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Evaluation of the Factors Associated with the Success of In Vitro Fertilization Cycles among Infertile Couples in Qassim Region, Saudi Arabia

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ABSTRACT

The science gets developed and we can get fertilization process in vitro under special condition, (Wang, J, et al, 2006). Female age reflecting ovarian function, is predictor of pregnancy after in vitro fertilization (IVF). (L.L.van Loendersloot, et al, 2010), while Mediterranean diet may improve the IVF success rate among women. (Karayiannis D, et al., 2018). Thus, the aim of this study was to find out the factors that will associate with the success of IVF cycle among infertile couple in Qassim region. methods was a cross sectional study conducted at Prince Faisal Bin Mishaal fertility center in October,2019. (34) of fertility center patients willing to participate constituted the study sample. The data was collected using structured questionnaire to gather information on demographic characteristics, smoking habit, diet and supplement intake. data was analyzed in EPINFO v7 with descriptive and analytical statistics. results showing (94.12%) of successful IVF cycle. Most of females (92.9%) are under age of 40, whereas (66.7%) males were 40 or above. (9%) of total participants were smoker, (26%) had a partner who is a smoker. (65%) of the participants were neither them nor their partners a smokers. (38.24%) consume proteins (3-5) times a week, (55.88%) consume vegetable and fruits once a week, (35.29%) consume grains more than (5) times a week and (35.29%) consume dairy products (3-5) times a week. conclusion of study the pregnancy rate is higher in female who were under age of 40 but there is no significant association between age, smoking and dietary intake with the successful of IVF cycles.

Keywords: IVF, Age, Smoking, Diet, Supplement.

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Introduction:

Infertility is a universal problem that related to many reasons, privates couples from having their own babies. Defined as a condition of the reproductive system in which there is a failure to achieve clinical pregnancy. (Zegers-Hochschild, F., Adamson, G., Mouzon, J. D. et al, 2009). And it had labeled by the world health organization (WHO) as a worldwide public health issue which does not give the attention it deserves. (Al-Turki, H. A., 2015) nowadays, a science gets developed and we can get in vitro fertilization (IVF) process under special condition, by selecting the best sperm and egg that collected from the couples, and after the fertilization process succeeded, the embryo injected to the mother's uterus, and the embryo gets develop normally,(Wang, J, & Sauer, M, 2006) female age, subfertility duration, number of oocytes all reflecting ovarian function, are predictors of pregnancy after IVF. (L.L. van Loendersloot, M. van Wely, J. Limpens, et al, 2010). While Mediterranean diet may improve the IVF success rate among non-obese women who are less than 35 years old. And it is also impacts sperm health. (Karayiannis D, Kontogianni M, Mendorou C., et al., 2018). therefore, the aim of this study was to find out the factors that will associate with the success of IVF cycle among infertile couple in Qassim region.

Literature Review:

1. Age:

The specified age of onset of fertility decline differ among studies, there is widespread agreement that female fertility begins to decrease by a woman's early (30)s, and that the rate of decline markedly increases at age (37) and thereafter. (Yu.L, Peterson.B, Inhorn.M, et al., 2016), fertility is age-dependent in both males and females. For females, the decline in fertility starts in their early 30s and increases significantly by their late 30s. Besides a greater risk of infertility, increased maternal age is associated with a higher risk of miscarriage and

increase the rates of maternal and fetal morbidity and mortality. (Dolev.Y, Kaplan.A, Rafid.S, 2011), fertility is reduced with the increase of women age in both spontaneous conceptions and assisted reproduction methods. the reduction in fertility with aging is likely to be related to a continuous decline in the number of primordial follicles after birth. (Ng.E, Chan.C, Yeung.W, Ho.P., 2004).

