T.C.
YEDITEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF NUTRITION AND DIETETICS

INVESTIGATING THE EFFECTS OF BODY COMPOSITION CHANGES BY MEDITERRANEAN DIET ON SUCCESSFUL PREGNANCY RATES AMONG OVERWEIGHT AND OBESE WOMEN UNDERGOING IVF

MASTER THESIS

Dyt. Nur Pınar Doğan

İSTANBUL-2022

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Assist. Prof. Dr. İrem Kaya Cebioğlu

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APPROVAL

This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated .... and numbered ....

Prof. Dr. Bayram YILMAZ

Director of Institute of Health Science

DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

01.08.2022

Nur Pınar Doğan

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LIST OF ABBREVIATIONS

AA	Arachidonic Acid
AMH	Anti-Mullerian Hormone
ART	Assisted Reproductive Treatment
BMI	Body Mass Index
CT	Computed Tomography
DEXA	Dual-Energy X-ray Absorptiometry
DM	Diabetes Mellitus
EFA	Essential Fatty Acid
EPA	Eicosapentaenoic Acid
FA	Fatty Acids
FSH	Follicle Stimulating Hormone
GnRH	Gonadotropin-Releasing Hormone
GI	Glycemic Index
GL	Glycemic Load
HDL	High-Density Lipoprotein
HPO	Hypothalamic Pituitary Ovarian
IGF-1	Insulin-like Growth Factor I
IVF	In Vitro Fertilization
IVF/CSI	In Vitro Fertilization / Intracytoplasmic Sperm Injection
Kg	Kilogram
LA	Linoleic Acid
LDL	Low-Density Lipoprotein
LH	Luteinizing Hormone
m	Meter
MED	Mediterranean Diet
MDP	Mediterranean Diet Pattern
MDS	Mediterranean Diet Score
MRI	Magnetic Resonance Imaging
MUFA	Monosaturated Fatty Acids
PCOS	Polycystic Ovary Syndrome
PGT	Preimplantation Genetic Testing
PID	Pelvic Inflammatory Diseases

PUFA	Polyunsaturated Fatty Acid
TFA	Trans Fatty Acid
US	United States
WHO	World Health Organization

ABSTRACT

DOĞAN, P. (2022). Investıgatıng The Effects Of Body Composition Changes By Mediterranean Diet On Successful Pregnancy Rates Among Overweight And Obese Women Undergoing IVF. Yeditepe University, Institute of Health Sciences, Department of Nutrition and Dietetics, the MSc Thesis, İstanbul

Obese women have lower pregnancy rates than normal-weight women undergoing assisted reproductive treatment (ART). This study aimed to increase the fertility of obese individuals by weight loss with a Mediterranean Diet (MED). The participants were divided into two groups: a study group that underwent a 12-week weight loss MED before starting an In Vitro Fertilization / Intracytoplasmic Sperm Injection (IVF/ICSI) cycle, and a control group that started with no previous interventions. Thirty patients were enrolled in this study. All analyses were performed using R (version 4.1.2) and R Studio (version 1.4.1106) software. T-test analyses revealed that experimental and control groups were not significantly differed in their initial weight ($M_{difference}$= 0.51, t (28) = 0.12, p = .906), age ($M_{difference}$= 0.20, t (28) = 0.14, p = .892) and their score of MEDAS ($M_{difference}$= 0.33, t (28) = 0.70, p = .492). Individuals who lost 1 kilogram were 0.62 times more likely to get pregnant than individuals who did not lose any weight. Two patients in the study group were spontaneously pregnant. Finally, embryo quality did not significantly predict pregnancy success (p = .998). As a result of the study, there is a need for more extensive studies due to the limited number of people.

Keywords: Mediterranean Diet, Infertility, Obesity,

ÖZET

Doğan, P. (2022). IVF Uygulanan Fazla Kilolu ve Obez Kadınlarda Akdeniz Tipi Beslenme ile Sağlanan Vücut Kompozisyonundaki Değişimin Başarılı Gebelik Oranlarına Etkisinin Araştırılması. Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Bölümü, Yüksek Lisans Tezi, İstanbul

Obez kadınlar, normal kilolu kadınlara göre daha Asiste Üreme Teknolojileri (ART) tedavisinde daha düşük gebelik oranlarına sahiptir. Çalışmamızda Akdeniz Diyeti ile kilo vererek obez bireylerin doğurganlığının arttırılması hedeflenmektedir. Katılımcılar iki gruba ayrılmıştır: İn Vitro Fertilizasyon / İntrasitoplazmik Sperm Enjeksiyonu (IVF/ICSI) döngüsüne başlamadan önce 12 hafta Akdeniz Diyeti ile kilo kaybı sağlanması hedeflenen bir çalışma grubu, herhangi bir müdahale yapılmayan bir kontrol grubu bulunmaktadır. Bu çalışmaya otuz katılımcı dahil edilmiştir. Tüm analizler R (versiyon 4.1.2) ve R Studio (versiyon 1.4.1106) yazılımı kullanılarak yapılmıştır. T-testi analizleri, deney ve kontrol gruplarının başlangıç ağırlıkları (Mfark = 0,51, t (28) = 0,12, p = .906), yaş (Mfark= 0,20, t (28) = 0.14, p= .892) ve MEDAS puanları (Mfark = 0,33, t (28) = 0,70, p = .492) açısından anlamlı bir farklılık göstermediğini ortaya konmuştur. 1 kilo kaybının hamile kalma olasılığını, hiç kilo vermeyen bireylere göre 0,62 kat arttırdığı bulunmuştur. Çalışma grubundaki iki hasta spontan gebe kalmıştır. Son olarak da, embriyo kalitesinin gebe kalma başarısını önemli ölçüde etkilemediği bulunmuştur (p = .998). Çalışma sonucunda, kişi sayısının kısıtlı olması nedeniyle daha geniş çaplı çalışmalar yapılmaya ihtiyaç vardır.

