



## Predictive factors for infertility of women: a univariate and multivariate logistic regression analysis

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### ABSTRACT

**Background and aims:** Infertility is a major problem during reproductive age. Physical and psychological effects of infertility in women are problematic. The aim of this study was to determine the potential predictive factors of infertility, among women referring both public and private health centers in Ilam province, western Iran, in 2013.

**Methods:** In this cross-sectional study, 1013 women referring the health care centers of Ilam province were enrolled in 2013. The participants were selected by simple random sampling method and their demographic, medical and obstetric variables were collected. The univariate and multiple logistic regression analyses were used to predict the potential risk factors of infertility.

**Results:** The husband's education and occupation showed to be suitable independent predictor variables for infertility by multivariate logistic regression analysis (OR: 1.36 and 2, respectively). Overall percentage of correct classification of the model was 88.7%. It means that, considering the husband's education and women's occupation, the ability of the model to predict the actual category of the cases was 88.7%.

**Conclusions:** It seems that husband education level and women occupation are independent predictive variables. The women at risk of infertility have to be identified and high-quality counseling should be given in order to minimize the complications of infertility in both genders.

**Keywords:** Ilam, Female infertility, Risk factor.

### INTRODUCTION

Infertility is an important problem during reproductive age and is defined as failure to conceive after one year of regular unprotected sexual intercourse without any known reproductive pathology.<sup>1,2</sup> The actual prevalence of infertility is unclear; however, most of the couples successfully conceive

after 12 months of regular unprotected sexual intercourse.<sup>3</sup> Previous studies have reported that about a quarter of all couples could be affected by infertility in developing countries.<sup>4</sup> In addition, infertility could be divided into two main groups: the primary and secondary infertility. Primary infertility

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is defined as infertile couples who have never conceived and secondary infertility refers to infertile couples who have conceived at least once before.<sup>5</sup> The incidence of female infertility is rising<sup>6</sup> so, that the primary or secondary infertility occurs in almost 15% of all women worldwide.<sup>7</sup> In fact, female infertility is the cause of infertility in one third of all infertile couples.<sup>8</sup> Moreover, infertility has several physical and psychological impacts on the life of infertile couples including: societal repercussions, personal suffering, psychological disorders,<sup>9,10</sup> sexual dysfunctions<sup>11,12</sup> and marital discord.<sup>9</sup>

There are several risk factors for infertility whose recognition is important for management of infertile couples.<sup>13, 14</sup> Research has reported that age, high body mass index, age of onset of sexual activity, prior pelvic surgeries and stress could be considered as the most substantial risk factors associated with women's infertility.<sup>6</sup> Other main causes of female infertility could be polycystic ovary syndrome,<sup>15</sup> premature ovarian failure,<sup>16</sup> hyperprolactinemia,<sup>17</sup> obesity,<sup>7</sup> emotional stress,<sup>18</sup> pelvic inflammatory,<sup>19,20</sup> genital infections,<sup>21,22</sup> endometriosis,<sup>19,23</sup> peritoneal adhesions,<sup>24</sup> the fallopian tube obstruction,<sup>25</sup> the uterine malformation,<sup>26</sup> adenomyosis,<sup>27</sup> Asherman's syndrome,<sup>28,29</sup> tubal blockage,<sup>19,30</sup> cervical stenosis,<sup>31</sup> smoking<sup>32</sup> and medical complications such as diabetes,<sup>33,34</sup> thyroid disorders,<sup>35</sup> life style<sup>36-38</sup> and occupation.<sup>39</sup>

Infertility, as a serious and poorly understood complication of women during the reproductive age, needs to be recognized with its epidemiological and clinical risk factors in order to predict the infertility, so that the quality of couple's life could be promoted. Therefore, this study was conducted to determine the potential predictive factors of infertility, in women referring to both public and private health centers in Ilam province in 2013.

## METHODS

In this cross-sectional study, the prevalence and risk factors of infertility among married women were investigated in Ilam province, western Iran in 2013. The women referring both public<sup>8</sup> and private<sup>8</sup> health centers in Ilam province, were selected by simple random sampling method. Totally, 1013 women were entered into the study and their related data were collected by trained research midwives. Inclusion criteria consisted of married women with failure to conceive after one year of regular unprotected sexual intercourse, and women with marriage period less than 12 months. None of the women were excluded from the study.