Astudy in Qassim region about Demographic determinants and outcome of in vitro fertilization (IVF) services says that Age-specific pregnancy rates (PR) were highest for women <35 years and lowest for women >40 years. Male age and infertility duration had no effect on PR but sperm source (fresh vs. frozen) and female age had significant impacts. (Almaslami,F., Aljunid, S. M., & Ghailan, K.,2018). an across successive cohorts observed that age-specific fertility rates after assisted reproductive treatment (ART) is increased, and there was a clear tendency to have a child after an ART treatment at a younger age. (Lassen.T, Sobotka.T, Jensen.T, et al.,2012), rates of failed fertilization with intracytoplasmic sperm injection (ICSI) in women aged more than or equal to 45 undergoing IVF-ET. (Check JH, Chase DS, Horwath D, et al.,2012), We found that women did not have a clear understanding of the age at which fertility begins to decline. Over half of participants were surprised when they discover that the chances of conception at their ages were much lower than they had anticipated. After discovering that women's fertility declines rapidly after age (35) they rapidly seek fertility treatment. (Dougall.K, Beyene.Y, Nachtigall.R,2013), Another study finds that the proportion of couples with good-quality embryos was higher when female aged 30 years old or less, and the quality of embryos markedly reduced when female age exceeds (30). (Xue.L, Wang.R, He.B, et al.,2016).

2. Diet:

Lifestyle factors including diet, smoking, exercise, and stress affect the reproduction performance and results, also during assisted

reproduction. Several recent studies have suggested that preconception dietary habits may affect IVF outcomes, such as oocyte and embryo quality, implantation and successful completion of pregnancy. (Karayiannis.D, Kontogianni.M, Mendorou.C. et al,2016). (36) women had confirmed clinical pregnancy. Three dietary patterns were identified: Vegetable and seafood, Western and Rice and miso soup. The study shows no meaningful association of dietary patterns with IVF outcome. (Sugawa.M, Okubo.H, Sasaki.S, et al. 2018), a high fertility diet score was characterized by great intake of monounsaturated fat, vegetable protein, high-fiber, high-fat dairy products, nonheme iron and higher frequency of multivitamin use. (Chavarro, Jorge E. Rich-Edwards, Janet W. Rosner, Bernard A. Willett, Walter C.2007). diets high in unsaturated fats, whole grains, vegetables, and fish have been associated with improved fertility in both male and female. While saturated fats, and sugar have been associated with poorer fertility outcomes. (Panth, N., Gavarkovs, A., Tamez, M., & Mattei, J.,2018). a cross-sectional study, high intake of saturated fats was negatively related to sperm concentration whereas higher intake of omega-3 fats was positively related to normal sperm morphology. (Attaman J, Toth.T, Furtado.J, et al.,2012)

Mediterranean diet (MediDiet) had been reported to be beneficial to human health. However the association between diet and outcomes of in vitro fertilization (IVF) treatment shows that infertile women who strictly adhere to Mediterranean diet pattern were likely to obtain more embryos available in IVF cycle. (Sun, H., Lin, Y., Lin, D., Zou, C.,et al., 2019). It is characterized by a high consuming of fruits, vegetables, legumes and whole grains, and a less consuming of meat and saturated fatty acids. Recent study among 215 healthy male university students showed that higher adherence to a 'Mediterranean' pattern was positively associated with total sperm count which is increase the probability of the success if IVF cycle. (Karayiannis.D, Kontogianni.M,

Mendorou.C. et al, 2016). intake of supplemental folic acid, has been consistently related to lower frequency of infertility, lower risk of pregnancy loss, and greater success in infertility treatment. (Gaskins AJ, Chavarro JE.,2017).