Anahtar Kelimeler: Akdeniz Diyeti, Doğurganlık, Obezite

1. INTRODUCTION AND PURPOSE

Public health issues such as type 2 diabetes, cardiovascular disease, digestive, respiratory, and reproductive illnesses, and cancer are all linked to obesity. Obesity is a serious public health concern around the globe with substantial medical, psychological/social, and economic consequences (1).

Obesity's detrimental impacts on one's overall health as well as the health of one's reproductive organs. Weight-related infertility affects obese couples (2). Obesity decreases the possibility of pregnancy and increases miscarriage rates (3). In women with a normal menstrual cycle, hyperandrogenic anovulation which is typically associated with central obesity, insulin resistance, and hyperinsulinism, and alterations affecting obesity-related hormones (e.g. adipokines, ghrelin, and endorphins) can affect oocyte quality, fertilization, and embryo implantation and also decrease fertility (4,5). There have been few studies that have examined the impact of a weight reduction intervention, such as diet on women with overweight and obesity who want to become pregnant (6,7).

Low mineral and vitamin intake in the diet have been linked to poor reproductive health (8). Especially the B vitamins, folate, vitamin B6, and vitamin B12, are important for reproductive health (9,10). As the majority of micronutrients may be found in everyday foods like produce (fruits and vegetables) and grains (cereals), we're particularly interested in how nutrition affects the success of In Vitro Fertilization (IVF).

According to a study, preconceptional Mediterranean-type diet (MED) that is rich in fruits, vegetables, cereals, legumes, olive and olive oil is associated with a 40% increased probability of success in achieving pregnancy among couples undergoing IVF (11). However, studies that specifically evaluate the effects of the Mediterranean-type diet on fertility are limited. The aim of this study was to evaluate the effect of a standardized weight loss with Mediterranean diet intervention on pregnancy rates after a single IVF cycle in overweight and obese women.

2. LITERATURE REVIEW

2.1. Infertility

As the name implies, infertility is the inability to have children after one year of unprotected and regular sexual relations. Infertility is a problem for many couples, especially those in the prime of their reproductive years (1). Infertility affects about 15 percent of couples around the world, however, 35 percent of all infertility cases are attributed to women, 20 percent to both women and men, and 30 percent to male infertility. However, there is no known cause for 15% of all cases of infertility (2).

Throughout 80 million women around the world struggle with infertility, according to the World Health Organization (WHO) (3).

An estimated one out of every ten couples around the globe is dealing with infertility, which is often recognized as one of life's most stressful experiences (11). IVF, which is considered to be the most effective treatment for infertility, is very costly for both patients and their families, and it places pressure on the resources available within the healthcare system (4).

Ovulation problems, a diminished ovarian reserve; anomalies in the reproductive system (anatomical or endocrine; functional or immunological); chronic illness; and sexual situations incompatible with coitus as instances of infertility for women. There are a number of reasons why a man may not be able to conceive, including anomalies of the reproductive system; chronic illness; and sexual situations that are incompatible with a man's capacity to deposit semen in his rectum (3).

2.1.3. Infertility and Organs and Hormones

Hyperprolactinemia

Before starting with fertility treatment, a diagnosis of hyperprolactinemia must be accompanied by an investigation to rule out the development of pituitary adenoma or extra pituitary tumors, which would require particular treatment. Dopamine agonists are commonly used to treat hyperprolactinemia. While a variety of new dopamine agonists are available, nothing is known about their impact on reproductive outcomes or their safety in pregnant women. In the past, surgery was the standard treatment for tubal illness, however, in recent years, IVF is favored these days (5).

Endometriosis

As with unexplained infertility, moderate and mild endometriosis may well be treated in the same way as endometriosis that is more severe. But medical treatment is no longer regarded as a suitable alternative in the lack of pelvic discomfort Endometriosis surgery, such as ablation and excision of endometriomas, is a tried-and-true procedure, but many women with endometriosis of any severity choose IVF therapy instead (6).

Uterine malformations

Undiagnosed reproductive issues. Excluding couples who have not had children and whose standard exams have indicated no abnormalities is the first step in diagnosing infertility. It's responsible for around 40% of infertility in women and 8%–28% of infertility in marriages (7).

2.1.2. Prevalence of causes of fertility

An increasing number of people worldwide are struggling with infertility. According to the 2nd decade of the 21st century, the following infertility-related demographic facts remain significant (8).

Infertility affects an estimated 186 million individuals globally. However, deny the reality that male infertility accounts for more than half of all instances of worldwide having children, infertility continues to become a societal burden for women (7). Recent global demographic studies reveal that infertility continues to be a persistent reproductive issue, characterized by six major demographic characteristics (8).

Based on the present global population, 72.4 million people are infertile, and of these, 40.5 million are seeking infertility treatment (8). The need for additional study on the global prevalence of infertility and treatment-seeking behavior, as well as the factors that influence these estimates, such as medical care accessibility (7).

There is a 9 percent prospective demand for infertility medical treatment, as shown by the current prevalence of fertility problems in more and less developed nations (9). Fertility rates have not grown significantly over the last two decades, even though there are many differing views on how prevalent infertility is throughout the world and there are no statistics on the number of infertile males, who account for more than half the instances of childlessness (10).

Population growth has slowed in part because worldwide fertility rates have declined dramatically, meaning fewer individuals are attempting to have children (1).

As a result, the prevalence of infertility in the population has important demographic and health consequences. It's possible that breakthroughs in the capacity to have children may thwart attempts at reducing fertility rates since high levels of infertility limit total fertility and population growth (8).

Over 186 million married women between the ages of 15 and 49 in developing countries (excluding China) were predicted to be infertile in 2002, according to the research. Moreover, a quarter of all women in these countries who are of childbearing age were married at some point in their lives, according to this estimate(12).

