

Imperial College
London

Polycystic Ovary Syndrome: The Influence of Ethnicity and Body Mass

Hamza Ikhlqa, Stephen Franks

Background

- Polycystic ovarian syndrome (PCOS) is the most common endocrine disorder affecting women of reproductive age (1).
- The aetiology behind PCOS is poorly understood but influencing ethnic, environmental, and genetic factors have been recognised (2).
- Current literature identifies obesity as one of these factors exacerbating clinical presentations. However, literature examining the impact of ethnicity is scarce.
- We hypothesised body mass index (BMI) and ethnicity influence the clinical, metabolic, and biochemical presentations of PCOS, with an interaction between these factors.

Methods

- This was a large retrospective cohort study analysing data obtained from 1081 women with PCOS who had presented at St Mary’s Hospital, London.
- BMI values were grouped using the World Health Organisation (WHO) classification into normal weight (18.5-24.9), overweight (25.0-29.9) and obese groups (> 30.0).
- Ethnicities were classified as European, South Asian, and Afro-Caribbean groups.
- Biochemical and clinical presentations were compared among these groups and Mann-Whitney U tests and Chi-squared analyses were used to assess for significance between these variables.
- Interactions between ethnicity and body habitus were determined using simple linear regressions.

Results

Influence of BMI

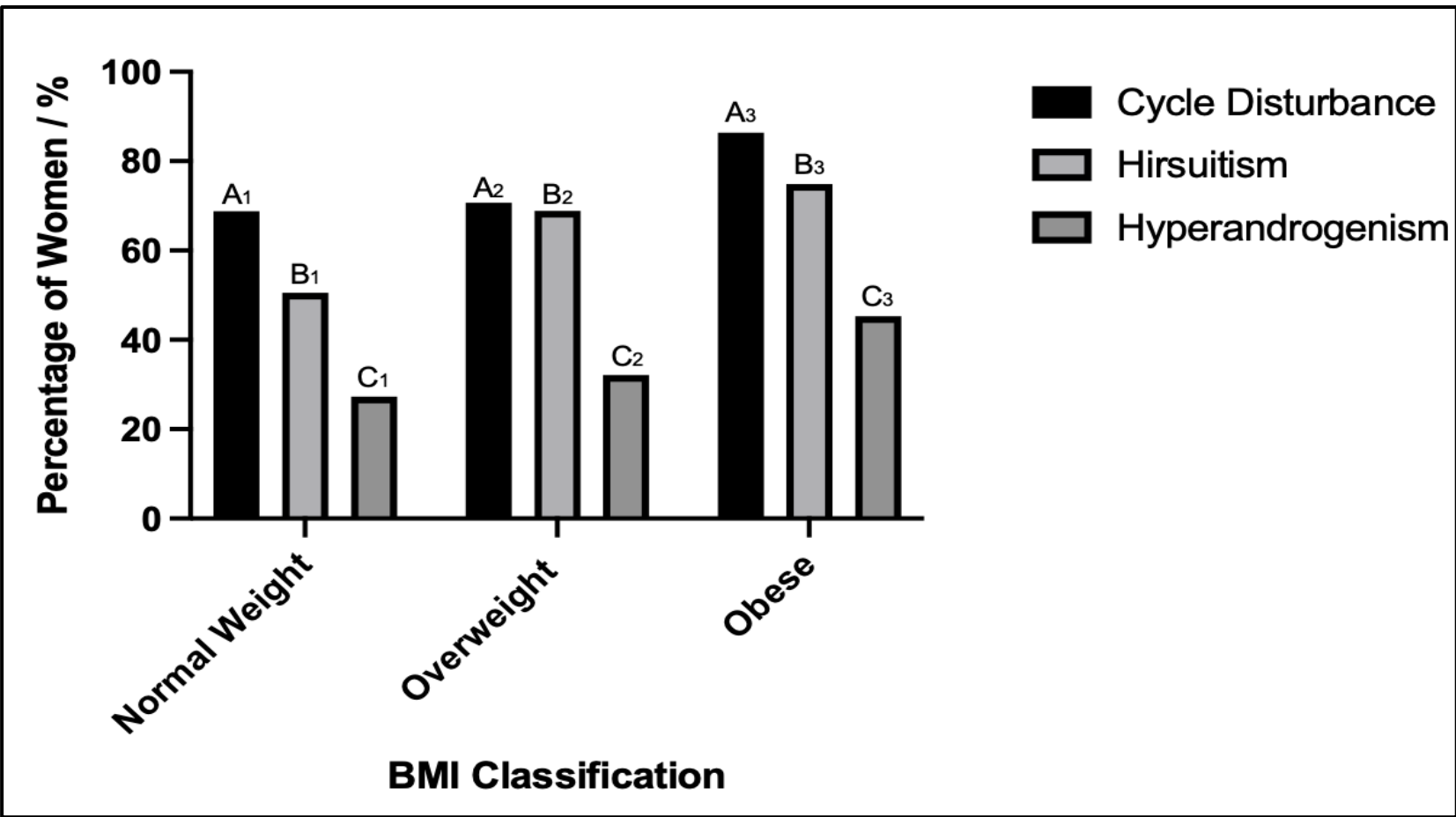


Figure 1. BMI Classifications and the proportions of women presenting with differing PCOS phenotypes.
The following n numbers were used to generate the above figure: Obese (n=302), Overweight (n=206), Normal Weight (n=442).