3. Smoking:

A few lifestyle changes will increase the probability of a healthy pregnancy, regardless of the treatment process. Each partner, if smokers, should quit. Smoking reduces fertility and is known to lower pregnancy rates. A study of sperm counts showed an increase in men who stopped smoking. (Kovac, Khanna, & Lipshultz, 2015), Cigarette smoke affects spermatozoa structure and function, reducing fertilizing capacity, ovarian aging is accelerated in smokers and oocyte number and maturation are negatively affected by cigarette smoke. Clinical parameters of IVF cycle outcome are worse in female smokers. (Soares S, Melo M., 2008). fertility rate is higher in people who were less likely to be smokers. (Chavarro, Jorge E. Rich-Edwards, Janet W. Rosner,et al., 2007). Female cigarette smoking has been implicated as having a harmful effect on IVF outcomes mediated through a diminished ovarian reserve (DOR), and an elevated pregnancy loss. (K A Joesbury, W R Edirisinghe, M R Phillips, J L Yovich., 1998). this study show that male smoking has an adverse effect on pregnancy outcome among IVF patients. A reduced pregnancy rate was associated with male smoking possibly through pre-zygotic genetic damage. The higher realization of a paternal component of reproductive impairment suggests that studying the male is necessary. (K A Joesbury, W R Edirisinghe, M R Phillips, J L Yovich., 1998) .

It has been well known that cigarette smoking decreases female fertility. We also found that cigarette smoking has a multigenerational effect on female fertility. (Camlin.N, Jarnicki.A, Vanders.R, et al,2017). study of the effect of smoking on the IVF outcomes shows that with 9.3% of patients reported current smoking and 12.1% reported a history of smoking. Smoking

status did not significantly affect pregnancy outcome or live birth rate. (Wright.K, Trimarchi.J, Allsworth.J, Keefe.D,.2006). nicotine as a component of cigarette smoke adversely influences follicular growth by inducing the apoptotic cell death. As follicular growth is necessary in normal ovulation and fertilization, nicotine-induced cell apoptosis may represent one of the mechanisms underlying the well-established link between smoking and infertility. (Bordel.R, Laschke.M, Menger.M, et al.,2006), according to subfertility diagnosis, the delivery rate for non-smoking women was higher than for smoking women. The effect of smoking was the biggest for women with unexplained subfertility. Smoking had decreased the live birth rate by 7.3% in compare with decreases of 3.0% for women with male subfertility and 2.5% for tubal pathology. (Lintsen.A, Jong.P, Boer.E, et al,2005).

Research Objectives:

General Objective: to evaluate the factors associated with the success of IVF cycles among infertile couples in qassim region, saudi arabia.

Specific Objectives:

To prepare the paper survey contains questions that help us to evaluate the factors that associate with the success of IVF cycles.

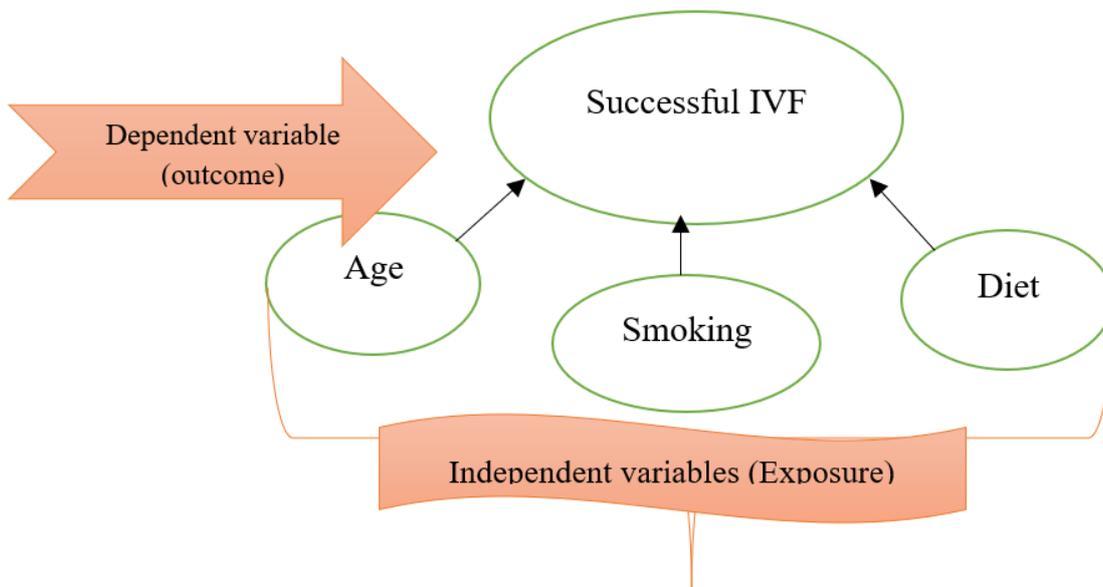
1. To collect data from participant in Prince Faisal Bin Mishaal fertility center both male and female.
2. To analyze the data collected and find out how the factors affect the IVF cycles.
3. To estimate the relationship between age and the success of IVF cycles.
4. To assess the effect of smoking on the success of IVF cycles.
5. To consider the effect of diet on the success of IVF cycles.

