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OCCUPATIONAL REPRODUCTIVE HEALTH HAZARDS AMONG UNIVERSITY WORKING FEMALES

By

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Abstract

Introduction: Women constitute nearly 22% of Saudi Arabia's workforce where they may be exposed to workplace hazards. The risk factors for reproductive problems could be due to occupational or environmental factors. **Aim of Work:** This study aimed to determine reproductive health problems, investigate potential occupational reproductive health hazards, work-related factors, and measure the effectiveness of reproductive health education in improving female employee's knowledge and attitude toward occupational reproductive hazards. **Materials and Methods:** A pre-post interventional study was conducted using a semi-structured questionnaire that included a workplace screening tool for reproductive hazards, and questions for assessment the reproductive health of the participants. A cluster sampling technique was used and all the female employees involved in the randomly selected clusters were invited to participate in the study. **Results**: Ergonomic factors were the highest reproductive health hazards followed by psychological, chemical, physical, and biological agents (66%, 52.3%, 45.1%, 30.0%, and 10.0%, respectively). About 40.4% of the studied group reported a problem in conceiving a child, and 38% had a history of miscarriage, preterm, stillbirth, or deformed offspring. Miscarriage was the highest reported abnormal obstetric outcome among married participants (22.5%). **Conclusion**: Ergonomic and psychological hazards were the highest reported ones affecting the reproductive health of participants. Significant associations have been observed between workplace factors and both history of treatment of infertility, and time of pregnancy longer than one year. A significant change

in reproductive safety knowledge and attitude has been reported after health education. **Recommendations**: Periodic health education sessions and prevention orientation have to be carried out for all females working in the university indoors together with periodic assessment of the workplace for possible reproductive health hazards.
Keywords: Employees, Occupational hazards, Reproductive, Infertility and Miscarriage.

Introduction

Reproductive health represents one of the major aspects of human life, especially among women of childbearing age. Saudi Arabia has no minimum legal age for marriages as well as a high rate of early marriages compared with other Arab countries (Shawky and Milaat, 2000). The risk factors for reproductive problems include recognized genetic diseases in the family or the individual, congenital diseases, chronic maternal diseases, lifestyle, and occupational or environmental factors; adverse reproductive outcomes include miscarriage, prematurity, fetal growth restriction and infertility (Rim, 2017). In recent years, the employment rate for women has increased and work environments have changed with ubiquitous exposure to various occupational reproductive hazards with negative impact on women′s reproductive health (Park, 2020). Furthermore, exposure to stress such as work for long hours and shift work have been suggested to affect the reproductive outcomes of women (Bonde et al., 2013). Evidence accumulated that the menstrual cycle can be disrupted by strenuous physical work, exposure to hormones, chemicals, alkylating agents, heavy metals, solvents, pesticides with manifestations of dysmenorrhea, amenorrhea, anovulatory cycles, and reduction in fertility (Bonde, 2020). Several occupations with different hazards and exposures are known to be associated with various adverse reproductive outcomes (Dos Santos Silva et al., 2009; Yang et al., 2014; Kim et al., 2015; Kim et al., 2016). However, occupational health and safety are still a neglected component in occupational health programs.

Now, females represent a significant workforce in Saudi Arabia, thus, they have a fundamental right to work in an environment that is free from significant reproductive health risks, and also have the right to know the potential reproductive health risks encountered in the workplace.

Aim of Work

This study aimed to determine

the reproductive health problems, investigate potential occupational reproductive health hazards, work-related factors, and measure the effectiveness of reproductive health education in improving female employee's knowledge and attitude toward occupational reproductive hazards.

Materials and Methods

Study design: A pre-post interventional study.

Place and duration of study: This study was conducted from March 10th to September 10th, 2019 at the female section of Taibah University, Medinah city, Saudi Arabia.

Study sample: A cluster sampling technique was used. The main branch of Taibah University in Medinah city was divided into 15 clusters (each Faculty acts as a cluster). Ten clusters were randomly selected from the 15 ones **(**Faculties of Medicine, Nursing, Pharmacy, Science, Applied science, Engineering, Business Administration, Arts and Human Science, Family Science, and Computer Science)**.** All the female employees involved in these 10 clusters whether professional or administrative were invited to participate in this study.

