



Original article

Relationship between health literacy and body mass index among Arab women with polycystic ovary syndrome



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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) puts patients at higher risk for obesity and diabetes. Poor health literacy is also associated with these conditions. Notably, weight loss is associated with improved ovulation and pregnancy rates for women with PCOS. In this study the association between health literacy and body mass index (BMI) among women with PCOS was examined.

Methods: The health literacy of women with PCOS was measured using the Arabic version of the single item literacy screener (SILS) at a university medical center. Sociodemographic and medical information was collected by interviewing the participants and reviewing their medical records, respectively. The relationship between health literacy and BMI was assessed by multiple logistic regression analysis.

Results: Health literacy was assessed in 127 women with PCOS from September 2015 to February 2016. Only 16.54% of participants had limited health literacy. The mean BMI for all participants was 30.57 (kg/m²), and the mean age was 27.40 years. Further, most of the participants (74%) had a high school diploma or a higher degree. Almost 56% of the participants were taking metformin, and 11.81% had hypothyroidism. After controlling for age, education, hypothyroidism diagnosis, and the use of metformin, participants with high BMI were 10% less likely to have a good health literacy level (OR = 0.904; 95% CI = 0.829–0.987; *P* = 0.0238).

Conclusion: Improving the health literacy of patients with PCOS may have a positive impact on their BMI and eventually lead to favorable health outcomes.

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1. Introduction

According to the US Institute of Medicine (IoM), health literacy is defined as “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions” (Nielsen-Bohman et al., 2004). The World Health Organization (WHO) went further in their definition of health literacy to include both the cog-

nitive and social skills needed to gain access to health care as well as to understand and use health information in a way that will eventually enhance the health of an individual (Marmot, 2007). Patients with chronic health conditions and limited health literacy are more likely to misunderstand their physicians' instructions than their peers with adequate health literacy (Gazmararian et al., 2003; Williams et al., 1998). Limited health literacy was also linked to unfavorable health outcomes such as higher hospital admission rates, overutilization of emergency care, nonadherence to medications, and increased risk of chronic diseases such as hypertension and diabetes (Berkman et al., 2011; Adams et al., 2009; Wu et al., 2016).

Although multiple studies have shown that limited health literacy is prevalent among various patient populations, there is a dearth of studies on health literacy in the Middle East (Hernandez, 2013). In a study that was recently conducted in Iran to identify factors that influence health literacy among patients

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with diabetes, more than 80% of surveyed patients had marginal or inadequate health literacy skills. Furthermore, male and highly educated participants were more likely to have high health literacy than their female and poorly educated counterparts, respectively. On the other hand, older patients had lower health literacy scores than their younger counterparts (Mohammadi et al., 2015). Similar findings were reported in another study conducted in a primary health care setting in Saudi Arabia. However, contrary to the Iranian study, only 16% of the participants were classified as having marginal or inadequate health literacy (Alamari and Alkwaari, 2010).

Obese women have a higher likelihood of experiencing menstrual irregularity and reduced fecundity than normal-weight women (Rich-Edwards et al., 2002; Kulie et al., 2011; Brewer and Balen, 2010). Further, the incidence of anovulatory infertility rises with higher BMI among women of childbearing age (Sam, 2007). Obesity is common among women with polycystic ovary syndrome (PCOS), which is the most prevalent endocrine disorder among women of childbearing age (Sam, 2007; Sam and Dunaif, 2003; Badawy and Elnashar, 2011). PCOS has been associated with up to 75% of anovulatory infertility (Badawy and Elnashar, 2011). Its cause is still largely unknown, however, insulin resistance with a compensatory hyperinsulinemia are hallmark signs of this syndrome (Sam, 2007; Sam and Dunaif, 2003). Decreased sensitivity to insulin among PCOS patients is prevalent in women of both healthy and high BMI (≥ 25 kg/m²), however, it is more noticeable among women with high BMI (Sam, 2007). This syndrome is not associated only with anovulatory infertility, but it also puts patients at higher risk of diabetes, dyslipidemia, and cardiovascular disease (Sam and Dunaif, 2003). Although, the prevalence of PCOS among premenopausal women can be as high as 15–20%, its prevalence in Saudi Arabia is largely unknown (Badawy and Elnashar, 2011; Al-Ruhaily et al., 2008). However, in a study that was conducted at a university medical center in the western region of Saudi Arabia, the prevalence of PCOS was more than 50% among the study sample of unmarried Saudi women aged ≤ 23 years (Guraya, 2013). Moreover, the prevalence of high BMI (e.g., BMI ≥ 25 kg/m²) in women with PCOS in Saudi Arabia is estimated to be as high as 80% (Tamimi et al., 2009). Therefore, lifestyle modifications that entail diet, exercise, and weight reduction are considered the first line of treatment for women with PCOS (Badawy and Elnashar, 2011; Pasquali et al., 2003; Bruner et al., 2006).

