RESEARCH ARTICLE

PREVALENCE OF HYPERANDROGENISM AND ITS ASSOCIATED FACTORS AMONG FEMALE UNIVERSITY STUDENTS AT TAIF CITY, SAUDI ARABIA

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ABSTRACT

Background: Hyperandrogenism is a common disorder in adolescent females. Objectives: Our study investigated prevalence of hyperandrogenism among female students of Taif University in kingdom of Saudi Arabia and its associated correlates. **Methods:** The study was conducted from September, 2017 to June, 2018. Nine hundred undergraduate volunteer students from the female university participated in the study. Questionnaires about demographic characters, menstrual history of students, self-estimate of hirsutism and alopecia were distributed to students. An mF-G score ≥ 8 was used to identify hirsutism and we used Ludwig Scale to identify cases of androgenic alopecia. **Results:** A high prevalence; 18.4% of hyperandrogenism; its main component was hirsutism was encountered among students. Significant associations between hyperandrogenism and smoking (p value 0.040), marital status (p value 0.027), young age of menarche (p value < 0.0001) and irregularity of cycles (p value = 0.002) were observed among students. **Conclusion:** Hyperandrogenism is a significant problem among adolescent females at Taif University in Saudi Arabia.

INTRODUCTION

Hyperandrogenism usually manifests during adolescent age (Gambineri, 2013). It is a common endocrine disorder in females in the reproductive age (Knochenhauer, 1998). Although androgen production within normal range occurs in all healthy females and is needed for synthesis of estrogens, the pathologic condition of female hyperandrogenism can occur due to numerous causes; the most common worldwide cause is polycystic ovary syndrome (PCOS) (Meek, 2013). The pathologic changes which occur in this situation are dysfunctional production of androgens or inadequate conversion to estrogens (Baptiste, 2010). It has been recently proposed that the problem of hyperandrogenism is underestimated in females. Moreover, recent studies suggests a high percentage for this problem in females; between 15 to 30% (Ammer, 2009). Androgen excess if left untreated has many adverse physical effects which are distressing for many females (Meek, 2013).

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It results in not only cosmetic problems which include development of acne, hirsutism and or androgenic alopecia, but severe complications can also develop like reproductive, metabolic and cardiovascular disorders (Karrer-Voegeli, 2003). Physical appearance is often extremely important to adolescents. Consequently, early onset hair loss has a remarkable negative effect on self-image and self-esteem (Price, 2003). Psychological morbidities like societal anxiety and depression have been observed in the adolescent females suffering from hyperandrogenism. Brettenthaler et al. reported association between adverse cosmetic changes caused by hyperandrogenism and development of bad self-esteem of the individuals (Brettenthaler, 2004). Reproductive disorders that have been associated with hyperandrogenism include amenorrhea, and ovulatory dysfunction, which can lead to infertility (Ndefo, 2001). Hyperandrogenism is also linked to serious cardiovascular and metabolic disorders as hypertension, microvascular disease, dyslipidemias and type 2 diabetes mellitus (Endocrinologists, 2001). Hirsutism which is a component of the hyperandrogenic status is described by most female sufferers as the most disturbing symptom causing unfeminine feeling and making marked psychological stress for them which badly impacts their lives (Kitzinger, 2002).

Table 1. Relationship of clinical hyperandrogenism with sociodemographic characteristics of students

Socio-demographic characteristics	Hyperandrogenism		χ^2	p
	No	Yes		
Residence:				
Rural	91 (77.8)	26 (22.2)	1.3	0.259
Urban	643 (82.1)	140 (17.9)		
College:				
Theory	122 (77.7)	35 (22.3)	2.4	0.305
Scientific	367 (81.6)	83 (18.4)		
Medical	245 (83.6)	48 (16.4)		
Educational year:				
1	182 (83.1)	37 (16.9)	7.6	0.177
2	133 (85.3)	23 (14.7)		
3	121 (76.6)	37 (23.4)		
4	131 (78)	37 (22)		
5	71(80.7)	17 (19.3)		
6	96 (86.5)	15 (13.5)		
Smoking:				
Yes	142 (76.3)	44 (23.7)	4.2	0.040
No	592 (82.9)	122 (17.1)		
Marital status:				
Unmarried	532 (83.4)	106 (16.6)	4.9	0.027
Married	202 (77.1)	60 (22.9)		
BMI				
Underweight	163 (81.5)	37 (18.5)	5.3	0.373
Normal weight	449 (82.8)	93 (17.2)		
Over weight	91(76.5)	28 (23.5)		
Obesity grade 1	25(83.3)	5 (16.7)		
Obesity grade 2	2 (50)	2 (50)		
Severe obesity	4 (80)	1 (20)		