For married women in their 40s to 44s, 96 percent of those who've been together for at 1 east four years have one or more biological kids (40 out of 46). Nearly all moms have at least one surviving kid in 29 out of 46 countries. Nearly all moms in 29 of the 46 countries had at least one kid who survived. 40 nations, 97% of these ladies have had at least one viable pregnancy (12).

A similar pattern occurs among currently married women aged 25 to 49 with at least five years of exposure to the risk of pregnancy. In 38 nations, at least 97% of these women have had one or more pregnancies; only in the Central African Republic does this percentage fall below 94% (12).

Countries having Demographic and Health Surveys (DHS) were able to compute weighted worldwide subregional averages for the proportion of 15-29-year-olds who had ever been married, based on the number of women aged 15-49 (Table 1.1). The subregional weighted average was used to calculate the percentage of people who had ever been married in a nation without a DHS survey. Each subregion's weighted average of the number of women aged 15 to 49 was multiplied to arrive at the expected number of women who had never been married. Women who are childless or infertile were counted using the expected proportion of these statuses, together with all of the women who had never been married in this area (Table 1.2) (12).

Table 1.1. Primary Infertility: Sex but no pregnancy

Percentage of women age 15-49 who have had sexual intercourse but have never been pregnant, by age group, Demographic and Health Surveys 1994-2000

Country	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total 25-49	Age standardized 15-49	Age standardized 25-49
Sub-Saharan Africa										
Benin	51.0	20.4	8.4	2.2	1.3	2.2	1.3	3.6	16.6	3.3
Burkina Faso	48.2	11.1	3.5	1.5	1.6	1.0	0.8	1.9	13.4	1.8
Cameroon	47.9	21.5	5.4	2.3	3.4	1.9	4.5	3.7	16.2	3.5
Central Afr. Rep.	35.2	12.1	5.7	3.7	3.8	5.7	5.5	4.8	12.6	4.8
Chad	29.8	7.9	2.9	2.5	2.5	4.0	4.2	3.0	9.6	3.1
Comoros	45.8	22.9	11.9	8.6	3.9	4.7	2.4	6.9	18.1	6.9
Côte d'Ivoire	51.9	18.3	6.2	3.1	1.9	3.4	3.4	4.0	16.6	3.7
Eritrea	37.7	12.2	7.2	4.4	2.9	2.6	1.2	3.9	12.7	4.0
Ghana	57.6	24.0	11.0	3.3	1.7	0.5	1.9	4.5	19.2	4.1
Guinea	37.8	14.8	6.2	3.3	2.2	2.3	2.1	3.6	12.8	3.4
Kenya	50.9	16.9	5.0	1.7	1.6	1.4	2.3	2.7	15.4	2.5
Madagascar	35.6	12.4	7.1	5.6	3.3	4.6	4.7	5.3	13.0	5.2
Malawi	41.1	8.3	2.5	2.3	1.9	1.0	1.2	1.9	11.4	1.9
Mali	34.1	9.3	3.7	2.5	1.5	1.4	2.3	2.4	10.4	2.3
Mozambique	42.5	15.7	6.2	3.9	3.3	4.2	5.7	4.8	14.7	4.6
Niger	32.1	7.7	3.4	2.5	1.4	2.8	5.5	2.9	10.0	2.9
Nigeria	46.5	25.7	11.8	5.7	2.3	3.3	2.7	6.2	18.1	5.6
Senegal	36.1	13.4	7.2	2.8	2.2	2.2	1.7	3.7	12.3	3.5
Tanzania	51.6	11.1	5.4	3.8	2.8	1.9	0.5	3.4	14.9	3.2
Togo	68.0	34.6	10.1	3.7	2.6	1.6	2.1	4.8	23.5	4.4
Uganda	30.4	9.2	5.5	4.3	2.9	2.2	2.2	3.9	10.4	3.6
Zambia	47.4	14.0	6.9	3.3	1.3	1.3	0.9	3.5	14.5	3.1
Zimbabwe	32.2	11.4	4.1	2.8	2.6	2.0	1.7	2.9	10.6	2.8
North Africa/West Asia										
Egypt	26.8	10.7	5.3	3.4	3.6	2.4	2.3	3.5	9.8	3.6
Jordan	23.1	10.2	4.1	3.3	4.2	2.5	2.9	3.5	8.9	3.5
Morocco	92.5	62.2	40.6	18.9	10.7	4.8	3.4	19.2	42.2	17.8
Turkey	89.3	47.2	19.3	8.8	5.5	3.5	3.1	9.2	33.1	8.9
Yemen	39.1	10.9	3.6	2.8	2.0	2.3	1.3	2.6	11.9	2.5
Central Asia/South and Southeast Asia										
Bangladesh	26.9	8.6	3.6	1.2	1.4	1.7	1.2	2.1	8.5	1.9
Cambodia	36.0	13.6	3.4	2.8	1.8	2.1	2.8	2.5	11.7	2.6
India	37.3	11.2	4.3	2.8	2.5	2.3	2.3	3.0	11.8	2.9
Indonesia	30.2	9.4	4.8	3.0	3.0	3.3	2.7	3.4	10.2	3.4
Kazakhstan	49.9	19.8	7.8	5.1	1.8	2.1	2.2	3.8	16.8	4.1
Kyrgyz Rep.	31.2	11.6	3.6	2.1	1.6	1.2	0.4	1.9	10.0	2.0
Nepal	41.6	9.7	2.9	2.7	1.2	1.5	2.8	2.3	12.0	2.2
Philippines	20.2	7.4	4.3	3.5	1.6	2.2	2.1	2.8	7.4	2.9
Turkmenistan	25.1	8.1	3.9	1.8	2.0	1.5	0.6	2.1	8.1	2.1
Uzbekistan	24.9	8.8	4.1	1.5	0.7	1.2	1.3	1.9	8.1	1.9
Vietnam	26.1	7.2	2.6	2.0	1.0	0.9	1.5	1.6	7.9	1.7
Latin America/Caribbean										
Bolivia	30.3	15.2	8.5	3.9	2.2	2.0	2.5	4.1	11.8	4.1
Brazil	41.3	25.8	14.9	7.5	4.7	4.2	4.6	7.5	18.3	7.7
Colombia	49.4	29.5	14.5	8.3	4.9	3.7	4.3	7.6	20.7	7.7
Dominican Rep.	25.6	13.4	7.0	4.3	3.2	2.3	1.5	4.1	10.3	4.0
Guatemala	20.3	4.4	1.2	0.5	1.7	1.4	1.4	1.2	5.8	1.2
Haiti	48.9	27.0	11.8	4.4	2.7	3.0	4.6	5.7	18.8	5.6
Nicaragua	23.7	8.2	4.8	2.5	2.0	0.9	1.6	2.6	8.1	2.5
Peru	39.0	21.1	11.6	5.9	3.1	3.1	2.9	5.6	15.7	5.8

