**An-Najah National University**

**Faculty of Graduate Studies**

# THE INFLUENCE OF SMOKING AND OTHER LIFESTYLES ON MALE SEMEN QUALITY IN NABLUS GOVERNORATE: A CROSS-SECTIONAL STUDY

**By**

**Bara' Salameh**

**Supervisors**

**Dr. Amjad Hussein**

**Dr: Adham Abu Taha**

**This Thesis is Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Cinical Biochemistry, Faculty of Graduate Studies, An-Najah National University, Nablus - Palestine.**

**2022**

# THE INFLUENCE OF SMOKING AND OTHER LIFESTYLES ON MALE SEMEN QUALITY IN NABLUS GOVERNORATE: A CROSS-SECTIONAL STUDY

By

Bara' Salameh

This Thesis was Defended Successfully on 26/6/2022 and approved by

| | |
|---|---|
| Dr. Amjad Hussein<br>Supervisor | Signature |
| Dr. Adham Abu Taha<br>Co-Supervisor | Signature |
| Dr. Fekri Samarah<br>External Examiner | Signature |
| Dr. Majdi Dwikat<br>Internal Examiner | Signature |

# Dedication

To everybody who helps science seeker and paves a way for him. To everyone who a self-made, studious, and believe that success, realization, and achievement depend basically on himself and not on others. To everyone who helps and contributes to building a school, university, or buying school bag to the schoolboy. To every mother, father, sister, and brother who devotes themselves to encourage their sons for success, excellence, and creativity. To my parents, my husband, my son, my husband's family, and my teachers. To my sisters and brothers who are the optimistic source in my life. To everybody who helped me to execute this work during my study and in my life. To all of my relatives in Spain.

# Acknowledgements

First and foremost, of all, perpetual and eternal thankfulness to Allah Subhana Watalla who bestowed us the grant of being, the grace of health, and blessed my efforts to carry out and execute this research.

Special thanks and love to my great family, my father who is the ideal person for me in all of my life, and my mother who gives me optimism and power in my life. My wonderful, leader husband who stayed with me all the time, encouraged me and he still supports me, a big thank for him for providing a loving atmosphere for me with our baby son, I learned from him how to manage my time, and to be patient to achieve my goals. Big respect and thanks to my mother-in-law, who helped me a lot and took after my son to make me have free time to study to get a master's with excellent grades. My father-in-law, also deserves a lot of respect and thanks because he works to make us happy all the time. Special thanks to my sister and brothers who are the optimistic source for me.

It is a bend of veneration and great respect to all my teachers at Najah National University for their time, patience, lenience, support and all the time they put us in a family atmosphere during my study at the bachelor's and master's levels. Special appreciation to my supervisor Dr. Amjad Hussein, I did not just take the science from him but also the morals and ethics through being exemplary patterns. Thanks to my co-supervisor Dr. Adham Abu Taha for the challenging atmospher. Big thanks to Dr. Mohammad Qadi who believed in me and for his encouragement which raised my self-confidence at all times. Gratefulness and thanks are continuous to my great inspirers, Dr. Jaber Haj - Ali, the manager of Jamaaen center, who advised me in every step during my study for my master not just writing this thesis and accepted to participate in our study. Mr. Ashraf Khuffash, the manager of Medicare center in Nablus, who worked hard with me to achieve this study and for his interest, care and directing. Thanks to Dr. Sohail Sawalha who helped me in understanding SPSS analysis to get this study results.

Special thank for the specialized laboratories in the Nablus region (Central Medicare lab, Consulting Medical Laboratory – Jammain, Professional lab branches (Nablus, Hawara, Qabalan), Med lab, Al Rahma clinic, and Central lab in Hawara) for this study sampling approval.  all thanks to everyone who gave me a hand and was not mentioned above, thank you all.

## Declaration

I, the undersigned, declare that I submitted the thesis entitled:

# THE INFLUENCE OF SMOKING AND OTHER LIFESTYLES ON MALE SEMEN QUALITY IN NABLUS: A CROSS-SECTIONAL STUDY

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

**Student's Name:** Bara' Aziz Salameh

**Signature:** Bara' Salameh

**Date:** 26.06.2022

# Table of Contents

# List of Tables

# List of Figures

# List of Appendices

# THE INFLUENCE OF SMOKING AND OTHER LIFESTYLES ON MALE SEMEN QUALITY IN NABLUS GOVERNORATE: A CROSS-SECTIONAL STUDY

**By**
**Bara' Salameh**
**Supervisors**
**Dr. Amjad Hussein**
**Dr: Adham Abu Taha**

## Abstract

**Background:** Infertility is the failure of a non-contracepting, sexually active couple to conceive within a year according to the World Health Organization (WHO) definition. Male infertility is a serious health issue, not only in our society, affecting millions of people worldwide and accounts for 50% of all infertility cases. The proportion of cases linked to malefactors in the Middle East has risen to 70%. Males whose sperm parameters are lower than the WHO normal values have male factor infertility. Many causes lead to infertility in men, including physical problems, hormonal disorders, psychological issues, lifestyle problems, environmental factors, sex problems, single-gene defects, and chromosomal abnormalities.

**Aims:** This study aims to determine the correlation between smoking and some lifestyles (drinks like energy drinks, coffee and tea intake, nature of food as high sugar intake, processed and canned food, fruits and vegetables, obesity, antioxidant and vitamin intake) and male semen quality in Nablus district.

**Methods:** A descriptive cross-sectional study was performed among men in Nablus. A total number of 168 samples were collected from the consented volunteers. A convenience sampling technique was conducted from October 2021 to February 2022, the samples were collected from the main semen analysis provider laboratories in the Nablus area, namely, the Central Medicare lab, Consulting Medical Laboratory – Jammain, and Professional lab branches (Nablus, Hawara, Qabalan), Med lab, Al Rahma clinic, and the Central lab in Hawara. A self-administered questionnaire was introduced in the present study for data collection.

**Results:** The study showed that the highest age groups of study participants were 21-30 years (54.8%), 72% of the study participants now live in the village while 22% live in the city and only 6% live in a camp. There is a relationship between waterpipe smoking and liquefaction time. Both obesity and high sugar intake relate to agglutination. There is a relationship between obesity and processed and canned food and progressive motility, and between fruit and vegetables and semen volume and progressive motility. According to drinks intake, participants who drink more than 3 cups of tea daily will impair or reduce sperm motility, count, and morphology. Both coffee and energy drinks intake have an association with sperm count. There is a link between antioxidants or vitamins and sperm morphology (P-value < 0.05).

**Conclusion:** The seminal fluid analysis determines the quality of semen as seminal density, sperm count, morphology, and motility, it is the most crucial stage and diagnostic technique to determine fertility. Waterpipe smoking and lifestyles (using drinks like energy drinks, coffee and tea intake, nature of food as high sugar intake, processed and canned food, fruits and vegetables, obesity, antioxidant and vitamin intake) may affect semen quality (agglutination, liquefaction time, sperm count, motility, and morphology).

**Keywords:** Male infertility, semen analysis, smoking, lifestyles, Nablus, Palestine.

# Chapter One

# Introduction

## 1.1 Background

Infertility is the failure of a non-contracepting, sexually active couple to conceive within a year according to the definition by the World Health Organization (WHO). After a year of trying, one out of every six couples (15%) is unable to conceive (1). It has also been known by WHO as a public health problem worldwide (2).

Infertility is defined by the International Committee for Monitoring Assisted Reproductive Technology as the inability of a couple to achieve pregnancy after 12 months of regular sexual intercourse without using any contraception tool in women less than 35 years old and after 6 months of regular intercourse without the use of contraception in women whose age is equal or higher than 35 years (3). According to the updated WHO statistics, infertility affects roughly 50–80 million individuals worldwide (4).

Male infertility is a serious health issue, currently affecting millions of people worldwide (5). Male infertility is mainly responsible for 10-30% of infertility cases and accounts for 50% of all infertility cases. (6). The proportion of cases linked to malefactors in the Middle East has risen to 70% (7).

Less developed and industrialized countries have a significantly greater incidence of infertility than highly industrialized countries (8). Males whose sperm parameters are lower than the WHO normal values have male factor infertility. The most significant of these are asthenospermia (poor sperm motility), oligospermia (low sperm concentration), and teratozoospermia (abnormal sperm morphology) (9). In Palestine, there is a lack of data on the prevalence of male infertility. In a study by Issa Y et. al, which lasted two years and involved 207 newly married couples in the villages of Hebron, Palestine, the percentage of infertility was estimated to be 13.4% (10).

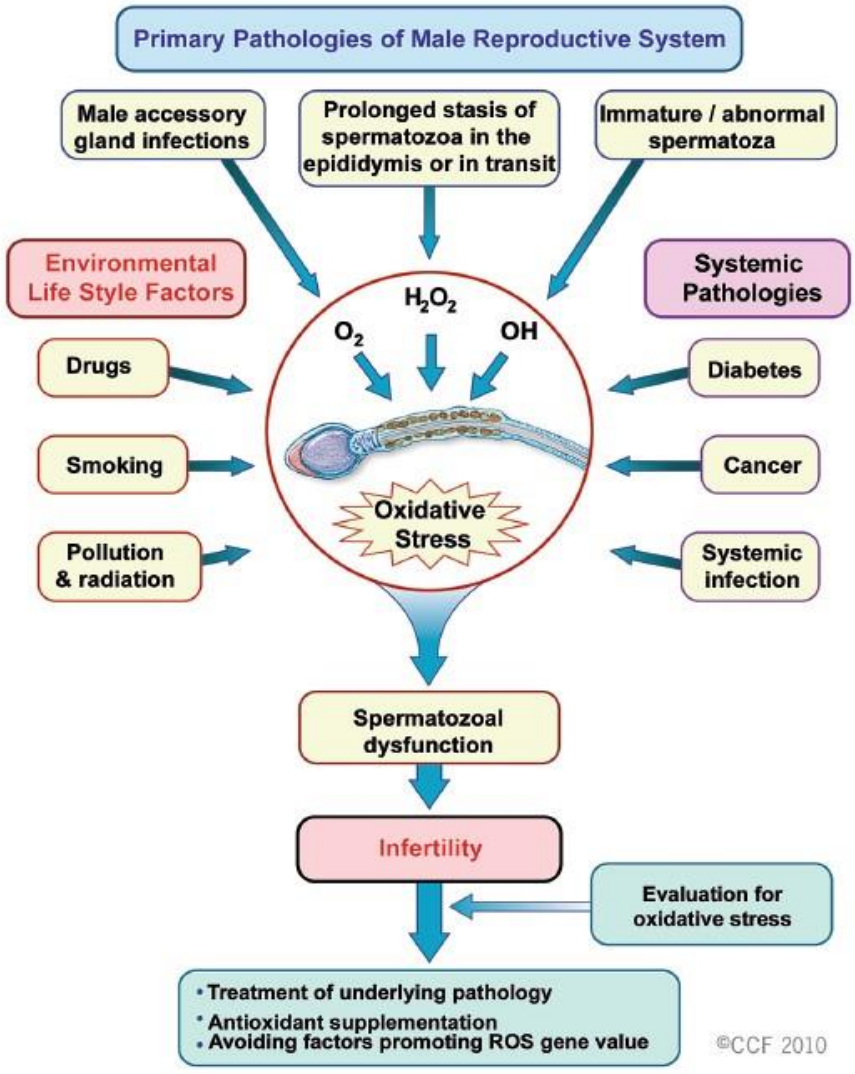
## 1.2 Main causes involved in infertility of men

Infertility diseases might affect both sexes or be specific to one gender.

Hyperprolactinemia, hypogonadotropic hypogonadism, cystic fibrosis, ciliary function problems, systemic illnesses, infections, and lifestyle-related factors all influence both genders' fertility. Other variables that may be implicated include the long-term deterioration in sperm quality, endocrine disrupting substances, and consanguinity (11). Many causes lead to infertility in men, including physical problems, hormonal disorders, psychological issues, lifestyle problems, environmental factors, sex problems, single-gene defects, and chromosomal abnormalities (12) as shown in figure 1. Psychological stress affects negatively semen quality by increasing the glucocorticoid levels which induce the apoptosis of sensitive germ cells although the mechanism of action is more complicated (13).

**Figure 1**

*Main causes of infertility in men (14).*



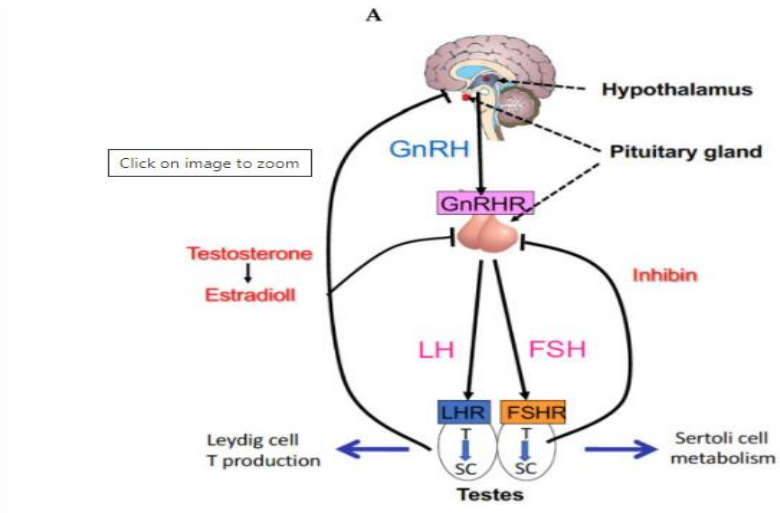
### 1.3 Spermatogenesis process

Understanding the spermatogenesis process is important to know the sperm's significance and its role in male fertility. Spermatogenesis is an essential phase in male fertility (15). Spermatogenesis means the production of male gametes from diploid spermatogonia in the seminiferous epithelial tissue, which leads to the release of the differentiated haploid germ cells into the seminiferous tubules (5). Leydig cells, Sertoli cells, peritubular cells, and germ cells are involved in the spermatogenesis control, which involves a complex array of endocrine, paracrine, and metabolic interactions that keep spermatogenic cells proliferating and differentiating (16).

The hypothalamus produces gonadotropin-releasing hormone (GnRH), which enhances the synthesis and secretion of the gonadotropins (Follicle-Stimulating Hormone (FSH), luteinizing hormone (LH)) in the anterior pituitary gland by activating GnRHR receptors. LH causes interstitial Leydig cells to proliferate and mature, allowing them to release Testosterone (T). FSH stimulates the synthesis of metabolites and signaling molecules that are required for the spermatogenesis process in the Sertoli cells (SC) of the seminiferous tubules. Sertoli cells, in combination with T and FSH, encourage germ cell growth and maturation in the seminiferous tubules, the mature sperms are discharged into the seminiferous tubular fluid and transferred to the epididymis to complete the maturation and for storage. (figure 2) (17).

**Figure 2**

*Hormonal control and regulation of spermatogenesis (17).*



### 1.4 Semen analysis test

Semen analysis is often referred to as seminogram or spermiogram (1). It is an important component of population-based investigations of male reproductive health that provides information on the functional state of the reproductive system of males (18). Semen analysis is one of the first procedures used in clinical practice to assess male fecundity or the biological ability for reproduction (19). The seminal fluid analysis determines the quality of semen as seminal density, sperm count, morphology, and motility. It is the most crucial stage and diagnostic technique to determine fertility (13). Whether for those pursuing pregnancy or checking the effectiveness of vasectomy, it is done to help determine male fertility because it is a routine and simple test that evaluate sperm formation and maturation and how the sperm interacts in the seminal fluid (20). The significant societal and economic cost of male infertility, which is still growing, underlines the necessary need of assessing semen quality (2).

### 1.5 Problem statement

Nowadays, lifestyle-related issues or habits such as smoking, obesity (sedentary lifestyle, lack of physical activity, unhealthy diet), high exposure to electromagnetic radiation (long usage of portable computers and mobile phones), and alcohol intake are prominent causes of male infertility in the world. For any couple seeking to conceive, losing weight, and eliminating or reducing unhealthy lifestyle factors may be the best and right options (21).

Lifestyle habits are global epidemic issues that are of the most significant risk factors involved in human diseases associated with lifestyle. Although some men may have a particular illness, the majority of men have no obvious explanation for infertility (22). So, this has focused attention on the influence of lifestyle and environmental variables on the reproductive health of such men.

There is still a discussion about the relationship between cigarette or waterpipe smoking, some lifestyles, and semen quality. There is a gap or lack of definitive evidence so this encourages us to perform this study on semen quality in the general population (fertile and infertile men) in the variety of smoking habits and different lifestyles.

### 1.7 Study significance

This research is very important because we think that men in Nablus are heavy smokers without understanding the bad or adverse effects of smoking on their reproductive system,

not only on lungs and other body systems but also on fertility. So, from this study, we hope to limit the smoking effects on infertility by growing the men's knowledge and awareness about the bad effects of smoking and the lifestyles on their infertility. Several predisposing parameters including sitting for more than 4 hours, long usage of mobile phone, storage sites of mobile phone, diet, coffee or tea drink, hard exercise, long exposure to radiation, chemicals and heat, psychological stress and obesity will be studied whether they affect the semen quality or not to reach the effective management of infertility in men of Nablus region.

## 1.8 Study objectives

### 1.8.1 The general aims

The general objective of this study is to determine if there is an association between smoking and some lifestyles on male semen quality in Nablus.

### 1.8.2 The specific aims

The study was conducted to

- Evaluate the relationship between smoking and male semen quality in Nablus.
- Assess the correlation between some lifestyles such as (using drinks like energy drinks, coffee and tea intake, nature of food, obesity, antioxidant and vitamin intake) and male semen quality in Nablus.
- Explain the effects of these lifestyles on parameters of seminal fluid like sperm count, motility, morphology, and also on semen viscosity

## 1.9 Research Questions and Hypothesis

### 1.9.1 Research Questions

1. What is the association between smoking and male semen quality in Nablus?
2. Is there a relationship between some lifestyles (using drinks like energy drinks, coffee and tea intake, nature of food, obesity, antioxidant and vitamin intake) and male semen quality in Nablus?
3. How do these lifestyles influence the male semen quality in Nablus if there is a relation between them?

4. How does smoking status affect semen parameters?

### 1.9.2 Hypothesis

#### 1.9.2.1 Alternative non-directional hypothesis:

1. There is a relationship between smoking and male semen quality in Nablus.
2. There are relationships between some lifestyles (using drinks like energy drinks, coffee and tea intake, nature of food, obesity, antioxidant and vitamin intake) and male semen quality in Nablus?

#### 1.9.2.2 Null hypothesis:

1. There is no relationship between smoking and male semen quality in Nablus.
2. There are no relationships between some lifestyles (using drinks like energy drinks, coffee and tea intake, nature of food, obesity, antioxidant and vitamin intake) and male semen quality in Nablus?

## 1.10 Literature review

Several studies have been performed to determine if there are potential correlations between smoking, other lifestyles, and male infertility.

### 1.10.1 Influence of smoking on male semen quality

Tobacco is smoked in a variety of ways, including cigarettes, e-cigarettes, cigars, and water pipes (23). Cigarettes and Waterpipe (WP) both include toxins such as carbon monoxide, nicotine, and polycyclic aromatic hydrocarbons (PAH)(24). Heavy metals like cadmium and lead are the principal active components of the smoke of tobacco which affect semen parameters (25). Waterpipe tobacco smoke (WTS) is a widely accepted smoking habit across the world (26), WTS is extremely common among youth in European and Middle Eastern countries, and it is especially prevalent among adults in the Middle East (27).

