

Reasons for Increasing of In Vitro Fertilization Treatment In Palestine: Cross-sectional Study Design

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Abstract— In the last decade it has been observed that more Palestinian women have had In Vitro Fertilization (IVF) treatment to have their babies than ever, however this study aims to identify major factors that influence the decision to have this treatment, evaluating public support for fertility treatment exist, This research connects the IVF patient information, and annual reports of ministry of health, data collected by questionnaire, that couples who undergo IVF asked to fill questionnaire about their life style to modify Lifestyle factors effects on fertility (such as nutrition, the quality of drinking water, weight, exercise, psychological stress, environmental and occupational exposures, and some manners can have substantial; lifestyle factors such as cigarette smoking, and caffeine consumption). Data was analyzed using SPSS tools used to produce a descriptive tabulation of data obtaining variables which will be presented as frequency, percentage, and charts ,and This study revealed that infertile women seeking treatment having unhealthy lifestyle that decrease chances of becoming pregnant.

Keywords— In Vitro Fertilization, lifestyle, fertility factors, exercise, psychological stress, nutrition.

I. INTRODUCTION

In Vitro Fertilization (IVF) is a one of assistive reproductive technology types (ART) it is defined as is a complex series of procedures used to enable people with reproductive problems to have a baby with fertility or prevent genetic problems, Usually in IVF, fertility hormones are administered to the woman to encourage the follicles in the ovaries to produce several eggs the eggs are retrieved and fertilized with sperm in the laboratory. the fertilized eggs are then inserted into the woman's uterus or it can be frozen for storage[1].

Today, IVF is an important method for the treatment of infertility; it is the preferred treatment for complex fertility disorders[2]. In the last decade, it has been observed that more Palestinian women have had IVF treatments to have their babies than ever. IVF technology has spread swiftly throughout the world.

According to the ministry of health in Israel, Israel has the highest number of IVF cycles performed (relative to population size) in the world, and the main reason is the unprecedented Israeli health basket services of IVF, which provides practically unlimited IVF treatments for eligible infertility patients under the age of 45 years and who have no more than two children, Including single mothers[3].

IVF services in Palestine are provided at the private sector facilities(for profit) which all must have been licensed from the Ministry Of Health (MOH), the current number of licensed IVF centers in Palestine is 24 (14 in the West Bank and 10 in Gaza Strip). Relative to the Palestine population number (5, 1

million), the ratio of IVF centers in the west bank and Gaza strip together is 4.6 per million, which is considered much higher than most countries in the world, in comparison to the neighboring countries, the number of centers per million in Palestine is higher than Egypt, Jordan and Lebanon (0.45 per million, 1.74 per million and 2 per million respectively) [4]. Increased awareness, along with better availability and knowledge of IVF services, has increased the demand for assisted pregnancy therapy over the last decade.

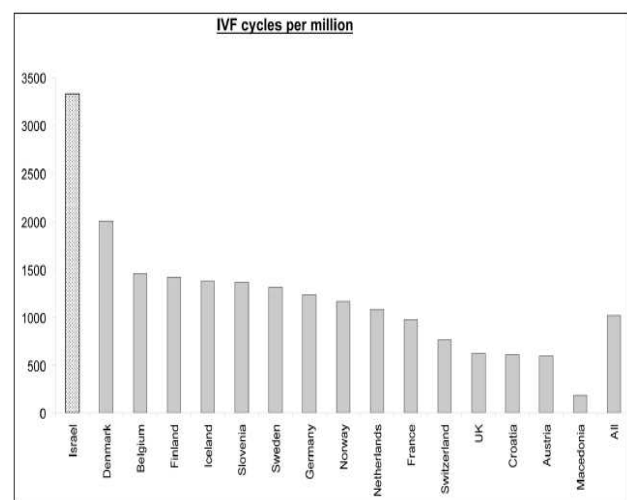


FIG.1. Number of IVF cycles per million persons per annum (2003 figures). Europe sources: nyboe Andersen et al. 2007; Israel sources: population: 6,689,700 citizens (central bureau of statistics 2008); number of IVF cycles: 22,449 (Ministry of Health)

II. BACKGROUND

A. Fertility Rate

A fertility rate is an index that measures fertility by relating the number of children with the women population in their reproductive ages. Fertility rate differs between countries and over time, due to many factors which affect fertility rates. Traditions factors, lifestyle factors, and genes).and it can be measured by two expressions age-specific fertility rates and the total fertility rate.