The most commonly used scoring system for hirsutism is the modified Ferriman-Gallwey (mF-G) score, proposed by Hatch et al in 1981. It is regarded as the gold standard for the evaluation of hirsutism (Yildiz, 2009). It grades terminal hair growth severity from 0–4 (i.e., no hair to extensive hair growth) on 9 different body areas which are upper lip, chin, chest, upper back, upper abdomen, lower back, lower abdomen, arm and thigh. The mF-G score calculates the sum of these nine areas to assess the overall hirsutism score (Escobar-Morreale, 2011). Most researchers use mFG score that is above or equals 8 to define hirsutism (Aswini, 2017). This score of ≥8 was put forward by Hatch et al (Hatch, 1981). There are many scales that are used to determine the stages of women's hair loss. However, the Ludwig Scale is the most commonly used one for analysis of hair loss in females. It is a 3-point scale which grades female pattern genetic hair loss into 3 types according to its severity; type I is mild degree, type II is moderate, and type III is extensive. In all the three stages, the hair loss is observed on the front and top of the scalp while there is a relative preservation of the frontal hairline (Firooz,, 2016). Our study was conducted to highlight the problem of hyperandrogenism in female adolescent students at Taif university and explore some of its correlating factors.

SUBJECTS AND METHODS

This study was conducted at Taif city in the Kingdom of Saudi Arabia from the 1st of September, 2017 to the 1st of June, 2018. A cross-sectional design was used where 900 undergraduate volunteer students from the female university were asked to participate in the study after taking their verbal consent. Questionnaires were distributed to students during the college time. Questionnaires included 4 parts. First part was about demographic and anthropometric data like age and type of college, weight and height. Weight and height of participants were assessed in light clothes and without shoes using a digital scale and a portable stadiometer.

Body mass index was calculated for participants as weight (kg)/height square (m²). Participants were divided into six groups using the World Health Organization's (WHO) classification of BMI; underweight (BMI < 18.5), normal weight (BMI 18.5 - 25), overweight (BMI 25-30), obese class I (BMI 30-35), obese class II (BMI 35-40) and obese class III (BMI >40) (Control, 2008). The second part of the questionnaire was about menstrual history of students while the third and fourth parts were about self-estimate of hirsutism and alopecia. In our study, hyperandrogenism was defined by the presence of hirsutism or androgenic (Gambineri, 2013).We used an mF-G score ≥ 8 to identify hirsute females and females were graded according to hirsutism severity into mild hirsute if they have an mF-G score of 8–16, moderate with a score 17–25, and severe if >25 (Hussein, 2017). We used Ludwig Scale to identify cases of androgenic alopecia in our study. It also adopts 3 grades for classifying the females according to the severity (Firooz, 2016). Menstrual irregularity was identified in our study by presence of more than 6 lengthy cycles per year (more than 35 days) or absence of menstrual bleeding for 3 consecutive months (Goodman, 2007). Students who were on contraceptives or who suffered from endocrine disorders were excluded from the study.

Statistical Analyses: All the statistical analyses were carried out with SPSS version 20 (SPSS, 2011). Normality of distribution was tested using Kolmogorov-Smirnov test. Data for continuous variables were described as mean ± SD and median (range). Categorical variables were expressed in frequencies and percentages. Chi squared test and its associated p value was used to assess relationship between categorical variables in the study**.** The significance level was set at or less than 5%.

