



Differences of Polycystic Ovary Syndrome (PCOS) Effects among Asian and Caucasian Women

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Authors' contributions

This work was carried out in collaboration by all authors. All authors designed the study. Authors WC, JKP and AO wrote the protocol, performed the literature searches and the statistical analysis and wrote first draft of the manuscript under the supervision of author OM. All authors read and approved the final manuscript.

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ABSTRACT

PCOS, Polycystic ovary syndrome, is the most common endocrine disorder occurring in women with normal reproductive age. General symptoms of PCOS include irregular menstrual cycles, polycystic ovaries, hirsutism, and hyperandrogenism. Also, Insulin resistance that is associated with obesity, skin conditions such as acne, and even psychiatric conditions have been reported. Comparison of prevalence of PCOS is not an easy task due to the fact that there are too many variables to consider. The biggest one is that each research uses different diagnostic criteria. Also, some studies use small sample sizes, and some studies are too specific in location to represent the whole country. This study reviewed articles to determine how geographical and ethnic differences among Asians and Caucasians would affect the prevalence of polycystic ovary syndrome.

Keywords: Geographical; ethnic; polycystic ovary syndrome; Asian; Caucasians.

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1. INTRODUCTION

Polycystic ovary syndrome (PCOS) is a common endocrine disturbance in women of reproductive ages, and it is “characterized by clinical and/or biochemical androgen excess, ovulatory dysfunction and polycystic ovarian morphology (PCOM)” (Sendur & Yildiz, 2020, p.2). According to Wolf et al. [1], women who are at reproductive age (studies were done on women of age between 18 and 45) are the ones that PCOS impacts regardless of races and ethnicities. Therefore, knowing the differences among races and ethnicities might give more light on the pathogenesis of PCOS (Sendur & Yildiz, 2020). According to Wolf et al. [1], “the etiology of PCOS is not completely understood and there is no known cause, although a genetic component and diet/lifestyle factors, such as insulin resistance and obesity have been identified.” Moreover, because of the complex inheritance mode of PCOS, the “genomic variants interfere with important environmental factors” (Li et al., 2013). By understanding “the impact of ethnicity on disparities in phenotypic expression of PCOS” (Li et al., 2013), aetiology of PCOS expressed among different ethnicities could lead to different treatments. Therefore, the article is to exam any differences in prevalence among Asian and Caucasian women. If the differences among Asian and Caucasian women do exist, there could be different treatments. Even if there is no known differences among Asian and Caucasian women, understanding differences in phenotypes for certain symptoms could affect treatments of PCOS for the patients.

2. UNDERSTANDING THE PCOS CRITERIA

There are three well-known diagnostic criteria for polycystic ovary syndrome: National Institutes of Health (NIH) criteria, Rotterdam criteria, and AE-PCOS society criteria [39]. Depending on which diagnostic criteria were used in the study, the prevalence of PCOS gets affected greatly. According to the study of Wolf et al. [39], when the subjects were diagnosed with Rotterdam criteria, there were 1.5 times more subjects diagnosed than those diagnosed with the NIH criteria. The review gathered data mainly from the Rotterdam criteria to compare PCOS prevalence in multiple researches.

The Rotterdam criteria are one of the most widely used diagnostic criteria of PCOS [39]. Among three criteria, patients are required to

have at least two to be diagnosed as PCOS according to Rotterdam criteria. First, it is oligomenorrhea and/or amenorrhea; second, clinical and/or biochemical hirsutism (HA), and lastly, polycystic ovary (PCO) morphology on ultrasonography [18].

3. PREVALENCE OF PCOS IN AMONG ASIAN AND CAUCASIAN WOMEN

Various studies have researched the prevalence of PCOS in many different Asian countries such as China, Korea, Thailand, India and Sri-Lanka. Fig. 1 below is based on the research done in Rotterdam diagnostic criteria. According to Ding et al. [8], the prevalence of PCOS in China was 5.6%. In India, the prevalence was 9.13% (Nidh et al., 2008), a little higher than other Asian countries like 5.80% in Korea (Sung Y, 2011), 5.29% in Thailand [4], and 6.30% in Sri-Lanka (Kumarapeli et al., 2008).

According to Bart et al. (2012), the prevalence of PCOS among Western populations was reported to be as high as 15% based on the Rotterdam criteria. However, according to Li et al. (2013), PCOS among Asian women was reported to be 5.6% in the Southern Chinese population (Li et al., 2013), 5.7% in Thai women (Vutyavanich et al., 2007), 6.3% in Sri Lankan women (Kumarapeli et al., 2008), and 14.3% in Iranian women (Tehrani et al., 2011). Even one of the studies showed 6% to 15% PCOS ranges for Caucasian women (Zhao & Qiao, 2013). The differences among the populations could be due to “different criteria used in the diagnosis of the condition” [14]. Huang et al. [14] also claim that there may be “technical [...], lack of reference standards for androgen assays and inter-observer differences in the measurement of ovarian morphology” (p. 47, 2016). Table 1 shows the results from different studies. However, Huang et al. [14] found that hirsutism had distinct ethnic differences. Table 2 shows the prevalence of hirsutism among different Asian populations.