Methodology:

1. Study Design:

This is an analytical observational, cross-sectional study. The data will collected by questionnaire from the patients who came to Prince Faisal Bin Mishaal fertility center, in King Fahad Specialty Hospital, Buraidah. During October 2019.

2. Conceptual Model of the Study:



3. Study Sample: the sample frame will include patients with infertility problems who volunteer to take a part in the study. Sample

size of 30 volunteers was included in the study.
 ▪ Inclusion criteria: Patient with infertility problems who starting IVF cycle.

- Exclusion criteria: Completely infertile patient, Patient who doesn't start their IVF cycle, Patient lost-to-follow up for IVF cycle.
- 4. Data Collection:** A paper questionnaire were written in Arabic language and distributed in Prince Faisal Bin Mishaal fertility center. All the participants who will voluntarily contributed in the study will informed about the purpose of the study before they start filling the questionnaire. The questionnaire will divided into two parts:
- First part: will ask about the demographical characteristics including (Gender, age).
 - Second part: will be yes or no questions asking about the habits like (Diet, smoking). the questionnaire will take 5-10 mints to fill completely.
- 5. Ethical Considerations:** ethical approval for this study was obtained from Qassim

University, College of Applied medical sciences, and departmental research review committee. and laboratory department in King Fahad specialty hospital (Prince Faisal Bin Mishaal Fertility center). Informed consent was obtained from volunteers before participation in the study. all information was kept confident and for research purpose only.

- 6. Data Analysis Plan:** Statistical data entry was done in Microsoft excel and analysis of results was performed using EpiInfo 2007 (Free download from CDC website) analyzing data using descriptive statistics, with frequency and percent, and the result was presented using tables and charts.

Results:

The data collected from (34) participant (28) female and 6 male who undergo IVF cycle. Demographic characteristics for all participant are shown in Table (1):

Table (1)

Demographic characteristics	
Sex:	
Male	6 (17.6)
Female	28 (82.4)
Age:	
Male	39 ±7.5
Female	34±10
Educational level:	
Non-formal education	2 (5.9)
Secondary school	16 (47.1)
University student	1 (2.9)
Bachelor degree	13 (38.2)
Master or above	2 (5.9)

Values are shown as n (%), range- or mean±SD.

Female age range from 23-44 years old, (66.7%) males were 40 or above. (94.12%) of the all participants undergo a successful IVF cycle. Data shows no association between female age and the successful of IVF cycles with

(P-value=0.15>0.05). And no association successful rate was grater in the female between male age and the successful if IVF participants who were (40) years old or younger cycles with (P-value=1>0.05). However, the data shown in Table (2).