RESULTS

Mean age of the students was 20.7 years with a standard deviation of 1.6 and in a range from 17 to 23 years. Figure 1

shows that 18.4% (166 students) had clinical hyperandrogenism. In Figure 2 about 6.8 % (61 students) and 16.6% (149 students) had alopecia and hirsutism respectively.
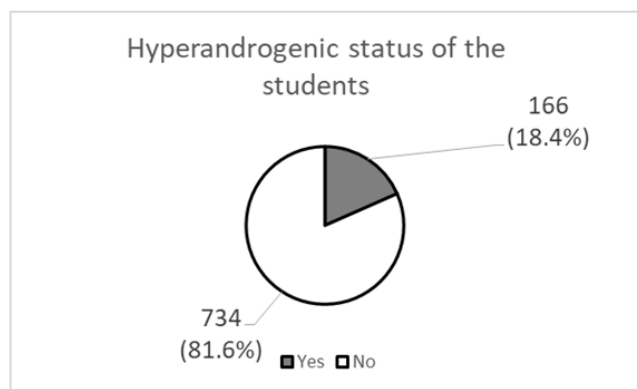

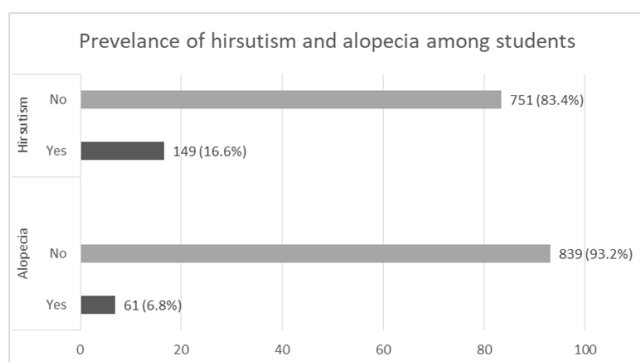**Figure 1. Hyperandrogenism in students**

Figure 2. Alopecia and hirsutism among students

Table 2. Relationship between hyperandrogenism and menstrual history of students

Menstrual history	Hyperandrogenism		χ^2	p
	No	Yes		
Menarche				
9-11 years	75 (46.3)	87 (53.7)	163.3	<0.0001
12- 14 years	529 (89.2)	64 (10.8)		
15-16 years	130 (89.7)	15 (10.3)		
Bleeding duration				
<3days	38 (76)	12 (24)		
3-7 days	622 (82.6)	131 (17.4)	3.4	0.186
>7 days	74 (76.3)	23 (23.7)		
Regularity:				
Yes	628 (83.3)	126 (16.7)	9.3	0.002
No	106 (72.6)	40 (27.4)		
Dysmenorrhea:				
No	465 (80.2)	115 (19.8)	2.1	0.150
Yes	269 (84.1)	51 (15.9)		
Premenstrual tension:				
No	89 (76.1)	28 (23.9)		
Yes	645 (82.4)	138 (17.6)	2.7	0.101

Figure 3 shows that most of students with alopecia (57.4%) and hirsutism (69.2%) had a mild severity degree while severe degree of alopecia and hirsutism were observed in only 11.5% and 13.4% of the alopecia and hirsutism sufferers, respectively. In Table 1 and 2, significant associations between hyperandrogenism on one hand and smoking (p value 0.040), marital status (p value 0.027), young age of menarche (p value < 0.0001) and irregularity of cycles (p value = 0.002) on the other hand were observed among students. Table 3 shows that no significant association was observed between hyperandrogenism and chronic diseases or weight gain.
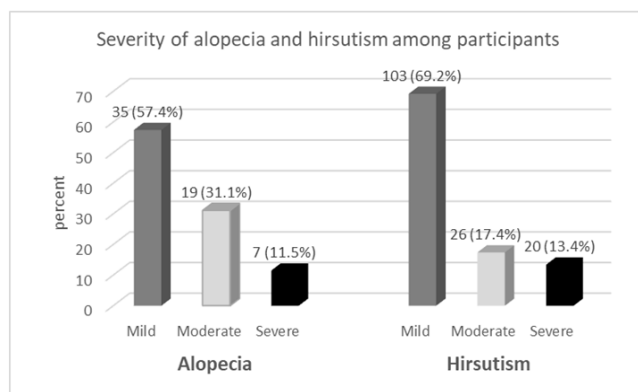

Figure 3. Severity of alopecia and hirsutism among students

Table 3. Relationship between hyperandrogenism and chronic diseases and weight loss

Chronic disease/ weight gain	Hyperandrogenism		χ^2	p
	No	Yes		
Chronic disease:				
Yes	26 (70.3)	11 (29.7)	3.3	0.071
No	708 (82)	155 (18)		
Weight gain:				
Yes	268 (79.5)	69 (20.5)	1.5	0.224
No	466 (82.8)	97 (17.2)		