B. Age-Specific Fertility Rate

The age-specific fertility rate (ASFR) measures the annual number of births to 1000 women of a specified age group. ASFR rate is computed as a ratio as equation (1) It is expressed as births per 1,000 women. The reproductive years of women classified in single or five-year age groups divided into seven groups, with five years intervals[5] .

The ASFR is calculated as:

$$ASFR_a = (B_a/E_a) \times 1000 \quad (1)$$

Where:

B_a = Number of live births to women in specified age group
E_a = Number of women in same age group.

In Table 1 the age specific fertility rate in Palestine in 2020:

Table 1. THE AGE SPECIFIC FERTILITY RATE IN PALESTINE IN 2020

Age group	Female population number	Birth per 1000 women
15-19	151,236	52.766
20-24	141,668	185.07
25-29	128,127	192.8
30-34	103,385	159.13
35-39	83,925	101.73
40-44	74,720	39.45
45-49	65,241	2.50

C. Total Fertility Rate

The total fertility rate (TFR) is considered a measure of population growth. (TFR) is defined as the average number of living children born to a woman who survives her reproductive years (ages 15–49).

$$TFR = \sum ASFR_a \times E / 1000 \quad (2)$$

Where:

ASFR_a = the age-specific fertility rate

E = Age interval

The total fertility rate is used by Governments and international organizations to forecast population changes and help plan for services, education, and other societal needs.

According to the UN Population Division, as the total fertility rate (TFR) dips about 2.1 children per woman is called the population replacement-level fertility within a given country. A TFR below this 'population replacement level, population size starts to decline [6].

The present total fertility rate for the world is 2.5. Many countries have TFRs of 6 or higher such as Niger (7.6), the Democratic Republic of the Congo (6.3), and Uganda (6.2). But on the other end total fertility rate is lower in developed countries such as the United Kingdom (2.0), Brazil (1.8), or Japan (1.4) that have lower total fertility rates, averaging 2 or below [7].

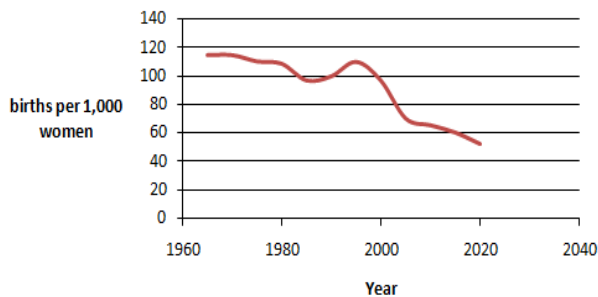


FIG 2. Age specific fertility for women in age group (15-19) years old during (1960-2020)

D. Total Fertility Rate in Palestine

Over the last few decades, There has been a remarkable global decline in the number of children women are having and Palestine is not an except, it has been already seen a decline in The fertility rate, according to the MOH and Palestinian Central Bureau of Statistics (PCBS) reports, the fertility rate in Palestine fell gradually from 7.9 births per woman in 1970 to 3.4 births per woman in 2019 [8].

As shown in Fig. 3, and Table 1 there has been a remarkable decline in the number of children women are having.