Table 1.2. Primary Infertility: Sex but no birth

Percentage of women age 15-49 who have had sexual intercourse but have never had a birth, by age group, Demographic and Health Surveys 1994-2000

Country	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total 25-49	Age standardized 15-49	Age standardized 25-49
Sub-Saharan Africa										
Benin	63.3	23.5	9.3	2.8	1.3	2.2	1.3	4.0	20.1	3.7
Burkina Faso	58.9	13.0	4.1	1.8	1.6	1.0	0.8	2.1	16.1	2.0
Cameroon	61.5	30.1	9.4	4.7	5.7	4.3	7.9	6.6	22.4	6.4
Central African Rep.	54.2	20.4	10.7	6.6	7.1	7.9	8.4	8.3	20.2	8.1
Chad	45.6	11.1	3.5	2.7	2.5	4.0	4.2	3.3	13.7	3.3
Comoros	56.3	26.3	12.9	8.9	4.1	4.7	2.4	7.3	21.2	7.2
Côte d'Ivoire	60.7	20.8	6.8	3.2	1.9	3.4	3.4	4.2	19.0	3.8
Eritrea	50.0	18.5	9.3	5.3	3.1	2.7	1.2	4.7	17.0	4.8
Ghana	69.0	33.5	16.1	5.9	3.2	1.1	2.5	7.0	24.8	6.4
Guinea	46.6	17.8	6.7	3.5	2.2	2.3	2.1	3.8	15.4	3.6
Kenya	60.3	22.2	5.7	2.5	2.4	1.7	2.6	3.3	18.7	3.1
Madagascar	45.7	16.4	9.3	6.7	3.7	4.9	4.9	6.3	16.5	6.1
Malawi	55.7	12.9	3.3	2.9	2.2	1.5	1.9	2.6	15.7	2.5
Mali	49.1	12.7	5.8	3.2	1.7	2.0	3.8	3.5	14.8	3.4
Mozambique	56.3	19.4	6.7	3.9	3.3	4.2	5.7	4.9	18.4	4.7
Niger	42.7	9.7	3.8	2.6	1.6	2.8	5.5	3.1	12.7	3.1
Nigeria	57.2	33.8	15.0	7.7	3.0	3.7	3.0	7.8	22.7	7.1
Senegal	47.7	18.0	8.3	2.8	2.3	2.2	1.7	4.0	15.8	3.7
Tanzania	62.6	16.4	7.0	4.9	3.0	1.9	0.6	4.2	18.7	3.9
Togo	74.4	38.2	11.3	3.8	2.6	1.6	2.1	5.2	25.7	4.7
Uganda	44.6	12.5	6.0	4.3	3.2	2.2	2.2	4.2	14.1	3.8
Zambia	59.1	16.9	7.6	3.4	1.3	1.3	0.9	3.7	17.7	3.2
Zimbabwe	49.8	17.6	5.4	4.0	3.4	2.5	1.9	3.9	16.0	3.7
North Africa/West Asia										
Egypt	48.8	21.1	8.4	5.0	4.8	3.3	2.8	5.1	17.4	5.2
Jordan	51.4	20.7	7.3	5.2	4.9	3.1	3.4	5.1	17.8	5.0
Morocco	95.1	66.1	43.0	20.3	12.1	5.0	4.2	20.6	44.3	19.1
Turkey	92.1	53.9	22.8	10.2	6.0	3.8	3.7	10.7	35.8	10.3
Yemen	55.0	16.2	5.4	3.7	2.2	2.7	1.5	3.4	16.7	3.3
Central Asia/South and Southeast Asia										
Bangladesh	38.2	12.5	4.8	1.9	1.9	1.9	1.3	2.8	12.0	2.5
Cambodia	57.1	21.4	5.0	3.3	2.1	2.7	3.4	3.3	18.1	3.3
India	52.5	17.7	6.3	3.6	3.1	2.8	2.9	4.0	16.8	3.9
Indonesia	47.4	16.7	7.4	4.1	3.6	3.5	3.0	4.5	15.9	4.5
Kazakhstan	74.8	33.5	12.6	6.6	2.8	3.8	3.6	5.9	25.9	6.3
Kyrgyz Rep.	55.7	18.7	6.0	3.2	2.4	1.9	1.1	3.1	17.2	3.2
Nepal	56.3	14.1	4.3	3.2	1.7	1.9	2.9	3.0	16.3	2.9
Philippines	39.9	15.4	7.7	5.1	2.2	2.7	2.6	4.2	14.0	4.3
Turkmenistan	55.0	18.7	7.3	2.5	2.7	1.8	0.9	3.3	17.2	3.3
Uzbekistan	52.0	22.9	6.4	2.4	1.1	1.4	1.5	2.9	17.0	2.8
Vietnam	54.9	17.4	5.1	2.8	1.2	1.2	1.8	2.5	16.4	2.6
Latin America/Caribbean										
Bolivia	42.0	18.6	10.0	4.1	2.2	2.0	2.5	4.5	15.1	4.5
Brazil	56.4	33.1	18.0	9.0	5.9	5.0	5.4	9.1	23.8	9.3
Colombia	62.3	36.5	17.7	10.7	6.1	4.5	5.4	9.4	25.8	9.6
Dominican Rep.	43.9	20.4	10.2	6.1	4.5	4.0	2.8	6.1	16.7	5.9
Guatemala	37.0	8.8	3.0	1.0	1.8	1.5	1.5	1.8	10.5	1.8
Haiti	62.7	34.5	16.0	6.2	4.4	3.8	5.6	7.9	24.4	7.6
Nicaragua	39.2	13.2	6.0	2.7	2.5	1.4	1.6	3.1	12.6	3.1
Peru	52.1	27.0	14.5	8.0	3.9	3.9	3.8	7.2	20.6	7.4