Smoking has generally detrimental effects on health and particularly on the male reproductive system. It is related to decreased male fertility by altering the semen content or quality (28). As a consequence of smoking, oxidative stress will be occurred due to increasing the reactive oxygen species (ROS), then decreases male infertility by changing sperm characteristics as

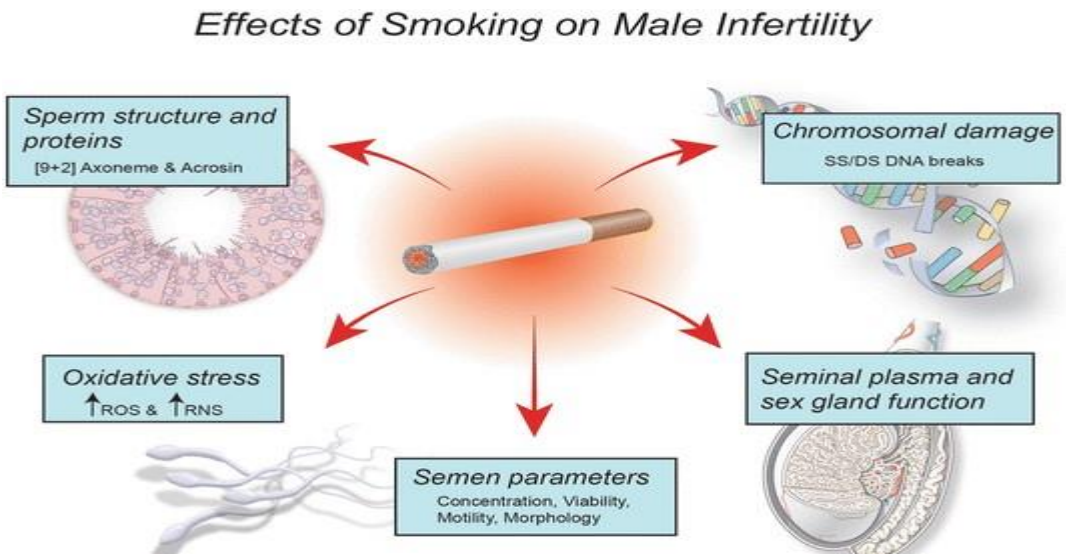
sperm function, count, motility, and morphology as shown in figure 3 (29).

The WHO estimates that 30% of smokers are all 15 years of age and older males, roughly 46% of smokers are males of reproductive age (20-39 years of age). It also estimates that 8% of couples around the world, (10-15) % of those in developed nations have infertility (25). Cigarette smoke hurts the reproductive health of both men and women (20). Smoking is considered to be toxic directly and indirectly to spermatogenesis. It is a significant public health concern. The incidence of smoking is the highest in the reproductive period of young adult males (30).

Some studies have shown negative and adverse effects of smoking on parameters of semen fluid analysis and male infertility, otherwise, some have reported positive effects on sperm motility and damage to sperm from nuclear Deoxyribonucleic acid (DNA), and others have found no such effects. The influence of smoking on male fertility has not been demonstrated. Therefore, this needs more parameters like hormonal levels to diagnose infertility. Impairments in sperm parameters like decreased concentration, motility, and changes in morphology have been observed in several studies (31,32).

**Figure 3**

*Smoking effect on male infertility (29).*




Rehman R et al. conducted a one-year cross-sectional study on 376 male volunteers at the University of Aga Khan in Karachi, Pakistan, and found that semen quality of infertile smokers' (total count, morphology, and motility) was lower than non-smokers. Furthermore, the multivariate analysis revealed that smokers had 1.29% lower normal

sperm morphology than non-smokers. Sperm motility was reduced by 5.25%, and the total sperm count in non-smokers was 17.7 million higher than in smokers (31).

A meta-analysis of forty-six cross-sectional studies found that smoking was correlated with reductions in all semen characteristics, the recent evidence about cigarette smoking effect and impaired semen quality is moderate. The status of smoking was split into heavy, medium, and moderate in some situations, thus, these findings were contradictory. As a consequence to these discrepancies, some researchers have difficulties recognizing a dose-dependent smoking pattern and decreased semen consistency or quality (33).

A prospective longitudinal analysis that determined the effect of smoking on semen quality was identified and a substantial decrease in total sperm count after multivariate analysis was recorded in this study (P-value = 0.012) (32). Since 2010, it was reported by meta-analysis of the literature evaluating 20 studies containing 5865 participants that cigarette smoking impact negatively all semen parameters (34).

It was reported that current smokers at > 20 packs per year had a lower normal morphology percentage and a decrease in normal-morphology sperm proportion in those who smoked >10 cigarettes per day (P = 0.04) compared to non-smokers (35), whereas another study documented no significant impact of smoking on sperm concentrations and total motile sperm concentrations (36).

### 1.10.2 Influence of obesity on male semen quality

Obesity is a big health problem worldwide. It's becoming more common among individuals attempting to conceive, especially among young males of reproductive age (37). It has an impact on not just cardiovascular disorders, but also other such health issues that are linked to them. Obesity can adversely affect male reproduction (38) through genetic and sexual processes, such as the conversion of steroids to estrogens in peripheral tissues, resulting in hypogonadotropic hypoestrogenic hypogonadism with a considerable reduction in total and free testosterone levels and an elevation in estradiol (39). This might be related to toxic and harmful chemicals accumulating in adipose tissue, as well as endocrine disruptors (40). Obese men's adipose tissue buildup around the scrotum raises the temperature of the scrotum and produces oxidative stress in the testicles, impacting semen quality (40).

A meta-analysis was published in 2021, containing 20,367 obese patients, showed that obesity was linked to lower semen volume (p-value = 0.001), lower sperm count (p-value = 0.001), lower progressive motility (p-value = 0.001) in obese cases vs non-obese controls) (41). To the contrary, a meta-analysis and comprehensive systemic review published in 2010, showed no link between sperm quality and BMI in general (42).

Couples with an obese male were substantially more prone to develop infertility than couples with a normal weight male with an odds ratio (OR) = 1.66, according to a meta-analysis published by Campbell et al. When compared to normal weight males, men who were obese had a relative ratio (RR) of 0.75 to have a child (43).

Another meta-analysis published in 2017 found that overweight men had a lower semen volume and total sperm count, whereas obese men had a lower semen volume, sperm concentration, and total sperm count per ejaculate, with no difference in sperm motility (44).

### 1.10.3 Influence of radiation on male semen quality

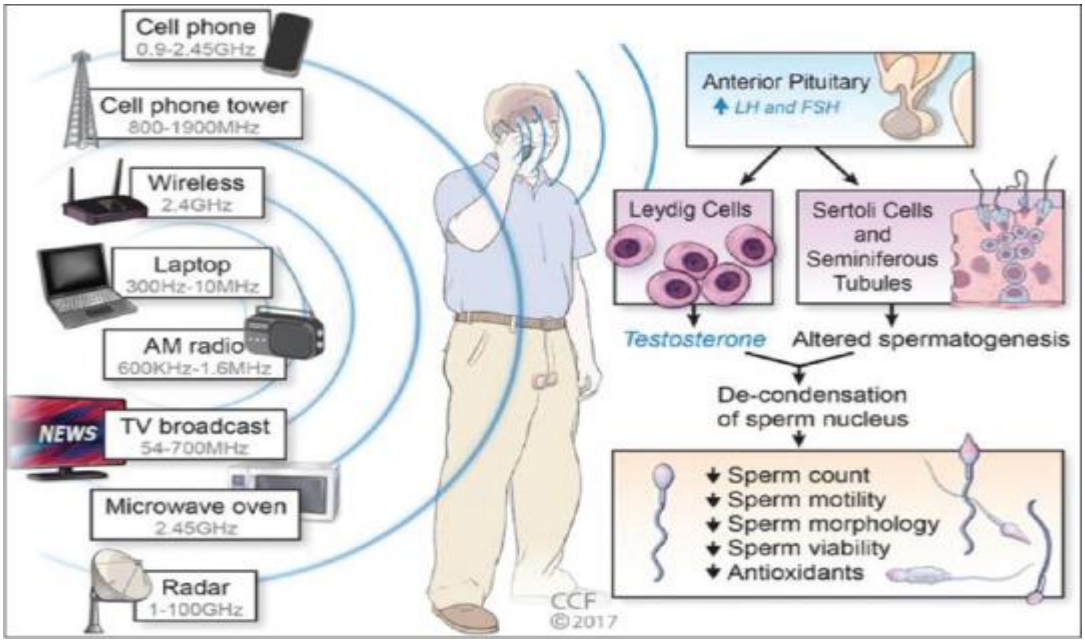
Using radiation emission devices such as mobile phones, wireless internet equipment, and laptops affects the male semen quality by emitting a significant quantity of electromagnetic radiation (EMR) that interacts thermally or nonthermally with the male reproductive system, badly affecting testicular functions which are important for the production of testosterone and sperm (45). In most instances, the positioning of mobile phones is frequently in trouser pockets close to exterior male reproductive organs, the thermal influence may increase testicular temperature (46), but the non-thermal influence is thought to enhance the generation of ROS leading to DNA damage (47). Due to ROS production, EMR may cause scrotal hyperthermia, which lowers sperm motility and causes structural defects. As a result, it impacts male fertility. Moreover, the length of time spent on a mobile phone is linked to these detrimental consequences (45). As shown in Figure 3, mobile phone use has an impact on all semen characteristics (48).

The storage and keeping of the mobile phone in trouser pockets had a statistically significant reduction in LH and the proportion of morphologically normal sperm (P-value was < 0.001), although there was no combined impact between varicocele and storing the phone in the trouser pocket (P-value 0.76) (49). The laboratory results of mean sperm motility, morphology, and count had a statistical and significant decrease in four different

groups of mobile phone use exposed to mobile phone EMR daily (50). Sperm motility was reduced and sperm DNA disintegration was significantly increased in normal semen samples exposed to a laptop linked to Wi-Fi for about 4 hours (51).

**Figure 4**

*Possible effects of EMR on testicular function (48).*




### 1.10.4 Influence of chemicals on male semen quality

Endocrine-disrupting chemicals (EDCs) induce male reproductive diseases and disrupt hormonal systems through several processes, and certain EDCs can directly disrupt spermatogenesis, resulting in low sperm quality. Chemicals, pesticides that are used in plastic products (bisphenol A (BPA) and phthalates), electronic and hydraulic devices (polychlorinated biphenyls (PCBs)), personal care products (parabens and triclosan), flame retardants, chemicals used in clothing (perfluorinated compounds), chemicals produced unintentionally during chemical processes (dioxins), solvents, and many other chemicals are examples of environmental EDC (52).

Organophosphate (OP) pesticides are substantial environmental pollutants in developing nations due to their extensive usage in agriculture. OP pesticides reduce sperm concentration by causing damage to the seminiferous epithelium and altering germ cell proliferation, as well as decreasing sperm quality, viability, and motility by interfering with ATP production or proteins of sperm tail assembly (53).

Among the high-risk group, studies have shown a link between OP pesticide exposure and abnormal semen analysis. Fifty men (50) with normal semen analysis (controls) and the same number of males with idiopathic abnormal semen analysis (cases) were recruited for cross-sectional pilot research. As a result, cases had a considerably greater rate or percentage of OP pesticide exposure than controls (P-value = 0.015) (53).

### 1.10.5 Influence of Diet on male semen quality

Diet and nutrition have a big impact on sperm quality. Males' sperm quality and fecundity rates might be improved by eating a healthy, balanced diet (54)**.** At least one measure of sperm quality is improved by a healthy diet (55)**.** The Dietary Approaches to Stop Hypertension (DASH) diet is based on a comprehensive approach to healthy eating, supporting foods rich in antioxidants, minerals, and vitamins, while reducing foods high in salt, sugar, and saturated fats. This food pattern may help maintain adequate sperm quality (56). The DASH may be considered an anti-inflammatory and antioxidative diet due to its naturally high content of minerals, polyphenols, and vitamins. Antioxidants have a positive relationship with sperm parameters in male reproductive health (57).

Foods that were significantly related to sperm quality included fruits and vegetables, poultry and fish, cereals, and low-fat foods. Full-fat diet, processed meat, coffee, and sugar-sweetened drinks, on the other hand, were linked to impaired semen quality and decreased rate of fertility (54). A case-control study had shown that a higher diet of sweets, processed meat, saturated and trans-fatty acids has been associated with an increased risk of asthenozoospermia, whereas a higher intake of dark green vegetables and skim milk has been associated with a lower risk of asthenozoospermia (58).

In cross-sectional research of 207 males published in 2020, it was discovered that the concentration of sperm was directly associated with seeds, nuts, and legumes but adversely correlated with total grains and sweets. Sperm volume and count were positively linked to low-fat dairy, oils, and fats but total sperm motility was inversely linked with total grains (59).

Dietary patterns and a healthier diet including fruit, vegetables, white meat, and whole grains in young men were shown to be unrelated with sperm concentration or morphology but positively linked with sperm progressive motility (60).

The intake of caffeine may harm the function of the male reproductive system by damaging sperm DNA (61). There is a study that revealed no link between cola intake (one liter per day) or caffeine (moderate intake of 800 mg/day) and male sperm quality (62), while another one provided a correlation (63). Semen quality was altered by caffeine-containing soft drinks and cola-containing beverages but not by intake of caffeine from mostly tea, coffee, and cocoa drinks, according to a recent systematic analysis (64).

### 1.10.6 Influence of antioxidants and vitamins on male semen quality

Vitamin D is a fat-soluble substance that is predominantly generated from cholesterol in the skin through a mechanism that depends on sun exposure (65). The role of vitamin D in the reproductive system of men has been hypothesized, since vitamin D receptor (VDR) expression and metabolizing enzymes of vitamin D were established in spermatozoa and the testis. Semen and hormone function are both affected by hypovitaminosis D (66)**.**

Antioxidants have been investigated as potential therapeutics for reversing the deleterious consequences of high ROS levels on sperm quality (67). Some antioxidants (zinc, lycopene, vitamin E, vitamin C, selenium, cryptoxanthin, and β-carotene), vitamins (vitamin D and folate), low saturated or trans-fatty acid and omega-3 fatty acids intake have been significantly correlated with high quality to sperm measures (54). On the one hand, a simple random sampling technique was used in a cross-sectional study that was performed on 350 infertile males, with a mean age of 34.77 years, a BMI of 26.67 kg/m2, a vitamin D level of 20.17 ng/ml in serum, a semen volume of 3.82 mL, a sperm concentration of 44.48 ($10^6$/mL), total motility of 38.10%, and normal morphology of 7.0%. Vitamin D level in serum was positively related to semen volume, total motility, normal morphology, and sperm count after controlling for potential confounders (68). On the other hand, a prospective observational study was performed on 222 individuals aged 27 to 32 in 2017 and 2018 and reported a clinically significant relationship between vitamin D level and sperm count, but no influence on sperm morphology or motility (69). Some studies such as a meta-analysis published in 2019 reported a significant association between sperm motility or progressive motility and vitamin D, but not for other semen characteristics (70).

A study of males who visited an Italian reproductive clinic found that higher -carotene intake was linked to a reduced frequency of low sperm concentration and total sperm count per ejaculate. Increased -carotene intake was linked to an increased total sperm count. Vitamin D level was found to have a positive relationship with sperm volume (71).

Another cross-sectional study of 189 physically active university-aged men reported a linear relationship between sperm morphology and motility and higher intakes of lycopene and the carotenoids β-carotene. In addition , moderate β-carotene and vitamin C intakes were associated with the highest concentration, total count, and motility of sperms, but no significant linear relationship was found between vitamins A and E intakes and any of the parameters of semen (57).

### 1.10.7 Influence of sedentary lifestyle and physical activity on male semen quality

Physical exercise is vital for practitioners' physical performance, whatever of their level of performance, as well as Witness maintenance. A physically active lifestyle is also recommended for preventing systemic disorders such as obesity and related pathologies, cardiovascular diseases, and other illnesses. It is also advised for improving the quality of life in the elderly by preventing muscle loss, decreasing bone mineral density loss, and preventing falls (72)**.**

In Ghana, a study published in 2020 found that several lifestyle factors, such as smoking, sitting for long periods, and drinking alcohol, affect sperm. Smoking influenced sperm count (P-value = 0.036) and sitting for long periods of time influenced sperm motility (P-value = 0.017) (73). Physically inactive men (OR 2.20) with fat mass greater than the reference values for their age (OR 2.83) were shown to be positively linked with male infertility in a case-control study (73). Infertility in males was not linked to sedentary behavior with fat-free mass (74).

Semen samples from 15 sedentary males and 17 physically active males were collected for a descriptive cross-sectional study, and it was discovered that semen parameters (semen volume, normal morphology, viability, progressive motility, and total motility) were worse in the sedentary group when compared to physically active group (74). Another study of 1,210 healthy adult Danish males reported that time spent sitting in front of a computer was not connected with reduced sperm counts, but time spent viewing television was connected with decreased sperm counts. Those who did not watch

television for more than 5 hours each day had an adjusted sperm concentration of 52 million/mL versus 37 million/mL among males who watched television each day for more than 5 hours (75).

### 1.10.8 Influence of coronavirus on male semen quality

Coronavirus disease or COVID-19 is a contagious illness that is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Even though respiratory droplets are the predominant method of transmission, SARS-CoV-2 has been found in other body fluids like urine, semen, and feces. As a result, concerns regarding viral shedding and dissemination through semen have been highlighted, as well as the potential influence on male fertility. SARS-CoV-2 uses angiotensin-converting enzyme 2 (ACE2) receptor to enter cells which has been found in the testis and genitourinary tissues (76) . Therefore, coronavirus influences men more than women (77). Accordingly, fears have been sparked that the coronavirus could be a vector or route for transmission through semen or affect sperm properties (76). COVID-19 is a systemic disease with a wide range of manifestations (78).

A recent study looked at the semen characteristics of 41 male patients of reproductive age who had recovered from coronavirus after being discharged from the hospital. A second sample was taken from 22 of the 41 individuals for longitudinal analysis. At the first sample, sperm concentration, the total sperm count, and percentages of progressively motile and total motile spermatozoa in the patients (who had been exposed to coronavirus) were significantly lower than in controls who had not been exposed to coronavirus, while sperm vitality and morphology were unaffected. In the 22 patients studied, sperm concentration, the total sperm count, the proportion of morphologically normal sperms, and the number of motile spermatozoa were considerably higher at the second sampling (79).

A cohort study included 24 male patients who had started to recover from mild coronavirus infection. Before COVID-19, their sperm parameters were normal. During the COVID-19 recovery periods, these individuals' sperm samples were taken. There was no statistically significant difference in the semen parameters before and after the coronavirus, but overall motility percentage (p-value = 0.01) and total motile sperm count (p-value =.02) decreased significantly after coronavirus infection against to pre-infection values (80).

### 1.10.9 Influence of varicocele on male semen quality

Varicocele is the second most common cause of infertility in men, and it is an aberrant venous dilatation of the plexus of pampiniform usually linked with blood reflux. Varicoceles affect about 15% of adult males in the general population, but they affect about 40% of infertile men in cases of primary infertility and about 80% of infertile men in cases of secondary infertility (81).

Because varicocele is common in infertile men, researchers decided to investigate the links between traditional sperm characteristics and varicocele. Varicocele-negative and varicocele-positive infertile men (case groups) had considerably lower standard sperm parameters in seminal fluid than healthy volunteers with established fertility (control groups). The findings explain that spermatogenesis problems might play a role in varicocele-related infertility. Reduced standard semen characteristics, as well as increased oxidative stress and decreased integrity of sperm DNA in semen, are all symptoms of these disorders (82).

The meta-analysis comprised ten studies, including a total of 1232 males. Reduced sperm motility (P-value < 0.001), morphology (P-value < 0.001), and count (P-value < 0.001), were all linked to varicocele, but it was not associated with the volume of semen (83).

A total of 709 males were studied to see how varicocele affected their sperms. Approximately 8% of those (56 men) had varicocele, which was discovered by clinical exam. Men who did not have the varicocele had a larger left testis and higher total motile sperm counts and total sperm count than men who had this disorder (84).