Study methods: The data were collected using a semi-structured questionnaire consisting of five parts:

First part: Questions on *socio-demographic characteristics* of the participants as age, educational level, marital status, residence (e.g. urban or rural), weight, height, habits (smoking, exercise), family history, medical history of chronic diseases, and the history of any medicine used.

Second part: Questions on *occupational history* as current occupation, workplace, work duration, work hours, shift work, and second job.

Third part: Questions on core issues of our study *Workplace Screening Tool* for reproductive hazards adapted from Environmental Health & Safety, University of Toronto, 2015 (Environmental Health & Safety, 2018): Questions about any reproductive health hazards in the workplace as chemical (e.g. laboratory reagents, solvents, detergents), physical (e.g. noise, vibration, heat, ionizing and non-ionizing radiation); biological agents (e.g. virus, bacteria, parasites), psychological (work stress, overload, busy work schedules, and conflict),

and ergonomic hazards (e.g. prolonged sitting, standing, uncomfortable workstation height, poor body positioning, repetitive bending, and repetitive climbing of ladders or stairs) that can cause either reproductive impairment or adverse developmental effects.

Fourth part: included questions for *assessment of the reproductive health* of the participants adapted from similar studies (ACOEM Reproductive Hazard Management Guidelines, 1996 and Győrffy et al., 2014) (e.g. asking about miscarriages, delayed time to pregnancy longer than 1 year, high-risk pregnancy, preterm labor, fetal growth restriction, infertility, termination of pregnancy, menstrual problems, and deformed offspring).

Fifth part: The pre-post questionnaire (Yes/NO) answers for measuring *awareness of female employees* before and after health education sessions regarding occupational reproductive health hazards, problems, occupational health and safety measures, and the attitude toward maintaining their reproductive health.

Procedures:

Data were collected by self-administered, and when needed by personal, interview method among female employees in the reproductive age group (15-49 years). The respondents were recruited consecutively who met the inclusion and exclusion criteria. Inclusion criteria; female employees who had been employed at the university for at least six months at the time of the assessment, no history of medical, genetic, or familial disorders affecting reproductive health (e.g. endometriosis, polycystic ovary). While those employees who were temporary, on leaves, using contraceptives, and menopausal employees were excluded. Announcement and invitation for participation in the study were sent by email to all female employees working in Taibah University, Medinah branch. The total number of registered university female employees at the time of the study was 850; 310 were not eligible for inclusion in this study. The remaining, 540 female employees were invited to participate in this study where 470 agreed to participate with the response rate (470/540) = 87.03 %.

The intervention educational sessions:

The educational sessions were given after filling the questionnaire

(pretest questionnaire) for the 10 clusters in the workplace by direct face to face communication during the break time from 12:00-1:00 pm. Also posters, flyers, and educational booklet/ pamphlet were added to lectures. The sessions were conducted per cluster. The total numbers of sessions given were 10 sessions (5 sessions per educator) for the 10 clusters over 3 weeks. The message of health education was to give sound knowledge about different types of occupational reproductive hazards, ways of exposure, possible effects on reproductive health, and safety behavior to participants of different professional background. After 3 months, a post-test questionnaire was done to measure the effectiveness of reproductive health education in improving female employees' knowledge and attitude towards occupational reproductive health hazards and problems and safety behavior problems by comparing pre/ post results.

Validation and Pilot study: as most of the participants were Arabic speakers, the questionnaire was translated into Arabic by a bilingual researcher and back-translated by another bilingual expert. The questionnaire has been tested on 8 employees before the start of the study, and the necessary rewording and corrections were made to ensure clarity of all questions. The reliability coefficient test (Cronbach's alpha) was > 0.70 for most of the questions.

Consent

Participation was voluntary and written informed consent was obtained from all the participants after explaining the aim of the study. Privacy and confidentiality were ensured.

Ethical Approval

Official permission was obtained from the Scientific Research Ethical Committee of the Taibah University (No #039#).

Data Management

Data were analyzed using the Statistical Package for Social Science (SPSS) version 21.0. Descriptive statistics were used to determine the prevalence of reproductive health problems and workplace hazards. The relationship between reproductive health problems and the role of some socio-demographic or occupational factors was assessed by the Chi-squared test. McNemar's test was conducted to compare between pre and post-test results and the results were considered significant when $p < 0.05$.