Chi-Squared analyses were performed to test for significant differences and revealed the following: A₁ & A₂ (p>0.05^{NS}) A₂ & A₃ (p<0.01**) A₁ & A₃ (p<0.01**), B₁ & B₂ (p<0.01**), B₂ & B₃ (p>0.05^{NS}) B₁ & B₃ (p<0.001***), C₁ & C₂ (p>0.05^{NS}) C₂ & C₃ (p>0.05^{NS}) C₁ & C₃ (p<0.01**)
^{NS}Indicates no statistical significance where p>0.05, * Indicates statistical significance where p<0.05, ** indicates statistical significance where p<0.01, *** indicates statistical significance where p<0.001

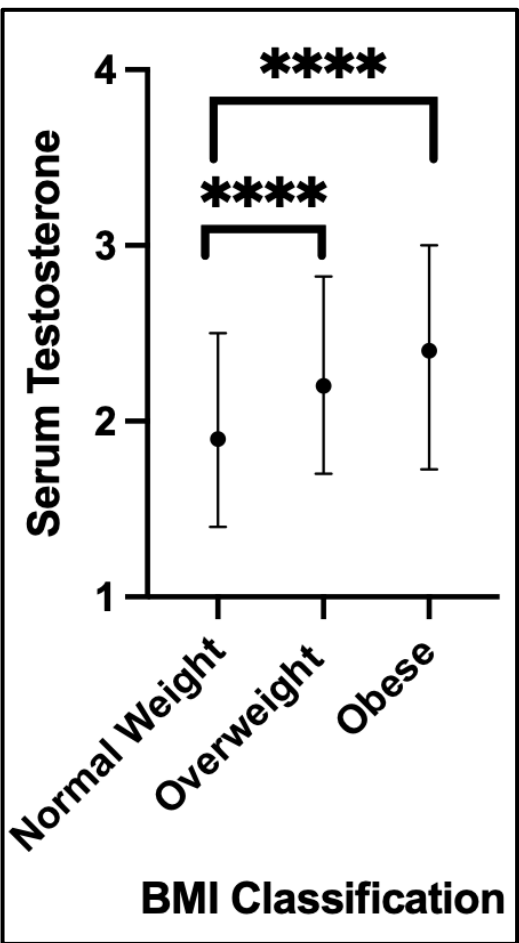


Figure 2. BMI Classifications and average serum testosterone levels (nmol/l).
Results are shown as median ± interquartile range (n=578).
^{NS}Indicates no statistical significance where p>0.05, * Indicates statistical significance where p<0.05, ** indicates statistical significance where p<0.01, *** indicates statistical significance where p<0.001, **** indicates statistical significance where p<0.0001

- Across all BMI groups, cycle disturbances are the most prevalent phenotype across all BMI groups, followed by hirsutism and hyperandrogenism.
- Increasing BMI appears to significantly increase the prevalence of all studied PCOS phenotypes, with significant differences observed between normal-weight and obese women in all their presentations.
- The most significant differences are seen between normal-weight and obese women presenting with hirsutism. 74.9% of obese women presented with hirsutism compared to 50.5% of normal-weight women, an increase of nearly a quarter.
- Figure 2 highlights the significant increases in serum testosterone observed between normal-weight women and women who are overweight and obese.
- The average serum testosterone increases from 1.9nmol/l in normal-weight women to 2.2nmol/l and 2.4nmol/l in overweight and obese women respectively.