### 1.10.11 Influence of some environmental factors on male semen quality

Due to the ubiquitous presence of environmental toxins, environmental pollution has emerged as a prominent cause of the growing trend of male infertility today and all across the world. As seen in figure 5, environmental factors including excessive heat exposure and air pollution affect the quality of semen and hence the infertility of men, by damaging Sertoli cells, steroidogenesis, spermatogenesis, and sperm functions (85).

#### 1.10.11.1 Heat exposure

High-temperature exposure (either by environmental factors such as climate or

occupational factors such as work in bakeries, furnaces, those working for long hours in dry cleaning shops, laundries, kitchens, or drivers) hurts semen quality and can lead to male infertility. The rising scrotal temperature which must be lower than the core body temperature by 2–4 °C, will affect the spermatogenesis process and impair sperm production and morphological abnormalities. Occupational exposure to high temperatures can result in loss of thermoregulatory function of the scrotum, affecting one or more parameters of semen quality (85).

A study in Wuhan was conducted and observed that exposure to high and low temperatures was linked with decreased progressive motility, total motility, sperm concentration, and total sperm count, (86). It was also observed in a retrospective study that progressive and total motile sperms were significantly higher in spring and summer than in autumn and winter, but sperm concentration and total sperm count per ejaculate were higher in winter than in summer (87).

Cross-sectional analysis revealed that tight undergarments in males also lead to an increase in the scrotal temperature, which leads to impaired semen quality like reduced sperm concentration, total sperm count, and motility (88).

#### 1.10.11.2 Air pollution

Air pollution has many negative consequences on human health, such as cancers, respiratory, cardiovascular, and reproductive diseases. It comes mainly from factories, motor vehicle exhaust, households, agriculture, waste treatment, fire, natural sources (volcanic eruptions, wind), oil refineries, etc. It dangerously affects the semen quality by increasing the fragmentation of sperm DNA, morphological changes in sperm, and reducing sperm motility (85).

It is thought that air pollutants that are found in automobile exhaust lead to hormonal disruption by antiandrogenic, estrogenic, and antiestrogenic actions, and so, can result in abnormal gametogenesis and gonadal steroidogenesis. Air pollutants also lead to oxidative stress and increased ROS production, resulting in sperm DNA fragmentation, lipid peroxidation, and infertility (85).

A systematic meta-analysis was conducted to evaluate the outdoor air pollution effects on semen parameters and reported that the air pollution level was significantly linked with

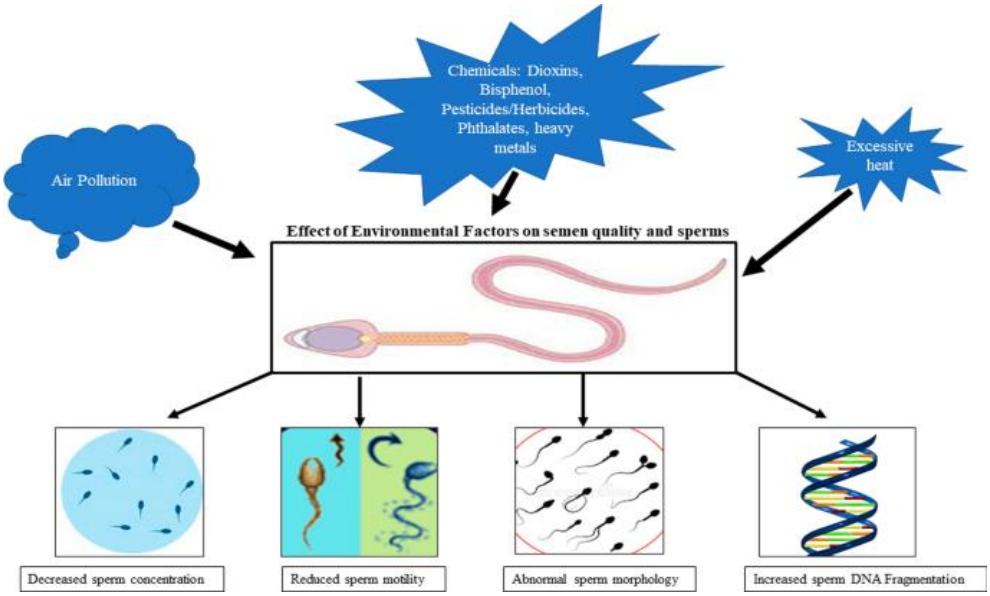
reduced semen volume, sperm concentration, the rate of morphologically normal sperm, progressive motility, and total sperm motility (89).

Recent cross-sectional research conducted in China reported that gaseous pollutants like nitrogen dioxide ($NO_2$) and sulfur dioxide ($SO_2$) have a significant negative effect on the quality of semen as sperm concentration and motility, particularly through the sperm development period (90).

A study was conducted on 85 men reported that the forward progression motility, total sperm motility, and sperm kinetics of workers in motorway tollgates were significantly lower than other males who did not work in motorway tollgates and lived in the same area. It is also reported that the $NO_2$ and lead released from automobile exhaust severely affected the overall quality of semen in these men when compared to controls (91).

**Figure 5**

*Possible effects of environmental factors on sperms (85).*



# Chapter Two
# Methodology

## 2.1 Study design

A descriptive cross-sectional study was performed among men in Nablus. Nablus at the middle of West-Bank represents the typical Palestinian population who live in rural, camp and urban residences with multiple variables of lifestyle and environmental factors. These factors and lifestyle behaviors include: smoking habits with special Pipe-smoking, sitting for a long time, obesity, diet, exposure to radiation and chemicals, antioxidant and vitamins intake, sedentary lifestyle or physical activity, and semen parameters at the time of the data snapshot meaning taking data from a population at a single point in time. As descriptive statistics are often used to illustrate the basic characteristics of the research data, it provides summaries of the measures and the sample. Also, it forms the base of approximately every quantitative data analysis, along with simple graphics analysis (92).

This study was designed to investigate the ordinary assumption of probable relationships and effect of smoking and lifestyles on semen quality.

## 2.2 Study population and setting

The samples were collected from the main semen analysis provider laboratories in the Nablus area, namely, the Central Medicare lab, Consulting Medical Laboratory – Jammain, Professional lab branches (Nablus, Hawara, Qabalan), Med lab, Al Rahma clinic, and the Central lab in Hawara.

### 2.2.1 Inclusion criteria

All men sought the semen analysis test whether they smoke or not and regardless of their lifestyles are approached to participate in this study.

### 2.2.2 Exclusion criteria

The patients who have any of the following conditions were excluded:

- Their ages are less than 18 years.
- Having varicocele disorder.

- Their abstinence days are less than 2 days or more than 7 days.

### 2.3 Study time

After receiving approval from Faculty of Graduate Studies ( appendix 3), the approval from the Institutional Review Board (IRB) of An-Najah National University in 24 October 2021 ( appendix4), and verbal approval from the nominated laboratories (Central Medicare lab, Consulting Medical Laboratory – Jammain, Professional lab branches (Nablus, Hawara, Qabalan), Med lab, Al Rahma clinic, Central lab in Hawara), sampling was conducted from October 2021 to February 2022. Also, data analysis, reviewing of literature, and writing the study were continued until May 2022.

### 2.4 Sample size

A total number of 168 samples were collected from the consent volunteers. Noteworthy, that it seems due to the sensitivity of this research in Palestinian culture, the sample size was less than the estimated population sample size of 370 according to the sample size calculator which was calculated by two methods:

**First:** By an online sample size calculator. It is accessible on the website "Select Statistical Services", and it is used to calculate the accurate sample size (93).

**Second:** By Stephen Thompson Equation which uses the following formula for the sample size:

$$n = \frac{N \times p\,(1-p)}{\left((N-1)\times(d^2 \div z^2)\right) + p\,(1-p)}$$

Where, n: Size of the sample; N: Size of population; z: Confidence level at 95% = (1.96); d: Error proportion = (0.05); and p: Population proportion (expressed as a decimal) = 0.50 (94).

### 2.5 Sampling technique

This study used a convenience sampling technique. It is considered one of the types of non-probability sampling technique that focuses on collecting data from members of the

population who are readily available to participate in the study. So, it is often referred to as availability sampling (95). This technique was chosen because it has several advantages, including simplicity of sampling, time sensitivity and participants convenience; as well as being useful for pilot studies, and generation of hypothesis (95).

### 2.6 Study variables

The variables of our study were identified and determined in a well-established questionnaire that include the sociodemographic information and the independent and the dependent variables attained from the lab.

#### 2.6.1 Independent variables

##### 2.6.1.1 Smoking:

A- Smoking status was classified as a nonsmoker, former smoking, and current smoking with determining the length time of smoking.
B- The number of cigarettes per day was classified as (less than 10, from 10 to 30, more than 31 cigarettes).
C- Deciding the pipe-smoking (yes or no) with determining the average smoking per day if yes.

##### 2.6.1.2 Using drinks

It was classified into two categories: Using energy drinks and cola or sprite drinks per week with each one has four options (not drink, drinks from one to three cups, drinks three to five cups, or drinks more than five cups). Daily intake of coffee and tea was classified into four options (not drink, drinks from one to three cups, drinks from three to five cups, or drinks more than five cups).

##### 2.6.1.3 Nature of food:

High amount of sugar, vegetables and fruits, and canned and processed foods were classified into four options: always eating, usually eating, rarely eating, and never at all.

##### 2.6.1.4 Obesity

It was defined by using body mass index (BMI). BMI was calculated through a person's

weight in kilograms divided by the square of height in meters (kg/$m^2$). The patient is underweighted when his BMI is <18.5 kg/$m^2$ is, normal weight if BMI is 18.5–24.9 kg/$m^2$, overweight when BMI is 25.0–29.9 kg/$m^2$ and obese if BMI is ≥ 30 kg/$m^2$ (96). The weight and height were taken by self-reported by patients.

#### 2.6.1.5 Oral antioxidants and herbal therapies

Oxidative stress has a major role in sperm dysfunction and hence on male infertility, treatment the infertile man with antioxidants may improve his semen quality and fertility (38). They were classified as yes or no with reminding the name antioxidants.

### 2.6.2 Dependent variable

**Male semen analysis:**

Low sperm motility, low sperm count, low morphology, and semen viscosity abnormality, positive agglutination, prolonged liquefaction time confirmed abnormal semen quality.

### 2.6.3 Other variables (Confounders)

**1. Age:** All participants should be more than 18 years old.

**2. Physical problems**: They alter the production of sperms and blockage the ejaculatory process (12). Varicocele, due to sperm vessels enlargement, is considered one of the most common infertility problems affecting 40% of males (97).

These confounder variables were controlled to eliminate their effect on infertility and to evaluate just the relationship between smoking and other lifestyle factors and male semen quality in Nablus.

## 2.7 Materials and methods

### 2.7.1 Questionnaire

A self-administered questionnaire (appendix 2) was introduced in the present study for data collection. It was prepared with the assistance of the supervisor of the researcher, after seeing, reading many questions and questionnaires from different related previous kinds of literature and studies. The questionnaire was composed of many sections, including questions about sociodemographic data: age group, living region and period, residential area, weight, height, marital

condition, number of family members, employment (current work), income, and place of work. It was also included questions about food nature, environmental and lifestyle factors, health status, and psychological status.

The questionnaire was submitted and sent to academics and laboratory technicians to get their feedback whether the questionnaire used is scientifically accurate or not and to know if the questionnaire is reasonably well structured to analyze the factors and variables and examine the relationships, to provide judgment and suggestions on the appropriateness of the questionnaire, and to evaluate and decide if the questions are important and related to the goals of the study. It was also piloted and sent to selected ordinary people not in the field to be confirmed that the questionnaire was clear and easy to understand. So, all feedback and amendments to the questionnaire were considered. Hopefully, the questionnaire was reliable and validated to suite Palestinians situation.

### 2.7.2 Sample collection

Data collection started in October 2021 until February 2022 in the nominated laboratories in Nablus governorate. Participants were asked to fill out the self-administered questionnaire that included questions about their socio-demographic data, food nature, environmental and lifestyle factors, and health status and psychological status. Participants were then asked to put seminal samples into sterile cups using the masturbation method (98).

### 2.7.3 Manual semen analysis

Seminal fluid analysis was used as a routine test to explain the severity of male infertility in the nominated Nablus laboratories (Central Medicare lab, Consulting Medical Laboratory – Jammain, Professional lab branches (Nablus, Hawara, Qabalan), Med lab, Central lab in Hawara). The patients were informed of the rules of the test such as the abstinence days or period (no sexual intercourse) should be 2-7 days because abstinence of more than 5 days will affect the results and give false elevated sperm count. On the other hand, abstinence of fewer than 2 days will produce a false decrease in sperm count, so the patient should complain about the test rules (98). The patients collected and prepared the semen samples in specific sterile container and they shouldn't lose the first portion of the semen because it is rich in sperms, then semen samples were put in an

incubator and analyzed by guidelines of WHO for semen analysis.

### 2.7.3.1 Macroscopic examination

It was performed to evaluate parameters such as liquefaction time, consistency, appearance with color, pH, and volume of semen.

- Liquefaction time, the time required to liquefy the semen sample, the normal to be less than 30 minutes but if the sample is not liquefied, wait for another 30 minutes.
- Semen appearance (clear or turbid), the normal is to be clear. Color (gray, yellow, red), the normal is to be gray.
- Semen volume was evaluated by using a graduated Pasteur pipette. The lower reference limit is 1.5 ml.
- Viscosity was observed by using a Pasteur pipette to allow the semen to drop by gravity, and the thread length was observed.
- Semen pH was measured by using a pH strip, the lower threshold value is 7.2-8.

### 2.7.3.2 Microscopic examination

It was conducted to determine parameters such as sperm agglutination, sperm count, motility, and morphology. So, the light microscope was used to assess these parameters.

- **Sperm count:**

It was determined by making at first wet preparation to assess the appropriate dilution that should be used, for example, diluting 50 $\mu$l of liquefied semen in 950 $\mu$l sodium bicarbonate -formalin solution to get 1:20 dilution from the well-mixed sample. An improved Neubauer hemocytometer was loaded with enough mixed solution, then waited 3-5 minutes to allow the spermatozoa to settle. Sperm cells were counted in a 2 $mm^2$ area by using a ×10 objective lens. The total number of sperm cells counted was multiplied by $1 \times 10^6$ to calculate sperm count per ml. A sperm concentration of less than 15 million was recorded as oligospermia but more than 15 million was recorded as normospermia. It was recorded as azoospermia If there was no sperm cell in semen (98).

- **Sperm motility**

  Semen drop was dropped onto a clean glass slide that had been covered and treated with a 22 × 22 mm coverslip. The slide was inspected under a light microscope with a ×40 objective lens to count 100 spermatozoa in total. The motility of the sperms was classified as active progression (moved actively, either linearly or in a large circle, the normal > 32%), sluggish progression (all other motility patterns with no movement, such as moving in small circles with the flagellar force barely pushing the head, or when just a flagellar beat can be detected), the total motile sperms (progressive and sluggish should be >40%) (98).

- **Sperm morphology**

A thin smear of enough-mixed semen was prepared on a slide and it was dried by air and then fixed in 95% ethanol for 5-10 minutes. The smear slide was placed vertically on absorbent paper to drain the excess solution. The smear was stained with diluted Geimsa stain (1:4) (Quimica Clinica Aplicada company/ Spain) for 15 minutes and washed with distilled water to remove the excess stain. Air was used to dry the smear again and the smear was observed with a microscope at ×100 objective lens using oil immersion (98).

The normal shape of sperm is a smooth head, generally oval and regularly contoured, with a well-defined acrosomal region. The midpiece should be regular, slender, approximately the same length as the head, and thicker than the principal piece. The lower reference limit is 4 % and the morphological normal sperm values should be > 30 % (98).

### 2.7.4 Automated semen analysis

It was used in the Al Rahma clinic lab, and was performed using the SQA-V (Medical electronic systems company in Los Angeles) sperm quality for sperm concentration, motility, and normal morphology (99). The SQA-V technology uses a principle of the electro-optical signal in combination with built-in computer algorithms (Figure 6A).

According to the instructions of SQA-V manufacturers, a disposable testing capillary was used to be filled with undiluted, completely liquefied, and well-mixed semen sample and run at room temperature on the SQA-V instrument that has two independent channels, one detecting and evaluating motile sperm concentration, and the other measuring sperm count, transmitting analog and distinct signals for analysis (Figure 6B) (100).

## 2.8 Statistical Analysis

After assuming the hypothesis for this study, the significant level was 5%, the data were collected from special Nablus laboratories were about their lifestyle habits and their semen quality. Then the hypotheses were tested by a significant test (*P*-value). The null hypothesis was rejected (there is a relationship between smoking, lifestyle habits, and male semen quality in Nablus) if *P*-value was less than 0.05, whereas the null hypothesis was not rejected if *P*-value was more than 0.05, even there was not enough proof that null hypothesis was true.

The statistical package for social science (SPSS) was used for data entry and analysis. Frequency tables or specific charts were used to describe the categorical data. Continuous data were described by mean and SD. Inferential statics were conducted to assess the relationship between two groups and this by using specific significant test (chi-squared). Pearson Correlation Coefficient was used to test correlations between individual variables.

## 2.9 Ethical considerations

All procedures performed in this study were attributed and linked to the ethical standards of the Institutional Review Board (IRB). The patients were informed and introduced to this research, its goals or purposes, its benefits, there was no risk or any harm to patients, and the rights of patients in withdrawing during the study were conserved and taken into consideration.

The most important thing was, that participation was voluntary after assigning the informed consent (Appendix 1). Patient's privacy and data confidentiality were insured and qualified staff who were working in Nablus laboratories treated or dealt respectfully with all participants. So, everything was understood by all patients about the trial or the study.

**Figure 7**

*shows the tools used in the automated seminal fluid analysis (A) shows the SQA-V sperm quality analyzer instrument, and (B) shows the SQA-V measurement capillary.*


# Chapter Three

# Result

## 3.1 Sample distribution according to socio-demographic data.

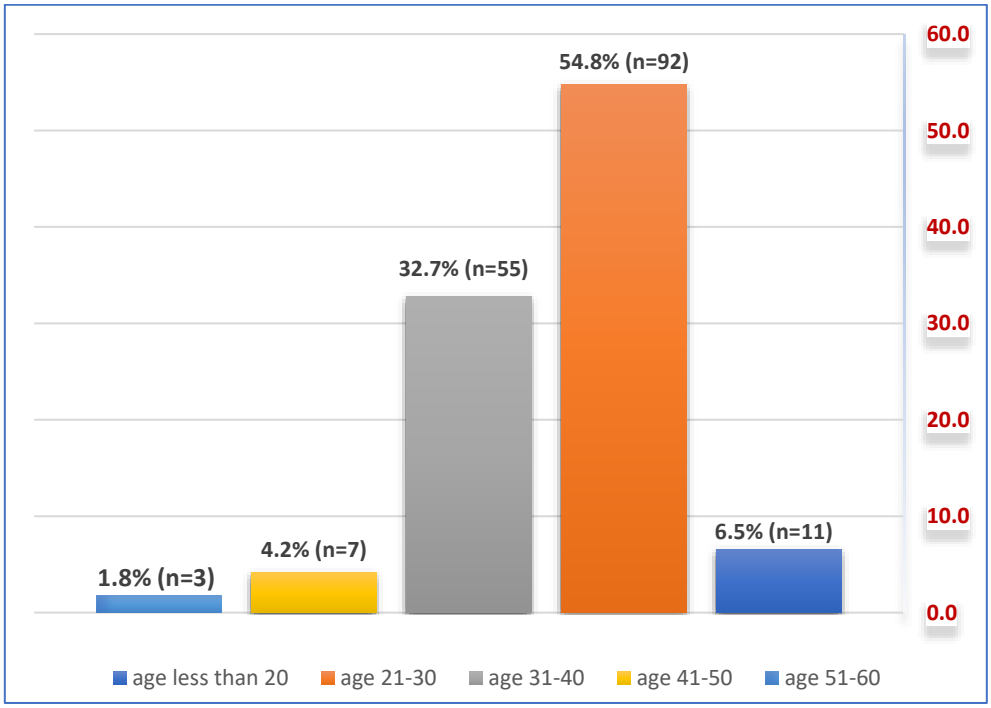
The present study is a cross-sectional study that included 168 subjects. The socio-demographic characteristics that were studied included age group, place of residency, marital status, number of family members, family income, and employment (current work).