Result

This study had been conducted on 470 female employees working in the females' Taibah University campus. The mean age of participants was (35.7±6.2) with a range of 22-49 years. More than two-thirds of participants were ever married (86.8%), however, 39% without offspring. The majority was satisfied by their income and was nonsmoker (86%, 79.8% respectively). Nearly one-third of participants worked as an academic staff members (35.5%) and 27.3% were medical staff members, 28.3% had previous work experience of 1-5 years, and only 39.8% worked more than 40 hours weekly. Regarding the workplace, the highest percentage of the participants worked in departments and classes, followed by administration/ information technology, medical unit, cafeteria/catering, and the least worked at laboratory/ radiology units (35.5%, 28.9%, 27.2%, 5.3, 3%, respectively).

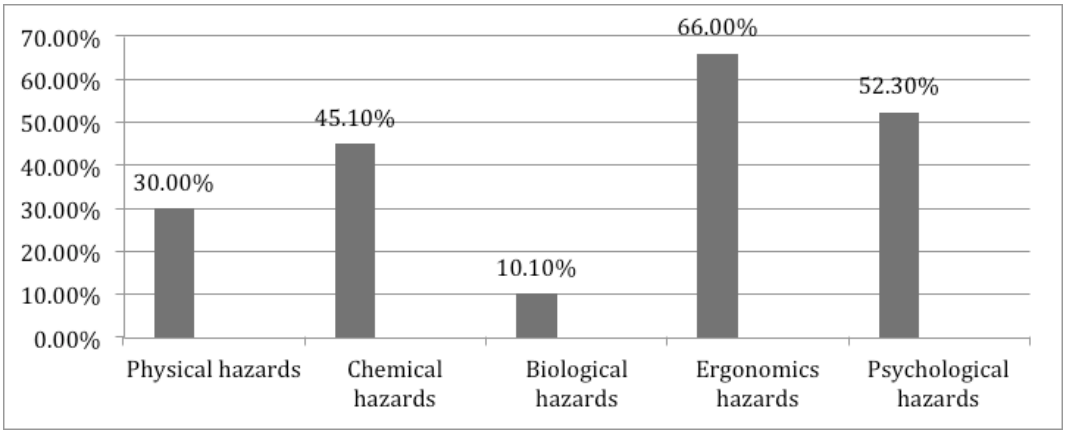

Figure 1: Percentages of the participants exposed to different reproductive health hazards.

After screening for reproductive health hazards among participants, ergonomic hazards were the highest followed by psychological, chemical, physical, and biological hazards (66%, 52.3%, 45.1%, 30%, and 10%, respectively) (Figure 1). Some participants were exposed to two or more types of hazards.

For never-married employees, 32.3% reported having menstrual disorders; about half of them stated that these problems started with the present employment (Results are not tabulated).

More than one-third of ever-married participants (40.4%) reported having a problem in conceiving a child, and 38% reported a history of miscarriage, preterm, stillbirth, or deformed offspring. Miscarriage was the highest reported abnormal obstetric outcomes among married participants (22.5%). Interestingly, the results showed lower rates of reproductive health problems among overweight, obese, and smoker participants (Results are not tabulated).

Table (1): Reproductive health problems of female university personnel in association with their occupational characteristics.