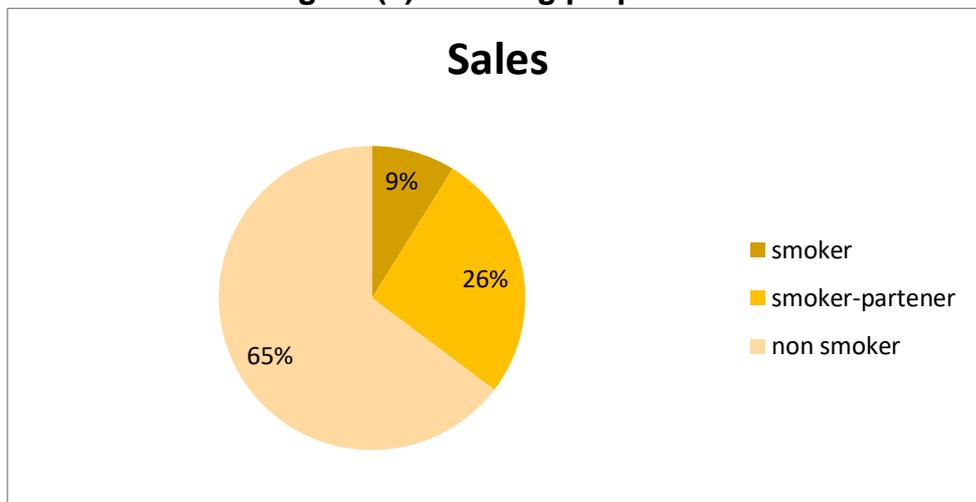
Table (2) Successful rate

Age	Number of cases	Successful rate (%)
20-25	2	100%
26-30	10	100%
31-35	9	100%
36-40	8	100%
>40	5	60%

All the female participants were non-smoker while (9) of them have a smoker husband, out of the male participants 3 of them were a smoker. that's means 9% of total participants were smoker, 26% have a partner who is a smoker. 65% of the participants were neither them nor

their partners a smokers as shown in figure (1). cross tabulation of smoking and the successful of the IVF cycles shown in tables (3) and (4). So there is no association between male smoking and successful of the IVF cycles.

Figure (1) smoking proportion



Association between male smoking and successful of the IVF cycles

Table (3)

Smoker	IVF		
	successes	failed	
Yes	3	0	3
No	29	2	31
TOTAL	32	2	34

P-value= 0.8288770053

Table (4)

Smoker partner	IVF		Total
	successes	failed	
Yes	9	0	9
No	23	2	25
TOTAL	32	2	34

P-value=0.5347593583

Dietary intake of participants was described in table 5. Shows no association between any type of food consuming and the successful of IVF cycles. Proteins (P-value 0.516>0.05), grains (P-value 0.5525>0.05), fruit and vegetables (P-value 0.7291>0.05), and dairy products (P-value 0.1426>0.05).

Table (5): Diet in frequencies.

Diet.	Frequencies (%)			P- value
	1-2 times a week	3-5 times a week	>5 times a week	
Portions	11(32.35)	13 (38.24)	10 (29.41)	0.516
Fruit& Vegetables	19 (55.88)	10 (29.41)	5 (14.71)	0.7291
Grains	10 (29.41)	12 (35.29)	12 (35.29)	0.5525
Dairy products	11 (32.35)	12 (35.29)	11 (32.35)	0.1426

(41%) of the participant describe their diet as good. (21%) describe it as excellent. (26%) as fair and (12%) as poor diet. Whereas (79 %) were not taking any supplements, and only (21%) were taking supplement. These data are

shown in figure (2). Also there is no association between supplement consumption and the successful of IVF cycles with (P-value=0.625>0.05). Cross tabulation shown in table (6).

Figure (2)