2.1.4. Factors affecting fertility

2.1.4.1. Alcohol Consumption

Pregnant women who drink no more than one or two units per week and avoid drunkenness may reduce the risk of harming their unborn child, according to a new study. Men should be advised that consuming 3- 4 portions of alcohol per day, as recommended by the Department of Health, will not impact the quality of their sperm. The quality of a man's sperm might be negatively impacted by heavy alcohol use (7).

2.1.4.2. Smoking

If a woman smokes, she should be aware that she is likely to have a smaller family (8). In order to help women who smoke stop, a stop smoking program should be recommended to them. Infertility in women may be harmed if they are exposed to secondhand smoke while trying to become pregnant. There is a correlation between decreased sperm quality (though the impact on male fertility is not yet understood) and smoking, and men who smoke should be made aware of this (7).

2.1.4.3. Folic acid supplementation

Folic acid tablets are often used by infertile women, resulting in a high level of folate in their bodies. But, not enough research has been done to determine whether or not folic acid pills help women who are experiencing infertility to get pregnant. The research studied the link between folic acid supplementation and folate status in women with unexplained infertility and IVF pregnancy success (13).

Be aware that folic acid supplements may be used before conception and throughout the first 3 months of pregnancy to reduce the chance of neural tube defects (3). 0.4 mg is the recommended daily dosage. If a woman has previously given birth to a child with a neural tube defect, is on anti-epileptic medicine, or has type 2 diabetes, she should take a higher dose of 5 mg each day (7).

There were also comparisons between fertile, non-pregnant control subjects and women who were unable to become pregnant due to unexplained reproductive issues (7). More folic acid supplements were taken by infertile women than fertile ones, and the median total folic acid consumption was substantially greater in the infertile group. Compared to fertile women, those with unexplained infertility had higher median plasma folate and lower median plasma homocysteine concentrations. There was no correlation between folic acid supplementation and pregnancy outcomes (14). In women with unexplained infertility, folic acid supplementation or appropriate folate status had no influence on pregnancy outcome after infertility therapy. Folic acid supplements and a greater folate status among women with unexplained infertility were found in research, however, it did not suggest that this would have a favorable effect on pregnancy outcomes after assisted reproduction (15).

A study reported that 7.9% of the participants were unaware that folic acid consumption may prevent neural tube abnormalities (15). Nonspecific advantages of vitamin intake and prevention of congenital abnormalities were known to 35% of patients who spoke Spanish and 56.3 percent of patients who spoke English. Women with less than four years of high school education were significantly less likely to use a multivitamin supplement before conception than those with education beyond high school. Vitamin supplementation was much less common among patients who speak Spanish than among those who speak English (3.7 percent versus 22.4 percent). An overwhelming majority (92%) of those surveyed had no idea that folic acid consumption may help prevent neural tube abnormalities, whereas just 8% of those surveyed spoke Spanish ($p < .0001$) (16). Preconceptional folic acid intake is neglected and misunderstood in the fight against neural tube defects. It seems that people who speak Spanish and have a lower level of formal education are more likely to lose out on the advantages of folic acid during the preconception period. Increased folic acid intake and awareness must target the Spanish-speaking population (16).

2.1.4.4. Obesity

It should be highlighted that women with obesity are more likely than normal-weight women to have difficulty becoming pregnant. When it comes to non-ovulating women with obesity, it's important to tell them that decreasing weight will boost their chances of becoming pregnant (17).

If more pregnancies are desired, women should be referred to join an organized weight reduction program that combines both exercise and nutritional guidance. Men who have a BMI of 30 or more are likely to have a lower reproductive rate (7).

2.1.4.5. Low Body Weight

It has been demonstrated that leptin is a key regulatory component in controlling BMI and reproduction processes (8). Because leptin corresponds with adipose density, it has been utilized as a marker for energy balances and consequently imbalances inside the human body. Energy homeostasis is essential for optimal reproductive activities; hence, high or low BMI conditions might negatively impact the female reproductive environment (7).

It is well recognized that estrogen is the most essential reproductive hormone. Its responsibilities in female reproductive pathophysiology and its well-defined roles in modifying BMI make it an important factor to consider when advising infertile couples. All of these variables have been demonstrated to alter regular ovulation and endometrial receptivity, which must be taken into account when consulting for ART (18).

After a 10%–15% fall in normal body weight, menstruation typically ceases in underweight individuals. In women with anorexia nervosa and bulimia, the hypothalamus produces fewer pulses of gonadotropin-releasing hormone (GnRH) that limit the pulsatile release of follicle-stimulating hormone (FSH) and lutein hormone (LH) and shut down ovarian stimulation, which is why anovulation occurs. However, being underweight appears to have little effect on the reproductive result with ART, but it does raise the risk of obstetric problems (hyperemesis gravidarum, anemia, intrauterine growth restriction, preterm delivery, cesarean deliveries, post-partum complications and depression, low birth weight) (19).

Menstruating women with a BMI under 19 should be warned that gaining weight will increase their chances of getting pregnant (7).

2.1.4.6. Tight Underwear

Wearing loose-fitting underwear does not seem to improve fertility, even if there is a correlation between excellent sperm quality and high scrotal temperature (9).