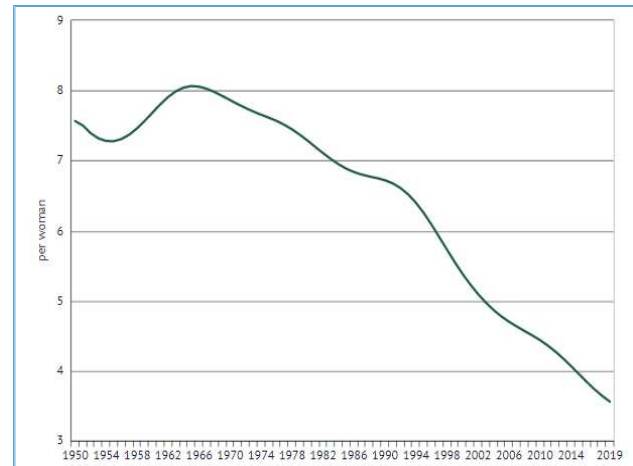


FIG.3. total fertility rate during (1950-2019) in Palestine

III. FRAMEWORK:

Total fertility rate is an indication to the health of the public, and so the link between infertility and general health can be expressed in two ways. First, the population health consequences of an increased use of ART such as IVF [9] and second, the prophylactic of infertility, most of which are already public health affairs.

Social and gender norms present significant challenges for women in Palestine, married women must have children to save their marriage, the inability to have children For a significant proportion of them, create broader problems, in terms of social stigma, therefore, so It is not surprising, that there is a growing demand for reproductive technologies services assisted.

TABLE 2. FERTILITY RATE CANGE DURING THE LAST DECADE

Year	Total Fertility rate	Change%
2008	4.56	-
2009	4.50	-1.38
2010	4.43	-1.49
2011	4.36	-1.74
2012	4.27	-2.02
2013	4.17	-2.29
2014	4.06	-2.56
2015	3.95	-2.75
2016	3.84	-2.81
2017	3.73	-2.76
2018	3.64	-2.54
2019	3.56	-2.28
2020	3.48	-2.22

Unhealthy lifestyles (exercise less, smoking, drinking caffeine, eating junk food, etc.) lead to a decrease in public health that leads to fertilization problems which growing demand for reproductive technologies services assisted. Palestinians are more likely to have boys, Family planning increased the demand for reproductive technologies services assisted which allow parents the option of being able to choose the sex of the incoming baby, even couple that has no infertility problems[10].

Palestinian women empowerment in education and in the workplace Even though family planning services are less available in rural and remote parts of least developed countries, the poor who live in urban areas have more difficulty, for a variety of financial, social, and cultural reasons, accessing family planning services than do wealthier residents. There are many family planning services provided by MOH and UNRWA family planning centers[11].

IV. RESEARCH DESIGN

This study conducted to investigate the relationship among lifestyle factors (urbanization, Nutrition, Exercises, Psychological effects, cigarette smoking, caffeine consumption, pollution, and occupation exposure) and fertility rate and to predict lab test results such as SEMLHI using machine learning technique[12]. This study most likely qualifies as minimal interference by providing lifestyle habits that are indisputably effect on reproductive health.

This study will use both quantitative and qualitative methods:

A. Qualitative methods

Qualitative research strategy is particularly applicable for the purposes of this research, data is collected from Ministry Of Health, and Palestinian Central Bureau of Statistics - PCBS annual reports, where the connection between several different variables will be established through interpretation.

A. Quantitative method:

For the purposes of this research, it has decided to use a questionnaire tool – Google form questionnaires, and 50 reliable Arabic questionnaire papers were distributed among couples who are having IVF treatment in several IVF centers in Palestine,

The questionnaire included many questions in the first part asked about the reasons for doing this treatment, their age and their education level and the second part were questions to measure the healthy lifestyle for them (Nutrition, Exercises, Psychological states, cigarette smoking, caffeine consumption, pollution recourses near their habitats and occupation). Data collected for one month from January 7th, 2020 to February 2020 and then supported measured variables with last studies discussed using SPSS tools to produce a descriptive tabulation and charts of data obtaining variables which presented as frequency and percentage. Couples were contacted via e-mail and asked to participate.

Sample size:

We had 36 Google form questionnaire filled and a 50 questionnaire papers filed in different four IVF centers.

