Prevalence of Polycystic Ovarian Syndrome in Iranian Adolescents: A Systematic Review and Meta-analysis

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ABSTRACT

Objective: Polycystic ovarian syndrome (PCOS) is an endocrine disorder that frequently manifests during adolescence. The studies performed in Iran have reported a different prevalence of PCOS in adolescents. Therefore, the aim of this systematic review and meta-analysis study was to estimate the pooled prevalence of PCOS in Iranian adolescents.

Materials and methods: An electronic search was performed using Web of Science, PubMed, Scopus, Magiran, SID, and also search engine Google Scholar from inception until November 2018 to identify published papers on the prevalence of PCOS in Iranian adolescents. Of 458 articles that were assessed for eligibility with the PRISMA statement, a total of 8 studies met inclusion criteria. Data were analyzed using Review Manager Software (RevMan v5.3).

Results: The included studies in the review involved 12,796 participants, with a minimum of 895 and a maximum of 3,190. Pooled estimates revealed that the prevalence of PCOS in Iranian adolescents according to the NIH criteria and Rotterdam criteria were 3% (95% CI: 2–4%), and 7% (95% CI: 6–8%) respectively.

Conclusion: Considering the significant effect of PCOS on fertility and public health of women, interventions for prevention, diagnosis, and management of this syndrome from adolescence are necessary.

Keywords: Adolescence, Polycystic ovarian syndrome, Systematic review.

Introduction

Polycystic ovarian syndrome (PCOS) is one of the most common endocrine disorders in reproductive-age women with an estimated prevalence of 6–10%. It is a heterogeneous condition that is characterized by increased androgen levels (i.e., acne, hirsutism, and alopecia) and features of anovulation (i.e., oligomenorrhea, amenorrhea, and unexplained infertility). Polycystic ovarian syndrome is a disease that frequently manifests during adolescence, but an overlap between PCOS symptoms and normal pubertal changes, utilize adult diagnostic criteria making the diagnosis of this syndrome complicated in adolescent age-group. Despite these difficulties, early diagnosis of PCOS in adolescence has undeniable importance, because this syndrome is a significant risk factor for infertility, obesity, dyslipidemia, diabetes mellitus (type II), cardiovascular disease, and endometrial hyperplasia later in life. Indeed, early diagnosis of PCOS in adolescence is the first step for the prevention and treatment of future complications and morbidity associated with this syndrome. Furthermore, awareness about the prevalence of PCOS in adolescents facilitates other related studies. Today, few cross-sectional studies have assessed the prevalence of PCOS in adolescents. In Iran, a number of studies have investigated the prevalence of PCOS in adolescent girls, but none has systematically summarized them. Hence, the present systematic review and meta-analysis study aim to estimate the pooled prevalence of PCOS among Iranian adolescents.

Materials and Methods

A systematic search was performed up to November 2018 in national electronic databases including the Scientific Information Database (www.SID.ir), Magiran (www.magiran.com), Barakat Knowledge Network System (http://health.barakatknsw.com), and international electronic databases including Web of Science, PubMed, and Scopus to identify relevant studies published in Farsi (Persian) or English. Key search terms used were as follows: “prevalence”, “Iran”, “adolescent”, “polycystic ovarian syndrome”, “PCOS”. Reference lists of the most relevant articles were also hand-searched to identify any pertinent papers (snowball method).

Eligibility Criteria

All cross-sectional studies addressing the prevalence of PCOS according to the National Institutes of Health Criteria (NIH, 1990) or the Rotterdam (2003) criteria among Iranian adolescents were considered for inclusion. However, studies combining the prevalence of PCOS in adolescents with other reproductive-age women were excluded due to the inability to separate the results related to the adolescents.

Study Selection

All articles retrieved from the systematic search were imported into Endnote X7 and duplicates were removed. Then, remained articles were screened and selected based on title, abstract, and full-text screening.
Data Extraction
The following data were extracted from each study that met the criteria for inclusion in the review: article title, first author’s name, year of publication, the age of participants, sample size, study location, sampling method, criteria used to diagnose PCOS, and prevalence rates.

Quality Assessment
The methodological quality of the included studies was rated by using the STROBE (strengthening the reporting of observational studies in epidemiology) statement.12 This checklist consists of 22 items with a score range of 0–44. Total scores below 23 points were considered of “low quality”, studies with total scores between 23 and 33 were considered of “moderate quality” and those with total scores of 34 or greater were deemed of “high quality”.