This study was undertaken with the approval of the Ethics Committee of the Ilam University of Medical Sciences (No: 923002/27). The purpose of the study was explained to the participants and the informed consent was obtained from all participants before enrolment. Data were collected by a two-part questionnaire. The questionnaire validity was confirmed by content validity (Cronbach's alpha coefficient: 81%). In the first part of the questionnaire, demographic characteristics such as age of the couples, education level of women and their husbands (four levels: academic, high school, primary school and illiterate) and women occupation (official, unofficial, housewife) were gathered. In the second part, all the data related to the date and the outcome of reproductive events, fertility medical records, and surgical and familial history were obtained. In this study, the infertility was defined as the inability to conceive live birth after one year of unprotected sexual intercourse. Women with primary infertility were the women never able to become pregnant after at least one year of unprotected intercourse. Women with secondary infertility were the women

with at least one previous pregnancy, but unable to become pregnant again.

Results were expressed as mean  $\pm$  standard deviation (SD). Kolmogorov-Smirnov test was used to assess the normality for continuous variables. Independent t-test was used to compare the mean age and monthly income in two groups. To explore the relationship between the occupation and education level of women as well as husband's job, the Chi-square test was used. Both univariable and multiple logistic regression analyses were used to indicate the association between the dependent (infertility compared to no fertility) and independent variables. P value less than 0.05 was considered as the level of significance. All the statistical analyses were performed by SPSS software 16.

## RESULTS

The demographic and obstetric characteristics of all participants are presented in Table 1. A total of 1013 women were enrolled in the study. Overall, 897 (88.6%) women were fertile, while 115 (11.4%) women were assigned to the infertile group. The overall distribution of infertility was as following: primary infertility 54 (5.3%), secondary infertility 31 (3%), and 26 (2.5%) never experiencing pregnancy. Generally, 5.4% of all the participants had a female factor of infertility and 2.6% male factor of infertility. In approximately 0.5% of the participants, both men and women were involved in infertility and in 0.2%, the cause of infertility was unclear. The mean age was  $31.1 \pm 7.9$  years in fertile women and  $38.1 \pm 7.77$  in infertile women, with a significant difference ( $P < 0.001$ ).

**Table 1:** Comparison of the characteristics between groups

Characteristics	Groups		P-value
	Fertile*	Infertile*	
	897 (88.6)	115 (11.4)	
Age (year)**	$31.1 \pm 7.9$	$38.1 \pm 7.77$	<0.001
Education	College	59 (10)	
	High school	281 (88.9)	35 (11.1)
	Primary school	47 (100)	0 (0)
	Illiterate	40 (65.6)	21 (34.4)
Husband education	College	506(90)	56(10)
	High school	322(88.5)	42(11.5)
	Primary school	25(100)	0(0)
	Illiterate	25(59.5)	17(40.5)
Occupation	Official	418 (92.1)	36 (7.9)
	Unofficial	8(88.9)	1(11.1)
	Home worker	438(85.7)	73 (14.3)
Husband occupation	Official	528(88)	72(12)
	Unofficial	331(89.7)	38(10.3)
	Non occupation	21(80.8)	5(19.2)
History of dysmenorrhea	No	88(88)	12(12)
	Yes	224(87.8)	31(12.2)
	>13	324(86.9)	49(13.1)
Menarche age, year	13-16	460(90.6)	48(9.4)
	<16	38(67.9)	18(32.1)

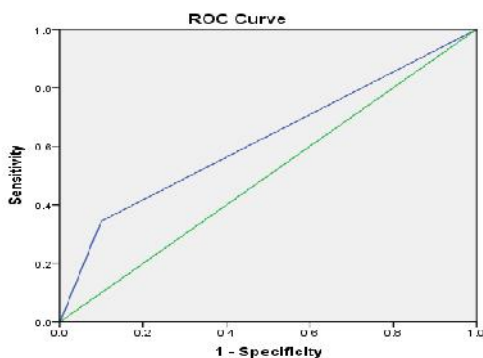
\*Number (%); \*\*Mean  $\pm$  SD

**Table 2:** Association between the infertility and other variables using univariate logistic regression analysis

Characteristics		SE	OR (95% CI) *	P-value
Education	College		1.0 (ref.)	<0.001
	High school	0.226	0.717 (0.72-1.47)	0.846
	Primary school	5862.747	0.000	0.012
	Illiterate	0.302	2.62 (2.60-8.51)	<0.001
Husband education	College		1.0 (ref.)	<0.001
	High school	0.216	1.79( 0.771-1.8)	0.975
	Primary school	8038.594	0.000	0.067
	Illiterate	0.344	6.14 (3.128-12.06)	<0.001
Occupation	Official		1.0 (ref.)	<0.001
	Unofficial	1.075	1.45 (0.177-11.93)	0.729
	Home worker	0.215	1.93 (1.27-2.95)	0.002

