The impact of Hookah on anti-Mullerian hormone level

Tariq IrteimahMD, Amaal AlDubais MD, Rami AlRubaihat MD, Nansy AlFayez MD.

ABSTRACT

Purpose: The aim of our study is to determine if smoking hookah has an effect on ovarian reserve by measuring the serum levels of Anti- Mullerian hormone.

Material and methods: A cross-sectional study was performed at the fertility clinic at Prince Ali Hospital, in the city of Karak, Jordan. Two hundred healthy women within the 20 to 35 years age range, were chosen from those attending the fertility clinic. AMH serum levels were checked on one occasion on day 2–4 of the menstrual cycle. Data was collected from November 2020 to July 2021. The serum levels of AMH of 100 smoking hookah women were compared to the other non-smoking hookah women and results were analysed by Chi-square and independent samples T-result.

Result: A total of 200 hundred women were enrolled in the study. The mean age of the participants was 29 ±0.6 years. The mean AMH level was (2.29 ± 0.106 ng/mL) in hookah non- smokers compared to (1.5 ± 0.126 ng/mL) in hookah smokers. P values ≤ 0.05 were considered statistically significant. There is a considerable variation in Anti-Mullerian hormone levels between smokers and non-smokers.

Conclusion: Hookah smoking has a significant effect on serum Anti-Mullerian hormone levels.

Key words: Hookah, ovarian reserve, smoking, anti-Mullerian hormone.

RMS April 2022; 29(1): 10.12816/0060310

Introduction

A hookah is an ancient waterpipe tobacco-smoking device. Its first use goes back to the Persian empire, and it was made by Abu'l-Fath Gilani, a Persian physician of Akbar (1,2). It was thought that inhaling tobacco smoke through a water pipe would filter the harmful ingredients. This theory, along with the scents and flavours added to tobacco, led to the misconception that hookah is a safer alternative compared to regular cigarette smoking (3). This misleading thought has increased hookah smoking, not just in the Middle East, but also worldwide (4). So, it is considered a critical issue.

From the departments of: Obstetric and gynaecology
Corresponding author: Tariq IrteimahMD, Obstetric and gynaecology department IVF Unit ,King Hussein Medical Services ,Amman ,Jordan
Email: tariqirtaimeh@gmail.com

The detrimental effects of hookah smoking have been consistently shown in many studies. The harmful effect of hookah on the cardiovascular system, as well as it being a major risk factor for certain cancers, is now well established. However, there are few good-quality studies, if any, which show the negative impact of hookah smoking on ovarian reserve, measured objectively by serum levels of anti-Müllerian hormone (5,6).

There is also a strong association between hookah smoking, and adverse fetal and maternal outcome in pregnant women, such as growth restriction, preterm labour, and pre-eclampsia (7,8). AMH, secreted by granulosa cells (9), begins to surge in the male fetus at 7 weeks of gestation. It inhibits development of the Müllerian ducts. In the female fetus, however, granulosa cells start secreting AMH at 36 weeks of gestation. In women, it has its peak at between 23 and 25 years old (10). AMH `1has the best predictive value for assessing ovarian reserve in ageing women. It is secreted by developing antral follicles, thus reflecting the number of primordial follicles. This mechanism of secretion makes AMH less fluctuating throughout the menstrual cycle (11,13). The role of AMH in predicting response in women undergoing fertility treatment is well established (12,14).

Cigarette smoking has a harmful effect on fertility and AMH levels (16), shown by several studies. However, there are scarce data in the literature about the effect of hookah. We found only one study related to the effect of hookah on AMH (15).

Through this study, we aim to identify the effect of hookah smoking on fertility, by objectively measuring the AMH levels in participants.

MATERIALS AND METHODS

This cross-sectional study was performed at the fertility clinic at Prince Ali Hospital, in the city of Karak, Jordan. Ethical committee approval was obtained, as well as informed written consent from participants.