Occupational characteristics	Problem conceiving a child (No=165)	Consulted a physician for infertility or other reproductive problems (No = 153)	Previously treated for infertility (No =89)	Abnormal obstetric outcomes (Miscarriage/ Preterm/ stillbirth/ deformed offspring (No = 155)	Time-to-pregnancy interval longer than one year (No =82)	High-risk pregnancy (ies) (No =106)#	Termination of pregnancy (s) (No =21)
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Workplace:							
University medical unit	44(26.7%)	45(29.4%)	37(41.6%)	51(32.9%)	22(26.8%)	24(22.6%)	12(57.1%)
Departments/ classes	65(39.4%)	58(37.9%)	43(48.3%)	57(36.8%)	43(52.4%)	46(43.4%)	7(33.3%)
Administration/ IT	46(27.9%)	42(27.5%)	7(7.9%)	39(25.2%)	12(14.6%)	30(28.3%)	2(9.5%)
Lab/ radiology unit	4(2.4%)	2(1.3%)	0(0.0)	1(0.6)	4(4.9%)	1(0.9%)	0(0.0)
Cafeteria/catering	6(3.6%)	6(3.9%)	2(2.2%)	7(4.5%)	1(1.2)	5(4.7%)	0(0.0)
p value	0.359	0.372	**0.001****	0.090	**0.009***	0.055	0.088
Work duration /years:							
<1	2(1.2%)	7(4.6%)	3(3.4%)	2(1.3%)	6(7.3%)	3(2.8%)	0(0.0)
1-5	49(29.7%)	44(28.8)	25(28.1%)	54(34.8%)	22(26.8%)	31(29.2%)	6(28.6%)
6-10	49(29.7%)	42(27.5%)	25(28.1%)	50(32.3%)	18(22.0%)	38(35.8%)	8(38.1%)
>10	65(39.4%)	60(39.2%)	36(40.4%)	49(31.6%	36(43.9%)	34(32.1%)	7(33.3%)
p value	0.362	0.366	0.909	**0.040***	**0.016***	0.473	0.761
Work hours/week:							
≤ 40	98(59.4%)	85(55.6%)	35(39.3%)	93(60.0%)	49(59.8%	41(38.7%)	10(47.6%)
□40	67(40.6%)	68(44.4%)	54(60.7%)	62(40.0%)	33(40.2%)	65(61.3%)	11(52.4%)
p value	0.249	**0.020***	0.648	0.369	0.531	0.724	0.141
Shift work:	61(37.0%)	63(41.2%)	21(23.6%)	46(29.7%)	38(46.3%)	44(41.5%)	7(33.3%)
p value	0.352	**0.024***	**0.016***	0.123	**0.01***	0.070	0.923

*: Statistically significant at $p < 0.05$; **: Statistically significant at $p < 0.01$

#High-risk pregnancy (ies): ex. Multiple gestations, abnormal placenta position, high blood pressure,…etc.

Significant associations ($p<0.05$) have been observed between the workplace and both history of the treatment of infertility, and time of pregnancy longer than one year ($p <0.001$, and $p= 0.009$, respectively). Working duration in years was associated significantly with a history of abnormal obstetric outcome and time of pregnancy longer than one year among participants ($p= 0.04$, and $p= 0.016$, respectively). Shift work were found to be significantly associated with consulting a physician of infertility, history of infertility treatment, and time of pregnancy longer than one year ($p= 0.024$, 0.016, 0.01, respectively). Working more than 40 hours per week was associated with consulting a physician for infertility or other reproductive problems (Table 1).

Table (2): Reproductive health problems of female university employees in association with workplace reproductive hazards exposure.

Workplace reproductive hazards exposure	Problem conceiving a child (No =165)	Consulted a physician for fertility or other reproductive problems (No = 153)	Previously treated for infertility (No =89)	Abnormal obstetric outcomes (Miscarriage/ Preterm/ stillbirth/ deformed offspring (No = 155)	Time-to-pregnancy interval longer than one year (No =82)	High-risk pregnancy (ies) (No =106) #	Termination of pregnancy (ies) (No =21)	Total ## (No= 771)
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)
Physical hazards:	48(29.1%)	51(33.3%)	**41(46.1%)****	41(26.5%)	27(32.9%)	31(29.2%)	**2(9.5%)***	241(31.2%)
Chemical hazards:	**60(36.4%)***	59(38.6%)	**27(30.3%)****	**83(53.5%)****	**26(31.7%)***	44(41.5%)	5(23.8%)	304(39.4%)
Biological hazards:	18(10.9%)	20(13.1%)	**4(4.5%)***	12(7.7%)	6(7.3%)	11(10.4%)	0(0.0)	71(9.2%)
Ergonomic hazards:	113(68.5%)	**94(61.4%)***	67(75.3%)	**98(63.2%)***	59(72.0%)	75(70.8%)	**19(90.5%)***	525(68.1%)
Psychological hazards:	93(56.4%)	**70(45.8%)***	47(52.8%)	86(55.5%)	39(47.6%)	49(46.2%)	14(66.7%)	398(51.6%)

*: Statistically significant at $p < 0.05$; **: Statistically significant at $p < 0.01$

##: Participants were supposed to have more than one reproductive health problems.

#:High-risk pregnancy (ies): ex. Multiple gestations, abnormal placenta position, high blood pressure, etc.