V. FINDINGS AND DISCUSSION

At first we shed light on the role of pressure on couples to go through and perform IVF. Results showed in figure (4) that IVF treatment is considered in 3 main cases:

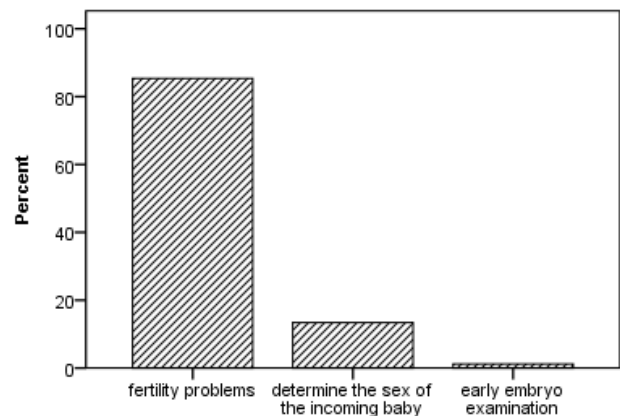


FIG.4 Reasons Forced Couples to Have IVF Treatments

84.15% of the respondents had IVF treatments because of a diseases impacting fertility they or their couples or both of them have,14.63% of the respondents couples have no reproductive problems they just wanted to select the coming baby's gender, and only 1.22% of them have IVF treatments to make early examination for birth defects of the fetus.

Early Examination for Birth Defects of the Fetus

1.12% of the respondent undergoes IVF treatments to have an early embryo cleavage, embryo cleavage is a strong biological indicator of embryo potential, to prevent genetic problems and may be used as an additional embryo selection factor for IVF embryos.

A. IVF Allows Couples Gender Selection

14.63% of the respondent said they had no reproductive problems they have to peruse IVF to have a child with a specific sex. IVF treatment allows parents to have a child of specific sex after having many children of the same gender, Gender selection takes place during the IVF process, where the embryo of the specific gender would be selected before being transferred into the mother's uterus, It is also made possible for a couple that has no infertility problems to want to have IVF treatments in order to select their child's sex.

In past families in Palestine depend on children for economic, but nowadays children gradually became increasingly expensive dependents, The high Cost of Raising a Child (housing expenses, childcare, education, transportation, healthcare, and clothing), contributed to parents choosing to have fewer children.

Family planning increased the demand for reproductive technologies services assisted which allow parents the option of being able to choose the sex of the incoming baby; when it comes to family planning Gender selection gives parents more flexibility. It gives control the number of children that the parents decide to raise. Many Palestinian parents may continue to have babies until they get the baby's gender they want [13].

A. Fertility problems

IVF has proven to be a powerful solution for conception for many couples who want to have a baby but they struggle with diseases impacting fertility, such as (ovulation problems, endometriosis, fallopian tube damage, prolonged infertility, obstruction, pelvic adhesions, poor semen quality, and unexplained infertility). According to data collected from the questionnaire infertility identified in females alone in 27.54% of couples, in men alone (36.23%) couples and causes of infertility found in both couples were (7.52%), and Unexplained Infertility has pertained in (28.9%) couples.

a. Urbanization Growth And Education Level

The urban population in Palestine today is increasing significantly, the urban population in 2018 is estimated at 76% Statistics from the World Bank show that Palestine has a fast urban-population-growth rate that approximated at 3.2% which is high compared to a regional rate of 2.5%[14].