### 3.1.1 Distribution of the study participants according to their group age.

The age group was classified into 5 groups, figure 3.1 illustrated that the highest age groups of study participants were 21-30 years (54.8%) followed by 32.7% of participants aged between 31-40 years and 6.5% of study participants were aged less than 20 years old. The results showed that only 4.2 % of study participants were aged 41-50 years, and 1.8% of them were in the 51 – 60 years.

**Figure 8**

*Distribution of study participants according to their age.*

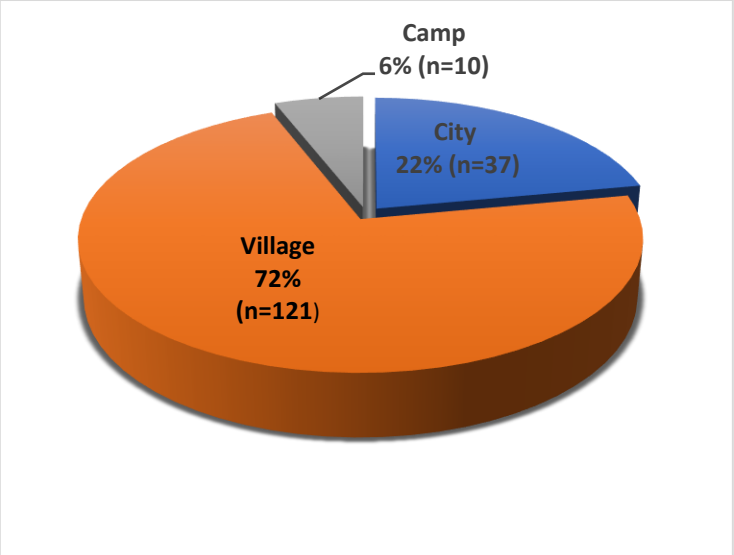


### 3.1.2 Distribution of the study participants according to their place of residency

Figure 3.2 pointed out that 72% of the study participants now live in the village while 22% live in the city and only 6% live in a camp.

**Figure 9**

*Distribution of study participants according to their place of residence.*




### 3.1.3 Distribution of the study participants according to their sociodemographic data.

Table 3.1 illustrated that the majority of the study participants were married (88.1%) while 11.3% of study participants were single, and only 1 man was divorced (0.6%). The results showed that from 168 patients, 144 (write the %) have recorded data. One hundred fourteen (114) 67.9% of study participants had 1-3 family numbers and (30) 17.9% have more than 3 members. About 61.3% of the study participants have income from 1500 to 3500 shekels while 25.0% have income from 3500-7000, 8.3% have income more than 7000 shekels but only 2.4% of the study participants have less than 1500 shekels. Regarding current work, the table showed that 55.4% of the study participants are workers, 20.8% as government employee, 3% were unemployed and 8.2% of the study participants were drivers. Table 3.1 also showed that 38.7% of the study participants work in Nablus city, 22% work in Israel, 10.1% work in Jamaaen, while only 2.4% of the study participants work in Alfaraa camp and 10.7% work in another places.

**Table 1**

*Distribution of study participants according to their socio-demographic characteristics.*

| Variables | | Frequency (n) | Percentage (%) | |
|---|---|---|---|---|
| **Marital status** | Single | 19 | 11.3% | |
| | Married | 148 | 88.1% | |
| | Divorce | 1 | 0.6% | |
| **Family number** | 1-3 | 114 | 67.9% | |
| | >3 | 30 | 17.9% | |
| | < 1500 | 4 | 2.4% | |
| | 1500-3500 | 103 | 61.3% | |
| **Family income** | 3501-7000 | 42 | 25% | |
| | >7000 | 14 | 8.3% | |
| | Government employee | 35 | 20.8% | |
| | Telecom engineer | 3 | 1.8% | **P- value >0.05 with all semen parameters.** |
| **Current work** | Worker | 93 | 55.4% | |
| | Driver | 14 | 8.3% | |
| | Tailor | 6 | 3.6% | |
| | Kitchen worker | 9 | 5.4% | |
| | Not work | 5 | 3% | |
| | Alfaraa camp | 4 | 2.4% | |
| | Nablus city | 65 | 38.7% | |
| **Place work** | Jamaaen | 17 | 10.1% | |
| | Israel | 37 | 22% | |
| | Another | 18 | 10.7% | |

### 3.2 The relationship between smoking and semen quality.

Table 3.2 showed the proportion of participants according to their smoking status (yes, no) with semen quality status (normal, abnormal). The total number of participants who filled cigarette smoking parameter was 166 and the total number of participants who filled waterpipe smoking parameter was 165. Chi square test is used to evaluate the relationship between smoking and semen parameters (viscosity, volume, liquefaction time, agglutination, progressive motility, total motility, sperm count and morphology). There is no statistically significant association between cigarette smoking and semen quality and between water pipe smoking and semen parameters (P value > 0.05), but 70.5% of patients who smoke waterpipe have abnormal liquefaction time. So, there is a significant association between waterpipe and only agglutination (P value < 0.05).

**Table 2**

*The proportion of participants according to their smoking status with semen quality status*

| | | Cigarette smoking | | | Waterpipe smoking | |
|---|---|---|---|---|---|---|
| | | **NO** | **Now smoking** | **In the previous** | **NO** | **Yes** |
| Viscosity | Normal | 66.7% (34) | 70.5% (74) | 80.0% (8) | 69.4% (84) | 70.5% (31) |
| | Abnormal | 33.3% (17) | 29.5% (31) | 20.0% (2) | 30.6% (37) | 29.5% (13) |
| | P-value | | 0.686 | | 0.530 | |
| Volume | Normal | 86.3% (44) | 81.9% (86) | 0% (0) | 84.3% (102) | 88.6% (39) |
| | Abnormal | 13.7% (7) | 18.1% (19) | 100% (10) | 15.7% (19) | 11.4% (5) |
| | P-value | | 0.290 | | 0.335 | |
| Liquefaction time | Normal | 49% (25) | 40% (42) | 40% (4) | 47.9% (58) | 29.5% (13) |
| | Abnormal | 51% (26) | 60% (63) | 60% (6) | 52.1% (63) | 70.5% (31) |
| | P-value | | 0.556 | | **0.026*** | |
| Agglutination | Normal | 80.4% (41) | 75.2% (79) | 80% (8) | 75.2% (91) | 84.1% (37) |
| | Abnormal | 19.6% (10) | 24.8% (26) | 20% (2) | 24.8% (30) | 15.9% (7) |
| | P-value | | 0.753 | | 0.159 | |
| Progressive motility | Normal | 51% (26) | 36.2% (38) | 50% (5) | 43.8% (53) | 36.4% (16) |
| | Abnormal | 49% (25) | 63.8% (67) | 50% (5) | 56.2% (68) | 63.6% (28) |
| | P-value | | 0.182 | | 0.250 | |
| Total motility | Normal | 56.9% (29) | 49.5% (52) | 40% (4) | 53.7% (65) | 43.2% (19) |
| | Abnormal | 43.1% (22) | 50.5% (53) | 60% (6) | 46.3% (56) | 56.8% (25) |
| | P-value | | 0.529 | | 0.154 | |
| Sperm count | Normal | 62.7% (32) | 59% (62) | 80% (8) | 64.5% (78) | 52.3% (23) |
| | Abnormal | 37.3% (19) | 41% (43) | 20% (2) | 35.5% (43) | 47.7% (21) |
| | P-value | | 0.418 | | 0.108 | |
| Sperm morphology | Normal | 68.6% (35) | 64.8% (68) | 70% (7) | 66.1% (80) | 65.9% (29) |
| | Abnormal | 31.4% (16) | 35.2% (37) | 30% (3) | 33.9% (41) | 34.1% (15) |
| | P-value | | 0.862 | | 0.560 | |

### 3.3 The relationship between obesity and semen quality.

The proportion of participants according to their obesity scale (normal, overweight and obese) with semen quality status (normal, abnormal) is displayed in table 3.3. The total number of participants who filled this parameter was 167. Chi square test that is used to evaluate the relationship between obesity and semen parameters represents that there is statistically significant association between increasing BMI or overweight and agglutination (P value < 0.05). Otherwise, there is no significant association between obesity scale and other semen parameters (viscosity, volume, liquefaction time, progressive motility, total motility, sperm count and morphology) (P value > 0.05).

**Table 3**

*The proportion of participants according to their obesity scale with semen quality status*

| | | Body mass index | | |
|---|---|---|---|---|
| | | Normal | Overweight | Obese |
| **Viscosity** | Normal | 63.5% (47) | 75.8% (50) | 70.4% (19) |
| | Abnormal | 36.5% (27) | 24.2% (16) | 29.6% (8) |
| | P-value | | 0.290 | |
| **Volume** | Normal | 82.4% (61) | 84.8% (56) | 88.9% (24) |
| | Abnormal | 17.6% (13) | 15.2% (10) | 11.1% (3) |
| | P-value | | 0.725 | |
| **Liquefaction time** | Normal | 48.6% (36) | 37.9% (25) | 40.7% (11) |
| | Abnormal | 51.4% (38) | 62.1% (41) | 59.3% (16) |
| | P-value | | 0.422 | |
| **Agglutination** | Normal | 85.1% (63) | 66.7% (44) | 81.5% (22) |
| | Abnormal | 14.9% (11) | 33.3% (22) | 18.5% (5) |
| | P-value | | **0.029 *** | |
| **Progressive motility** | Normal | 37.8% (28) | 40.9 (27) | 59.3% (16) |
| | Abnormal | 62.2 (46) | 59.1 (39) | 40.7% (11) |
| | P-value | | 0.147 | |
| **Total motility** | Normal | 45.9% (34) | 50% (33) | 70.4% (19) |
| | Abnormal | 54.1% (40) | 50% (33) | 29.6% (8) |
| | P-value | | 0.09 | |
| **Sperm count** | Normal | 58.1% (43) | 63.6% (42) | 70.4% (19) |
| | Abnormal | 41.9% (31) | 36.4% (24) | 29.6% (8) |
| | P-value | | 0.509 | |
| **Sperm morphology** | Normal | 71.6% (53) | 59.1% (39) | 70.4% (19) |
| | Abnormal | 28.4% (21) | 40.9% (27) | 29.6% (8) |
| | P-value | | 0.262 | |

### 3.4 The relationship between diet and semen quality.

#### 3.4.1 The relationship between high sugar intake and semen quality.

Table 3.4 showed the percentage of participants according to their high sugar intake status (always, often, rarely, and never at all) with semen quality status (normal, abnormal). By using chi square test, it was found that that there is statistically significant association between high sugar intake and agglutination (P value < 0.05). Otherwise, there is no significant association between high sugar intake and other semen parameters (viscosity, volume, liquefaction time, progressive motility, total motility, sperm count and morphology) (P value > 0.05).

**Table 4**

*The proportion of participants according to their high sugar intake with semen quality status*

| | | High sugar intake | | | |
|---|---|---|---|---|---|
| | | always | Often | Rarely | Never at all |
| Viscosity | Normal | 76.3% (29) | 67% (75) | 75% (12) | 50% (1) |
| | Abnormal | 23.3% (9) | 33% (37) | 25% (4) | 50% (1) |
| | P-value | 0.623 | | | |
| Volume | Normal | 78.9% (30) | 88.4% (99) | 68.8% (11) | 2% (100) |
| | Abnormal | 21.1% (8) | 11.6% (13) | 31.3% (5) | 0.0% (0) |
| | P-value | 0.133 | | | |
| Liquefaction time | Normal | 42.1% (16) | 44.6% (50) | 31.3% (5) | 50% (1) |
| | Abnormal | 57.9% (22) | 55.4% (62) | 68.8% (11) | 50% (1) |
| | P-value | 0.783 | | | |
| Agglutination | Normal | 92.1% (35) | 69.6% (78) | 93.8% (15) | 100% (2) |
| | Abnormal | 7.9% (3) | 30.4% (34) | 6.3% (1) | 0% (0) |
| | P-value | **0.009 *** | | | |
| Progressive motility | Normal | 39.5% (15) | 43.8% (49) | 31.3% (5) | 100% (2) |
| | Abnormal | 60.5% (23) | 56.3% (63) | 68.8% (11) | 0% (0) |
| | P-value | 0.290 | | | |
| Total motility | Normal | 47.7% (18) | 51.8% (58) | 56.3% (9) | 100% (2) |
| | Abnormal | 52.6% (20) | 48.2% (54) | 43.8% (7) | 0% (0) |
| | P-value | 0.515 | | | |
| Sperm count | Normal | 50% (19) | 67.9% (76) | 50% (8) | 50% (1) |
| | Abnormal | 50% (19) | 32.1% (36) | 50% (8) | 50% (1) |
| | P-value | 0.168 | | | |
| Normal morphology | Normal | 60.5% (23) | 67% (75) | 75% (12) | 0% (0) |
| | Abnormal | 39.5% (15) | 33% (37) | 25% (4) | 100% (2) |
| | P-value | 0.542 | | | |

### 3.4.2 The relationship between processed and canned food with semen quality.

Table 3.5 showed the percentage of participants according to their status of processed and canned food intake (always, often, rarely, and never at all) with semen quality status (normal, abnormal). By using chi square test, it was found that that there is statistically significant association between processed and canned food and progressive motility (P value < 0.05). Otherwise, there is no significant association between processed and canned food and other semen parameters (viscosity, volume, liquefaction time, agglutination, total motility, sperm count and morphology) (P value > 0.05).

**Table 5**

*The proportion of participants according to processed and canned food intake with semen quality status*

| | | Processed and canned food | | | |
|---|---|---|---|---|---|
| | | Always | Often | Rarely | Never at all |
| **Viscosity** | Normal | 80.8% (21) | 64.5% (49) | 72% (36) | 68.8% (11) |
| | Abnormal | 19.2% (5) | 35.5% (27) | 28% (14) | 31.3% (5) |
| | P-value | 0.454 | | | |
| **Volume** | Normal | 80.8% (21) | 82.9% (63) | 92% (46) | 75% (12) |
| | Abnormal | 19.2% (5) | 17.1% (13) | 8% (4) | 25% (4) |
| | P-value | 0.298 | | | |
| **Liquefaction time** | Normal | 46.2% (12) | 40.8% (31) | 44% (22) | 43.8% (7) |
| | Abnormal | 53.8% (14) | 59.2% (45) | 56% (28) | 56.3% (9) |
| | P-value | 0.964 | | | |
| **Agglutination** | Normal | 84.6% (22) | 76.3% (58) | 76% (38) | 75% (12) |
| | Abnormal | 15.4% (4) | 23.7% (18) | 24% (12) | 25% (4) |
| | P-value | 0.817 | | | |
| **Progressive motility** | Normal | 26.9% (7) | 38.2% (29) | 46% (23) | 75% (12) |
| | Abnormal | 73.1% (19) | 61.8% (47) | 54% (27) | 25% (4) |
| | P-value | **0.016 *** | | | |
| **Total motility** | Normal | 42.3% (11) | 47.4% (36) | 54% (27) | 81.3% (13) |
| | Abnormal | 57.7% (15) | 52.6% (40) | 46% (23) | 18.8% (3) |
| | P-value | 0.066 | | | |
| **Sperm count** | Normal | 53.8% (14) | 57.9% (44) | 66% (33) | 81.3% (13) |
| | Abnormal | 46.2% (12) | 42.1% (32) | 34% (17) | 18.8% (3) |
| | P-value | 0.248 | | | |
| **Normal morphology** | Normal | 61.5% (16) | 61.8% (47) | 72% (36) | 81.3% (13) |
| | Abnormal | 38.5% (10) | 38.2% (29) | 28% (14) | 18.8% (3) |
| | P-value | 0.351 | | | |

### 3.4.3 The relationship between fruit and vegetables with semen quality.

Table 3.6 showed the percentage of participants according to their status of fruit and vegetables intake (always, often, rarely, and never at all) with semen quality status (normal, abnormal). By using chi square test, it was found that there is statistically significant association between fruit and vegetables intake and volume (P value = 0.042) and progressive motility (P value = 0.015), both have (P value < 0.05). Otherwise, there is no significant association between fruit and vegetables and other semen parameters (viscosity, liquefaction time, agglutination, total motility, sperm count and morphology) (P value > 0.05).

**Table 6**

*The proportion of participants according to fruit and vegetables intake with semen quality status*

| | | Fruit and vegetables | | | |
|---|---|---|---|---|---|
| | | Always | Often | Rarely | Never at all |
| Viscosity | Normal | 67.2% (43) | 71.6(48) | 70.4% (19) | 70% (7) |
| | Abnormal | 32.8% (21) | 28.4(19) | 29.6% (8) | 30% (3) |
| | P-value | | 0.957 | | |
| Volume | Normal | 81.3% (52) | 92.5(62) | 70.4% (1) | 90% (9) |
| | Abnormal | 18.8% (12) | 7.5(5) | 29.6% (8) | 10% (1) |
| | P-value | | **0.042 *** | | |
| Liquefaction time | Normal | 46.9% (30) | 38.8(26) | 44.4% (12) | 40% (4) |
| | Abnormal | 53.1% (34) | 61.2(41) | 55.6% (15) | 60% (6) |
| | P-value | | 0.818 | | |
| Agglutination | Normal | 71.9% (46) | 83.6(56) | 77.8% (21) | 70% (7) |
| | Abnormal | 28.1% (18) | 16.4(11) | 22.2% (6) | 30% (3) |
| | P-value | | 0.408 | | |
| Progressive motility | Normal | 53.1% (34) | 31.3(21) | 33.3% (9) | 70% (7) |
| | Abnormal | 46.9% (30) | 68.7(46) | 66.7% (16) | 30% (3) |
| | P-value | | **0.015 *** | | |
| Total motility | Normal | 56.3% (36) | 46.3(31) | 44.4% (12) | 80% (8) |
| | Abnormal | 43.85 (28) | 53.7(36) | 55.6% (15) | 20% (2) |
| | P-value | | 0.165 | | |
| Sperm count | Normal | 70.3% (45) | 59.7(40) | 48.1% (1) | 60% (6) |
| | Abnormal | 29.7% (19) | 40.3(27) | 51.9% (14) | 40% (4) |
| | P-value | | 0.237 | | |
| Normal morphology | Normal | 70.3% (45) | 62.7(42) | 63% (17) | 80% (8) |
| | Abnormal | 29.7% (19) | 37.3% (25) | 37% (10) | 20% (2) |
| | P-value | | 0.609 | | |

### 3.5 The relationship between drinks and semen quality.

#### 3.5.1 The relationship between tea intake and semen quality.

Table 3.7 showed the percentage of participants according to their tea intake status daily (no, 1-3 cups, 3-5 cups and >5 cups) with semen quality status (normal, abnormal). By using chi square test, it was found that that there is statistically significant association between tea intake and total motility, sperm count and morphology (P value = 0.021, 0.022, 0.01) respectively. Otherwise, there is no significant association between tea intake and other semen parameters (viscosity, volume, liquefaction time, agglutination) (P value > 0.05).