All clusters shared to some extent in the history of exposure to all the studied hazards, however, some of them were at higher risk of exposure to certain hazards than others. Exposure to physical, chemical, and biological hazards at work was associated significantly with a history of infertility treatment (p-value= < 001, 0.009, 0.03 respectively). Exposure to chemical hazards was significantly associated with history of having a problem in conceiving a child, treatment of infertility, abnormal obstetric outcomes, and time of pregnancy longer than one year (p = 0.042, 0.009, <0.001, 0.028 respectively). Moreover, ergonomic hazards were associated significantly with history of consulting a physician for infertility, history of the abnormal obstetric outcome, and termination of pregnancy (p = 0.009, 0.044, 0.030 respectively) (Table 2).

Table (3): Knowledge of the participants about occupational reproductive hazards and problems before and after health education.

Knowledge about occupational reproductive health hazards and workplace exposure	Before health education (No =470) No	%	After health education (No =470) No	%	p	RR (95%CI)
Potential **physical hazards** at the workplace affecting reproductive health	81	17.2%	146	31.1%	**0.001****	.167 (.134-.209)
Potential **chemical hazards** at the workplace affecting reproductive health	153	32.6%	218	46.4%	**0.001****	.205 (.165-.255)
Potential **biological hazards** at the workplace affecting reproductive health	273	58.1%	284	60.4%	0.506	.056 (.031-.099)
Potential **ergonomic hazards** at the workplace affecting reproductive health	113	24.0%	153	32.6%	**0.004***	.112 (.084-.150)
Potential **psychological hazards** at the workplace affecting reproductive health	123	26.2%	155	33.0	**0.026***	.096 (.069-.133)
Knowledge about reproductive health problems that can occur from exposure to occupational hazards	**Before health education No**	**%**	**After health education No**	**%**	**p**	**RR (95%CI)**
Could workplace hazards exposure adversely affect reproductive function, fecundity, and fertility of women?	106	22.6%	171	36.4%	**0.001****	.179 (.143-.223)
Could workplace hazards exposure cause menstrual irregularities?	239	50.9%	263	56.0%	0.132	.104 (.071-.152)
Could workplace hazards exposure delay the ability to conceive a child?	217	46.2%	250	53.2%	**0.028***	.130 (.095-.179)
Could workplace hazards exposure be one of the causes of infertility?	74	15.7%	151	32.1%	**0.001****	.194 (.159-.238)
Does a workplace hazard exposure in pregnant women increase the chances of miscarriage?	111	23.6%	191	40.6%	**0.001****	.228 (.188-.276)
Does a workplace hazard exposure during pregnancy increase the risk of fetal malformations?	193	41.1%	198	42.1%	0.791	.022 (.010-.048)
Does a workplace hazard exposure increase the chance of premature delivery?	227	48.3%	261	55.5%	**0.031***	.140 (.102-.191)
Could workplace hazard exposures be one of the causes of stillbirth?	108	23.0%	166	35.3%	**0.001****	.160 (.127-.203)
Should pregnant women be excluded from certain job exposure as an attempt to protect them and the coming baby?	186	39.6%	241	51.3%	**0.0004****	.194 (.153-.246)

McNemar's test was used No=number of yes response, % percentage of yes responses.

*: Statistically significant at $p < 0.05$; **: Statistically significant at $p < 0.01$

Knowledge of participants regarding occupational reproductive health hazards (physical, chemical, ergonomic, and psychological) have been changed significantly after health education except for biological hazards. Knowledge about different reproductive health problems that can occur from exposure to occupational hazards has been significantly changed after health education (<0.05) except menstrual irregularity and increased risk of fetal malformations (Table 3).

Table (4): Occupational health and safety knowledge and attitude toward maintaining the reproductive health before and after health education.