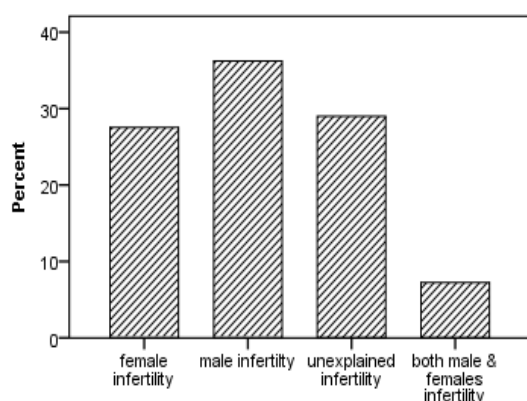


FIG.5. infertility responsibility

It is also related to the availability to access to the planning services provided by MOH in Palestine and other specialized centers, Women with higher levels of education and income, are more likely to have access to family planning services, there are 323 MOH centers provide family planning services (306 in the West Bank, and 17 in Gaza Strip), and 65 agencies centers are affiliated to UNRWA(43 in West Bank and 22 in Gaza Strip)[15][16].

IVF increases pregnancy probability for women in advanced age, according to many studies fertility begins to decline around the age of 32, becomes more rapid at 35 until by age 40, fertility has fallen by half, IVF, have made it easier for women to become pregnant at a more advanced age. The questionnaire results showed that 60% of women who are undergoing IVF treatments are in their 30' years Scientists have associated the female fertility decrease with age, age affects to the ability to get pregnant and have a healthy baby for both men and women, When under the age of 30, a woman's chances of conceiving may be as high 71%; when over 36,it may only be 41% [10].

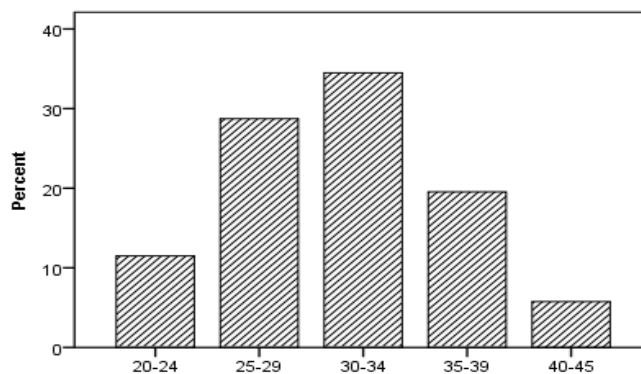


FIG. 6. Wife's age Groups

The plot graph in figure(2) shows that the number of births per 1000 women who are in (15-19)years old age group is decreased during the last decades and that is due to the increase in the marriage age for Palestinian women. Palestinian women are having their first child later in life than in the past , Increases in average age at first birth were more pronounced in Palestine in the last two decades, Financial concerns and a desire to focus on their education and career aspirations are two common reasons women delay having children.

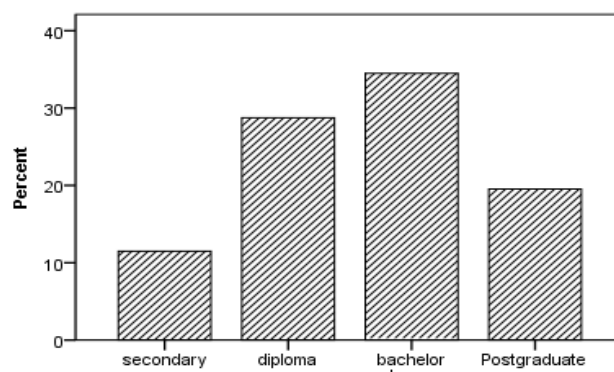


FIG.7. Education Level for Wives

the social empowerment of women, especially through the increase in education as a result of the data of the Ministry of Education and the Ministry of High Education and Scientific Research for the academic year 2018/2019, which showed that to female enrollment secondary schools by 91%[8], as shown in figure (7) that 71.26% of women who undergoes IVF treatments had a post-secondary education, educated women are more likely to enter the labor market, fertility treatments, like intrauterine insemination, and assisted reproductive technology IVF, have made it easier for women to become pregnant at a more advanced age.

a. Nutrition

Couples asked about their Nutrition, if they usually eat excess sugar, salt, animal fats, or junk food, and the results obtained as in Table (3).