Influence of Ethnicity

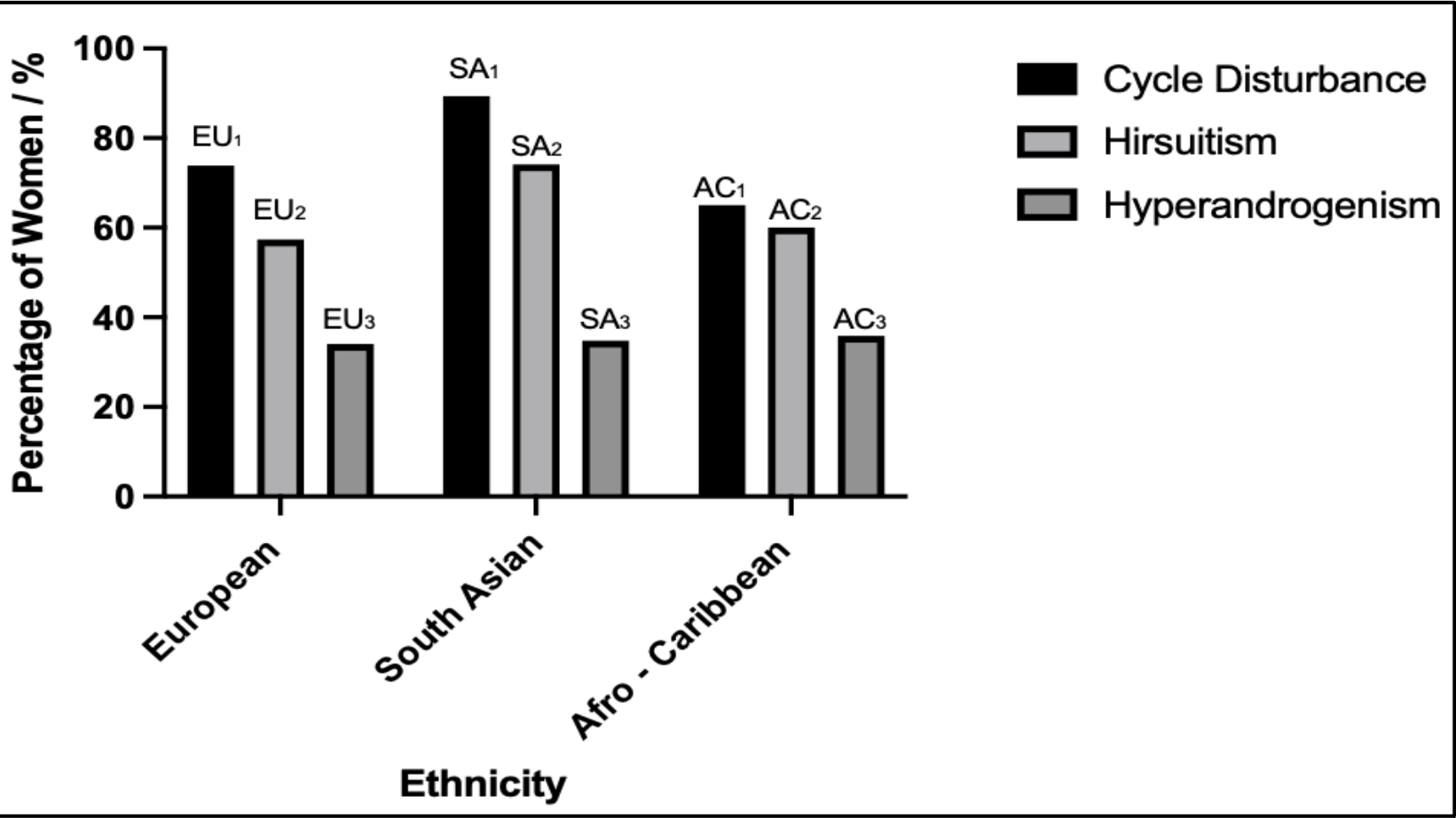


Figure 3. Ethnicity and proportions of women presenting with differing PCOS phenotypes.
The following n numbers were used to generate the above figure: European (n=833), South Asian (n=85), Afro-Caribbean (n=60).
Chi-Squared analyses were performed to test for significant differences and revealed the following: EU₁ & SA₁ (p<0.001**) EU₁ & AC₁ (p>0.05^{NS}) SA₁ & AC₁ (p<0.0001***), EU₂ & SA₂ (p<0.05*) EU₂ & AC₂ (p>0.05^{NS}) SA₂ & AC₂ (p<0.05*), EU₃ & SA₃ (p>0.05^{NS}) EU₃ & AC₃ (p>0.05^{NS}) SA₃ & AC₃ (p>0.05^{NS})
^{NS}Indicates no statistical significance where p>0.05, * Indicates statistical significance where p<0.05, ** indicates statistical significance where p<0.01, *** indicates statistical significance where p<0.001, **** indicates statistical significance where p<0.0001