2.1.4.7. Occupation

Because some occupations expose people to hazards that can affect men's or women's fertility, those who are concerned about their fertility should inquire about their occupation and be given appropriate guidance (7).

2.1.4.8. The use of prescribed, over-the-counter, and recreational drugs

Men and women who are worried about their fertility should learn about the potential risks of various prescription, over-the-counter, and recreational drugs and seek advice from a health professional (7).

2.1.4.9. The frequency and duration of sex or artificial insemination

Vaginal sex every two to three days increases the likelihood of pregnancy in women who are concerned about their fertility. People who are seeking to conceive artificially should have their artificial insemination performed during the time of their ovulation (7).

2.1.4.10. Caffeine

Caffeine can be found in coffee, tea, soft drinks, and chocolate. The evidence for a link between caffeine and female infertility is mixed. There has been no research on the influence of caffeine on pregnancy rates, nor have there been any studies on the effect of decaffeinated beverages on fertility (4).

2.1.5. Causes of Infertility

The WHO conducted a massive international investigation to establish gender distribution and the causes of infertility. Female infertility was detected in 37 percent of the infertile couples; 35 percent had both male and female infertility, and; 8 percent had male factor infertility (3).

As a result of a poll, these are the most often cited reasons for infertility among women: Ovulatory disorders 25%, Endometriosis 15%, Pelvic adhesions 12%, Tubal blockage 11%, Other tubal/uterine abnormalities 11%, Hyperprolactinemia 7%. Male factor infertility makes up a large portion of the known causes of infertility, even if these variables are not included in the article (20).

2.1.5.1. Anovulation

Twenty-five percent of the recognized causes of female infertility are ovulatory abnormalities. Anovulation or oligo-ovulation leads to infertility since no oocyte is released each month (21). In the absence of an oocyte, fertilization and pregnancy are not possible WHO has divided ovulatory disorders into four groups to make treatment and subsequent classification easier:

- Adrenal anovulation, or hypothalamic amenorrhoea, may be caused by hypogonadotropic deficiency.

- Normal anovulation, often known as the polycystic ovarian syndrome (PCOS), is a condition in which the ovaries fail to produce an egg.

- Precocious ovarian failure is another term for hypergonadotropic hypoestrogenic anovulation.

- A pituitary adenoma (hyperprolactinemic anovulation)

Anorexia nervosa and excessive exercise are both linked to hypothalamic amenorrhea or functional hypothalamic amenorrhoea, which results in hypothalamic GnRH production being reduced (21).

Reduced calorie intake, resulting in weight loss, or extreme activity induces an increase in cortisol, suppressing GnRH. The anterior pituitary gland's production of gonadotropins, such as FSH and LH, is reduced when GnRH's pulsatility is reduced or absent. Anovulation, abnormal follicle growth, and low estrogen levels are all the results of these deficiencies. As a prepubescent girl's hormone levels fluctuate from normal to low, the FSH-to-LH ratio will look like this: FSH is greater than LH. Normalogonadotropic normoestrogenic anovulation is the most common kind of condition. 80 to 85 percent of anovulatory individuals and 8 percent of reproductive-age women have PCOS. For the Rotterdam criteria to be used to diagnose PCOS, two of the following three criteria must be present, with no additional pathogenic factors present (21):

-Oligoovulation or anovulation

- Symptoms of hyperandrogenism and/or a rise in the levels of androgen in the bloodstream

-Ultrasound documentation of polycystic ovaries (21).

Infertility from PCOS is thought to be caused by a defect in the development of follicles, which results in anovulation. The concentrations of FSH and estrogen will be within the allowed parameters for the laboratory. The hormone of LH may be normal or excessive. PCOS and infertility are poorly understood; abnormal GnRH pulsatility may be a reason. Anti-Mullerian hormone (AMH) increases with stopped follicles and polycystic ovaries (22).

2.1.5.2. Endometriosis

An endometrial condition in which endometrial tissue may be seen outside the uterus is known as endometriosis. Endometrial glands and/or stroma may be found outside the uterus using histology. Endometriosis affects between 10 and 15 percent of women of childbearing age, most often in the pelvis, although it may extend across the abdomen. Endometriosis may cause infertility in forty to fifty percent of women (23).

2.1.5.3.Adhesions of the Pelvic and Tubal Region

Adhesions of the pelvic and tubal region are largely responsible for female infertility, along with uterine and tubal problems. The most common cause of pelvic and tubal adhesions is an infection in the abdomen: Pelvic inflammatory disease (PID) is the most prevalent infectious disorder associated with infertility. When it comes to PID and infertility, Chlamydia trachomatis is the main culprit. For every fourth woman with tubal factor infertility, chlamydia antibodies are shown to be adversely related to success rates at conception (24).

2.1.5.4. Uterine Origins

Uterine infertility may be caused by either lesions taking up too much space in the uterus or a lack of endometrial receptivity. However, in a meta-analysis of uterine leiomyomas (fibroids), only submucosal or intracavitary fibroids were found to affect fertility rates as compared to other infertile individuals (25).

2.1.5.5. Psychological effects of fertility problems

In a limited percentage of cases, psychological issues are the sole cause of infertility. These cases must be identified early on so that the patients affected can avoid the time-consuming and expensive process of reproductive care. The impact of fertility issues, particularly medical therapy, on the psychological state of involuntarily childless couples is significantly greater. Many of the women engaged experience an increase in depressive tendencies and anxiety as a result of the treatment's misery. In some circumstances, this may necessitate psychosocial counseling for them. At all stages of medical treatment, psychosocial counseling should be accessible (26).

The impact of psychological elements on infertility issues is still exaggerated in lay etiology (26).

No scientific evidence exists to suggest that an infertile couple's "fixed" desire for a baby or a certain pattern of connection is the cause of their infertility, or that giving up on having a child aid in increasing their chances of becoming pregnant. Distress and reproductive constraints have been linked in recent investigations on the relationship between psychological stress and physiological systems Distress, on the other hand, has not yet been shown to be the only cause of infertility in major research. Because infertile women may experience shame and guilt (blaming the victim), they may be more susceptible to questionable treatment alternatives if they are labeled as having psychogenic infertility, which is unfounded and actively detrimental (27).