According to Huang et al. [14], hirsutism is clinically identified by the presence of excessive coarse terminal hair in androgen-responsive areas of the female body. The modified Ferriman-Gallwey (mFG) is commonly used to score nine body areas (upper lip, chin, chest, upper and lower back, upper and lower abdomen, arm, forearm, thigh and lower leg), according to a scale ranging from 0 (no hair) to 4 (similar to that of a well-virilized adult male) [14] p.48.

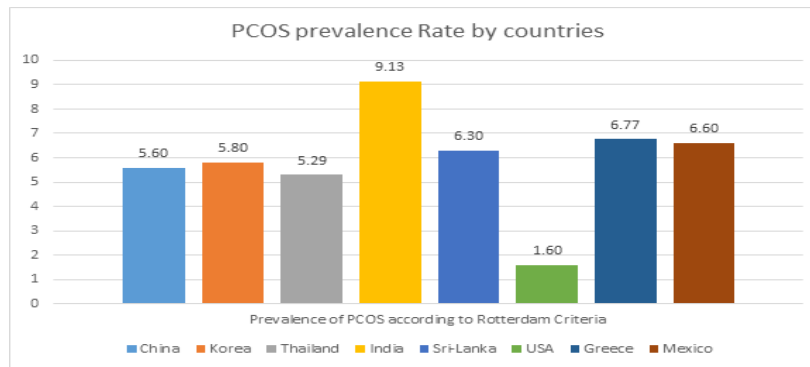


Fig. 1. Prevalence of PCOS according to Rotterdam Criteria by countries

Table 1. Prevalence of women with PCOS of different ethnicities [14]

Ethnicity	Criteria	Total Number of subjects	Prevalence	Reference
Korea	NIH	203	4.9%	Byun et al., 2005
Chinese	Rotterdam	15,924	5.6%	Li et al., 2013
Thai	Rotterdam	1095	5.7%	Vutyavanich et al., 2007
Sri Lankan	Rotterdam	2915	6.3%	Kumarapeli et al., 2008
Iranian	Rotterdam	929	14.3%	Tehrani et al., 2011
Caucasian	Rotterdam	728	11.9%	March et al., 2010
Turks	Rotterdam	392	19.9%	Yildiz et al., 2012

Table 2. Prevalence of hirsutism in PCOS women of different ethnicities [14]

Ethnicity	Modified Ferriman-Gallwey (mFG) cut-off score	Percentage of PCOS women with hirsutism	Reference
Chinese	> 3.5	20.8% (114/547)	Guo et al., 2012
	≥ 6.0	85.0% (708/833)	Li et al., 2013
	≥ 6.0	8.1% (58/719)	Zhang et al., 2013
	≥ 5.0	10.5% (314/2988)	Zhao et al., 2011
	> 2.0	62.6% (553/883)	Zhao et al., 2010
	> 8.0	34.8% (95/273)	Le et al., 2007
Taiwan	> 8.0	43.7% (66/151)	Chen et al., 2007
Chinese			
Japanese	≥ 6.0	23.2% (16/69)	Ichikawa et al., 1991
Thai	≥ 3.0	2.1% (11/531)	Cheewadhanaraks et al., 2004
Korea	≥ 6.0	33.9% (293/865)	Kim et al., 2014

When Huang et al. [14] studied the prevalence of PCOS among Caucasian women using Ferriman and Gallwey, they got 76.3% as the prevalence rate for hirsutism. In other words, Asian women had shown “lower mean hirsutism score” [14] than Caucasian women.

Glintborg et al. [11], studied the clinical manifestations and metabolic risk factors of PCOS among Caucasian, Middle East and Asian women. The studied measured “clinical evaluation (hirsutism, BMI, waist, blood pressure), hormone analyses (testosterone, sex hormone-binding globulin, prolactin, lipids, insulin, glucose)

and transvaginal ultrasound” [11]. When Caucasian and Middle Eastern women were tested for different clinical evaluation, they showed differences. However, the study made corrections because Caucasian “were significantly older than Middle Eastern women and had significantly higher BMI” (Glintborg et al., 2010). The overall discussion showed that different populations showed different phenotypes, such as “more unfavorable cardiovascular risk profile was found in Caucasian women” The study also showed decreased insulin sensitivity among south Asian women when compared with Caucasian women

(Glintborg et al., 2010). Therefore, the study concluded that the "ethnic groups differ in clinical and biochemical presentation of polycystic ovary syndrome" (Flintborg, et al., 2010). In addition, various studies were conducted on Caucasian in the US, Spain, and Australia to determine whether or not Caucasian populations in other countries showed similar prevalence rates across the world (Glintborg et al., 2010). One of the studies designed by March et al. (2009), concluded that Caucasian women showed lower rates of PCOS and its symptoms, compared to South Asian women.