**Table 7**

*The proportion of participants according to their tea intake with semen quality status*

| | | Tea intake (daily) | | | |
|---|---|---|---|---|---|
| | | No | 1-3 cups | 3-5 cups | >5 cups |
| Viscosity | Normal | 70% (35) | 71.8% (61) | 58.3% (14) | 77.8% (7) |
| | Abnormal | 30% (15) | 28.2% (24) | 41.7% (10) | 22.2% (2) |
| | P-value | 0.590 | | | |
| Volume | Normal | 80% (44) | 87.1% (74) | 79.2% (19) | 55.6% (5) |
| | Abnormal | 12% (6) | 12.9% (11) | 20.8% (5) | 44.4% (4) |
| | P-value | 0.066 | | | |
| Liquefaction time | Normal | 50% (25) | 40% (34) | 37.5% (9) | 44.4% (4) |
| | Abnormal | 50% (25) | 60% (51) | 62.5% (15) | 55.6% (5) |
| | P-value | 0.656 | | | |
| Agglutination | Normal | 84% (42) | 77.6% (66) | 58.3% (14) | 88.9% (8) |
| | Abnormal | 16% (8) | 22.4% (19) | 41.7% (10) | 11.1% (1) |
| | P-value | 0.075 | | | |
| Progressive motility | Normal | 52% (26) | 42.4% (36) | 33.3% (8) | 11.1% (1) |
| | Abnormal | 48% (24) | 57.6% (49) | 66.7% (16) | 88.9% (8) |
| | P-value | 0.098 | | | |
| Total motility | Normal | 60% (30) | 55.3% (47) | 37.5% (9) | 11.1% (1) |
| | Abnormal | 40% (20) | 44.7% (38) | 62.5% (15) | 88.9% (8) |
| | P-value | **0.021 *** | | | |
| Sperm count | Normal | 56% (28) | 70.6% (60) | 58.3% (14) | 22.2% (2) |
| | Abnormal | 44% (22) | 29.4% (25) | 41.7% (10) | 77.8% (7) |
| | P-value | **0.022 *** | | | |
| Sperm morphology | Normal | 70% (35) | 75.3% (64) | 45.8% (11) | 22.2% (2) |
| | Abnormal | 30% (15) | 24.7% (21) | 54.2% (13) | 77.8% (7) |
| | P-value | **0.001 *** | | | |

### 3.5.2 The relationship between coffee intake and semen quality.

Table 3.8 showed the percentage of participants according to their coffee intake status daily (no, 1-3 cups, 3-5 cups and >5 cups) with semen quality status (normal, abnormal). The total number of participants who filled this parameter was 167. By using chi square test, it was found that that there is statistically significant association between coffee intake and sperm count (P value = 0.04 < 0.05). Otherwise, there is no significant association between coffee intake and other semen parameters (viscosity, volume, liquefaction time, agglutination, progressive motility, total motility, and morphology) (P value > 0.05).

**Table 8**

*The proportion of participants according to their coffee intake with semen quality status*

| | | Coffee intake (daily) | | | |
|---|---|---|---|---|---|
| | | No | 1-3 cups | 3-5 cups | >5 cups |
| Viscosity | Normal | 66.7% (26) | 71% (49) | 63% (29) | 92.3% (12) |
| | Abnormal | 33.3% (13) | 29% (20) | 37% (17) | 7.7% (1) |
| | P-value | 0.229 | | | |
| Volume | Normal | 82.2% (32) | 81.2% (56) | 91.3% (42) | 84.6% (11) |
| | Abnormal | 17.9% (7) | 18.8% (13) | 8.7% (4) | 15.4% (2) |
| | P-value | 0.497 | | | |
| Liquefaction time | Normal | 48.7% (19) | 43.5% (30) | 32.6% (15) | 61.5% (8) |
| | Abnormal | 31.3% (20) | 56.5% (39) | 67.4% (31) | 38.5% (5) |
| | P-value | 0.224 | | | |
| Agglutination | Normal | 76.9% (30) | 73.9% (51) | 80.4% (37) | 84.6% (11) |
| | Abnormal | 23.1% (9) | 26.1% (18) | 19.6% (9) | 15.4% (2) |
| | P-value | 0.776 | | | |
| Progressive motility | Normal | 48.7% (19) | 49.3% (34) | 30.4% (14) | 30.8% (4) |
| | Abnormal | 51.3% (20) | 50.7% (35) | 69.6% (32) | 69.2% (9) |
| | P-value | 0.146 | | | |
| Total motility | Normal | 64.1% (25) | 53.6% (37) | 43.5% (20) | 38.5% (5) |
| | Abnormal | 35.9% (14) | 46.4% (32) | 56.5% (26) | 61.5% (8) |
| | P-value | 0.199 | | | |
| Sperm count | Normal | 76.9% (30) | 65.2% (45) | 47.8% (22) | 53.8% (7) |
| | Abnormal | 23.1% (9) | 34.8% (24) | 52.2% (24) | 46.2% (6) |
| | P-value | **0.040 *** | | | |
| Normal morphology | Normal | 76.9% (30) | 65.2% (45) | 60.9% (28) | 69.2% (9) |
| | Abnormal | 23.1% (9) | 34.8% (24) | 39.1% (18) | 30.8% (4) |
| | P-value | 0.449 | | | |

### 3.5.3 The relationship between energy drinks intake and semen quality.

Table 3.9 showed the percentage of participants according to their energy drinks intake status weekly (no, 1-3 cups, 3-5 cups and >5 cups) with semen quality status (normal, abnormal). The total number of participants who filled this parameter was 167. By using chi square test, it was found that there is statistically significant association between energy drinks intake and sperm count (P value = 0.041 < 0.05). Otherwise, there is no

significant association between energy drinks intake and other semen parameters (viscosity, volume, liquefaction time, agglutination, progressive motility, total motility, and morphology) (P value > 0.05).

**Table 9**

*The proportion of participants according to their energy drinks intake with semen quality status*

| | | Energy drinks intake (weekly) | | | |
|---|---|---|---|---|---|
| | | No | 1-3 cups | 3-5 cups | >5 cups |
| Viscosity | Normal | 64.8% (68) | 76.6% (36) | 75% (6) | 85.7% (6) |
| | Abnormal | 35.2% (37) | 23.4% (11) | 25% (2) | 14.3% (1) |
| | P-value | 0.361 | | | |
| Volume | Normal | 83.8% (88) | 85.1% (40) | 87.5% (7) | 85.7% (6) |
| | Abnormal | 16.2% (17) | 14.9% (7) | 12.5% (1) | 14.3% (1) |
| | P-value | 0.990 | | | |
| Liquefaction time | Normal | 42.9% (45) | 40.4% (19) | 62.5% (5) | 42.9% (3) |
| | Abnormal | 57.1% (60) | 59.6% (28) | 37.5% (3) | 57.1% (4) |
| | P-value | 0.713 | | | |
| Agglutination | Normal | 79% (83) | 74.5% (35) | 75% (6) | 71.4% (5) |
| | Abnormal | 21% (22) | 25.5% (12) | 25% (2) | 28.6% (2) |
| | P-value | 0.906 | | | |
| Progressive motility | Normal | 35.2% (37) | 57.4% (27) | 50% (4) | 42.9% (3) |
| | Abnormal | 64.8% (68) | 42.6% (20) | 50% (4) | 57.1% (4) |
| | P-value | 0.080 | | | |
| Total motility | Normal | 43.8% (46) | 61.7% (29) | 75% (6) | 71.4% (5) |
| | Abnormal | 56.2% (59) | 38.3% (18) | 25% (2) | 28.6% (2) |
| | P-value | 0.062 | | | |
| Sperm count | Normal | 54.3% (57) | 74.5% (35) | 87.5% (7) | 71.4% (5) |
| | Abnormal | 45.7% (48) | 25.5% (12) | 12.5% (1) | 28.6% (2) |
| | P-value | **0.041 *** | | | |
| Normal morphology | Normal | 65.7% (69) | 68.1% (32) | 75% (6) | 57.1% (4) |
| | Abnormal | 34.3% (36) | 31.9% (15) | 25% (2) | 42.9% (3) |
| | P-value | 0.893 | | | |

### 3.6 The relationship between antioxidants and vitamins and semen quality.

The proportion of participants according to their antioxidants and vitamins intake (yes, no) with semen quality status (normal, abnormal) is displayed in table 3.10. The total number of participants who filled this parameter was 167. Chi square test that is used to evaluate the relationship between antioxidants and vitamins intake and semen parameters represents that there is statistically significant association between antioxidants and vitamins intake and morphology (P value < 0.05). Otherwise, there is no significant association between antioxidants and vitamins intake and other semen parameters

(viscosity, volume, liquefaction time, agglutination, progressive motility, total motility, and sperm count) (P value < 0.05).

**Table 10**

*The proportion of participants according to their antioxidants and vitamins with semen quality status*

| | | Antioxidant and vitamins intake | |
|---|---|---|---|
| | | **No** | **Yes** |
| Viscosity | Normal | 71.3% (87) | 64.4% (29) |
| | Abnormal | 28.7% (35) | 35.6% (16) |
| | P-value | | 0.251 |
| Volume | Normal | 83.6% (102) | 86.7% (39) |
| | Abnormal | 16.4% (20) | 13.3% (6) |
| | P-value | | 0.414 |
| Liquefaction time | Normal | 44.3% (54) | 40% (18) |
| | Abnormal | 55.7% (68) | 60% (27) |
| | P-value | | 0.377 |
| Agglutination | Normal | 76.2% (93) | 82.2% (37) |
| | Abnormal | 23.8% (29) | 17.8% (8) |
| | P-value | | 0.273 |
| Progressive motility | Normal | 45.1% (55) | 33.3% (15) |
| | Abnormal | 54.9% (67) | 66.7% (30) |
| | P-value | | 0.117 |
| Total motility | Normal | 53.3% (65) | 46.7% (21) |
| | Abnormal | 46.7% (21) | 53.3% (24) |
| | P-value | | 0.280 |
| Sperm count | Normal | 62.3% (76) | 60% (27) |
| | Abnormal | 37.7% (46) | 40% (18) |
| | P-value | | 0.461 |
| Normal morphology | Normal | 71.3% (87) | 53.3% (24) |
| | Abnormal | 28.7% (35) | 46.7% (21) |
| | P-value | | **0.024 *** |

# Chapter Four
# Discussion

## 4.1 Introduction

We recruited 210 patients to participate in the study, but 42 of them have varicocele disorder, so the final sample size was 168 patients. The study findings showed that 54.8% of the participants aged between 21- 30 years old. This result can be justified by relying on the data of the Palestinian Ministry of Health, which states that the Palestinian society is a youth society. At the same time, the majority of participants 88.1% were married while 11.3% of study participants were single, and only 1 man (0.6%) was divorced. Regarding residency, 22% of patients live in Nablus city, 72% live in villages of Nablus and the rest 6% of them live in camps.

In the workplace, workers might be exposed to a variety of detrimental physical, chemical, and psychological elements. The different illnesses and disorders produced by these stresses have attracted the attention of a number of researchers throughout the world in recent years. One of the topics that has been examined and a number of publications released is the influence of specific workplace dangers on the human reproductive system. So, according to the current work or employment status, the study showed that 55.4% of the study participants were workers (in stone-pit, sawmills, smith, carpentry, and mechanical worker), 20.8% as government employee (officers, teacher, accouter) while only 3% of the study were unemployed, 8.3% of the study participants were drivers, 3.6% as tailor, 5.4% as kitchen workers and only 1.8% as telecom engineering.

We took different types of jobs in our consideration to evaluate their effects on semen quality for example working as driver and working in kitchen or bakers means longer exposure to heat more than other jobs, working as toiler and also driver means sitting for long hours, persons who works in telecom engineering expose to radiations more than others. This study revealed no relation between employment or patient's job and any of semen parameters (P value > 0.05), this is similar to a study that revealed no relation between occupation status and semen parameter in infertile men (101). Shift employment, noise, night work, heat, vibration, and extended sitting were not linked with semen quality in a sample of 456 men with an average age of 31.8 years, but job-related severe exertion was consistently related to decreased semen concentration and total sperm count. (102).

We consider that the small sample number and the length of time exposed to chemicals, heat, radiation, and other factors, contributed to our findings, as we were unable to adequately investigate and analyze these impacts. More study involving samples from larger demographic groups who are directly exposed to radiations, chemicals, heat, etc. for longer durations is recommended.

### 4.1.1 Influence of smoking on semen quality

Smoking variable in our study was classified to cigarette smoking and waterpipe smoking. Cigarette smoking was classified to non-smoke, former smoke and current smoke which has no relationship with semen quality (viscosity, volume, liquefaction, progressive and total motility, sperm count, morphology) because P value is > 0.05, so no significance association between cigarette smoking and semen quality in males in Nablus, so the null hypothesis was not rejected even there was not enough evidence that null hypothesis was true, and Narghile water pipe smoking does not relate to majority to semen quality (viscosity, volume, liquefaction, progressive and total motility, sperm count, morphology). Otherwise, water pipe smoking has a significant association with liquefaction time P value (0.026), the total patients who answered this question is 165 patients, 27% of them smoked by waterpipe, and 70.5% of them who smoked have liquefaction time more than 30 minutes where the normal value must be less than 30 minutes (98).

Liquefaction time is important in semen analysis, the laboratory technician cannot continue any procedure to analyze the sperm count, morphology, motility, volume and viscosity in case the semen sample does not liquified less than 30 minutes, so waiting for another 30 minutes to liquified, and delayed liquefaction will be treated by enzymatic or digestion mechanical mixing even though this treatment may affect the sperm morphology and motility (98). As we know some of abnormal condition connected with prolonged liquefaction time are poor or improper prostate secretions and obstruction of ejaculatory duct (103). This is approved by a case control study that showed no relation between cigarette smoking and motile sperm concentration, but in contrast to other studies that found a relationship between smoking and semen quality (31,32).

There is a big confusion that how waterpipe smoking affects one of the semen parameters (liquefaction time) but cigarette smoking no, although both include toxins such as carbon

monoxide, nicotine, and polycyclic aromatic hydrocarbons (24), because the smoke is passed via water, waterpipe smoking has been marketed as a safer alternative to cigarette smoking. (104).This enhances us to read more about this topic and to make further researches with larger number of participants. There is no definitive consensus on the effects of smoking on sperm parameters and reproductive outcomes (12)**.** It is presently unclear what causes sperm quality of smokers to deteriorate, and study findings to yet have been inconsistent. (21). Many factors, such as lifestyles, season, geographical variance, and procedures utilized in semen analysis, may influence the outcomes of current investigations.

### 4.1.2 Influence of obesity on semen quality

Obesity is a big health problem worldwide. It has an impact on not just cardiovascular disorders, but also other such health issues that are linked to them. Building up the adipose tissue in men's scrotum elevates the scrotal temperature which leads to increase ROS in the testicles (40), so, obesity can negatively affect male reproduction with a considerable elevation in estradiol and reduction in the levels of total and free testosterone, impacting semen quality (39). Obesity scale was defined by using BMI that was calculated through weight of person divided by the square of height ($kg/m^2$). The patient is underweighted when his BMI is less than 18.5 $kg/m^2$, normal weight if it is 18.5–24.9 $kg/m^2$, overweight when it is 25.0–29.9 $kg/m^2$ and obese if it is $\geq$ 30 $kg/m^2$ (96). Couples with a normal weight male were less prone to develop infertility than couples with an obese male (43). It has been suggested that overweight or obese men may need prolonged time to pregnancy, even though the effect of male BMI on fertility remains understudied.

In present study, weight (Kg) and height (m) were taken by self-reported of 167 of study population, and BMI was calculated by using SPSS program which expressed that 44% of them were normal weight, 39.6% of study participants were overweight, and 16% of patients were obese. It was found that overweight or obese patients have abnormal agglutination (positive) than normal patients. So, there is a statistically significant relationship between increase BMI and agglutination (P value = 0.029) and this study did not show any link between increase BMI and any of semen parameters (P value > 0.05) of the studied population except agglutination. This is against to several studies which reported deleterious effects of obesity on male semen quality (41,44). However, there are many reports that support our findings. One comprehensive meta-analysis didn't find any

relation between BMI and semen parameters (42), a prospective cohort study showed also there wasn’t statistically significant relationship between BMI and semen in a cohort of male partners in sub fertile couples (105), and finally a retrospective study done in Northern China revealed no relationship between BMI and sperm morphology and semen volume (106) . This issue looks to be far from being resolved. To achieve a strong conclusion, more trials with proper control of confounders are required.

No published studies were found to explain the effect of BMI on agglutination, the majority of studies explain the relation between BMI and main semen parameters (sperm count, motility, morphology, and semen volume,). So, this study opened our eyes on other parameters that obesity may affect such as agglutination which means motile sperms sticking to each other, tail-to-tail, head-to-head, or in a mixed way. It is important to know that the presence of agglutination maybe due to the presence of anti-sperm antibodies which requires further testing to be confirmed, in the same time severe agglutination can affect the assessment of sperm concentration and motility (98).

### 4.1.3 Influence of food nature on semen quality

Countries in the Middle East, including Palestine, have been losing their traditional diet, which was characterized by its richness and diversity in fresh, natural foods, multivitamins, and proteins, in favor of a more industrial diet consisting more processed foods, fats, sugars, alcohol, saturated- and trans-fatty acids, animal products, and relatively fewer minerals and vitamins, as well as decreased consumption of fruits, vegetables and milk. With the spread of western fast food into Middle Eastern countries, a large portion of this transformation may be linked to lifestyle changes and globalization. Other key elements that impact the nutritional status in the region include dietary choices, religious practices, minimal physical activity, consumer ignorance, economic considerations, high population growth rates, and a lack of both protection legislation and food fortification efforts. Diet-related chronic illnesses, micronutrient deficiencies, and obesity are all on the rise in the region as a result of these changes in dietary and lifestyle habits. Because of its significant influence on chronic illnesses, the diet has become a focus of public health programs aimed at restoring traditional Middle Eastern diets in order to enhance the health of their communities. (107). Diet and nutrition have a big impact on sperm quality. Males' sperm quality and fecundity rates might be improved by eating a healthy, balanced diet (54)**.** At least one measure of sperm quality is improved

by a healthy diet (55)**.** So, the diet factor was taken in this study as an important risk factor for impairing semen quality.

Our study found that there is a statistically significant relationship between high sugar intake and agglutination (P-value = 0.009), often quartile has the highest percentage of participants who have the abnormal agglutination more than rarely and never at all quartile. Otherwise, there is no significant association between high sugar intake and other semen parameters (viscosity, volume, liquefaction time, progressive motility, total motility, sperm count, and morphology). There are no published studies until now that study or evaluate the relation between high sugar intake and agglutination, but in general, it affects semen analysis. Our finding according to the association between sugar intake and semen quality, is similar to a cross-sectional study conducted among Rochester Young Men that showed the consumption of a Western dietary pattern that includes sweet and high sugar foods was unrelated to conventional semen quality parameters (sperm count, morphology, and progressive motility) (60). On the other hand, it is in contrast to a case-control study that had shown a higher diet of sweets has been linked with an increased risk of asthenozoospermia (58) and to cross-sectional research of 207 males that discovered the concentration of sperm was adversely correlated with sweets (59). As it is seen the always quartile has a lower proportion to have positive agglutination than often quartile, a small sample number of study in general and just 38 men eat high sugar food always in contrast to 112 men eat high sugar food often and the presence of uncontrolled confounders may affect the results and give a possible explanation for these unexpected results.

It was found that there is a statistically significant association between processed and canned food and only progressive motility (P-value = 0.016). Patients who eat processed and canned food always have abnormal lower progressive motility more than eating often, rarely, and never at all, respectively. This is similar to a cross-sectional study conducted among Rochester Young Men that showed the consumption of a Western dietary pattern that includes reprocessed meat, refined grains and pizza was not associated with sperm count and morphology (60) and it is consistent with a case-control study that showed the reprocessed diet, saturated and trans-fatty acids has been associated with an increased risk of asthenozoospermia (58), but it is a contrast to a cross-sectional study conducted in Murcia Region that showed the Western pattern was positively related to the percentage

of morphologically normal sperm and an inverse association to sperm concentration among overweight or obese men (108).