Obesity is prevalent among people with poor health literacy (Lam and Yang, 2014; Thomacos and Keleher, 2009). Furthermore, several studies have shown the positive impact of different health literacy improvement strategies on body weight (Faruqi et al., 2015). However, no study has yet examined the association between health literacy and obesity between women with PCOS. The aim of this study was to explore the association between health literacy and BMI among Arab women with PCOS.

2. Methods

2.1. Population

This study was approved by the Institutional Review Board of a University Hospital in Riyadh, Saudi Arabia. Patients with an established diagnosis of PCOS from 18–40 years old were identified by reviewing medical records of the patients visiting the Obstetrics and Gynecology clinics at the University Hospital. Patients with other medical conditions such as primary ovarian insufficiency and uterine fibroids were excluded from the study.

2.2. Data collection

Patients' age, BMI, medical conditions, medication list, and ovulation rate data were retrieved from their electronic medical records. Health literacy was assessed using the Arabic version of the single item literacy screener (SILS), which was translated and validated in Iraq, by interviewing the patients before being seen by their gynecologists (Al-Jumaili et al., 2015). The SILS was developed by Morris and colleagues, and it consists of a single question that asks about the amount of help that an individual needs to read and understand health instructions (Morris et al., 2006). The SILS was validated against Rapid Estimate of Adult Literacy in Medicine (REALM) with an AUROC of 0.79 (95% CI = 0.74 to 0.83) (Morris et al., 2006). The question is as follows "How confident are you filling out medical forms by yourself?" with five possible answers (e.g., extremely, quite a bit, somewhat, a little bit, or not at all). The "somewhat" response was recommended as the optimal cutoff point to identify patients with limited or marginal health literacy skills (Morris et al., 2006). Based on the patients' responses, they were classified as having either limited or good health literacy levels. In addition, the patients were asked how long ago they were diagnosed with PCOS, whether they have a high school diploma or a higher degree, and how many children they have. Data collection started in September 2015 and ended in February 2016.

2.3. Statistics

Comparisons between the two groups were made using the Student's *t*-test, the Chi-square test, or Fisher's exact test, as appropriate. Further, a multiple logistic regression analysis was conducted to examine the association between BMI and health literacy controlling for age, education, metformin use, and hypothyroidism (Mohammadi et al., 2015; Alamari and Alkwaari, 2010; Seifarth et al., 2013; Biondi, 2010). The minimum sample size was 55 participants for a medium effect size ($f^2 = 0.15$), a power of 0.80, and an alpha of 0.05 (Stevens, 2012).

3. Results

Out of the 127 patients with PCOS who were screened for their health literacy using the SILS, 21 patients were classified as having limited health literacy. More than 42% of patients with limited health literacy did not have high school diploma, while only 21.7% of patients with good health literacy did not have high school diploma. The participants' mean age and BMI were 27.40 years and 30.57 kg/m², respectively, with no significant difference between the two health literacy groups ($P \geq 0.05$). Participants with limited health literacy had higher likelihood of having hypothyroidism than their peers with good health literacy (28.57% vs. 8.49%; $P = 0.0187$). Most participants had been diagnosed with PCOS for ≥ 4 years; and almost 60% of study participants did not have children. In addition, approximately 56% of the participants were taking metformin with no significant difference in metformin use between the two literacy groups ($P \geq 0.05$). The vast majority of the patients in this study did have an improved ovulation rate (e.g., 89.76%) with no significant difference between the two literacy groups ($P \geq 0.05$) (Table 1). The PCOS patients with higher BMI values were 9.6% less likely to have good health literacy compared to their peers with lower BMI after controlling for their age, education, use of metformin, and whether they were diagnosed with hypothyroidism or not (OR = 0.904; 95% CI = 0.892–0.987; $P = 0.0238$) (Table 2). Further, PCOS patients with hypothyroidism were 73.6% less likely to have good health literacy (OR = 0.264; 95% CI = 0.074–0.943; $P = 0.0403$) (Table 2).