Psychogenic infertility might be attributable to assumptions rather than reality, and more research on the effects of psychological stress on both male and female fertility is required (28).

More women in this survey reported substantial anxiety and depression symptoms than their male partners. In addition, the mean scores of the women on the two psychopathology measures were considerably higher. These results suggest that the emotional toll of infertility is worse for these women (29).

This observation implies that women are on the receiving end when couples face the challenge of infertility, regardless of culture or race. However, the favorable connections between these women's emotional symptoms and those of their partners show that the males participate in the load and may offer support when necessary (30).

Despite the strong overall impact found in the available research, caution must be used when making conclusions because of the wide range in methodological quality, intervention type, and style (31).

2.1.6. Infertility Treatment

2.1.6.1.Lifestyle Changes

Infertility and ovulatory dysfunction in women are often linked to BMI extremes. Women who have a BMI of less than 17 kg/m^2 and a history of intensive exercise regimens or eating disorders have an increased risk of developing hypogonadotropic hypogonadism. This condition is identified by a lack of pituitary gonadotropin secretion. In the United States, inducing ovulation is accomplished by the use of controlled ovarian stimulation with exogenous gonadotropins. On the other hand, pulsatile GnRH treatment is an option for European women who do not respond to conventional therapy (32).

Weight reduction on its alone may improve ovulation in women who have an anovulation diagnosis and a BMI that is more than 27 kg/m^2. Multiple studies have shown that a weight reduction of ten percent may, in a little under a year's time, return regular ovulation to anywhere from fifty to one hundred percent of women. There was no significant difference in the pregnancy or live birth rates of obese women who had weight-loss counseling and treatments prior to infertility therapy compared to obese women who received infertility treatment but did not get weight-loss therapies. As a result, there is no requirement set by the BMI for beginning fertility therapy. As a result, there is no requirement set by the BMI for beginning fertility therapy (32). One study highlighted the significance of behavioral modification in ovulation induction. 87% of the women who had individualized therapy to correct energy deficits or behavioral issues returned to normal ovarian function, correcting their abnormal BMI (33).

2.1.6.2. Regulation of Ovarian Hyperstimulation

To treat infertility of unknown etiology, the most often prescribed medicine is clomiphene citrate. In order to increase the anterior pituitary's production of gonadotropin, clomiphene acts as an estrogen antagonist and agonist selective estrogen receptor modulator. Letrozole, a popular oral medication for ovulation induction, is another option. As an aromatase inhibitor, letrozole stops the conversion of androstenedione and testosterone to estrone and estradiol, therefore decreasing the production of estrogen (33).

2.1.6.3. Uterine Malformations

There is insufficient evidence regarding the relationship between leiomyomas, infertility, and birth rates. Prior to further examination into fibroids, it is advised that the patient undergo a thorough infertility evaluation. Location is the most crucial feature of fibroids. Implantation is hampered and miscarriage rates increase when fibroids impinge on the endometrium and alter the uterine cavity. It has been demonstrated that women with submucosal or submucosal-intramural fibroids that deform the uterine cavity have lower pregnancy rates. Pregnancy and live birth rates rise when it is eliminated (35).

2.1.6.4. Adhesions of the Tubal and Pelvic Organs

IVF is the first-line therapy for infertility caused by the bilateral tubal factor. However, after tubal reversal surgery, pregnancy outcomes are worse, and the chance of an ectopic pregnancy is higher. To increase the pregnancy rate of IVF, women with severe tubal disease, including hydrosalpinx, are encouraged to undergo bilateral salpingectomy. Fimbrioplasty is an option for women with mild distal tubal disease to enable multiple pregnancies without IVF (34).

2.1.6.5. IVF Treatments

IVF methods will be summarized in this part without mentioning medication regimens as the most effective treatment option for infertility. In most cases, the first step is to use injectable gonadotropins to stimulate the ovaries under strict supervision. A specialist will perform a transvaginal ultrasound-guided needle aspiration and oocyte retrieval thirty-six hours following a trigger shot or HCG injection. Insemination is carried out by adding normal sperm to the dish after the oocytes have been removed from the uterus. If the sperm is abnormal, an ICSI procedure is carried out. ICSI is a technique that involves placing a single spermatozoon directly into the cytoplasm of an egg. Following fertilization, the embryo is evaluated and ranked. On Day 3 or Day 5, the embryos are then transplanted. Preimplantation genetic testing (PGT) is an extra IVF process that helps discover known mutations or balanced translocation in the genetic material of the parents. In addition, PGT can identify both monosomies and trisomies from all 23 chromosomal pairs. PGT is likely useful for advanced maternal age, repeated IVF failures with high-grade embryos, recurrent pregnancy loss, and undiagnosed infertility in the absence of a known parental carrier for a genetic mutation or balanced translocation (36).

2.2. Infertility and Obesity

2.2.1. Prevalence and Etymology of Obesity

2.2.1.1. Definition of Overweight and Obesity

The ideal method for classifying obesity would be based on a realistic evaluation that is usually available to physicians in any context, would properly predict health risk (prognosis), and could be used to assign treatment strategies and objectives. Even though they fall short in comparison to these imaging approaches for estimating body fat, BMI and waist circumference measurements nonetheless give useful data and are simple to employ in several clinical contexts. The clinical applications of underwater weighing, dual-energy x-ray absorptiometry (DEXA) scanning, computed tomography (CT), and magnetic resonance imaging (MRI) are inappropriate.