Knowledge of occupational health and safety measures at workplaces	Before health education		After health education		p	RR (95%CI)
	No	%	No	%		
Do you know what are the occupational health and safety measures at the workplace?	206	43.8%	261	55.5%	**0.001****	.208 (.165-.264)
Did you attend a formal training on hazards and safety measures to be taken?	87	18.5%	166	35.5%	**0.001****	.206 (.169-.251)
Do you know the importance of using personal protective devices at work?	204	43.4%	253	53.8%	**0.001***	.184 (.143-.237)
Do you know that there are periodic checkup and investigations for occupational diseases as recommended by labor law?	110	23.4%	180	38.3%	**0.001****	.199 (.161-.245)
Do you know that policies allow female workers to transfer to different job while pregnant or while planning a child if the workplace is unsafe for reproductive health?	69	14.7%	143	30.4%	**0.001****	.185 (.150-.227)
The attitude of working females towards maintaining their reproductive health	**Before health education**		**After health education**		**p**	**RR (95%CI)**
	No	**%**	**No**	**%**		
Do you want to know the potential workplace hazards and work condition of exposure as well as names of any chemical, biological or physical agents and any potentially hazardous situations?	126	26.8%	183	38.9%	**0.001****	.123 (.087-.174)
Do you want to know the occupational health and safety measures at the workplace?	242	51.5%	269	57.2%	0.088	.183 (.146-.230)
Do you agree to keep records of your reproductive health histories to help to identify hazards and report on any reproductive health problem related to work?	206	43.8%	254	54.0%	**0.002***	.182 (.141-.235)
In case of pregnancy, are you ready to ask to be transferred from the start of pregnancy from work known or suspected to have a harmful reproductive health effects?	89	18.9%	162	34.5%	**0.001****	.196 (.160-.241)

McNemar's test was used No=number of yes response, % percentage of yes responses.
RR: Relative risk * Statistically significant at $p < 0.05$; ** statistically significant at $p < 0.01$

Differences in occupational health and safety knowledge and attitude toward maintaining reproductive health among female university personnel before and after health education have been significantly changed ($p<0.05$) (Table 4).

Discussion

Saudi Arabia reported the highest growth rate of women joining the labor force over the past few years, which reached 22% females in the workforce in 2019 (The Embassy of the kingdom of Saudi Arabia in United States of America, 2019), and continues to grow especially after the Saudisation of many work sectors. Recently, Saudi Arabia has launched various campaigns to empower its female population as part of the Kingdom's Vision 2030 plan to modernize the country and accelerate economic development. Therefore, this study is considered part of addressing female occupational reproductive health hazards and improving their knowledge and attitude for ensuring a comfortable healthy working environment.

The current study reported that ergonomic hazards were the most prevalent one among participants (66%) (Figure1). Those exposed to ergonomic hazards were significantly associated with history of consulting a physician for infertility, history of abnormal obstetric outcome, and termination of pregnancy (p-value= 0.009, 0.044, 0.030, respectively) (Table 2). A meta-analysis done by Mozurkewich et al., (2000) has shown a significant association between physically demanding work and pre-term birth. Also, one of the largest studies conducted to assess the role of workload on pregnancy was the one conducted in Montreal over 30000 women attending prenatal clinics. It detected that, physical effort, and lifting heavy objects were significantly ($p<0.05$) associated with spontaneous abortion and low birth weight (McDonald et al., 1988). A French study done on hospital workers reported that those who perform heavier tasks are exposed to more negative outcomes, including uterine contractions during pregnancy, low birth weight infants, and pre-term labor (Saurel-Cubizolles et al., 1985). Also, a study found that women performing activities that need high energy expenditure experienced menstrual irregularity and hormonal disturbance (Cho et al., 2017).

Miscarriage was the highest reported abnormal obstetric outcome among participants (22.5%). This finding could be explained by early marriages at young age of most Saudi females (Alghamdi et al., 2015); also, there is a trend that female employees usually keep working during pregnancy, despite the fact that their work might put a significant physical, and emotional

burden on them (Alshora and Kalo, 2018).

The present work showed that 45.1% were exposed to chemical hazards (Figure 1) which affect significantly the reproductive health among female employees (Table 2). In agreement with our results, a study done by Rim, 2017 on reproductive toxic chemicals at work and efforts to protect workers' health which reported the potentially damaging effects of chemicals to workers' reproductive systems. Similarly, a previous study conducted among employees working in biochemical research laboratories stated that exposure to solvents, metals continues to be an important risk for decreased fertility, spontaneous abortion, preterm birth, and reduced birth weight (Wennborg et al., 2002).