Table 1
Patient characteristics across the health literacy groups.^a

| Groups | Health Literacy | | | Total (n = 127) |
|------------------------------------|------------------|----------------|---------------------|-----------------|
| | Limited (n = 21) | Good (n = 106) | P-value | |
| <i>Education^b</i> | | | | |
| <High school diploma | 9(42.86%) | 23(21.70%) | 0.0345 [*] | 32(26.02%) |
| ≥High school diploma | 11(52.38%) | 80(75.47%) | | 91(73.98%) |
| Age (years) | 25.76 ± 4.39 | 27.73 ± 5.48 | 0.1247 | 27.40 ± 5.35 |
| BMI ^c | 33.24 ± 6.09 | 30.04 ± 5.73 | 0.9308 | 30.57 ± 5.89 |
| Diabetes | 0(0.00%) | 3(2.83%) | 1.000 | 3(2.36%) |
| Hypothyroidism | 6(28.57%) | 9(8.49%) | 0.0187 [*] | 15(11.81%) |
| Metformin use | 10(47.62%) | 61(57.55%) | 0.4025 | 71(55.91%) |
| <i>History of PCOS^d</i> | | | | |
| ≤1 year | 2(9.52%) | 2(1.89%) | 0.2061 | 4(3.15%) |
| 2–3 years | 2(9.52%) | 13(12.26%) | | 15(11.81%) |
| 4–5 years | 9(42.86%) | 32(30.18%) | | 41(32.28%) |
| 6–7 years | 3(14.28%) | 30(28.30%) | | 33(25.98%) |
| 8–9 years | 1(4.76%) | 15(14.15%) | | 16(12.60%) |
| ≥10 years | 4(19.04%) | 14(13.21%) | | 18(14.17%) |
| <i>Number of children</i> | | | | |
| 0 | 12(57.14%) | 64(60.37%) | 0.1984 | 76(59.84%) |
| 1 | 5(23.81%) | 18(16.98%) | | 23(18.11%) |
| 2 | 3(14.29%) | 15(14.15%) | | 18(14.17%) |
| 3 | 0(0.00%) | 8(7.55%) | | 8(6.30%) |
| 4 | 0(0.00%) | 1(0.94%) | | 1(0.79%) |
| 5 | 1(4.76%) | 0(0.00%) | | 1(0.79%) |
| <i>Ovulation rate improvement</i> | | | | |
| Yes | 19(90.48%) | 95(89.62%) | 1.000 | 114(89.76%) |
| No | 2(9.52%) | 11(10.37%) | | 13(10.24%) |

^a Data are expressed as n (%) and mean ± standard deviation (SD).^b Frequency is missing for 4 participants.^c Body Mass Index.^d Polycystic Ovary Syndrome.^{*} P < 0.05**Table 2**
Multiple logistic regression to determine the association between health literacy and Body Mass Index (BMI).

| Variable | Odds ratio (OR) | 95% Confidence Interval (CI) | | P-value |
|------------------|-----------------|------------------------------|-------------|---------------------|
| | | Lower limit | Upper limit | |
| BMI ^a | 0.904 | 0.829 | 0.987 | 0.0238 [*] |
| Metformin use | 1.232 | 0.908 | 1.673 | 0.1807 |
| Age | 1.084 | 0.979 | 1.200 | 0.1210 |
| Education | 1.702 | 0.561 | 5.162 | 0.3476 |
| Hypothyroidism | 0.264 | 0.074 | 0.943 | 0.0403 [*] |

^a Body Mass Index.^{*} P < 0.05.

4. Discussion

To the best of our knowledge, this study was the first to assess the relationship between health literacy and BMI among PCOS patients in Saudi Arabia. The results suggested that limited health literacy is associated with high BMI (e.g., BMI ≥ 25 kg/m²) among women with PCOS, which is consistent with previous studies (Lam and Yang, 2014; Thomacos and Keleher, 2009; Faruqi et al., 2015). The mean BMI of patients with limited health literacy was not significantly different from those with good health literacy as shown in Table 1. However, in the multiple logistic regression analysis, there was a significant relationship between the BMI and having limited health literacy after controlling for potential confounders such as age, education, hypothyroidism, and metformin use (Mohammadi et al., 2015; Alamari and Alkwaari, 2010; Seifarth et al., 2013; Biondi, 2010). The higher the BMI, the less likely patients with PCOS will have good health literacy as shown in Table 2. The point estimate prevalence of limited health literacy reported in this study could be compared to a previous study that estimated the prevalence of marginal and inadequate

health literacy among a sample of patients visiting a primary care setting in Saudi Arabia (Alamari and Alkwaari, 2010). This study found that 16.1% of the screened patients had limited health literacy using the Arabic version of the short test of functional health literacy in adults (S-TOFHLA), which is quite similar to the results of our study (e.g., 16.54%). Another interesting finding in the study, was the significant relationship between hypothyroidism and limited health literacy. This relationship might be due to the positive association between obesity and hypothyroidism. Patients with hypothyroidism are more likely to suffer from obesity (Biondi, 2010).