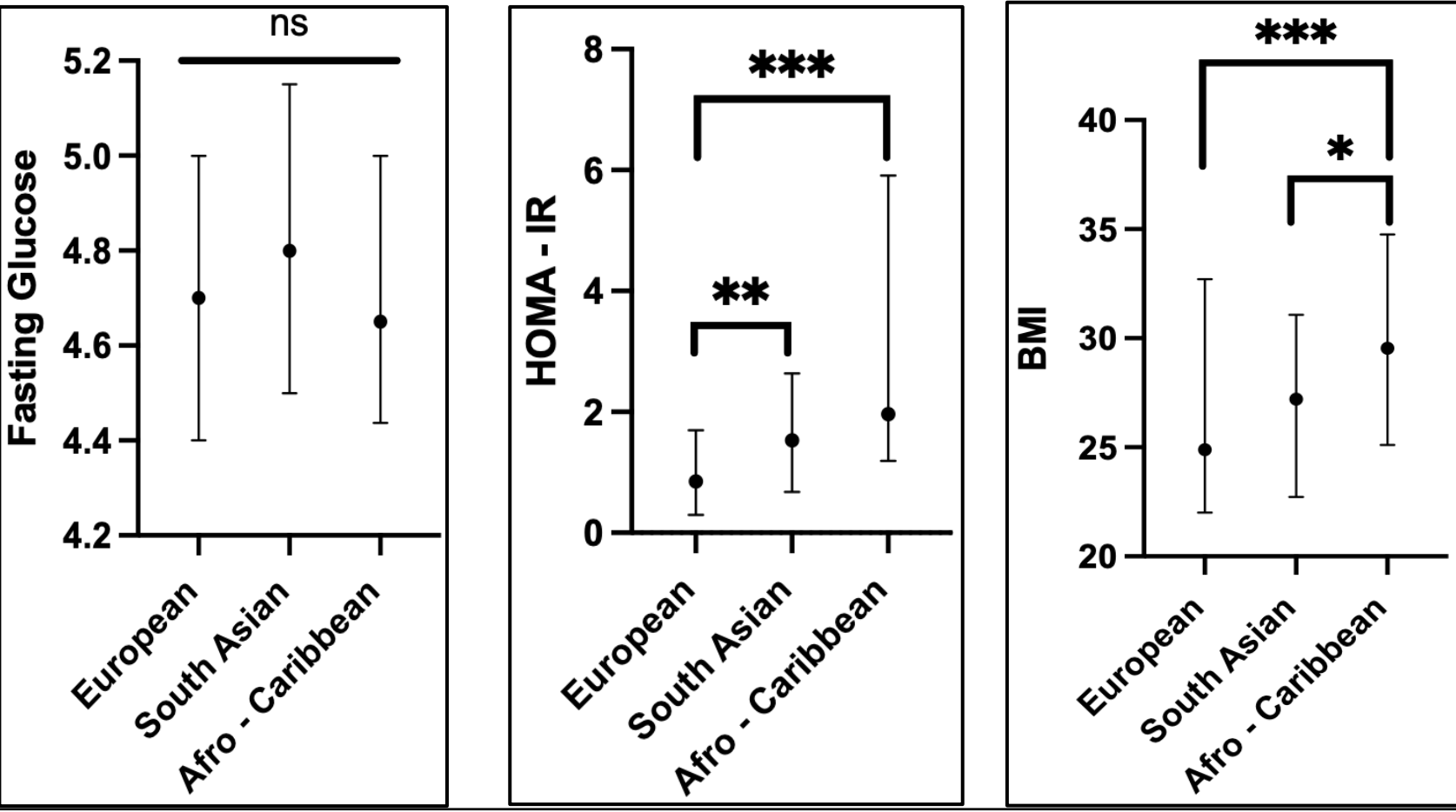


Figure 4. Ethnicity and biochemical parameters in women with PCOS.
Figure 4A (Fasting Glucose, mmol/l), Figure 4B (HOMA-IR), Figure 4C (BMI).
The abbreviations used are BMI (Body Mass Index) and HOMA-IR (Homeostasis Model Assessment – Insulin Resistance).
The following n numbers were used to generate each figure panel: Fasting Glucose (n=668), HOMA-IR (n=517) and BMI (n=887).
Results are shown as median ± interquartile range. ^{NS}Indicates no statistical significance where p>0.05, * Indicates statistical significance where p<0.05, ** indicates statistical significance where p<0.01, *** indicates statistical significance where p<0.001

- South Asian women have a significantly increased prevalence of cycle disturbances and hirsutism compared to other ethnic groups.
- The prevalence of hyperandrogenism across all ethnic groups is relatively constant, with no significant differences observed amongst the proportion of women in different ethnic groups.
- The most significant differences are observed between European and Afro-Caribbean groups, with significantly higher values for HOMA-IR (Figure 4B) and BMI (Figure 4C) observed for Afro-Caribbean groups.
- A 131% increase is seen in the average HOMA-IR value for Afro-Caribbean women when compared to European women.
- Despite slight variations between ethnic groups for the average fasting glucose levels and serum testosterone levels, no significant differences were found.