It was also found that there is a statistically significant association between fruit and vegetables and volume (P-value = 0.042) and progressive motility (P-value = 0.015). Otherwise, there is no significant association between fruit and vegetables and other semen parameters. Patients who eat fruit and vegetables always have higher normal progressive motility (53.1%) than those who eat them often, rarely. Although our study showed that those who did not eat fruit at all has the highest percentage of normal progressive motility (70%) which is an unexpected result, we can't depend on this because only 10 patients who don't eat fruit and vegetables in contrast to 156 patients who eat them regardless to the frequency of eating.

This is approved by many studies, a cross-sectional study showed that The 'Prudent' pattern which was characterized by a high intake of chicken, fish, legumes, fruit, vegetables, and whole grains was significantly related to higher progressive sperm motility and unrelated to sperm morphology and concentration (60) and higher intake of skim milk and dark green vegetables has been associated with a lower risk of asthenozoospermia (58). Fruit and vegetables may have an influence on sperm motility because they are high in vitamin B6, folate, and antioxidants including beta carotene, vitamin C, and vitamin E, all of which have a role in increasing sperm quality. Folate can reduce DNA damage by inducing homocysteine remethylation into methionine and trans-sulfuration into cystathionine and cysteine. Homocysteine is a strong oxidative stress factor that disrupts the methylation of lipids, proteins, and DNA, as well as inducing vascular inflammation and apoptosis. Increased reactive oxygen species (ROS) production is linked to oxidative stress, which is negatively connected to sperm concentration and motility (109).

These findings, which were based on diet pattern and sperm quality, add to the growing body of data suggesting diet is a significant modifiable factor of male reproductive capacity. More specifically, these findings suggest that reducing intake of high-sugar foods, processed, canned foods, and increasing intake of fruits and vegetables may have positive effects on sperm quality, in addition to their well-known benefits for the prevention of chronic diseases. These associations suggest the possibility of using

dietary intervention as a potential approach to elevate sperm motility in reproductive-aged men.

### 4.1.4 Influence of drinks on semen quality

Coffee, tea, soft drinks (especially energy drinks), and chocolate all contain caffeine. Caffeine is quickly absorbed by humans, reaching a peak in the bloodstream 15–45 minutes after consumption. Caffeine has a variety of biological effects, including stimulation of the central nervous system, enhanced catecholamine production, smooth muscle relaxation, and heart rate stimulation. It has been shown to have both favorable and harmful health consequences. While a moderate consumption may have a little preventive effect against some illnesses, large quantities might have negative health consequences. The rising use of energy drinks, which are high in caffeine and particularly popular among young people, is of particular concern. The mechanism behind caffeine's potentially detrimental influence on sperm quality is unclear. Caffeine, on the other hand, is thought to affect Sertoli Cells' glycolytic and oxidative profiles, impairing male reproductive capability (64).

It was found that that there is statistically significant association between tea intake and total motility, sperm count and morphology (P value = 0.021, 0.022, 0.01) respectively. Otherwise, there is no significant association between tea intake and other semen parameters (viscosity, volume, liquefaction time, agglutination). As shown in results, the highest percentage of men who have normal sperm count (70.6%) and morphology (75.3%) are those who drink 1-3 cups daily and more than 3 cups will impair the sperm count and morphology. Men who don’t drink tea at all have the highest percentage of normal total motility (60%) followed by 1-3 cups (55.3%). In overall, study participants who drink more than three cups of tea daily may have the higher abnormal total motility, sperm count and morphology. According to coffee intake, our results showed that there is statistically significant association between coffee intake and sperm count (P value = 0.04). Otherwise, there is no significant association between coffee intake and other semen parameters. Men who don’t drink coffee at all have the highest percentage of normal sperm count (76.9%) followed by 1-3 cups (65.2%) and more than 3 cups will decrease sperm count. It was also found that that there is statistically significant association between energy drinks intake and sperm count (P value = 0.041). Otherwise, there is no significant link between energy drinks intake and other semen parameters. Men who drink 3-5 cups of energy drinks weekly have the highest percentage

of normal sperm count (87.5%).

To support our findings and have a big clear picture about the influence of caffeine drinks on semen quality, literature review performed on previous studies. Many previous reports showed that the intake of caffeine may harm the function of the male reproductive system by damaging sperm DNA (61). A previous study revealed no link between caffeine (moderate intake of 800 mg/day) and male sperm quality (62), while another one provided a correlation (63). Semen quality was altered by caffeine-containing soft drinks and cola-containing beverages but not by intake of caffeine from mostly tea, coffee, and cocoa drinks, according to a recent systematic analysis (64). Another meta-analysis study revealed that that drinking coffee seems to have no correlation with sperm abnormalities (110). On the other hand, a case control study showed that the risk of dyspermia elevated with the increase number of cups of coffee drunk daily compared with men drinking no or one cup daily (111).

The majority of published studies found no link between semen characteristics and caffeine intake, at least not caffeine from coffee, tea, or coca beverages. Because there were no formal guidelines for evaluating research on sperm quality until recently, biased data derived from earlier studies with no quality controls may lead to erroneous conclusions. In our study, caffeine amount in a cup of coffee, tea or energy drinks wasn't estimated, and caffeine amount varies between cups depending on method of preparation, cup size, and product brand. In addition, we did not obtain information about the type of tea consumed. Due to all of these factors, we can't get a clear conclusion about drinks effect on semen quality.

### 4.1.5 Influence of antioxidants and vitamins on semen quality

Antioxidants have been investigated as a potential therapeutic for reversing the deleterious consequences of high ROS levels on sperm quality (67). Some antioxidants (zinc, lycopene, vitamin C, vitamin E, cryptoxanthin, selenium, and β-carotene), vitamins (folate and vitamin D), low saturated or trans-fatty acid and omega-3 fatty acids intake have been significantly correlated with high quality to sperm measures (54). Since vitamin D receptor (VDR) expression and metabolizing enzymes of vitamin D were established in spermatozoa and the testis, the crucial role of vitamin D in the reproductive system of men has been hypothesized. Semen and hormone function are both affected by

hypovitaminosis D (66)**.**

There are many studies that reveal the effect of vitamins and antioxidant diet on semen quality, but not all of them have the same conclusion on all semen parameters. A prospective observational study reported a clinically significant association between vitamin D level and sperm count, but no influence on sperm morphology or motility (69). Vitamin D level in serum was positively related to semen volume, sperm count, total motility, and normal morphology after controlling for potential confounders (68). Some studies such as a meta-analysis published in 2019 reported a significant association between only sperm motility or progressive motility and vitamin D, but not for other semen characteristics (70). A cross-sectional study reported a relationship between sperm morphology and motility and higher intakes of lycopene and the carotenoids β-carotene. In addition, moderate β-carotene and vitamin C intakes were associated with the highest concentration, total count, and motility of sperms, but no significant relationship was found between vitamins A and E intakes and any of the parameters of semen (57).

The present study revealed that there is statistically significant relationship between antioxidants and vitamins intake and morphology (P value = 0.024). Otherwise, there is no significant association between antioxidants and vitamins intake and other semen parameters. Participants who don't take vitamins or antioxidants have normal sperm morphology (71.3%) higher than those who take vitamins or antioxidants (53.3%). This is unexpected result and against to what was hypothesized. The type of vitamins or antioxidant, the amount of vitamin intake and frequency of its intake (daily or weekly) weren't determined in this study. These factors may play role in misunderstanding the question so the participants didn't answer accurately. At the same time, some of participants take vitamins without medical prescription and may they don't need for it so this may give results against to previous studies.

## 4.2 Strength points and limitations of study

### 4.2.1 Strength points:

To our best knowledge, this is the first study in Palestinian people to evaluate all of these risk factors or lifestyles, and determine their influences on male semen quality. The study included many laboratories in Nablus where are representative to Nablus area. The study participants were blinded to the study outcome, so preventing potential

bias that may influence their report according to lifestyles. Accurate precise results were obtained to patients because these laboratories used internal quality control to confirm that everything in semen analysis was done well. Professional and qualified lab technicians performed the semen analysis tests keeping the privacy and confidentiality for the patients.

### 4.2.2 Limitations:

This study has several important limitations. Causal inference is limited as the same for all cross-sectional studies, and despite of adjusting many suspected and known confounders, we can't exclude possibility of remaining confounders or chance finding were not representative. Due to the semen analysis is sensitive issue, many patients refused to participate in our study, so small number of study participants were collected. The small size number of subjects in each group makes it difficult to draw concrete conclusion, and a larger number may be necessary for such purpose. The clinical data of the presence of varicocele in the patients is lacking, so we don't sure that they have or not the varicocele disorder. The main outcome of our study was to determine if there is an association between smoking and some lifestyles on male semen quality in Nablus district in a cross-sectional way, to better understand the actual role of these factors in our region. Surely, a longitudinal study design and follow-up of patients for more long periods will provide us more information.

## 4.3 Recommendations and Conclusion

### 4.3.1 Recommendations

- It is recommended to make further studies or research with larger sample size, according to diet effect on semen quality.
- It is recommended to eat healthy food (fruit and vegetables), preventing high sugar intake and processed food.
- It is recommended to drink 1-3 cups of tea not more than 3 cups to have better semen quality.
- Although 3-5 cups weekly of energy drinks have better normal sperm count, it is recommended to drink moderately because excessive amounts of energy drinks adversely affect the health and causes diseases.
- In further studies, it is recommended to make physical examination to patients to

accurately exclude the varicocele.

- Determine the type of tea and exactly caffeine amount found in tea, coffee, energy drinks.

### 4.3.2 Conclusion

The seminal fluid analysis determines the quality of semen as seminal density, sperm count, morphology, and motility. It is the most crucial stage and diagnostic technique to determine fertility. Waterpipe smoking and lifestyles (using drinks like energy drinks, coffee and tea intake, nature of food as high sugar intake, processed and canned food, and fruit and vegetables, obesity, antioxidant and vitamin intake) may affect semen quality (agglutination, liquefaction time, sperm count, motility, and morphology).

# List of abbreviations

| Abbreviation | Meaning |
|---|---|
| ACE2 | Angiotensin-converting enzyme 2 |
| BMI | Body mass index |
| BPA | Bisphenol A |
| DASH | Dietary Approaches to Stop Hypertension |
| DNA | Deoxyribonucleic acid |
| EDCs | Endocrine-disrupting chemicals |
| EMR | Electromagnetic radiation. |
| etc. | Et cetera |
| FSH | Follicle-Stimulating Hormone. |
| GnRH | Gonadotropin-releasing hormone. |
| IRB | Institutional Review Board |
| LH | Luteinizing hormone |
| N | Population size |
| $NO_2$ | Nitrogen dioxide |
| OR | Odds ratio |
| OP | Organophosphate |
| PAH | Polycyclic aromatic hydrocarbons |
| PCBs | Polychlorinated biphenyls |
| ROS | Reactive oxygen species |
| RR | Relative ratio |
| SC | Sertoli cells |
| $SO_2$ | Sulfur dioxide |
| SPSS | Statistical package for social science |
| T | Testosterone |
| TSN | Total sperm number |
| VDR | Vitamin D receptor |
| WHO | World Health Organization |
| WP | Waterpipe |
| WTS | Waterpipe tobacco smoke |

# References


[1] Zambrano Serrano CA, Carvajal Obando A. Diagnosis and hormonal treatment of male infertility. Actas Urológicas Españolas (English Ed [Internet]. 2020;44(5):321–7. Available from: http://dx.doi.org/10.1016/j.acuroe.2020.05.007

[2] Boivin J, Bunting L, Collins JA, Nygren KG. International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care. Hum Reprod. 2007 Jun;22(6):1506–12.

[3] Definitions of infertility and recurrent pregnancy loss. Fertil Steril. 2008 Nov;90(5 SUPPL.):S60.

[4] Briceag I, Costache A, Purcarea VL, Cergan R, Dumitru M, Briceag I, et al. Fallopian tubes--literature review of anatomy and etiology in female infertility. J Med Life [Internet]. 2015;8(2):129–31. Available from: https://pubmed.ncbi.nlm.nih.gov/25866566

[5] Galdon G, Atala A, Sadri-Ardekani H. In Vitro Spermatogenesis: How Far from Clinical Application? Curr Urol Rep. 2016 Jul;17(7):49.

[6] Behboudi-Gandevani S, Bidhendi-Yarandi R, Panahi MH, Vaismoradi M. A Systematic Review and Meta-Analysis of Male Infertility and the Subsequent Risk of Cancer. Front Oncol [Internet]. 2021 Oct 14;11:696702. Available from: https://pubmed.ncbi.nlm.nih.gov/34722244

[7] Agarwal A, Baskaran S, Parekh N, Cho C-L, Henkel R, Vij S, et al. Male infertility. Lancet (London, England). 2021 Jan;397(10271):319–33.

[8] Kumar N, Singh AK. Trends of male factor infertility, an important cause of infertility: A review of literature. J Hum Reprod Sci [Internet]. 2015;8(4):191–6. Available from: https://pubmed.ncbi.nlm.nih.gov/26752853

[9] Plachot M, Belaisch-Allart J, Mayenga J-M, Chouraqui A, Tesquier L, Serkine AM. Outcome of conventional IVF and ICSI on sibling oocytes in mild male factor infertility. Hum Reprod. 2002 Feb;17(2):362–9.

[10] Issa Y, Sallmén M, Nijem K, Bjertness E, Kristensen P. Fecundability among newly married couples in agricultural villages in Palestine: a prospective study. Hum Reprod. 2010 Aug;25(8):2132–8.

[11] Vander Borght M, Wyns C. Fertility and infertility: Definition and epidemiology. Clin Biochem. 2018 Dec;62:2–10.

[12] Babakhanzadeh E, Nazari M, Ghasemifar S, Khodadadian A. Some of the Factors Involved in Male Infertility: A Prospective Review. Int J Gen Med [Internet]. 2020 Feb 5;13:29–41. Available from: https://pubmed.ncbi.nlm.nih.gov/32104049

[13] Rahban R, Nef S. Regional difference in semen quality of young men: a review on the implication of environmental and lifestyle factors during fetal life and adulthood. Basic Clin Androl [Internet]. 2020 Oct 15;30:16. Available from: https://pubmed.ncbi.nlm.nih.gov/33072332

[14] Esteves SC, Agarwal A. Novel concepts in male infertility. Int Braz J Urol. 2011;37(1):5–15.

[15] O'Hara L, Smith LB. Androgen receptor roles in spermatogenesis and infertility. Best Pract Res Clin Endocrinol Metab. 2015 Aug;29(4):595–605.

[16] McLachlan RI, O'Donnell L, Meachem SJ, Stanton PG, de Kretser DM, Pratis K, et al. Identification of specific sites of hormonal regulation in spermatogenesis in rats, monkeys, and man. Recent Prog Horm Res. 2002;57:149–79.

[17] Oduwole OO, Huhtaniemi IT, Misrahi M. The Roles of Luteinizing Hormone, Follicle-Stimulating Hormone and Testosterone in Spermatogenesis and Folliculogenesis Revisited. Int J Mol Sci [Internet]. 2021 Nov 25;22(23):12735. Available from: https://pubmed.ncbi.nlm.nih.gov/34884539

[18] Esteves SC, Zini A, Aziz N, Alvarez JG, Sabanegh ESJ, Agarwal A. Critical appraisal of World Health Organization's new reference values for human semen characteristics and effect on diagnosis and treatment of subfertile men. Urology. 2012 Jan;79(1):16–22.

[19] Bae J, Kim S, Chen Z, Eisenberg ML, Buck Louis GM. Human semen quality and the secondary sex ratio. Asian J Androl [Internet]. 2017;19(3):374–81. Available from: https://pubmed.ncbi.nlm.nih.gov/26975484

[20] Tang Q, Pan F, Wu X, Nichols CE, Wang X, Xia Y, et al. Semen quality and cigarette smoking in a cohort of healthy fertile men. Environ Epidemiol (Philadelphia, Pa) [Internet]. 2019 Aug 13;3(4):e055–e055. Available from: https://pubmed.ncbi.nlm.nih.gov/31538136

[21] Balawender K, Orkisz S. The impact of selected modifiable lifestyle factors on male fertility in the modern world. Cent Eur J Urol [Internet]. 2020/10/10. 2020;73(4):563–8. Available from: https://pubmed.ncbi.nlm.nih.gov/33552585

[22] Brugo-Olmedo S, Chillik C, Kopelman S. Definition and causes of infertility. Reprod Biomed Online. 2001;2(1):41–53.

[23] Haik MY, Ashour AA, Alahmad YFM, Al-Ishaq FA, Saad MM, Hussein MM, et al. Water-pipe smoking and serum testosterone levels in adult males in Qatar. Tob Induc Dis [Internet]. 2019 Mar 13;17:19. Available from: https://pubmed.ncbi.nlm.nih.gov/31582930

[24] Shihadeh A, Saleh R. Polycyclic aromatic hydrocarbons, carbon monoxide, "tar", and nicotine in the mainstream smoke aerosol of the narghile water pipe. Food Chem Toxicol an Int J Publ Br Ind Biol Res Assoc. 2005 May;43(5):655–61.

[25] Harlev A, Agarwal A, Gunes SO, Shetty A, du Plessis SS. Smoking and Male Infertility: An Evidence-Based Review. World J Mens Health [Internet]. 2015/12/23. 2015 Dec;33(3):143–60. Available from: https://pubmed.ncbi.nlm.nih.gov/26770934

[26] Maziak W, Ward KD, Afifi Soweid RA, Eissenberg T. Tobacco smoking using a waterpipe: a re-emerging strain in a global epidemic. Tob Control. 2004 Dec;13(4):327–33.

[27] Jawad M, Charide R, Waziry R, Darzi A, Ballout RA, Akl EA. The prevalence and trends of waterpipe tobacco smoking: A systematic review. PLoS One.

2018;13(2):e0192191.

[28] Cui X, Jing X, Wu X, Wang Z, Li Q. Potential effect of smoking on semen quality through DNA damage and the downregulation of Chk1 in sperm. Mol Med Rep [Internet]. 2016/05/20. 2016 Jul;14(1):753–61. Available from: https://pubmed.ncbi.nlm.nih.gov/27221653

[29] Haque O, Vitale JA, Agarwal A, du Plessis SS. The Effect of Smoking on Male Infertility BT - Male Infertility: A Complete Guide to Lifestyle and Environmental Factors. In: du Plessis SS, Agarwal A, Sabanegh Edmund S. J, editors. New York, NY: Springer New York; 2014. p. 19–30. Available from: https://doi.org/10.1007/978-1-4939-1040-3_2

[30] Asare-Anane H, Bannison SB, Ofori EK, Ateko RO, Bawah AT, Amanquah SD, et al. Tobacco smoking is associated with decreased semen quality. Reprod Health [Internet]. 2016 Aug 5;13(1):90. Available from: https://pubmed.ncbi.nlm.nih.gov/27496053

[31] Rehman R, Zahid N, Amjad S, Baig M, Gazzaz ZJ. Relationship Between Smoking Habit and Sperm Parameters Among Patients Attending an Infertility Clinic [Internet]. Vol. 10, Frontiers in Physiology . 2019. Available from: https://www.frontiersin.org/article/10.3389/fphys.2019.01356

[32] Yang H, Chen Q, Zhou N, Sun L, Bao H, Tan L, et al. Lifestyles Associated With Human Semen Quality: Results From MARHCS Cohort Study in Chongqing, China. Medicine (Baltimore) [Internet]. 2015 Jul;94(28):e1166–e1166. Available from: https://pubmed.ncbi.nlm.nih.gov/26181561

[33] Li Y, Lin H, Li Y, Cao J. Association between socio-psycho-behavioral factors and male semen quality: Systematic review and meta-analyses. Fertil Steril [Internet]. 2011;95(1):116–23. Available from: http://dx.doi.org/10.1016/j.fertnstert.2010.06.031

[34] Sharma R, Harlev A, Agarwal A, Esteves SC. Cigarette Smoking and Semen Quality: A New Meta-analysis Examining the Effect of the 2010 World Health Organization Laboratory Methods for the Examination of Human Semen. Eur

Urol [Internet]. 2016 Oct;70(4):635–45. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0302283816300690

[35] Jeng HA, Chen Y-L, Kantaria KN. Association of cigarette smoking with reproductive hormone levels and semen quality in healthy adult men in Taiwan. J Environ Sci Heal Part A, Toxic/hazardous Subst Environ Eng. 2014;49(3):262–8.