Health literacy is a key determinant of health outcomes (Marmot, 2007; Williams et al., 1998; Berkman et al., 2011; Wu et al., 2016). People with limited health literacy have higher odds of having chronic health conditions such as diabetes and hypertension and poor treatment outcomes (Berkman et al., 2011). Further, people with limited health literacy have higher chances of having a high BMI (≥25 kg/m²) (Lam and Yang, 2014; Thomacos and Keleher, 2009). Obesity is a determinant of poor health outcomes, particularly among PCOS patients (Kulie et al., 2011; Sam, 2007;

Pasquali et al., 2003). It is estimated that 40–80% of women with PCOS have a high BMI (e.g., BMI \geq 25 kg/m²) (Sam, 2007; Tamimi et al., 2009). Adopting a healthy lifestyle that involves diet and exercise is recommended to patients with PCOS (Badawy and Elnashar, 2011; Pasquali et al., 2003). These lifestyle modifications will hopefully lead to a reduction in body weight, which can improve the endocrine profiles of patients with PCOS and increase the likelihood of ovulation and pregnancy (Badawy and Elnashar, 2011). Although there are no national estimates of the prevalence of PCOS among women in Saudi Arabia, it is widely believed that this condition is common (Al-Ruhaily et al., 2008). A relatively recent study showed a staggering 53.7% prevalence of PCOS among a sample of women visiting a university hospital in the western region of Saudi Arabia (Guraya, 2013). Therefore, public health interventions to improve health literacy among women with PCOS are important. Such interventions should involve raising awareness about the importance of adopting healthy lifestyles that will eventually lead to a healthy body weight. Nutrition and physical activity education, behavioral therapy, and motivational interviewing provided in both individual and group settings are some examples of health literacy-enhancing interventions that have shown a positive impact on weight loss (Faruqi et al., 2015). Also, physical education or sports programs should be included in the curriculum of the public girls' schools. These interventions can also be effective in reducing the weight of PCOS patients with high BMI (e.g., BMI \geq 25 kg/m²).

This study had some limitations. First, health literacy was assessed using the single item literacy screener (SILS) (Al-Jumaili et al., 2015). Although this health literacy-screening tool has been validated using both the test of functional health literacy in adults (TOFHLA) and the rapid estimate of adult literacy in medicine (REALM) as reference standards, it is not as accurate as these two standard health literacy tests (Morris et al., 2006). Second, the results of this study are not generalizable due to its design as a single-center cross-sectional study.

5. Conclusion

In summary, PCOS patients with limited health literacy are more likely to have a higher body mass index (BMI). Future studies should not only examine the effectiveness of different health literacy-enhancing interventions for weight reduction, but also for improving treatment outcomes among PCOS patients, such as ovulation and pregnancy rates.

Disclosure

Authors of this study have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this study.