As in detailed Harvard fat intake study presented at an international fertility meeting in Istanbul[13], the authors found that saturated fat is associated with less fertilized egg recovery, the higher polyunsaturated fat and trans-fat were

associated with reduced fetus health, and higher monounsaturated fat was associated with higher birth rates. Excess sugar, Trans fats found in canned diet and eating a healthy diet is an essential part of maintaining good general health, vitamins and food groups can have a greater effect on reproductive health than others.

Consuming a diet rich in carbohydrates, folate, fiber, and lycopene [17] as well as consuming vegetables and fruit [18] correlates well with semen parameters improvement. Consuming lower quantities of both fats and proteins more is helpful for fertility; antioxidants play a main role in the body by palsy reactive oxygen species (ROS).

TABLE 3. FREQUENCY PERCENTAGES FOR NUTRITION LIFE STYLE

Nutrition	
often eat excess	Frequency percentage
excess sugar	25.3
excess salt	20.7
excess animal fats	4.5
junk food	18.4
I always eat a healthy food	31.0
Total	100

b. *Exercise and Activity*

Results in Table (4) show that 47.1 of the respondents don't exercise at all. Exercise has many benefits for health and reduces levels of stress, including. Increasing moderate physical activity has a positive impact on reproductive health for women and men, especially those with obesity the faithful enemy of fertilization in women.

TABLE 4. FREQUENCY PERCENTAGE FOR EXERCISING IN WEEK

exercising in week	
I do exercise	Frequency Percentage
I don't exercise at all	47.1
I don't exercise regularly	17.2
once a week	23.4
2-3 times a week	10.3
4 or more a week	2.3
Total	100.0

According to many studies men who exercising at least three times a week for one hour effectuated higher in sperm quality parameters compared to men who didn't exercise [17].

c. *Smoking Cigarettes*

Couples asked if one or both of the partners smoke tobacco and the result shown in Table (5):

The modern world presents numerous toxic insults, from water and air pollution to chemicals in processed foods. Many of them, like smog, are difficult to avoid, while others, like alcohol, nicotine, and illicit drugs are voluntarily introduced.

Assessing a personal toxic load (including things like caffeine, smoking, and exposure to second-hand smoke) is a good way to identify and target the toxins you can actively avoid.

TABLE 5. FREQUENCY PERCENTAGE FOR SMOKER INFERTILE COUPLES

Smoking tobacco	
smoke tobacco	frequency percentage
I don't smoke	47.1
5 or less cigarettes a day	3.4
6-10 cigarettes a day	4.6
More than 10 cigarettes a day	23.0
I smoke hookah	21.8
Total	100.0

Results showed that 31% of couples have one at least one partner smokes cigarettes, and 21.8% they of couple one of the partner at least smoke hookah.

The modern world presents numerous toxic insults, from water and air pollution to chemicals in processed foods. Many of them are difficult to avoid, on the other hand, others such as nicotine, alcohol, and illicit drugs are voluntarily introduced. Assessing a personal toxic load (including things like caffeine, smoking, and exposure to second-hand smoke) is a good way to identify and target the toxins person actively avoids.

Menopause occurs 1 to 4 years earlier in women who smoke because of Chemicals (such as nicotinand cyanide). Male smokers can cause lowered sperm parameter quality with lower counts and motility and increased numbers of abnormally shaped sperm. It also decreases the sperm's ability to fertilize eggs [19]. According to many studies fertility rates for both male and female smokers are about half the rate of fertility found in nonsmokers. Women who smoke do not conceive as efficiently as nonsmokers. The more cigarettes smoked daily increases The risk for fertility problems [20].

Even IVF treatments may be able to overpower smoking's effects on fertility. Female smokers need more ovary-stimulating medications, and they still have a lower number of eggs at retrieving mature eggs process time and have 30% lower pregnancy rates in comparison with IVF patients who do not smoke [21].

Because smoking harms the genes in eggs and carcasses, miscarriage and fertility rates are very high in smokers. Women who smoke are more likely to be chromosomally unhealthy (such as pregnancy-related pregnancies) than non-smoking mothers. premature labor and Ectopic pregnancy also procure more frequently among women who smoke [19].

d. *Caffeine*

Infertile couples asked in the questionnaire how much they drink caffeine the results shown in Table (6).