Two hundred healthy women, who met the inclusion criteria of the study, were randomly chosen from those attending the fertility clinic. AMH serum levels were checked on one occasion on day 2 or 3 or 4 of the menstrual cycle, as part of our regular investigations at our infertility clinic.

Inclusion criteria were as follows:
Women with no previous medical history, aged between 20 and 35 years, presenting to the clinic with primary infertility, defined by the WHO as inability to achieve pregnancy after 12 months of regular unprotected sexual intercourse. Hookah smoking, at least once daily for at least one year.
And the exclusion criteria include:

- Any woman with chronic medical illness
- Hormonal imbalances like premature ovarian failure
- Irregular cycle and previous ovarian surgery.
- Smoking conventional cigarettes, in addition to hookah use.

AMH serum levels were determined and compared between 100 women who met the inclusion criteria and 100 non-hookah users. For all women included in the study, demographics have been recorded and confirmed from medical records. The study was described to the patients who were enrolled, and the questionnaire was explained. Confirmation about patients' understanding of the study and questionnaire was obtained.

Any patient has the right to withdraw at any time without affecting their treatment plan. Five cc of blood were collected and allowed to clot for 30 minutes. After that, centrifugation for 10 minutes at 4500 cycles per minute was performed before analysis using Cobas 6000 (F. Hoffmann-La Roche Ltd, Basel,

Switzerland). A total volume of 2–3 cc of serum was used for the analysis. Calibration and measurement of AMH. levels were done using an Elecsys AMH kit (F. Hoffmann-La Roche Ltd, Basel, Switzerland).

Statistical analysis:

Pearson's chi-square test was used to evaluate if there were differences between different parameters and hookah smoking.

Data were analysed using SPSS-22 electronic data analysis software (IBM, Armonk, NY, USA).

Statistical significance was determined at the 95% confidence interval level.

Mean AMH was compared between two groups using a two-tailed t-test of independent samples.

RESULTS

Two hundred women participated in this study; 100 were hookah smokers and the other 100 were hookah not users.

The mean age for the participating women was 29+ 0. 6 years. The youngest age for smokers was 23 years, while the oldest was 35 years. The youngest non-smoker woman was 20 years, and the oldest was 35 years old. **Table III**

AMH levels were normally distributed for both groups evident by the normality statistical tests Kolmogorov-smirnov p= 0.2, which consider a non-significance (0.2> 0.05).

The mean AMH level was (2.29 ± 0.106 ng/mL) in hookah non- smokers compared to (1.5 ± 0.126 ng/mL) in hookah smokers **Table I**. Upon comparing the mean in AMH between smokers and non-smokers, independent t test revealed a statistically significant difference.t (198) =4.803, p<0.001). The mean difference between both groups in AMH was 0.79 with 95% confidence interval of 0.47 to 1.11, indicating the hookah smokers has a lower level of AMH as compared to hookah non-smokers.

The normal AMH levels were between 1.2 and 3.2 ng/ml. Referring to **Table II** of the total sample, 59 women had AMH levels less than 1.2 ng/mL, 44 were from the hookah smoking

group and the remaining 15 were from the non-smoking group. Also 111 women had AMH levels between 1.2 and 3.2 ng/mL, 65 of them were from the hookah non- smoking group and the remaining 46 were from the smoking group. This was considered as a subgroup of the normal AMH range.

Of the total sample of participants, 30 women had AMH levels more than 3.2 ng/mL, 20 of them were from the hookah non- smoking group and the remaining 10 were from the smoking group. **Table II**

A chi square of independence revealed a statistical significant association between hookah smoking and level of AMH, a low level of AMH was associated with hookah smokers compared to hookah non-smoking X^2 (2) =126.480. p< 0.001.