Statistical Analysis
The meta-analysis was performed with Review Manager, version 5.3.12 The pooled estimates were calculated with random-effects model. The meta-analysis was performed with Review Manager, version 5.3.

Results
A total of 458 articles were retrieved on the initial search. After excluding 161 duplicates and 284 irrelevant articles, 13 full-text articles were retrieved, of which, 4 studies were excluded due to the impossibility of separating results related to adolescent girls from other reproductive-age women and 1 was excluded due to the use of ultrasound criteria for the diagnosis of PCOS. Finally, 8 studies (7 articles, 1 Master’s thesis) were considered for the systematic review and 5 studies were eligible to be included in the meta-analysis (Flowchart 1).

Flowchart 1: PRISMA flow diagram of literature search and selection process

- Records identified through database searching = 458
- Records excluded = 284
- Full text screened = 13
- Included studies for systematic review (quantitative synthesis = 8)
- Included studies for meta-analysis (qualitative synthesis = 5)
- Studies excluded: 5, with reasons: impossibility of separating results related to adolescent girls from other reproductive-age women = 4
- Use of ultrasound criteria for diagnosis of PCOS = 1
- Ttitle and abstract screened = 297
- Duplicates removed = 161
- Included studies for meta-analysis (qualitative synthesis = 5)

The included studies were conducted in Esfahan, Kerman, Zanjan, Tehran, Shiraz, Yazd, Rasht, and Babol.13-20 The 8 studies selected for quantitative analysis consisted of 12,796 participants, with a range of between 895 and 3,190 per study.

NIH criteria in three studies13,15,19 and Rotterdam criteria in five studies14,16-18,20 were used to assess the prevalence rate of PCOS. The lowest (2.9%) and highest (13.4%) prevalence rates of PCOS were found in the studies performed by Rahmanpour et al. (Zanjan), and Naghash Hoseini (Kerman), respectively.15,16 (Table 1).

According to the STROBE checklist criteria, the eight included articles had moderate quality (Table 2).

The prevalence of PCOS using the NIH diagnostic criteria and after removal results of the study by Asgharnia et al.19 due to the large difference in the prevalence of PCOS in this study compared with other two studies, was estimated to be 3% (95% confidence interval: 2–4) (Fig. 1).

The prevalence of PCOS using the Rotterdam diagnostic criteria and after removal results of studies by Naghash Hoseini,15 and Salehpour et al.,16 due to the large difference in the prevalence of PCOS in these studies compared with the other relevant studies, was estimated to be 7% (95% confidence interval: 6–8) (Fig. 2).

Discussion
This systematic review and meta-analysis study was conducted to estimate the prevalence of PCOS exclusively in Iranian adolescents. According to the National Institute of Health (NIH) definition, clinical and/or biochemical hyperandrogenism (hyperandrogenemia), and clinical manifestations of ovulation disorders as oligomenorrhea, amenorrhea, or infertility in the absence of non-classical congenital adrenal hyperplasia ovulation disorders are diagnostic criteria for PCOS.21 In the meta-analysis, the prevalence of PCOS according to the NIH criteria was found to be 3% (95% CI: 2–4%). The Rotterdam criteria need the presence of at least 2 of the following 3 criteria: hyperandrogenism, oligo/anovulation, or presence of polycystic ovaries on pelvic ultrasound.24 In the meta-analysis, the prevalence of PCOS according to the Rotterdam criteria was estimated to be 7% (95% CI: 7–8%). Hence, the prevalence of PCOS when diagnosed by the Rotterdam criteria is estimated to be approximately 2.3 times greater than the prevalence of this disorder when diagnosed by the NIH criteria. In a study by Jalilian et al. that assessed prevalence of PCOS and its related complications in Iranian women via meta-analysis method, the prevalence of this syndrome according to NIH criteria was 6.8% (95% CI: 5.8–11.4%), and according to the Rotterdam criteria was 19.5% (95% CI: 14.8–24.2%).23 In their meta-analysis study, the prevalence of PCOS according to Rotterdam criteria was estimated to be approximately 2.8 times greater than the prevalence of this disorder according to NIH criteria, which is in agreement with results of our study. In a study conducted on Indian adolescents, the prevalence rate of PCOS according to Rotterdam criteria was 9.1%.24 In a study by Kaewnin et al., PCOS prevalence in Thai University adolescents using the Rotterdam criteria was estimated to be 5.29%.25 In a study conducted by Christensen et al., the prevalence PCOS in adolescents aged 15–19 years according to the NIH criteria was 0.56%.26 The present study has some limitations. The most recent study on the prevalence of polycystic ovarian syndrome in Iranian adolescent girls was an article published in 2014; hence, due to limited number of studies on Iranian adolescent girls, further research in this area is needed.