Interactions of Body Habitus and Ethnicity

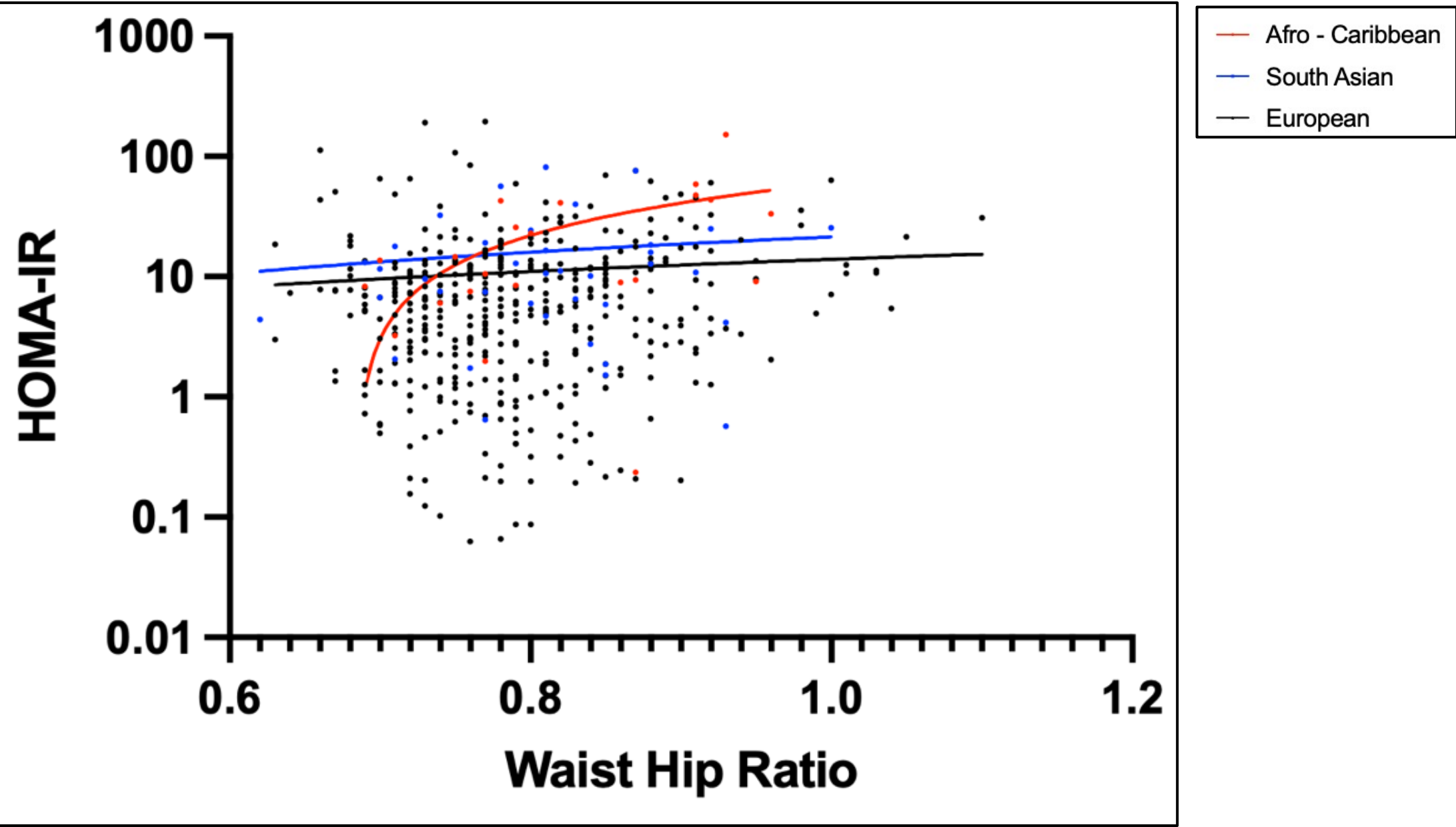


Figure 5. Association between waist-hip ratio and HOMA-IR values for women with PCOS in differing ethnicities.
A total sample of n = 477 women were analysed.
Calculated r-squared values for the correlations found were: European r² = 0.034, South Asian r² = 0.013, Afro-Caribbean r² = 0.237
Results of the simple linear regression to test for the significance between waist-hip ratio) and HOMA-IR: European (p>0.05^{NS}), South Asian (p>0.05^{NS}), and Afro-Caribbean (p<0.05*).
Results of the simple linear regression to test for any significant differences between the slopes of the different ethnic groups were as follows: European and South Asian (p>0.05^{NS}), European and Afro-Caribbean (p<0.001***), South Asian and Afro-Caribbean (p<0.05*).

- Figure 6 highlights a significantly different relationship between waist-hip ratios and HOMA-IR values for Afro-Caribbean women when compared to women from European and South Asian ethnic groups.
- Figure 6 demonstrates a significant association between HOMA-IR values and the waist-hip ratios for Afro-Caribbean women, with an increase in waist-hip ratio being associated with increased HOMA-IR levels.
- No significant association was found for European and South Asian women.

Conclusions

- This study revealed a significant interaction between body habitus and ethnicity in women with PCOS.