About 30% of the studied population was exposed to physical hazards (Fig.1) which significantly affect their reproductive health as 46.1% were previously treated for infertility and 9.5% got termination of pregnancy (ies) (Table 2).In agreement with our findings, there are related studies declared different results on physical hazards influencing women's reproductive health. Exposure to radiation and working in extremely cold or hot environments can contribute to disturbances of pregnancy causing abortion and stillbirth (Seidel, 1993). Also, occupational noise above 85-90 dB was associated with a decline in birth weight (Nurminen, 1995).

On studying the effect of work durations and reproductive health, the present study showed that working more than 40 hours /week was accompanied by previously treated for infertility and high risk pregnancies although it was statistically non-significant (Table 1). This is in agreement with a meta-analysis of evidence from 1998 to 2018 conducted by Wong et al., (2019) who reported several adverse effects of long working hours on the health of the workers.

The current work showed that night shifts can cause reproductive health problems (Table 1). This is in accordance with a study done in Iran by Davari et al., 2018 on shift work effects and pregnancy outcome and they found that shift work was significantly associated with the incidence of pre-eclampsia and eclampsia, intrauterine growth retardation, spontaneous abortion, and preterm delivery ($p<0.05$) and concluded that evening and night

shifts can disrupt the body's circadian rhythm that could affect the regulation of pregnancy hormones also women working at night often don't get enough sleep.

As regards the relation between workplace and reproductive health problems, the current work showed statistically significant associations between department classes and reproductive health problems (Table 1). A British study was done to assess the risk of small-for-gestational-age (SGA), it was found that low birth weight (LBW), and pre-term delivery (PD) were detected in different maternal occupations including office work, non-manual service workers, and housewives.

Stress is known to affect the endocrine system, which is often manifested by menstrual disorders. In the current study; exposure to psychological hazards was found to be the 2nd most prevalent hazard among participants (52.3%) (Figure 1). Interestingly, exposure to psychological hazards was inversely associated with a history of consulting physicians for infertility (p=0.024) (Table 2). Some studies reported the associations between stress at work and negative impacts on reproduction (Palomba et al., 2018; Rooney and Domar, 2018); however, a prospective study did not show significant reduction in the fertility rate, or miscarriage among women with higher work stress compared with others (Hjollund et al., 1998).

Biological hazards were the highest known hazards among participants before health education (58.1%) (Table 3), although they were the least prevailing among them (10.10%) (Figure 1). Similarly, a recent study conducted by Prajwal et al., 2020 which reported 59.4% biological hazards awareness among their nursing staff participants. Meanwhile, a Nigerian study reported that most of its respondent employees (89 %) were well informed about the biological high-risk practices in their work field (Aluko et al., 2016).

A significant change in knowledge of participants regarding reproductive health hazards in their workplace and possible reproductive health problems related to occupational hazards has been reported after the health education sessions ($p < 0.05$) (Table 3). Participants were willing to receive training on safety measures and were willing to know the potential workplace hazards among their work and the importance of doing

periodic checkups and investigations for early identification of occupation-related health problems, this was significantly ($p<0.05$) increased after getting the health education sessions (Table 4). Similar pre-post training statistically significant ($p=0.001$) improvement in knowledge of workers regarding occupational hazards have been reported by an Indian study done by Naithani et al., 2021 on evaluation of sensitization program on occupational health hazards for nursing and health care workers.

Conclusion: Ergonomic and psychological hazards were the highest reported hazards affecting the reproductive health of participants. Significant associations have been observed between workplace hazards and both history of the treatment of infertility, and time of pregnancy longer than one year. A significant change in reproductive safety knowledge and attitude has been reported after health education.

Recommendations: Periodic health education sessions and prevention orientation should be carried out for all females working in the university indoors together with periodic assessment of the workplace for possible reproductive health hazards and to take rapid action to remove it. Moving pregnant women to non-risk jobs is advisable. Adopting a reproductive health policy by the university is also recommended.

Limitations of the study: This study has some limitations. First: This study has been conducted among female employees at Taibah University, Madinah city, so results cannot be generalized over all female employees in Saudi Arabia. Second: The information bias can't be excluded as the data on occupational exposure and reproductive health problems were derived from the questionnaires. Third: one group measured before and after the intervention is inherently susceptible to bias and cannot support the cause-effect relationship. Finally: Our knowledge regarding how occupational exposures exactly affect the reproductive health of the female is not always conclusive.

Conflict of interest

There is no conflict of interest.

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