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References

- Adams, R.J., Appleton, S.L., Hill, C.L., Dodd, M., Findlay, C., Wilson, D.H., 2009. Risks associated with low functional health literacy in an Australian population. *Med. J. Aust.* 191, 530–534.
- Alamari, A., Alkwaari, M., 2010. Assessing the level of health literacy among adult visitors in the primary health care setting of National Guard Health Affairs, Jeddah, Saudi Arabia. *J. Fam. Community Med.*
- Al-Jumaili, A.A., Al-Rekabi, M.D., Sorofman, B., 2015. Evaluation of instruments to assess health literacy in Arabic language among Iraqis. *Res. Social Adm. Pharm.* 11, 803–813.
- Al-Ruhaily, A.D., Malabu, U.H., Sulimani, R.A., 2008. Hirsutism in Saudi females of reproductive age: a hospital-based study. *Ann. Saudi Med.* 28, 28–32.
- Badawy, A., Elnashar, A., 2011. Treatment options for polycystic ovary syndrome. *Int. J. Wom. Health* 3, 25–35.
- Berkman, N.D., Sheridan, S.L., Donahue, K.E., Halpern, D.J., Crotty, K., 2011. Low health literacy and health outcomes: an updated systematic review. *Ann. Intern. Med.* 155, 97–107.
- Biondi, B., 2010. Thyroid and obesity: an intriguing relationship. *J. Clin. Endocrinol. Metab.* 95, 3614–3617.
- Brewer, C.J., Balen, A.H., 2010. The adverse effects of obesity on conception and implantation. *Reproduction* 140, 347–364.
- Bruner, B., Chad, K., Chizen, D., 2006. Effects of exercise and nutritional counseling in women with polycystic ovary syndrome. *Appl. Physiol. Nutr. Metab.* 31, 384–391.
- Faruqi, N., Spooner, C., Joshi, C., Lloyd, J., Dennis, S., Stocks, N., et al., 2015. Primary health care-level interventions targeting health literacy and their effect on weight loss: a systematic review. *BMC Obes.* 2, 1–6.
- Gazmararian, J.A., Williams, M.V., Peel, J., Baker, D.W., 2003. Health literacy and knowledge of chronic disease. *Patient Educ. Couns.* 51, 267–275.
- Guraya, S.S., 2013. Prevalence and ultrasound features of polycystic ovaries in young unmarried Saudi females. *J. Microsc. Ultrastruct.* 1, 30–34.
- Hernandez, L.M., 2013. Health Literacy: Improving Health, Health Systems, and Health Policy Around the World: Workshop Summary, National Academies Press.
- Kulie, T., Slattengren, A., Redmer, J., Counts, H., Eglash, A., Schrage, S., 2011. Obesity and women's health: an evidence-based review. *J. Am. Board Fam. Med.* 24, 75–85.
- Lam, L.T., Yang, L., 2014. Is low health literacy associated with overweight and obesity in adolescents: an epidemiology study in a 12–16 years old population, Nanning, China, 2012. *Arch. Public Health.* 72, 11.
- Marmot, M., Commission on Social Determinants of Health, 2007. Achieving health equity: from root causes to fair outcomes. *Lancet* 370, 1153–1163.
- Mohammadi, Z., Banihashemi, A.T., Asgharifard, H., Bahramian, M., Baradaran, H.R., Khamesh, M.E., 2015. Health literacy and its influencing factors in Iranian diabetic patients. *Medical J. Islam. Repub. Iran* 29, 230.
- Morris, N.S., MacLean, C.D., Chew, L.D., Littenberg, B., 2006. The Single Item Literacy Screener: evaluation of a brief instrument to identify limited reading ability. *BMC Fam. Pract.* 7, 21.
- Nielsen-Bohman, L., Panzer, A.M., Kindig, D.A., 2004. Health Literacy: A Prescription to End Confusion. National Academies Press, Washington, DC.
- Pasquali, R., Pelusi, C., Genghini, S., Cacciari, M., Gambineri, A., 2003. Obesity and reproductive disorders in women. *Human Reprod. Update* 9, 359–372.
- Rich-Edwards, J.W., Spiegelman, D., Garland, M., Hertzmark, E., Hunter, D.J., Colditz, G.A., et al., 2002. Physical activity, body mass index, and ovulatory disorder infertility. *Epidemiology* 13, 184–190.
- Sam, S., Dunaif, A., 2003. Polycystic ovary syndrome: syndrome XX? *Trends Endocrinol. Metab.* 14, 365–370.
- Sam, S., 2007. Obesity and polycystic ovary syndrome. *Obesity Manage.* 3, 69–73.
- Seifarth, C., Schehler, B., Schneider, H.J., 2013. Effectiveness of metformin on weight loss in non-diabetic individuals with obesity. *Exp. Clin. Endocrinol. Diabetes* 121, 27–31.
- Stevens, J.P., 2012. Applied Multivariate Statistics for the Social Sciences. Routledge, Abingdon-on-Thames.
- Tamimi, W., Siddiqui, I.A., Tamim, H., AlEisa, N., Adham, M., 2009. Effect of body mass index on clinical manifestations in patients with polycystic ovary syndrome. *Int. J. Gynaecol. Obstet.* 107, 54–57.
- Thomacos, N., Keleher, H., 2009. Health literacy and Vulnerable Groups: What Works? Department of Health Social Science, Monash University, Melbourne.
- Williams, M.V., Baker, D.W., Parker, R.M., Nurss, J.R., 1998. Relationship of functional health literacy to patients' knowledge of their chronic disease. A study of patients with hypertension and diabetes. *Arch. Intern. Med.* 158, 166–172.
- Wu, J.R., Moser, D.K., DeWalt, D.A., Rayens, M.K., Dracup, K., 2016. Health Literacy mediates the relationship between age and health outcomes in patients with heart failure. *Circ. Heart Fail.* 9, e002250.