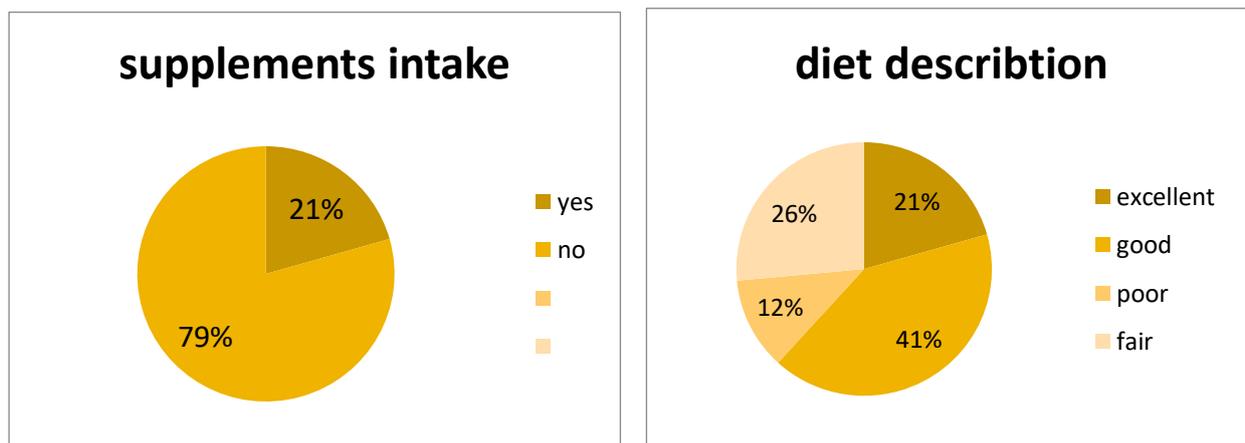


Table (6.) Association between the success of IVF cycles with supplements intake

Supplements	IVF		Total
	Successes	failed	
Yes	7	0	7
No	25	2	27
TOTAL	32	2	34

P-value= 0.6256684492

Discussion:

The successful of in vitro fertilization cycle is associated with many factors, but what we found in this study that is neither age, smoking nor diet is a factor undergo the success of it. in our study, (94.12%) of the participants had a successful IVF, we found that even with the negative association between age and successful of the IVF, female till the age of (40) recording a higher rate of the successful IVF in compere with the female who are more than (40) years old. And there is no association between male age and the success of IVF, we agree with Almaslami who had a study in Qassim region at 2018 about Demographic determinants and outcome of in vitro fertilization (IVF) services says that Age-specific pregnancy rates (PR) were highest for women <35 years and lowest for women >40 years. Male age and infertility duration had no effect on PR. wright had a study at 2006 about the effect of smoking on the IVF outcomes shows that smoking status did not significantly affect pregnancy, outcomes or live birth rate. comparing with our study we reach to the same result, (25%) of male where smoker but no female smoker were involved, result shows no effect of male smoking on the success of the IVF.

Sugawa 2018 had study about association between dietary patterns and in vitro fertilization. Thirty-six women had confirmed clinical pregnancy. He found that there is no association of dietary patterns with IVF outcome, we agree with him, we found no association between the type of food consuming and the successful of

IVF cycles. gaskins found in 2017 that the intake of supplemental folic acid had greater success in infertility treatment. In our study (21%) of the patients ware consuming supplement like Folic acid and Multivitamins but in our study we found the successful of IVF were not associated with the supplement that patients consuming.

Conclusion:

Our study was designed to evaluate the factor that associate with the success of IVF cycle among infertile couple in Qassim region. total (34) participants of Prince Faisal Bin Mishaal fertility center patients were involved in this study. (94.12%) of them had a successful IVF. (28) female and (6) male with age varies from (23) to (44) for females, and from (30) to (45) for males. With no females smokers but (26%) of them had had a smoker partner and (9%) smoker males. they varies in dietary intake some of them had a supplement intake. we found that the successful rate among female patients who were aged above 40 is less than the female patients who were younger than (40) years old. whereas, neither diet nor smoking had no association with the success of IVF cycle among infertile couples in Qassim region. dietary intake of proteins, grains, fruits and vegetables, dairy products and supplements intake of multivitamins and folic acids tablets had no association with the success of the IVF cycles.

Recommendation:

We also recommend to have more studies to evaluate the factors that associate with the

success of IVF cycles like body mass index, with higher number of participants.