4. PHENOTYPIC DIFFERENCES BY ETHNICITY

According to Huang et al. [14], hirsutism rate for Middle Eastern women was 93.2% (179/190), but the hirsutism rate for the South Asian women was 88.5% (337/381). As the results portrayed, hirsutism rates for different ethnicities were

different. However, other studies showed that hirsutism rate for South Asian descent showed a similar hirsutism rate with Caucasian women [24]. According to Welt, et al. [36], ethnic differences in PCOS symptoms manifested within the Caucasian populations. It showed that Icelandic women with PCOS showed the Ferriman-Gallwey score lower than in Boson women with PCOS. Table 3 shows modified Ferriman-Gallwey (mFG) cut-off scores for the different ethnicities.

Even Asian women showed different rates for modified Ferriman-Gallwey (mFG) cut-off score for polycystic ovary morphology. Table 4 reveals the differences among Asian women for prevalence of polycystic ovary morphology of women with PCOS, and Table 5 shows differences among Caucasian and Middle Eastern women for prevalence of polycystic ovary morphology of women with PCOS.

Table 3. Prevalence of hirsutism in PCOS women of different ethnicities [14]

Ethnicity	Modified Ferriman-Gallwey (mFG) cut-off score	Percentage of PCOS women with hirsutism	Reference
Caucasian	≥ 5.5 - 9.0	74.7% (3504/4691)	Azziz et al., 2009
Middle Eastern	Average 16 (11-22) when compared with Caucasian women	93.2% (179/190)	Glintborg et al., 2010
South Asians	Average as high as 18 Incidence of hirsutism higher in South Asian women than in Caucasian women	88.5% (337/381)	Wijeyaratne et al., 2002 Mani et al., 2015

Table 4. Prevalence of polycystic ovary morphology of women with PCOS [14]

Ethnicity	Definition of polycystic ovary morphology	Percentage of PCOS women with polycystic ovary morphology	Reference
Chinese	Rotterdam criteria	92.4% (664/719)	Zhang et al., 2009
		89.9% (492/547)	Guo et al., 2012
		95.7% (3388/3529)	Xu et al., 2012
Thai	Rotterdam criteria	76.9% (40/62)	Vutyavanich et al., 2007
Korean	Rotterdam criteria	86.1% (143/166)	Chae et al., 2008
		96.5% (835/865)	Kim et al., 2014
		84.2% (895/1062)	Sung et al., 2014
Asian	Rotterdam criteria	82.1% (23/28)	Wang et al., 2013

Table 5. Prevalence of polycystic ovary morphology of women with PCOS [14]

Ethnicity	Definition of polycystic ovary morphology	Percentage of PCOS women with polycystic ovary morphology	Reference
Caucasian	Rotterdam criteria	90.0% (384/427)	Guo et al., 2012
		85.0% (103/121)	Wang et al., 2013
	AE-PCOS Society	73.7% (2332/3163)	Azziz et al., 2009
Middle Eastern	Adams et al., 1986	47.0 (314/668)	Glintborg et al., 2010
	Adams et al., 1986	29.0% (50/172)	Glintborg et al., 2010

5. CONCLUSION

Based on the Rotterdam diagnostic criteria, the PCOS prevalence ranges between 1.6% and 9.3% among the different nationalities, with most of the countries having between 5.29% and 6.77%. While several some studies suggest that there is not much difference in the prevalence of PCOS among the ethnic, racial or geographical locations, most of the studies we reviewed have reported differences of PCOS manifestations among the different ethnicities considered. We observe that different researchers used different methods of choosing their samples, have different sample sizes, and many of them used small sample sizes. The differences in ethnicities and manifestations showed in the Figure and Tables above have revealed that even in the same country, depending on the choice of study sample, the results in prevalence varied. Therefore, we conclude that before generalizing the findings over the studies, further research should be conducted.

The International Guideline for the Assessment and Management of PCOS in the latest version recommends in their ethnic variation section that "Health professionals should consider ethnic variation in the presentation and manifestation of PCOS, including: (i) a relatively mild phenotype in Caucasians, (ii) higher body mass index (BMI) in Caucasian women, especially in North America and Australia, (iii) more severe hirsutism in Middle Eastern, Hispanic and Mediterranean women, (iv) increased central adiposity, insulin resistance, diabetes, metabolic risks and acanthosis nigricans in South East Asians and indigenous Australians, (v) lower BMI and milder hirsutism in East Asians, and (vi) higher BMI and metabolic features in Africans" [32]. As the guideline suggests, many studies we looked into have suggested phenotypic differences among PCOS patients by their ethnicity, race, and geographical location. Though our review has not reached the conclusion for the actual difference

in prevalence amongst ethnic, racial and geographical location, we are able to conclude that there are phenotypic differences amongst patients of PCOS due to their ethnic, racial and geographical location.

This review has focused on the prevalence of PCOS in terms of geographical location and ethnicities. The authors recommend that more research be conducted which shall involve a larger number of world ethnicities where similar diagnostic criteria would be utilized in assessing the PCOS and associated disorders.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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