[36] Povey AC, Clyma J-A, McNamee R, Moore HD, Baillie H, Pacey AA, et al. Modifiable and non-modifiable risk factors for poor semen quality: a case-referent study. Hum Reprod [Internet]. 2012 Sep 1;27(9):2799–806. Available from: https://academic.oup.com/humrep/article-lookup/doi/10.1093/humrep/des183

[37] Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity Among Adults and Youth: United States, 2015-2016. NCHS Data Brief. 2017 Oct;(288):1–8.

[38] Barratt CLR, Björndahl L, De Jonge CJ, Lamb DJ, Osorio Martini F, McLachlan R, et al. The diagnosis of male infertility: an analysis of the evidence to support the development of global WHO guidance-challenges and future research opportunities. Hum Reprod Update [Internet]. 2017 Nov 1;23(6):660–80. Available from: https://pubmed.ncbi.nlm.nih.gov/28981651

[39] Sermondade N, Faure C, Fezeu L, Shayeb AG, Bonde JP, Jensen TK, et al. BMI in relation to sperm count: an updated systematic review and collaborative meta-analysis. Hum Reprod Update. 2013;19(3):221–31.

[40] Oliveira JBA, Petersen CG, Mauri AL, Vagnini LD, Renzi A, Petersen B, et al. Association between body mass index and sperm quality and sperm DNA integrity. A large population study. Andrologia. 2018;50(3):1–10.

[41] Zhong O, Ji L, Wang J, Lei X, Huang H. Association of diabetes and obesity with sperm parameters and testosterone levels: a meta-analysis. Diabetol Metab Syndr [Internet]. 2021 Oct 16;13(1):109. Available from: https://pubmed.ncbi.nlm.nih.gov/34656168

[42] MacDonald AA, Herbison GP, Showell M, Farquhar CM. The impact of body mass index on semen parameters and reproductive hormones in human males: a systematic review with meta-analysis. Hum Reprod Update. 2010;16(3):293–311.

[43] Campbell JM, Lane M, Owens JA, Bakos HW. Paternal obesity negatively affects male fertility and assisted reproduction outcomes: a systematic review and meta-analysis. Reprod Biomed Online. 2015 Nov;31(5):593–604.

[44] Guo D, Wu W, Tang Q, Qiao S, Chen Y, Chen M, et al. The impact of BMI on sperm parameters and the metabolite changes of seminal plasma concomitantly. Oncotarget [Internet]. 2017 Jul 25;8(30):48619–34. Available from: https://pubmed.ncbi.nlm.nih.gov/28159940

[45] Okechukwu CE. Does the Use of Mobile Phone Affect Male Fertility? A Mini-Review. J Hum Reprod Sci [Internet]. 2020/10/27. 2020;13(3):174–83. Available from: https://pubmed.ncbi.nlm.nih.gov/33311902

[46] Agarwal A, Singh A, Hamada A, Kesari K. Cell phones and male infertility: a review of recent innovations in technology and consequences. Int Braz J Urol. 2011;37(4):432–54.

[47] Challis LJ. Mechanisms for interaction between RF fields and biological tissue. Bioelectromagnetics. 2005;Suppl 7:S98–106.

[48] Kesari KK, Agarwal A, Henkel R. Radiations and male fertility. Reprod Biol Endocrinol. 2018 Dec;16(1):118.

[49] Verón GL, Tissera AD, Bello R, Beltramone F, Estofan G, Molina RI, et al. Impact of age, clinical conditions, and lifestyle on routine semen parameters and sperm kinematics. Fertil Steril. 2018;110(1):68-75.e4.

[50] Agarwal A, Deepinder F, Sharma RK, Ranga G, Li J. Effect of cell phone usage on semen analysis in men attending infertility clinic: an observational study. Fertil Steril. 2008 Jan;89(1):124–8.

[51] Avendaño C, Mata A, Sanchez Sarmiento CA, Doncel GF. Use of laptop computers connected to internet through Wi-Fi decreases human sperm motility

and increases sperm DNA fragmentation. Fertil Steril. 2012 Jan;97(1):39-45.e2.

[52] Rodprasert W, Toppari J, Virtanen HE. Endocrine Disrupting Chemicals and Reproductive Health in Boys and Men. Front Endocrinol (Lausanne) [Internet]. 2021 Oct 7;12:706532. Available from: https://pubmed.ncbi.nlm.nih.gov/34690925

[53] Manikandan I, Bora S, Adole PS, Thyagaraju C, Nachiappa Ganesh R. Assessment of Organophosphate Pesticides Exposure in Men with Idiopathic Abnormal Semen Analysis: A Cross-Sectional Pilot Study. Int J Fertil Steril [Internet]. 2021/06/22. 2021 Jul;15(3):219–25. Available from: https://pubmed.ncbi.nlm.nih.gov/34155869

[54] Salas-Huetos A, Bulló M, Salas-Salvadó J. Dietary patterns, foods and nutrients in male fertility parameters and fecundability: a systematic review of observational studies. Hum Reprod Update. 2017 Jul;23(4):371–89.

[55] Giahi L, Mohammadmoradi S, Javidan A, Sadeghi MR. Nutritional modifications in male infertility: a systematic review covering 2 decades. Nutr Rev. 2016 Feb;74(2):118–30.

[56] Salas-Huetos A, James ER, Aston KI, Jenkins TG, Carrell DT. Diet and sperm quality: Nutrients, foods and dietary patterns. Reprod Biol. 2019 Sep;19(3):219–24.

[57] Zareba P, Colaci DS, Afeiche M, Gaskins AJ, Jørgensen N, Mendiola J, et al. Semen quality in relation to antioxidant intake in a healthy male population. Fertil Steril. 2013 Dec;100(6):1572–9.

[58] Eslamian G, Amirjannati N, Rashidkhani B, Sadeghi M-R, Hekmatdoost A. Nutrient patterns and asthenozoospermia: a case-control study. Andrologia. 2017 Apr;49(3).

[59] Danielewicz A, Morze J, Przybyłowicz M, Przybyłowicz KE. Association of the Dietary Approaches to Stop Hypertension, Physical Activity, and Their Combination with Semen Quality: A Cross-Sectional Study. Nutrients [Internet].

2019 Dec 22;12(1):39. Available from: https://pubmed.ncbi.nlm.nih.gov/31877862

[60] Gaskins AJ, Colaci DS, Mendiola J, Swan SH, Chavarro JE. Dietary patterns and semen quality in young men. Hum Reprod. 2012 Oct;27(10):2899–907.

[61] Durairajanayagam D. Lifestyle causes of male infertility. Arab J Urol [Internet]. 2018 Feb 13;16(1):10–20. Available from: https://pubmed.ncbi.nlm.nih.gov/29713532

[62] Jensen TK, Swan SH, Skakkebaek NE, Rasmussen S, Jørgensen N. Caffeine intake and semen quality in a population of 2,554 young Danish men. Am J Epidemiol. 2010 Apr;171(8):883–91.

[63] Belloc S, Cohen-Bacrie M, Dalleac A, Amar E, Hazout A, de Mouzon J. Caffeine intake and sperm parameters. Analysis of a cohort of 4474 consecutive semen samples. Fertil Steril. 2013;100(3):S212.

[64] Ricci E, Viganò P, Cipriani S, Somigliana E, Chiaffarino F, Bulfoni A, et al. Coffee and caffeine intake and male infertility: a systematic review. Nutr J [Internet]. 2017 Jun 24;16(1):37. Available from: https://pubmed.ncbi.nlm.nih.gov/28646871

[65] Borel P, Caillaud D, Cano NJ. Vitamin D bioavailability: state of the art. Crit Rev Food Sci Nutr. 2015;55(9):1193–205.

[66] Cito G, Cocci A, Micelli E, Gabutti A, Russo GI, Coccia ME, et al. Vitamin D and Male Fertility: An Updated Review. World J Mens Health [Internet]. 2019/05/17. 2020 Apr;38(2):164–77. Available from: https://pubmed.ncbi.nlm.nih.gov/31190482

[67] Ross C, Morriss A, Khairy M, Khalaf Y, Braude P, Coomarasamy A, et al. A systematic review of the effect of oral antioxidants on male infertility. Reprod Biomed Online. 2010 Jun;20(6):711–23.

[68] Hajianfar H, Karimi E, Mollaghasemi N, Rezaei S, Arab A. Is there a relationship between serum vitamin D and semen parameters? A cross-sectional sample of the

Iranian infertile men. Basic Clin Androl [Internet]. 2021 Dec 2;31(1):29. Available from: https://pubmed.ncbi.nlm.nih.gov/34852757

[69] Jueraitetibaike K, Ding Z, Wang D-D, Peng L-P, Jing J, Chen L, et al. The effect of vitamin D on sperm motility and the underlying mechanism. Asian J Androl. 2019;21(4):400–7.

[70] Arab A, Hadi A, Moosavian SP, Askari G, Nasirian M. The association between serum vitamin D, fertility and semen quality: A systematic review and meta-analysis. Int J Surg. 2019 Nov;71:101–9.

[71] De Cosmi V, Parazzini F, Agostoni C, Noli S, Cipriani S, La Vecchia I, et al. Antioxidant Vitamins and Carotenoids Intake and the Association With Poor Semen Quality: A Cross-Sectional Analysis of Men Referring to an Italian Fertility Clinic. Front Nutr [Internet]. 2021 Oct 4;8:737077. Available from: https://pubmed.ncbi.nlm.nih.gov/34671631

[72] Pedersen BK, Saltin B. Exercise as medicine - evidence for prescribing exercise as therapy in 26 different chronic diseases. Scand J Med Sci Sports. 2015 Dec;25 Suppl 3:1–72.

[73] Blay RM, Pinamang AD, Sagoe AE, Owusu EDA, Koney NK-K, Arko-Boham B. Influence of Lifestyle and Environmental Factors on Semen Quality in Ghanaian Men. Int J Reprod Med [Internet]. 2020 Oct 21;2020:6908458. Available from: https://pubmed.ncbi.nlm.nih.gov/33150165

[74] Foucaut A-M, Faure C, Julia C, Czernichow S, Levy R, Dupont C, et al. Sedentary behavior, physical inactivity and body composition in relation to idiopathic infertility among men and women. PLoS One [Internet]. 2019 Apr 24;14(4):e0210770–e0210770. Available from: https://pubmed.ncbi.nlm.nih.gov/31017887

[75] Priskorn L, Jensen TK, Bang AK, Nordkap L, Joensen UN, Lassen TH, et al. Is Sedentary Lifestyle Associated With Testicular Function? A Cross-Sectional Study of 1,210 Men. Am J Epidemiol. 2016 Aug;184(4):284–94.

[76] Best JC, Kuchakulla M, Khodamoradi K, Lima TFN, Frech FS, Achua J, et al. Evaluation of SARS-CoV-2 in Human Semen and Effect on Total Sperm Number: A Prospective Observational Study. World J Mens Health [Internet]. 2021/02/24. 2021 Jul;39(3):489–95. Available from: https://pubmed.ncbi.nlm.nih.gov/33663031

[77] Moshrefi M, Ghasemi-Esmailabad S, Ali J, Findikli N, Mangoli E, Khalili MA. The probable destructive mechanisms behind COVID-19 on male reproduction system and fertility. J Assist Reprod Genet [Internet]. 2021/05/11. 2021 Jul;38(7):1691–708. Available from: https://pubmed.ncbi.nlm.nih.gov/33977466

[78] Gupta A, Madhavan M V, Sehgal K, Nair N, Mahajan S, Sehrawat TS, et al. Extrapulmonary manifestations of COVID-19. Nat Med. 2020 Jul;26(7):1017–32.

[79] Guo T-H, Sang M-Y, Bai S, Ma H, Wan Y-Y, Jiang X-H, et al. Semen parameters in men recovered from COVID-19. Asian J Androl [Internet]. 2021;23(5):479–83. Available from: https://pubmed.ncbi.nlm.nih.gov/33975987

[80] Pazir Y, Eroglu T, Kose A, Bulut TB, Genc C, Kadihasanoglu M. Impaired semen parameters in patients with confirmed SARS-CoV-2 infection: A prospective cohort study. Andrologia [Internet]. 2021/07/15. 2021 Oct;53(9):e14157–e14157. Available from: https://pubmed.ncbi.nlm.nih.gov/34268784

[81] Lewis SEM, Esteves SC. What does a varicocele do to a man's fertility? There is much more than meets the eye. Int Braz J Urol [Internet]. 2021;47(2):284–6. Available from: https://pubmed.ncbi.nlm.nih.gov/33284533

[82] Gill K, Kups M, Harasny P, Machalowski T, Grabowska M, Lukaszuk M, et al. The Negative Impact of Varicocele on Basic Semen Parameters, Sperm Nuclear DNA Dispersion and Oxidation-Reduction Potential in Semen. Int J Environ Res Public Health [Internet]. 2021 Jun 2;18(11):5977. Available from: https://pubmed.ncbi.nlm.nih.gov/34199549

[83] Agarwal A, Sharma R, Harlev A, Esteves SC. Effect of varicocele on semen characteristics according to the new 2010 World Health Organization criteria: a systematic review and meta-analysis. Asian J Androl [Internet]. 2016;18(2):163–

70. Available from: https://pubmed.ncbi.nlm.nih.gov/26780872

[84] Redmon JB, Drobnis EZ, Sparks A, Wang C, Swan SH. Semen and reproductive hormone parameters in fertile men with and without varicocele. Andrologia [Internet]. 2019/08/25. 2019 Nov;51(10):e13407–e13407. Available from: https://pubmed.ncbi.nlm.nih.gov/31448444

[85] Kumar N, Singh AK. Impact of environmental factors on human semen quality and male fertility: a narrative review. Environ Sci Eur [Internet]. 2022;34(1):6. Available from: https://doi.org/10.1186/s12302-021-00585-w

[86] Zhou Y, Meng T, Wu L, Duan Y, Li G, Shi C, et al. Association between ambient temperature and semen quality: A longitudinal study of 10 802 men in China. Environ Int [Internet]. 2020;135:105364. Available from: https://www.sciencedirect.com/science/article/pii/S0160412019315193

[87] Mao H, Feng L, Yang W-X. Environmental factors contributed to circannual rhythm of semen quality. Chronobiol Int [Internet]. 2017 Mar 16;34(3):411–25. Available from: https://doi.org/10.1080/07420528.2017.1280046

[88] Mínguez-Alarcón L, Gaskins AJ, Chiu Y-H, Messerlian C, Williams PL, Ford JB, et al. Type of underwear worn and markers of testicular function among men attending a fertility center. Hum Reprod [Internet]. 2018 Sep 1;33(9):1749–56. Available from: https://doi.org/10.1093/humrep/dey259

[89] Zhang J, Cai Z, Ma C, Xiong J, Li H. Impacts of Outdoor Air Pollution on Human Semen Quality: A Meta-Analysis and Systematic Review. Schatten H, editor. Biomed Res Int [Internet]. 2020;2020:7528901. Available from: https://doi.org/10.1155/2020/7528901

[90] Wang X, Tian X, Ye B, Zhang Y, Li C, Liao J, et al. Gaseous pollutant exposure affects semen quality in central China: a cross-sectional study. Andrology. 2020;8(1):117–24.

[91] Rosa M De, Zarrilli S, Paesano L, Carbone U, Boggia B, Petretta M, et al. Traffic pollutants affect fertility in men. Hum Reprod [Internet]. 2003 May 1;18(5):1055–

61. Available from: https://doi.org/10.1093/humrep/deg226

[92] Trochim WM. Descriptive Statistics. Retrieved from Res Methods Knowl Base [Internet]. 2020; Available from: https://conjointly.com/kb/descriptive-statistics/

[93] Select Statistical Services Limited . Population Proportion – Sample Size. Retrieved from Select Statistical Services. 2020.

[94] Thompson, S. K. (2012). Sampling, Third Edition. USA: John Wiley & Sons, Inc.

[95] Dudovskiy, J. (2020, 11 12). Convenience sampling. Retrieved from Business Research Methodology: https://research- methodology.net/sampling-in-primary-data-collection/convenience- sampling/.

[96] Purnell JQ. Definitions, Classification, and Epidemiology of Obesity [Internet]. Endotext [. Feingold KR, Anawalt B, Boyce A et al., editor. Endotext. 2018. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25905390

[97] Sengupta P, Agarwal A, Pogrebetskaya M, Roychoudhury S, Durairajanayagam D, Henkel R. Role of Withania somnifera (Ashwagandha) in the management of male infertility. Reprod Biomed Online. 2018 Mar;36(3):311–26.

[98] Cao XW, Lin K, Li CY, Yuan CW. [A review of WHO Laboratory Manual for the Examination and Processing of Human Semen (5th edition)]. Zhonghua Nan Ke Xue. 2011;17(12):1059–63.

[99] No Title. Available from: https://mes-global.com

[100] Agarwal A, Sharma RK. Automation is the key to standardized semen analysis using the automated SQA-V sperm quality analyzer. Fertil Steril. 2007;87(1):156–62.

[101] Choobineh, Hamid and Sadighi Gilani, Mohamadali and Hassanzadeh, Gholamreza and Saeepour, Narges and Habibi, Masoud and Falahi, Parvin and Rezaeian, Fatemeh and Heydari, Hamed and Shamsi A. Assessment of Socio-Demographic Characteristics of Infertile Men Who Referred to Shariati Hospital, Tehran, Iran. Iran J Obstet Gynecol Infertil. 2017;

[102] Eisenberg ML, Chen Z, Ye A, Buck Louis GM. Relationship between physical occupational exposures and health on semen quality: data from the Longitudinal Investigation of Fertility and the Environment (LIFE) Study. Fertil Steril [Internet]. 2015/03/09. 2015 May;103(5):1271–7. Available from: https://pubmed.ncbi.nlm.nih.gov/25765658

[103] Siddeek B Mar'ie. Evaluation of Significance of Prolonged Liquefaction Time of Semen in Hypofertile Men. Iraqi Postgrad Med J . 2016;15(3):328–33.

[104] Al-Sawalha NA, Almomani BA, Al-Shatnawi SF, Almomani BN. Attitudes and Knowledge of the Harmful Effects of Waterpipe Tobacco Smoking among university students: A study from Jordan. Environ Sci Pollut Res. 2021;28(32):43725–31.

[105] Duits FH, van Wely M, van der Veen F, Gianotten J. Healthy overweight male partners of subfertile couples should not worry about their semen quality. Fertil Steril. 2010 Sep;94(4):1356–9.

[106] Wang E-Y, Huang Y, Du Q-Y, Yao G-D, Sun Y-P. Body mass index effects sperm quality: a retrospective study in Northern China. Asian J Androl [Internet]. 2017;19(2):234–7. Available from: https://pubmed.ncbi.nlm.nih.gov/26732109

[107] Fahed AC, El-Hage-Sleiman A-KM, Farhat TI, Nemer GM. Diet, genetics, and disease: a focus on the middle East and north Africa region. J Nutr Metab. 2012;2012:109037.

[108] Cutillas-Tolín A, Mínguez-Alarcón L, Mendiola J, López-Espín JJ, Jørgensen N, Navarrete-Muñoz EM, et al. Mediterranean and western dietary patterns are related to markers of testicular function among healthy men. Hum Reprod [Internet]. 2015/09/25. 2015 Dec;30(12):2945–55. Available from: https://pubmed.ncbi.nlm.nih.gov/26409012

[109] Eslamian G, Amirjannati N, Rashidkhani B, Sadeghi M-R, Hekmatdoost A. Intake of food groups and idiopathic asthenozoospermia: a case-control study. Hum Reprod. 2012 Nov;27(11):3328–36.