DISCUSSION

Androgen excess is considered the most common endocrine disorder in females of reproductive age (Goodman, 2015). Our study agrees with the literature in this aspect where we found that 18.4% of the female students at Taif university suffered from hyperandrogenism. Hirsutism was the main component of hyperandrogenism among students (in 16.6%). These findings were consistent with a recent study by Gambineri *et al.* who reported a prevalence rate of 17% for isolated clinical hyperandrogenism (mainly represented by hirsutism) among females aging from 16 to 19 years (Gambineri, 2013). Similarly, Gumeniuk and Chernenkov also reported 14% prevalence for hyperandrogenism among females in the age 11 to 19 years (Knochenhauer, 1998). A study conducted in 2010 in Iran (a neighbor country to Saudi Arabia) on the teenagers and used the same cut off score; mFG $\geq$ 8 for hirsutism reported a prevalence rate ranging from 9 to 13% (Noorbala, 2010). Smoking has devastating effects on reproductive-aged women. It doesn't only increase cardiovascular risk but it also has adverse effects on reproductive hormones (Craig, 1989).

The significant association between smoking and hyperandrogenism in our study was similarly reported by many studies (Pau, 2013 and Sowers, 2001). Some of these studies suggest that smoking can decrease estrogen levels through inhibiting aromatase activity (Barbieri, 1989). Others propose that smoking has the ability to increase both metabolic syndrome and hyperandrogenism in women with PCOS (Pau, 2013). The significant higher prevalence of hyperandrogenism among married females in our study may be justified by increased stress among them due to having both the load of study and giving care for a family. A recent study referred increased occurrence of PCOS in married females to increased stress and lack of awareness about PCOS among them (Ramani, 2017). In fact, hyperandrogenism is a major component of pathological changes associated with polycystic ovary syndrome (PCOS) (Baptiste, 2010).

Frequent studies have reported significant link between stress and PCOS (Zangeneh, 2012; Basu, 2018 and Canavatchel, 2014). In concordance with A recent study which reported significant association between early age of menarche and hyperandrogenism in the eight year girls (Thankamony, 2012), we found that female students who reported early menarche had significant higher prevalence of hyperandrogenism than their peers. However, research gives mixed data in case of the relationship between hyperandrogenism and early age of menarche. In a retrospective study, hyperandrogenic females were more likely than their peers to report early or late menarche (Carroll, 2012). Studies justified the significant link between earlier menarche in girls with hyperandrogenism to the overweight they experience (Rosenfield, 1989; Stark, 1989). Moreover, it is reported that later menarche in girls with primary amenorrhea is associated with higher androgen levels which is also linked to their overweight status (Rachmiel, 2008 and Bek, 2010). It has been proposed that menstrual irregularity in adolescence is a good marker of hyperandrogenaemia which could lead to the development of PCOS in adulthood (Lewy, 2008 and Pinola, 2012). Many studies are consistent with our findings that adolescent girls who have irregular menstrual cycles have higher androgen levels than those with regular menstrual cycles (Pinola, 2001; Venturoli, 1995 and Van Hooff, 2004). Research has demonstrated a significant link between hyperandrogenism and chronic metabolic diseases such as type 2 diabetes mellitus, hypertension, microvascular disease and dyslipidemias (Endocrinologists, 2001). However this association wasn't significant in our study which could be due to young age of participants. Similarly, no significant association was observed in our study between hyperandrogenism and weight gain. However many studies report a significant association between weight gain and PCOS (Ollila, 2016). This association could be dependent on the amount of weight gain which couldn't be investigated in our study. A significant association could develop in presence of remarkable weight gain which is recommended to be investigated by further research.

Conclusion

A high prevalence; 18.4% of hyperandrogenism mainly represented in hirsutism; 16.6% exists between Taif university female students in KSA. Most of students with alopecia (57.4%) and hirsutism (69.2%) had a mild severity degree while severe degree was observed in only 11.5% and 13.4% of the alopecia and hirsutism sufferers, respectively. Significant associations between hyperandrogenism and smoking (p value 0.040), marital status (p value 0.027), young age of menarche (p value < 0.0001) and irregularity of cycles (p value = 0.002) were observed among students.

No conflict of interst: We self-funded our study.

Glossary of abbreviations

BMI : Body Mass Index.
mF-G score: Modified Ferriman-Gallwey score.
PCOS: Polycystic Ovary Syndrome

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