Table I: independent t test result for mean differences

AMH mean values	N	Mean	Std. deviation	t	df	P value
Non-smoking	100	2.29	1.058	4.803	198	0.000
Smoking	100	1.50	1.259			

Table II: Numbers of women smoking and non-smoking with serum level of AM

	< 1.2 ng/mL	1.2–3.2 ng/mL	> 3.2 ng/mL	X^2	df	P value
Non-smoking	15 (15%)	65 (65%)	20 (20%)	126.480	3	0.000
Smoking	44 (44%)	46 (46%)	10 (10%)			
Observed cases	59	111	30			

Table III: Mean age for smoker and non-smoker women

Mean age and SD	Non smoker	smokers
	29+0.6	29+0.8

DISCUSSION

Tobacco is a major, direct cause of more than 8 million deaths each year, according to the WHO (18). There is an alarming increase in hookah use amongst women, and studies show that the number of women using hookah exceeds that of men (19,20).

This increase has been attributed, at least partly, to the misconception that hookah is a 'safer alternative to conventional cigarette smoking' and many women acknowledged their psychological dependence on hookahs as being addictive to smoking hookah. Studies have constantly shown the harmful effect of hookah on the general health of women, and wellbeing (21). And increased risk of premature menopause, reduced bone density, infertility, ectopic pregnancy, increased infant disease and mortality, intrauterine growth restriction and increased chromosomal disorders (29)(30).

Smoking cigarettes adversely affects the ovarian reserve of women, leading to poor response during ovarian stimulation (22), and it elevates atresia of the follicles (23) so it will lead to early menopause in women who smoke (24). Furthermore, cigarette is associated with a decline in AMH levels in reproductive age groups (17)

Hookah smoke contains 82 toxic chemicals and carcinogens (24,25) such as nicotine, carbon monoxide, tar and heavy metals, and 1 hour of hookah smoking releases 100 to 200 puffs in comparison to 10 puffs from cigarette smoking (26,27) so they have greater effect on the reproductive system.(31) Comparing our results between hookah smokers and hookah non-smokers the average AMH in hookah non- smokers was 2.29 ng/mL but for smokers it was 1.5 ng/mL, showing the decline in AMH in smokers, as the normal result of AMH was 1.2ng/ml to 3.2ng/ml.

Only 15% of non-smokers had a low AMH level beyond 1.5 ng/ml. In contrast, to 44% of smokers low AMH less than 1.2 ng/mL, showing the effect of hookah toxins on AMH. We therefore found a significant reduction of AMH in hookah smokers, which will affect their fertility and may reduce their fecundity. Moreover, there is an increased prevalence of infertility around the world and primary infertility have been reported in 3.6% of tobacco smokers. (Delpishe et al 2014). Also, tobacco use likely increases infertility by 1.6-fold (32).

We found that hookah smoking has a direct damaging effect on ovarian reserve, expressed here by the serum levels of AMH.Although no studies till now addressed the mechanism of how these changes occurred. However, we only found one study evaluating the effect of hookah on AMH levels, in which the effect was not statistically significant (28). And that study had a small sample, and patients were randomly selected from all clinics, and not specifically the infertility setting.

On the other hand, there is a strong association between hookah smokers and low semen count and volume and motility, so it has a negative impact on sperm parameters (33) which contribute to the increase in infertility issues these days among couples smoking hookah by their negative impact on the AMH in women and sperm parameters in men.

Limitations

The study did not record the duration nor the number of hookah smoking sessions. It would be advisable to understand if the duration of hookah smoking has a greater effect, for example, on AMH levels.

Further studies with a larger number of participants are recommended. And a long-term follow-up of participants who quit smoking would show if the detrimental effect is reversible.

CONCLUSION

In a nutshell, our findings shows that hookah has a negative impact on serum levels of Anti-Mullerian hormone

REFERENCES

1. The Wealth of India. Council of Scientific & Industrial Research. 1976. Retrieved 1 August 2007. The smoking of hookah and hubble-bubble started in India during the reign of the great Moghul emperor, Akbar.