Some studies concluded that an increase of caffeine consumption lead to several fertility issues. Caffeine contains

certain components which can lead to problems like miscarriage, premature birth, etc. Some researchers have found that women who consume large quantities of caffeine found in (cola soft drinks, coffee, tea, cocoa and energy drinks) may take a longer time to become pregnant and have a slightly higher risk of miscarriage and low birth weight[22].

TABLE 6. FREQUENCY PERCENTAGE FOR ACTIVITY MEASUREMENT

caffeine	
Drink caffeine	frequency percentage
I don't drink caffeine	23
seldom	14.9
Some of the time	14.9
fairly often	31.0
almost always	16.2
Total	100.0

e. *Stress*

Infertile women asked how much they feel sad, angry and how much they seem to be in a hurry, the results showed that 43% of them feel they are fairly often or almost always feeling sad, 46.5% of them are fairly often or almost always feel angry or hostile, and 57% feel they to be in a hurry .

TABLE 7. FREQUENCY PERCENTAGE FOR ACTIVITY MEASUREMENT

	psychological factors		
	I feel sad or depressed	I feel angry or hostile	I seem to be in a hurry
almost never	5.8	3.5	9.3
seldom	16.3	8.1	12.8
some of the time	34.9	41.9	20.9
fairly often	30.2	25.6	25.6
almost always	12.8	20.9	31.4
Total	100.0	100.0	100.0

Infertility is a major life indicator of social and psychological problems. Stress, depression, and anxiety have common consequences of infertility. Many studies have found that the happening of depression and sadness in infertile couples presenting for infertility treatment is higher than fertile couples.

Two years marriage duration without having a child makes a social pressure around on the couples due to fertility problems were their main concern in the family.

Couples probably feeling stress as they trying to conceive, as stress levels increase, so chances of getting pregnant decrease. This is likely due to the hormonal changes that happened at feeling stressed. Losing female oestrogen hormones (vital for conception) and gaining androgens[23][24].

f. *Pollution:*

Couples were asked if they already live in places near (factories, settlements landfills, or communication towers) and results shown in Table (8), Results showed that 42.4% of the couples live near one or more pollution resources and 32.1 % of infertile women have.

Table 8. frequency percentage for activity measurement

Pollution resources near my living place	
there isn't any pollution resource near my living place	57.47
Near factories	10.3
Near settlements landfills	10.3
Near communication towers	16.1
Near quarries	5.7
Total	100.0

1. *Israel Settlement landfills*

Many Israeli settlements don't have convenient waste treatment facilities. There is about 12 % of settlement Sewage water is still untreated and is transported through streams near Palestinian communities which is approximated to 19 million cubic meters of wastewater flows through the occupied West Bank each year[25].

Micro-plastics in waste, accumulates and contaminates in food chains through agricultural soils, and the water supply. Many studies pointed that micro-plastics entering the human body across direct contact through breathing or ingestion can lead to consequences of health impacts, including oxidative stress , necrosis, and inflammation which are related to a sequence of negative health outcomes[13].

All methods for the treatment of waste (including pyrolysis, incineration, gasification, and co-incineration,) result in getting away into the air, water, and soil of toxic metals such as mercury and lead, organic compounds (furans and dioxins), or acid gases and other toxic materials. All such developments contribute to direct and indirect insinuation of workers and surrounding populations to hazardous substances.

In Gaza Strip Water is undrinkable because of the scarcity of water supply, only 10 % of households have direct connection to safe and clean drinking water; 97 % of the water is supplied from the coastal aquifer, also ground water is susceptible to contamination with chlorine (saline) and nitrates, which are present at levels far above international water quality guidelines [14].