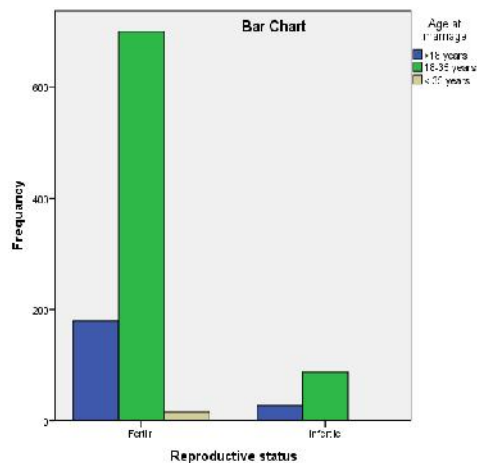
\*CI: Confidence interval

The infertility rate had a significant negative correlation with the educational level of women (-0.114) and men (-0.129). The increase in education level is associated with the decreased infertility in both men and women. The results obtained from the univariate logistic regression analysis indicated that there were significant differences in education, husband education and occupation between fertile and infertile women. By the multivariate logistic regression analysis, husband education (OR=1.36) and occupation (OR=2) were considered as independent predictive variables for infertility.



**Figure 1:** ROC of predicted probabilities of multivariate logistic model

The AUROC criterion was applied to calculate both the sensitivity and specificity of the model (Figure 1). Overall percentage of (correct) classification of the model was 88.7%. It means that, considering the husband education and women occupation, the ability of the model to predict the actual category of the cases was 88.7%. There was no statistically significant differences between marriage age and infertility between groups (P=0.157) (Figure 2).



**Figure 2:** Reproductive status and marriage age of participants

## DISCUSSION

In the present study, the causes of infertility in the study population were studied. Based on the results, 5.3% of our population experienced the primary infertility; however, the prevalence of primary was lower in another study in Iran, in which 0.6% to 3.4% of study population experienced primary infertility.<sup>40</sup> In this study, the prevalence of secondary and both types of infertility was reported 3% and 0.6%, respectively. In another study 10.5% of participants had secondary infertility.<sup>40</sup>

Based on the results, the female factor was the most common factor of infertility. In another study, similar to our results, the female factor was the main factor for infertility.<sup>6-8</sup> It was found a significant difference between fertile and infertile women in mean age. Age was also considered as a main effective factor of woman's fertility. Several studies evaluated the relationship between aging and women's fertility.<sup>6, 41, 42</sup> Moreover; another study reported the early and mid-twenties as the peaks of woman's fertility.<sup>43</sup>

The risk of infertility has increased 3 times in women with menarche age more than 16 compared to menarche age less than 13 years, but the difference was not statistically significant. Maturity and proper function of the hypothalamus, pituitary and ovary axis was the potential causes of menstrual cycle in women. In fact, any deviation from this axis could create a delay in menstruation and infertility. Therefore, hypothalamus disorders may cause the female infertility.<sup>35</sup> Moreover, several studies reported a relationship between the pituitary gland disorders and female infertility.<sup>30, 44</sup> Based on their results, the risk of infertility could increase by 2 times in housewives compared to outside home jobs. In addition, another cross-sectional

study reported that infertility and spontaneous abortion was higher among female hairdressers than among women working in other jobs.<sup>39</sup> The main point was that the insurances did not cover the costs of detection and treatment of infertility in Iran. Therefore, the housewives with no economic income were mostly unable to pay the cost of their treatment. Sometimes, the inability to treat the pelvic inflammatory disease could result in the women infertility.<sup>19, 20</sup> In the present study, the univariate and multivariate logistic regression showed that the husband's education could be considered as a predictor of female infertility. In most cases, higher income levels have been seen in people with higher education level in Iran. Therefore, we could expect that the women with husbands having higher levels of education may have fewer problems in their treatment of infertility. On the other hand, we know that sexually transmitted diseases (STDs) could be important risk factors for infertility; in fact, STDs are more likely among women living in poverty, being poorly educated, having poorly educated parents, and lacking educational and job opportunities.<sup>45</sup>

There were some limitations in our study. For example, there were no advanced infertility treatment centers in Ilam province and many infertile couples have to go to other infertility treatment centers outside of the province. Therefore, it cannot definitely say that the present study has covered a representative population of all infertile women. So, establishing an advanced infertility treatment center in Ilam province is necessary which makes it possible to collect reliable information on the prevalence and causes of infertility among women living in Ilam province.

## CONCLUSION

Based on our findings, there are several risk factors for infertility. In addition, it seems that aging, education level and occupation are independent predictive variables. Also, the women at risk of infertility should be identified and high-quality counseling has to be given to minimize the complications of infertility for both men and women.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

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