2. Encyclopaedia Iranica. 'Ḡalyān'. www.iranicaonline.org. Retrieved 29 May 2019. It seems, therfore, [sic] that Abu'l-Fatḥ Gīlānī should be credited with the introduction of the ḡalyān, already in use in Persia, to India.

3. Ehteshami Afshar A, Naghshin R, Amidshahi AA, Fereshtehnejad SM, Naserbakht M. Evaluation of the effects of hubble-bubble (waterpipe) smoking on pulmonary function in patients with respiratory symptoms referred to Hazrat Rasoul and Haft-e-Tir hospitals in Tehran. Razi Journal of Medical Sciences. 2006;13(52):49–57. (Persian)

4. Maziak W. The waterpipe: an emerging global risk for cancer. Cancer Epidemiol 2013;37:1–4.Web of ScienceGoogle Scholar

5. Ezzati M, Lopez AD. Estimates of global mortality attributable to smoking in 2000. Lancet. 2003;362:847–852. doi: 10.1016/S0140-6736(03)14338-3 [Crossref]

6. Blank MD, Cobb CO, Kilgalen B, Austin J, Weaver MF, Shihadeh A, Eissenberg T. Acute effects of waterpipe tobacco smoking: a double-blind, placebo-control study. Drug and Alcohol Dependence. 2011;116:102–109. doi: 10.1016/j.drugalcdep.2010.11.026

7. Kayemba-Kay's S, Ribrault A, Burguet A, Gouyon JB, Riethmuller D, Menget A, et al. Maternal smoking during pregnancy and fetal growth. Effects in preterm infants of gestational age less than 33 weeks. Swiss Medical Weekly. 2010;140:w13139. doi: 10.4414/smw.2010.13139 [PubMed]

8. Robinson JS, Moore VM, Owens JA, McMillen IC. Origins of fetal growth restriction. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2000;92:13–19. doi: S0301211500004218 [pii] [PubMed]

9. Vigier B, Picard JY, Tran D, Legeai L, Josso N. Production of anti-Müllerian hormone: another homology between Sertoli and granulosa cells. Endocrinology. 1984;114:1315–1320.

10. Rajpert-De Meyts E, Jørgensen N, Graem N, Müller J, Cate RL, Skakkebaek NE. Expression of anti-Müllerian hormone during normal and pathological gonadal development: association with differentiation of Sertoli and granulosa cells. Journal of Clinical Endocrinology and Metabolism. 1999;84(10):3836–3844.

11. Fanchin R, Taieb J, Lozano DH, Ducot B, Frydman R, Bouyer J. Human Reproduction. 2005 Apr;20(4):923–927.

12. Fanchin R, Mendez Lozano DH, Frydman N, Gougeon A, di Clemente N, Frydman R, Taieb J. Journal of Clinical Endocrinology and Metabolism. 2007 May;92(5):1796–1802. [PubMed] [Ref list]

13. . Dewailly, D., Andersen, C.Y., Balen, A., et al. The physiology and clinical utility of anti-Mullerianhormone in women. Human Reprod Update, 2014. 20:370–85. doi: 10.1093/humupd/dmt062

14. Freour, T., Masson, D., Mirallie, S., et al. Active smoking compromises IVF outcome and affectsovarian reserve. Reprod Biomed Online, 2008. 16:96-102.

15. Szkup, M., Jurczak, A., Karakiewicz, B., et al. Inuence of cigarette smoking on hormone and lipidmetabolism in women in late reproductive stage. Clin Interv Aging, 2018. 13:109–15. doi:10.2147/CIA.S140487.

16. Gulyas BJ, Mattison DR. Degeneration of mouse oocytes in response to polycyclic aromatic hydrocarbons. The Anatomical Record. 1979;193:863–882. [PubMed] [Google Scholar]

17.. Plante, B.J., Cooper, G.S., Baird, D.D., et al. The impact of smoking on antimüllerian hormone levels inwomen aged 38 to 50 years. Menopause, 2010. 17:571-5. doi: 10.1097/gme.0b013e3181c7deba.