In conclusion, although diagnosis of PCOS in adolescence is a challenge, due to the significant effect of PCOS on long-term health...
Prevalence of Polycystic Ovarian Syndrome in Iranian Adolescents

Table 1: Characteristics of included studies

<table>
<thead>
<tr>
<th>First author—publication year</th>
<th>Study location</th>
<th>Sampling procedure</th>
<th>Sample size</th>
<th>Age ranges</th>
<th>Diagnosis criteria</th>
<th>Prevalence</th>
<th>Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hashemipour et al. (2004)</td>
<td>Esfahan</td>
<td>Multi stage random sampling</td>
<td>1,000</td>
<td>14–18</td>
<td>NIH</td>
<td>3</td>
<td>1.9–4.1</td>
</tr>
<tr>
<td>Naghash Hoseini (2008)</td>
<td>Kerman</td>
<td></td>
<td>1,000</td>
<td>15–18</td>
<td>RTM</td>
<td>13.4</td>
<td>11.3–15.5</td>
</tr>
<tr>
<td>Rahamanpour et al. (2009)</td>
<td>Zanjan</td>
<td>Systematic randomization</td>
<td>1,882</td>
<td>14–18</td>
<td>NIH*</td>
<td>2.9</td>
<td>2.2–3.6</td>
</tr>
<tr>
<td>Salehpour et al. (2010)</td>
<td>Tehran</td>
<td>Multi stage random sampling</td>
<td>1,430</td>
<td>15–18</td>
<td>RTM</td>
<td>3.42</td>
<td>2.5–4.4</td>
</tr>
<tr>
<td>Nadri et al. (2010)</td>
<td>Shiraz</td>
<td>Cluster sampling</td>
<td>3,190</td>
<td>14–18</td>
<td>RTM**</td>
<td>6.97</td>
<td>5.7–8.3</td>
</tr>
<tr>
<td>Noorbala and Kefaie (2010)</td>
<td>Yazd</td>
<td>Cluster sampling</td>
<td>895</td>
<td>15–19</td>
<td>RTM</td>
<td>6.5</td>
<td>5–8.2</td>
</tr>
<tr>
<td>Asgharnia et al. (2011)</td>
<td>Rasht</td>
<td>Multi-stage cluster sampling</td>
<td>1,850</td>
<td>17–18</td>
<td>NIH</td>
<td>11.3</td>
<td>9.9–12.8</td>
</tr>
<tr>
<td>Esmaeilzadeh et al. (2014)</td>
<td>Babol</td>
<td></td>
<td>1,549</td>
<td>16–20</td>
<td>RTM</td>
<td>8.3</td>
<td>4–12</td>
</tr>
</tbody>
</table>

Appendix: NIH, National Institutes of Health Criteria; RTM, Rotterdam criteria

Table 2: Quality assessment of studies according to STROBE criteria

| S. no. | Study details                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | Total score |
|--------|--------------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|---------------|
| 1      | Hashemipour et al.             | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 23 |
| 2      | Naghash Hoseini                | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 30 |
| 3      | Rahamanpour et al.             | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 28 |
| 4      | Salehpour et al.               | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 30 |
| 5      | Nadri et al.                   | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 29 |
| 6      | Noorbala and Kefaie            | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 27 |
| 7      | Asgharnia et al.               | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 23 |
| 8      | Esmaeilzadeh et al.            | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂ | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | ⌂  | 29 |

Fig. 1: Prevalence of polycystic ovarian syndrome according to the NIH criteria

Fig. 2: Prevalence of polycystic ovarian syndrome according to the Rotterdam criteria
consequences, it is necessary to detect and manage adolescents with this syndrome.

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References
14. Naghash Hoseini SH. The prevalence of PCOS in Kerman final high school 1000 girls 18–15 years old. School of Medicine, Kerman University of Medical Sciences and Health Services; 2008;1(4):112–116.