- The most significant results when examining the interactions of body habitus and ethnicity are between fasting insulin and HOMA-IR with respect to the waist-hip ratio in Afro-Caribbean women.
- Results from this study confirm a significant association between increasing BMI and the increasing prevalence of clinical manifestations. Furthermore, significant increases are seen in the HOMA-IR and serum testosterone levels with increasing BMI.
- Our data shows a significant distribution of phenotypes across ethnicities. South Asian women are shown to be more hirsute, and a greater proportion of these women present with cycle disturbances.
- if ethnicity perpetuates metabolic disturbances and clinical presentations, more rigorous metabolic guidance and clinical screening are required for more vulnerable populations.
- Our study highlights the need to consider these variables in delivering clinical care for these women throughout the screening, diagnosis, and management processes.

References

1. Escobar-Morreale HF. Polycystic ovary syndrome: definition, aetiology, diagnosis and treatment. Nature Reviews Endocrinology 2018 14(5): 270–284. <https://doi.org/10.1038/nrendo.2018.24>

2. Deswal R, Narwal V, Dang A, Pundir CS. The Prevalence of Polycystic Ovary Syndrome: A Brief Systematic Review. Journal of human reproductive sciences. 2020;13(4): 261–271. https://doi.org/10.4103/JHRS.JHRS_95_18