References:

1. Almaslami, F., Aljunid, S. M., & Ghailan, K. (2018). Demographic determinants and outcome of in vitro fertilization (IVF) services in Saudi Arabia. *The Journal of international medical research*, volume 46, Issue 4, April 2018, Pages 1537–1544.
2. Al-Turki, H. A. (2015). Prevalence of primary and secondary infertility from tertiary center in eastern Saudi Arabia. *Middle East Fertility Society Journal*, volume 20, issue 4, Dec 2018, Pages 237–240.
3. Attaman J, Toth.T, Furtado.J, Campos.H, Hauser.R, Chavarro.J. (2012). Dietary fat and semen quality among men attending a fertility clinic, *Human Reproduction*, Volume 27, Issue 5, May 2012, Pages 1466–1474.
4. Bordel.R, Laschke.M, Menger.M, Vollmar.B. (2006). Nicotine does not affect vascularization but inhibits growth of freely transplanted ovarian follicles by inducing granulosa cell apoptosis, *Human Reproduction*, Volume 21, Issue 3, March 2006, Pages 610–617.
5. Camlin.N, Jarnicki.A, Vanders.R, Walters.K, Hansbro.P, McLaughlin.E, Holt.J. (2017). Grandmaternal smoke exposure reduces female fertility in a murine model, with great-grandmaternal smoke exposure unlikely to have an effect, *Human Reproduction*, Volume 32, Issue 6, June 2017, Pages 1270–1281.
6. Chavarro, Jorge E. Rich-Edwards, Janet W. Rosner, Bernard A. Willett, Walter C. (2007). Diet and Lifestyle in the Prevention of Ovulatory Disorder Infertility. *Journal of Obstetrics & Gynecology*. Volume 110, Issue 5, November 2007, pages 1050-1058.
7. Check JH, Chase DS, Horwath D, Yuan W, Garberi-Levito MC, Press M (2012). Oocytes from women of advanced reproductive age do not appear to have an increased risk of zona pellucida hardening. *Journal of Clinical and experimental obstetrics & gynecology*. Volume 39, Issue 4, January 2012, pages 440-1.
8. Dolev.Y, Kaplan.A, Rafid.S. (2011). The fertility myth: Israeli students' knowledge regarding age-related fertility decline and late pregnancies in an era of assisted reproduction technology, *Human Reproduction*, Volume 26, Issue 11, November 2011, Pages 3045–3053.
9. Dougall.K, Beyene.Y, Nachtigall.R. (2013). Age shock: misperceptions of the impact of age on fertility before and after IVF in women who conceived after age 40, *Human Reproduction*, Volume 28, Issue 2, February 2013, Pages 350–356.
10. Gaskins AJ., Chavarro JE. (2017). Diet and fertility. *American Journal of Obstetrics & Gynecology*. Volume 218, Issue 4, April 2017, Pages 379-389.
11. Güvenir, H. A., Misirli, G., Dilbaz, S., Ozdegirmenci, O., Demir, B., & Dilbaz, B. (2015). Estimating the chance of success in IVF treatment using a ranking algorithm. *Medical & Biological Engineering & Computing*, volume 53, issue 9, April 2015, Pages 911–920.
12. K A Joesbury, W R Edirisinghe, M R Phillips, J L Yovich. (1998). Evidence that male smoking affects the likelihood of a pregnancy following IVF treatment: application of the modified cumulative embryo score., *Human Reproduction*, Volume 13, Issue 6, Jun 1998, Pages 1506–1513.
13. Karayiannis.D, Kontogianni.M, Mendorou.C, Douka.L, Mastrominas.M, Yiannakouris.N. (2016). Association between adherence to the Mediterranean diet and semen quality parameters in male partners of couples attempting fertility, *Human Reproduction Journal*, Volume 32, Issue 1, 1 January 2017, Pages 215–222.
14. Karayiannis.D, Kontogianni.M, Mendorou.C, Mastrominas.M, Yiannakouris.N. (2018). Adherence to the Mediterranean diet and IVF success rate among non-obese women attempting fertility, *Human Reproduction*, Volume 33, Issue 3, March 2018, Pages 494–502.
15. Kovac, J. R., Khanna, A., & Lipshultz, L. I. (2015). The effects of cigarette smoking on male fertility. *Postgraduate medicine*, volume 127, issue 3, April 2015, Pages 338–341.
16. Lassen.T, Sobotka.T, Jensen.T, Jacobsen.R, Erb.K, Skakkebaek.N. (2012). Trends in rates of natural conceptions among Danish women born during 1960–1984, *Human Reproduction*, Volume 27, Issue 9, September 2012, Pages 2815–2822.
17. Lintsen.A, Jong.P, Boer.E, Burger.C, Jansen.C, Braat.D, Leeuwen.F. (2005). Effects of subfertility cause, smoking and body weight on the success rate of IVF, *Human Reproduction*, Volume 20, Issue 7, July 2005, Pages 1867–1875.
18. L.L. van Loendersloot, M. van Wely, J. Limpens, P.M.M. Bossuyt, S. Repping, F. van der Veen. (2010). Predictive factors in in vitro fertilization (IVF): a systematic review and meta-analysis, *Human Reproduction Update*, Volume 16, Issue 6, November-December 2010, Pages 577–589.
19. Ng.E, Chan.C, Yeung.W, Ho.P. (2004). Effect of age on ovarian stromal flow measured by three-