18. World Health Organization. Tobacco Key Facts. Geneva, Switzerland: World Health Organization. 2019. https://www.who.int/news-room/fact-sheets/detail/tobacco. Accessed 9 June 2019

19. Shearston JA, Park SH, Lee L, Oshinsky C, Sherman S, Weitzman M. Increasing hookah use among adolescent females in the US: analyses from the 2011–2014 National Youth Tobacco Survey (NYTS). Tobacco Prevention & Cessation. 2016;2(September).

20. Nakkash RT, Khalil J, Afifi RA. The rise in narghile (shisha, hookah) waterpipe tobacco smoking: a qualitative study of perceptions of smokers and non-smokers. BMC Public Health. 2011;11(1):315.

21. Tansaz M, Adhami S, Mokaberinejad R, Namavar Jahromi B, Atarzadeh F, Jaladat AM. An overview of the causes and symptoms of male infertility from the perspective of

traditional Persian medicine. Iranian Journal of Obstetrics, Gynecology and Infertility. 2016;18(182):11–17.

22. Hershel Jick,JanePortera , AlanS.Morrisonb RELATION BETWEEN SMOKING AND AGE OF NATURAL MENOPAUSE: Report from the Boston Collaborative Drug Surveillance Program, Boston University Medical Center et 1977.

23. Soares SR, Simon C, Remohi J, Pellicer A. Cigarette smoking affects uterine receptiveness, Hum Reprod, 2007, vol. 22 (pg. 543-547)

24. Ward KD, et al. The waterpipe: an emerging epidemic in need of action. Tobacco Control. 2015;24(S1):i1–i2.

25. Sepetdjian E, Shihadeh A, Saliba NA. Measurement of 16 polycyclic aromatic hydrocarbons in narghile waterpipe tobacco smoke. Food and Chemical Toxicology. 2008;46:1582–1590.

26. World Health Organization. WHO Advisory Note: Waterpipe Tobacco Smoking: Health Effects, Research Needs and Recommended Actions by Regulators. 2005.

27. American Lung Association. Hookah Smoking: A Growing Threat to Public Health. 2011

28. Soha Albeitawi , Lama Almehaisen, Rawan Obeidat ,Qasem Shehab ,Effect of Hookah (water pipe) smoking on AntiMullerian Hormone levels,

29. Tansaz M, Adhami S, Mokaberinejad R, Namavar Jahromi B, Atarzadeh F, Jaladat AM. An overview of the causes and symptoms of male infertility from the perspective of traditional persian medicine. Iran J Obstet Gynecol Infertility. 2016;18(182):11–17.

30. Sarokhani M, Veisani Y, Mohamadi A, Delpisheh A, Sayehmiri K, Direkvand-Moghadam A, et al. Association between cigarette smoking behavior and infertility in women: a case-control study. Biomed Res Ther. 2017;4(10):1705–1715. doi: 10.15419/bmrat.v4i10.376.

31. A. R. Cooper, K. H. & Moley. Maternal Tobacco Use and Its Preimplantation Effects on Fertility: More Reasons to Stop Smoking . Seminars in Reproductive Medicine. 2008; 26(02) : 204-212

32. E. E. Hatch, R. Troisi, L. A. Wise, M. Hyer, J. R. Palmer, L. Titus-Ernstoff, R. N. Hoover. Age at Natural Menopause in Women Exposed to Diethylstilbestrol in Utero . American Journal of Epidemiology. 2006; 164(7) : 682-688 .

33. Zhang JP, Meng QY, Wang Q, Zhang LJ, Mao YL, Sun ZX. Effect of smoking on semen quality of infertile men in Shandong, China. Asian J Androl. 2000;2(2):143-146