowledgements

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Fig 1. PCOS impact on the regulation of metabolomic biomarkers in the total population, the normal BMI subgroup, and the elevated BMI (≥25 kg/m²) sub-group.

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