[110] Bu FL, Feng X, Yang XY, Ren J, Cao HJ. Relationship between caffeine intake and infertility: A systematic review of controlled clinical studies. BMC Womens Health. 2020;20(1):1–9.

[111] Parazzini F, Marchini M, Tozzi L, Mezzopane R, Fedele L. Risk factors for unexplained dyspermia in infertile men: a case-control study. Arch Androl. 1993;31(2):105–13.

# Appendices

# Appendix A

# Informed consent

دولـــــة فلســـــطين
جامعة النجاح الوطنية
كلية الدراسات العليا

Palestine
An-Najah National University
Faculty of graduate studies

**استمارة موافقة مسبقة للمشاركة في الدارسة البحثية**

1) **الباحثة:** براء عزيز محمد حسين سلامة وبإشراف الدكتور أمجد عزالدين.
2) **هدف الدراسة:** تهدف هذه الدراسة الى معرفة تأثير التدخين وسلوكيات الحياة الأخرى والعوامل البيئية على جودة السائل المنوَي وبالتالي على الخصوبة عند الرجال في منطقة نابلس من خلال الاستبيانة المرفقة أدناه.
3) **سؤال الدراسة:** هل يوجد هناك علاقة بين أنماط الحياة مثل السمنة، والتدخين، وطبيعة الاكل، واستخدام الأجهزة مثل الحاسوب والتلفونات لفترة طويلة، والتعرض لملوثات أو مواد كيميائية وطبيعة المهنة، مع فحص السائل المنوَي وتأثيرها سواء على عدد أو حركة أو شكل الحيوانات المنوية؟ ويمكن معرفة ذلك من خلال تعبئة الاستبيانة ادناه.
4) **نتائج البحث:** سوف تستخدم نتائج البحث للأغراض العلمية فقط وذلك للحصول على درجة الماجستير في الكيمياء الحيوية السريرية/ جامعه النجاح الوطنية.
5) **طريقة البحث**: تعبئة الاستبيانة ادناه وعمل تحليل لهذه البيانات مع نتائج فحص السائل المنوَي.
6) **المخاطر المتوقعة**: لا يوجد أي مخاطر، حيث ان التعهد والمشاركة في تعبئة الاستبيانة اختياري. المشاركة في هذه الدراسة عبارة عن عمل تطوعي ويمكن الامتناع او الانسحاب عن المشاركة في أي وقت من دون ذكر الأسباب وبدون أي التزامات أو فقدان مزايا.
7) **الاستفادة المتوقعة للمشاركين:** ليست هناك فائدة مباشرة للمشاركين في هذه الدراسة ولكن قد يساعد في معرفة تـأثير أنماط الحياة على فحص السائل المنوي مما يدفع الرجال للتقليل من / الامتناع عن بعض السلوكيات التي تؤثر على الفحص وبالتالي امكانية عمل برامج وقاية في المستقبل للتقليل من هذه التأثيرات وتحسين وضع الخصوبة عند الرجال.
8) **السرية واحترام الخصوصية:** المعلومات سوف تستخدم لأغراض البحث العلمي فقط بما يضمن الحفاظ على الخصوصية والسرية التامة بحيث لا يكون هناك أي إزعاج للمشاركين. وأي استفسار او سؤال له علاقة بهذه الدراسة يمكن للشخص المشارك مراجعة الدكتور أمجد عز الدين (0599651641) وكما يحق لاي مشارك رفض دخول الدراسة في اي وقت من الدراسة. **كل المعلومات التي سوف يتم الحصول عليها من هذا الاستبيان هي سريه وليست للنشر.** شاكرين لكم مشاركتكم وتعاونكم البناء لما فيه من الخير.

موافقة المشارك: ..... تاريخ الإجابة: .....

# Appendix B

# Self-administered questionnaire

## الاستبيانة

### 1. أسئلة عامة:

ضع إشارة X او √ في المكان المخصص:

| | | | | | | |
|---|---|---|---|---|---|---|
| الاسم (اختياري): | _____ | | | | | |
| العمر (بالسنوات): | ☐ ≥ 20 | ☐ 21-30 | ☐ 31-40 | ☐ 41-50 | ☐ 51-60 | ☐ 60< |
| منطقة السكن: | ☐ مدينة | ☐ قرية | ☐ مخيم | | | |
| كم مدة السكن: | _____ | | | | | |
| مكان الإقامة: | ☐ محافظة نابلس | ☐ غير ذلك، ---------- | | | | |
| الوزن: | _____ | | | | | |
| الطول: | _____ | | | | | |
| الحالة الاجتماعية: | ☐ أعزب<br>☐ مطلق | ☐ متزوج، كم مضى على زواجك؟ _____<br>☐ أرمل | | | | |
| عدد أفراد الاسرة: | _____ | | | | | |
| المهنة: | العمل الحالي؟ ---------- منذ ----------<br>العمل السابق؟ ---------- مدة العمل السابق؟ ---------- | | | | | |
| مكان العمل: | _____ | | | | | |
| معدل دخل الأسرة الشهري (بالشيقل ): | ☐ اقل من 1500 | ☐ 1500 -3500 | ☐ 3501 -7000 | ☐ 7000 < | | |

2. الأسئلة التالية متعلقة بالحالة الصحية والسلوكية النفسية والعوامل البيئية للمتطوع/ المشارك، ضع إشارة X أو √ في المكان المخصص:

| أ. الطبيعة او العادات الغذائية: | | | | |
|---|---|---|---|---|
| | دائما | بتاتا | احيانا | نادرا |
| 1- الاكثار من تناول المأكولات التي تحتوي على كميات عالية من السكر. | □ | □ | □ | □ |
| 2- الاكثار من تناول المأكولات التي تحتوي على كميات كبيرة من الشحوم. | □ | □ | □ | □ |
| 3- تناول الوجبات السريعة. | □ | □ | □ | □ |
| 4- الاكثار من تناول المعلبات والمصلحات. | □ | □ | □ | □ |
| 5- تناول الخضار والفواكه. | □ | □ | □ | □ |
| 6- تناول الشاي يوميا. | □ لا | □1-3 كوب | □ 3-5 كوب | □ 5< كوب |
| 7- تناول القهوة يوميا. | □ لا | □1-3 كوب | □ 3-5 كوب | □ 5< كوب |
| 8- استخدام المشروبات أسبوعيا. | مشروبات الطاقة<br>□ لا □1-3 كوب<br>□ 3-5كوب □ 5< كوب | | مشروبات الكولا او السيرايت<br>□ لا □1-3 كوب<br>□ 3-5كوب □ 5< كوب | |

| ب. السلوكيات والعوامل البيئية: | | | | |
|---|---|---|---|---|
| | دائما | بتاتا | أحيانا | نادرا |
| 9- ارتداء الملابس او البطلونات الضيقة. | ☐ | ☐ | ☐ | ☐ |
| 10- التعرض بشكل مباشر للإشعاعات، مثل العمل في مركز أشعة او عمل صور أشعة كثيرا. | ☐ | ☐ | ☐ | ☐ |
| 11- تعرض جسمك للحرارة العالية، مثل العمل بقرب مخبز أو فرن. | ☐ | ☐ | ☐ | ☐ |
| 12- التعرض للمبيدات الحشرية أو المواد الكيميائية. | المبيدات الحشرية<br>☐ لا ☐ أحيانا<br>☐ نعم، اذكر اسمه ------ | | المواد الكيميائية<br>☐ لا ☐ أحيانا<br>☐ نعم، اذكر اسمه ------ | |
| 13- ممارسة التمارين الرياضية أو الاعمال اليدوية الشاقة. | ☐ | ☐ | ☐ | ☐ |
| 14- كم مدة استخدام الجوال اللاسلكي او اللابتوب؟ | ☐ < 4 ساعات | ☐ > 4 ساعات | | |
| 15- كم مسافة المسكن أو العمل عن أقرب برج اتصالات؟ | ---------- | | | |
| 16- كم المدة التي تقضيها في وضعية الجلوس؟ | ☐ < 4 ساعات | ☐ > 4 ساعات | | |
| 17- اثناء النوم، المسافة بينك وبين الجوال (بالسنتيمتر). | ☐ أقل من 50 سم | ☐50-150 | | ☐ >150 |
| 18- عندما تقود السيارة، اين تضع الجوال؟ | ☐ في جيب بنطالك | ☐ أسفل فخذك | | ☐ في مكان الشحن |
| 19- هل تدخن؟ | غير مدخن | مدخن سابقا، المدة ------ | | مدخن حاليا، المدة ------ |
| 20- كم عدد السجائر التي كنت تدخنها سابقا او تدخنها حاليا يوميا؟ | ☐ < 10 | ☐ 10-20 | | ☐ >20 |
| 21- هل تدخن النرجيلة (الشيشة)؟ | ☐ لا | ☐ نعم، معدل التدخين (إذا نعم) ---------- | | |
| 22- هل تسكن بالقرب من المصانع او المنشآت الصناعية؟ | ☐ لا | ☐ نعم، 1. ما اسم المصنع أو المنطقة؟ ----------<br>2.كم يبعد المصنع عن مكان السكن؟ ----------<br>3.كم مدة السكن؟ ---------- | | |

| ج – الحالة الصحية والسلوكية النفسية: | | |
|---|---|---|
| 23- هل يوجد مرض وراثي بالعائلة؟ | ☐ لا | ☐ نعم، ما صلة القرابة؟ _____ |
| 24- هل يوجد مشاكل او امراض نفسية لدى أحد افراد العائلة؟ | ☐ نعم | ☐ لا |
| 25- هل يوجد حالات اجهاض في العائلة؟ | ☐ لا | ☐ نعم، كم عدد الحالات الإجهاض؟ ---------- |
| 26- هل يوجد مشاكل العقم في العائلة؟ | ☐ نعم | ☐ لا |
| 27- مشاكل الانجاب: | ☐ نعم | ☐ لا |
| 28- الحالة النفسية: | ☐ طبيعية تماما ☐ احباط او اكتئاب ☐ الحزن<br>☐ القلق ☐ غير ذلك _____<br>إذا خضعت للعلاج اذكر اسماء العلاجات او الادوية: _____ | |
| 29- الامراض المزمنة؟ | ☐ السكري ☐ الضغط ☐ الدهنيات<br>☐ لا يوجد ☐ غير ذلك _____<br>اذكر اسماء العلاجات او الادوية: ---------- | |
| 30- هل سبق وان شخصت بامراض؟ | ☐ القلب ☐ الكبد ☐ الكلى ☐ القولون العصبي ☐ لا ☐ غير ذلك | |
| 31- هل عانيت/ تعاني من دوالي الخصية؟ | ☐ لا | ☐ نعم حاليا ☐ نعم في السابق |
| 31 – إذا كانت الإجابة نعم للسؤال السابق، فهل قمت بالعلاج؟ | ☐ نعم | ☐ لا |
| 32 – هل اصبت بفيروس كورونا؟ | ☐ نعم | ☐ لا هل تاقيت اللقاح او الطعم؟ ---------- |
| 33 – هل تتناول ادوية مضادات الاكسدة مثل الفيتامينات؟ | ☐ لا | ☐ نعم، اذكر اسم الفيتامين ---------- |
| 35 – هل تستخدم المنشطات الجنسية (صناعية او طبيعية)؟ | ☐ لا | ☐ نعم، النوع؟ ---------- |
| 34 – هل تعالج او تستخدم الأعشاب الطبيعية مثل الزنجبيل والمرمية والنعنع؟ | ☐ لا | ☐ نعم، كم كوب يوميا؟ ---------- |

# Appendix C

# Approval from Faculty of Graduate Studies


An-Najah
National University
Faculty of Graduate Studies
Dean's Office

جامعة
النجـــاح الوطنية
كلية الدراسات العليا
مكتب العميد


التاريخ: 2021/10/14

حضرة الدكتور اياد العلي المحترم
منسق برنامج ماجستير الكيمياء الحيوية السريرية

تحية طيبة وبعد،

***الموضوع: الموافقة على عنوان الاطروحة وتحديد المشرف***

قرر مجلس كلية الدراسات العليا في جلسته رقم (410) المنعقدة بتاريخ 2021/10/7، الموافقة على مشروع الأطروحة المقدم من الطالب/ة براء عزيز محمد سلامة، رقم التسجيل 12053086، تخصص ماجستير الكيمياء الحيوية السريرية، عنوان الأطروحة:

**تأثير التدخين وسلوكيات الحياة الأخرى على جودة السائل المنوي عند الرجال في محافظة نابلس: دراسة مقطعية**
**The Influence of Smoking and other Life Styles on Male Semen Quality in Nablus Governorate: A Cross-Sectional Study**

**بإشراف: د. امجد عز الدين**

***ملاحظة: لاعتماد الأطروحة وتسجيلها على الفصل الاول 2022/2021.***

***يرجى اعلام المشرف والطالب بضرورة تسجيل الاطروحة خلال اسبوعين من تاريخ اصدار الكتاب. وفي حال عدم تسجيل الطالب/ة للاطروحة في الفترة المحددة له/ا ستقوم كلية الدراسات العليا بإلغاء اعتماد العنوان والمشرف***

وتفضلوا بقبول وافر الاحترام ،،،

عميد كلية الدراسات العليا
أ.د. وليد صويلح

نسخة : د. رئيس قسم الدراسات العليا للعلوم الطبية والصحية المحترم
: عميد القبول والتسجيل المحترم
: مشرف الطالب

# Appendix D

# IRB approval

An-Najah National University
Faculty of medicine & Health Sciences
Institutional Review Board

جامعة النجاح الوطنية
كلية الطب وعلوم الصحة
لجنة اخلاقيات البحث العلمي

Ref :Mas. Oct.*2021/27*

**IRB Approval Letter**

**Title of Research:**

**The influence of smoking and other life styles on male semen quality in Nablus Governorate: A cross-Sectional Study**

**Submitted by:**
Bara Aziz Salameh

**Supervisor:**
Adham Abu Taha , Amjad Hussein

**Date Approved:**
24h October 2021

Your Study Title **"The influence of smoking and other life styles on male semen quality in Nablus Governorate: A cross-Sectional Study"** reviewed by An-Najah National University IRB committee and was approved on 24th October 2021

Hasan Fitian, MD

IRB Committee Chairman

IRB

Nablus - P.O Box :7 or 707 | Tel (970) (09) 2342902/4/7/8/14 | Faximile (970) (09) 2342910| E-mail : hgs@najah.edu

جـامعـــة النجاح الوطنية

كليـــة الدراســـات العليـــا

# تأثير التدخين وسلوكيات الحياة الأخرى على جودة السائل المنوي عند الرجال في محافظة نابلس: دراسة مقطعية

إعداد

براء سلامة

إشراف

امجد حسين

ادهم ابو طه

قدمت هذه الرسالة استكمالا لمتطلبات الحصول على درجة الماجستير في الكيمياءالحيوية السريرية، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس– فلسطين.

2022

**تأثير التدخين وسلوكيات الحياة الأخرى على جودة السائل المنوي عند الرجال في محافظة نابلس:**
**دراسة مقطعية**

**إعداد**
**براء سلامة**
**إشراف**
**امجد عز الدين**
**ادهم ابو طه**

## الملخص

**الخلفية:** العقم هو عدم قدرة الزوجين النشيطين جنسيا على الانجاب رغم عدم استعمال وسائل منع الحمل في غضون عام وفقًا لتعريف منظمة الصحة العالمية (WHO). يعد العقم عند الرجال مشكلة صحية في مجتمعنا، يؤثر العقم حاليًا على ملايين الأشخاص في جميع أنحاء العالم. ويشكل العقم الناتج من الرجال ً 10–30٪ من حالات العقم ويمثل 50٪ من جميع حالات العقم. ارتفعت نسبة الحالات المرتبطة بالعقم في الشرق الأوسط إلى 70٪. يعانون الرجال الذين تكون معاملات الحيوانات المنوية لديهم أقل من القيم الطبيعية لمنظمة الصحة العالمية من عقم عامل الذكور. هناك العديد من الأسباب التي تؤدي إلى العقم عند الرجال، بما في ذلك المشاكل الجسدية، والاضطرابات الهرمونية، والقضايا النفسية، ومشاكل في أنماط الحياة، والعوامل البيئية والمشاكل الجنسية.

**الهدف:** تهدف الدراسة إلى تحديد العلاقة بين التدخين وبعض أنماط الحياة (استخدام مشروبات مثل مشروبات الطاقة، وتناول القهوة والشاي، وطبيعة الطعام مثل تناول كميات كبيرة من السكر، والأطعمة المصنعة والمعلبة، والفواكه والخضروات، والسمنة، ومضادات الأكسدة وتناول الفيتامينات) مع جودة السائل المنوي للذكور في نابلس.

**المنهجية:** أجريت دراسة وصفية مقطعية بين الرجال في نابلس. تم جمع 168 عينة من المتطوعين. تم إجراء تقنية أخذ العينات الملائمة في الفترة من تشرين الأول (أكتوبر) 2021 إلى شباط (فبراير) 2022،

حيث تم جمع العينات من المعامل الرئيسية لتحليل السائل المنوي في منطقة نابلس، وهي مختبر ميديكير المركزي، والمختبر الطبي الاستشاري – جماعين، وفروع مختبرات بروفيشنال (نابلس، حوارة، قبلان)، مختبر ميد، مستوصف الرحمة، والمختبر المركزي في حوارة. تم تقديم استبيان ذاتي التعبئة في الدراسة الحالية لجمع البيانات.

**النتائج:** أظهرت الدراسة أن أعلى الفئات العمرية للمشاركين في الدراسة كانت 21–30 سنة (54.8٪)، 72٪ من المشاركين في الدراسة يعيشون الآن في القرية بينما 22٪ يعيشون في المدينة و6٪ فقط يعيشون في المخيم. هناك علاقة بين تدخين الشيشة والوقت الازم لتسييل أو تفكيك السائل المنوي. ترتبط كل من السمنة وتناول كمية عالية من السكر بالتراص (بقوة ارتباط الحيوانات المنوية مع بعضها البعض)، وهناك علاقة بين السمنة وتناول الأغذية المصنعة والمعلبة والحركة التقدمية للحيوانات المنوية، وبين تناول الفواكه والخضروات وحجم السائل المنوي والحركة التقدمية للحيوانات المنوية. وفقًا لتناول المشروبات، فإن المشاركين الذين يشربون أكثر من 3 أكواب من الشاي يوميًا ستضعف أو تقل حركة الحيوانات المنوية وعددها وشكلها. يرتبط تناول القهوة والطاقة بعدد الحيوانات المنوية. هناك ارتباط بين مضادات الأكسدة أو الفيتامينات وشكل الحيوانات المنوية (قيمة P <0.05).

**الخلاصة:** يحدد تحليل السائل المنوي جودة السائل المنوي من حيث كثافة السائل المنوي، وعدد الحيوانات المنوية، والشكل، والحركة، وهي المرحلة الأكثر أهمية لتشخيص أو لتحديد معدل الخصوبة عند الرجال. قد يؤثر تدخين الشيشة وأنماط الحياة (استخدام المشروبات مثل مشروبات الطاقة، وتناول القهوة والشاي، وطبيعة الطعام مثل تناول كميات كبيرة من السكر، والأطعمة المصنعة والمعلبة، والفواكه والخضروات، والسمنة، ومضادات الأكسدة، وتناول الفيتامينات) على جودة السائل المنوي (عدد وحركة وشكل الحيوانات المنوية والوقت الازم لتسييل السائل المنوي وقوة التراص بين الحيوانات المنوية).

**الكلمات المفتاحية:** عقم الرجال، تحليل السائل المنوي، التدخين، أنماط الحياة، نابلس.