- dimensional ultrasound with power Doppler in Chinese women with proven fertility, *Human Reproduction*, Volume 19, Issue 9, September 2004, Pages 2132–2137.
20. Panth, N., Gavarkovs, A., Tamez, M., & Mattei, J. (2018). The Influence of Diet on Fertility and the Implications for Public Health Nutrition in the United States. *Frontiers in public health*, Volume 6, Issue 211, July 2018.
 21. Sérgio R Soares & Marco A Melo (2008) Cigarette smoking and IVF, *Expert Review of Obstetrics & Gynecology*, Volume 3, Issue 4, January 2014, pages 555-563.
 22. Sugawa.M, Okubo.H, Sasaki.S, Nakagawa.Y, Kobayashi.T, Kato.K. (2018). Lack of a meaningful association between dietary patterns and in vitro fertilization outcome among Japanese women. *Reproductive medicine and biology*, volume 17, Issue 4, pages 466–473.
 23. Sun.H, Lin.Y, Lin.D, Zou.C, Zou.X, Fu.L, Meng.F, Qian.W. (2019). Mediterranean diet improves embryo yield in IVF: a prospective cohort study. *Reproductive Biology and Endocrinology*. Volume17, Issue 1, September 2019, page 73.
 24. Wang, J, & Sauer, M. (2006). In vitro fertilization (IVF): a review of 3 decades of clinical innovation and technological advancement. *Therapeutics and clinical risk management*, Volume 2, Issue 4, December 2006, pages 355–364.
 25. Wright.K, Trimarchi.J, Allsworth.J, Keefe.D. (2006). The effect of female tobacco smoking on IVF outcomes, *Human Reproduction*, Volume 21, Issue 11, Nov 2006, Pages 2930–2934.
 26. Xue.L, Wang.R, He.B, Mo.W, Huang.L, Wang.S,Mao.X, Cheng.J, Huang.Y, Liu.R. (2016). Effect of sperm DNA fragmentation on clinical outcomes for Chinese couples undergoing in vitro fertilization or intracytoplasmic sperm injection. *The Journal of international medical research*, Volume 44, Issue 6, Dec 2016, pages 1283–1291.
 27. Yu.L, Peterson.B, Inhorn.M, Boehm.J, Patrizio.P. (2016). Knowledge, attitudes, and intentions toward fertility awareness and oocyte cryopreservation among obstetrics and gynecology resident physicians, *Human Reproduction*, Volume 31, Issue 2, February 2016, Pages 403–411.