2. *Power plants, Factories, and Quarries*

Crystalline silica is found in varying proportions in rocks, sands, and clays, There are more than 1000 stone cutting and 300 quarries industries exist in Palestine, According to" Semen quality and reproductive health of young Czech men exposed to seasonal air pollution" study concluded that Air pollution exhaustion is related with reduced fertility in males as well[26], [27] Men living in an industrial town suffered sizable discount in sperm motility and morphology and higher ranges of sperm with atypical chromatin when in contrast with these living in a rural district with little air pollution[26].

A study in Islamic University-Gaza focused on monitoring and observing the air pollutants (PM2.5, CO, CO2and health effects of air pollution), noise level, on inhabitation around

the power plant in Gaza City-Palestine. The results concluded that the concentration of particulate matter exceeded on WHO standard. The concentration of carbon dioxide oscillated from 254ppm to 514ppm and the highest level was 79 mg/m³ and the lowest level was 49mg/m³[28].

Many studies, including the general population and women undergoing IVF and embryo transfer (IVF/ET), the findings of the analysis concluded that air pollution has a notable effect on miscarriage and clinical pregnancy rates in the general population[26][27] [29].

3. Communication towers

The study reported that microwave irradiation caused by a decrease in sperm viability and sperm count along with the decrease in degeneration of seminiferous tubules and seminiferous tubule diameter. Another recently published experimental study funded by ICMR reported an increase in various kinds of health symptoms (i.e. cardiovascular problems, blurred vision, headaches, skin and, dizziness, nausea, depression memory loss, loss of appetite, tinnitus, and feeling of discomfort) in residents within 200 meters of communication towers in comparison to control group. There were a remarkable increase in case of headache was observed in females in comparison to males residing near the communication tower[30].

g. Occupation Exposure

Results showed that 26.4% of the infertile men work as workers; there are many sorts of chemicals that construction workers are often exposed to, including pest control substances and pesticides, fuel and bacterial exposure from sewage or wastewater, or mechanical oils and lubricants. Four commonly used compounds and chemicals that pose high-risk effects to construction laborers are, Polyvinyl chloride, flame retardants, lead, and mercury these elements have been clinically reported to contribute to reduced reproductive health. Also a lot of hard work those are physically demanding, leads to low sperm production, abnormal sperm function, or blockages that prevent the delivery of sperm[31].

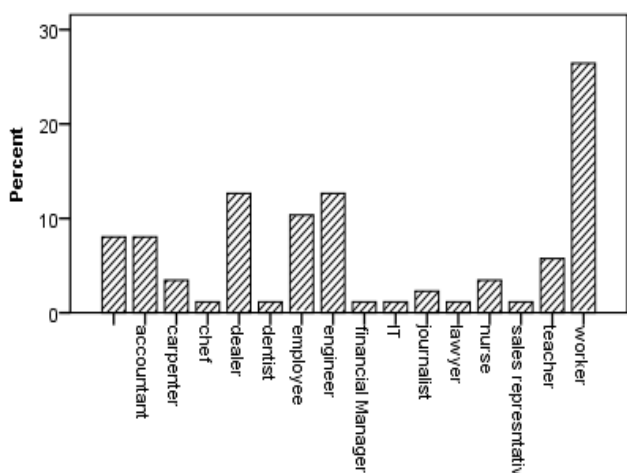


FIG. 8. Husbands Occupation

VI. CONCLUSION

In sum, the study reported that raising both of level of education, and participation in labor for women, it lowers the total fertility rate for women in Palestine. Also, it found that infertile females and males are contributed to the unhealthy lifestyles that infertile couples are contributed to poor lifestyles such as smoking, poor diet, excess stress, toxins inhaled from air and water pollution, and occupation exposure.

VII. ETHICS

Approval and Consent to participate, the research meets all applicable standards with regard to the ethics of experimentation and research integrity, and the following was certified/declared true. The informed consent of human participants was obtained in written format, and it was approved by patients and local standers. As an expert scientist and along with coauthors in the concerned field, the paper has been submitted with full responsibility, following due ethical procedure, and there is

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