Regarding the criteria used to diagnose overweight and obesity, two important considerations must be taken. The first is that, despite our propensity for assigning specific BMI cutoffs and growing risk, the links between body weight and health-impairing illnesses are fundamentally constant. Increased risk of type 2 diabetes and early death, for example, occur long before a BMI of 30 kg/m^2 (the criteria of obesity in European countries) is reached. Preventing additional weight gain and/or supporting weight reduction will have the most favorable health impacts in these early phases. The second aspect is that as more effective therapies for these conditions become accessible, the previous connections between increasing weight thresholds and co-morbidities are altering. In the United States, for example, despite growing obesity rates, atherosclerotic cardiovascular disease mortality has steadily dropped over the last several decades. Updated epidemiological data on the health consequences of being overweight or obese should include data on morbidity and death, as well as statistics on health-care use and expenses, such as the number of medicines and treatment-related procedures (37).

2.2.1.2. Classification of Overweight, Obesity and Central Obesity

2.2.1.2.1. Body Fat Mass and Percentage

Several imaging techniques, including DEXA, CT, and MRI, may directly assess fat mass; however, these technologies are impracticable and prohibitively expensive for general clinical usage, therefore they are mostly used in research. Water (underwater weighing), air displacement (BODPOD), and bioimpedance analysis can all be used to indirectly assess fat mass (BIA). Each of these approaches calculates the percentage of body fat by estimating the quantity of fat and non-fat mass. Fitness facilities and clinics with obesity medicine experts frequently provide the BODPOD and BIA. However, it is not yet advised that they be used widely in the management of overweight and obese people. The frequency of disorders linked with obesity may confound the interpretation of results from these procedures when the fluid status is changed, such as in congenital heart failure or chronic renal disease. Furthermore, the normal and abnormal ranges for these procedures are unknown, and knowing them will have little bearing on existing guidelines for supporting patients in attaining long-term weight loss (38).

2.2.1.2.2. Index of Isometric Body Mass

The BMI allows for weight comparisons between populations that are not based on size. Except for those whose lean weight has increased owing to severe exercise or resistance training, BMI corresponds well with body fat %. (e.g., bodybuilders). Weight comparisons across populations that aren't dependent on size are possible using the BMI. Gender, age, and race all have an impact on this association, especially in South Asians, whose BMI-adjusted % body fat is greater than in other groups. Adult obesity in the

United States is defined as a BMI of 27.3 kg/m^2 or higher for women and 27.8 kg/m^2 or higher for men, according to the findings of the second National Health and Nutrition Examination Survey (39). The 85th percentile BMI data for adults aged 20 to 29 by gender were used to create these classifications. NIH's Expert Panel on Adult Overweight and Obesity was the first to use the World Health Organization's classification system for adult overweight and obesity in 1998. It has been shown that people with a higher BMI (BMI between 18.5 and 25 kg/m^2) have a larger risk of comorbid illnesses such as hypertension, type 2 diabetes, and cardiovascular disease. At lower BMI levels, Asian populations are known to be at a higher risk for diabetes and hypertension than non-Asian races due to the predominance of central fat distribution (see below). As a result, the WHO has set lower limits for therapeutic intervention consideration among Asians: a BMI of 18.5 to 23 kg/m^2 indicates a low risk, 23 to 27.5 kg/m^2 indicates moderate risk, and 27.5 kg/m^2 or more indicates a high risk (40, 41).

2.2.1.2.3. Dispersion of Fat (Central Obesity)

In both men and women, a higher proportion of fat in the belly or trunk compared to the hips and lower extremities has been linked to an increased risk of type 2 diabetes, hypertension, and cardiovascular disease. The waist-to-hip ratio is widely used to describe abdominal obesity, although it is best assessed by taking a single circumferential measurement at the level of the superior iliac crest. Men with a waist circumference longer than 102 cm (40 inches) and women with a waist circumference more than 88 cm (35 inches) have an elevated relative risk of co-morbidities such as diabetes and cardiovascular disease, according to the original US national guidelines (35 inches). A person who is overweight and has a preponderance of belly fat is regarded to be at "high" risk for certain illnesses, even if they do not fulfill the BMI requirements for obesity. The American Heart Association and the National Lipid Association utilize these waist circumference parameters to describe "metabolic syndrome" in their most recent recommendations (41).

There is a wide range of associations between central adiposity and co-morbidities, depending on racial or ethnic background. For example, among persons of Asian origin, abdominal (central) obesity has long been thought to be a more reliable predictor of disease risk, particularly type 2 diabetes, than BMI. Several countries and health organizations have established varying sex- and population-specific cutoff values for waist circumference thresholds that predict an increased risk for weight-related comorbidities, as recommended by the International Diabetes Federation and outlined in the 2008 WHO report. Men and women of European heritage should have a waist circumference of >94 cm (37 inches) and >80 cm (31.5 inches), whereas men and women of South Asian, Japanese, and Chinese descent should have a waist circumference of >90 cm (35.5 inches) and >80 cm (31.5 inches).

A visit is not complete without an examination of the patient's waist circumference and weight. Diabetic and cardiovascular disease risk may be identified independently of BMI with this test, which is essential for establishing a personalized weight management approach as well as encouraging patients to adhere to the prescribed lifestyle and medication adjustments. Lower waist circumference thresholds than those currently recommended in the United States should be considered when counseling a patient of South and Southeast Asian ancestry or if other components of the metabolic syndrome (e.g., hypertension, elevated fasting glucose (100 – 125 mg/dL; 5.5 – 6.9 mmol/L), dyslipidemia) or prediabetes (hemoglobin A1c between 5.7 and 6.4 percent) have been identified (41,42).

2.2.1.3. Epidemiology of Overweight and Obesity

The steady increase in childhood and adult obesity prevalence over the past several decades has continued in the US, according to data from the National Health and Nutrition Examination Survey based on measured heights and weights, with exceptions among subpopulations described in greater detail below. According to the most current US research (2015-2016), obese adults (BMI 30 kg/m^2) and children (BMI 95^{th} percentile of age- and sex-specific development charts) account for 39.8% of adults and 18.5 percent of children (43).

2.2.2. Polycystic Ovary Syndrome, Obesity, and Infertility

In developed and emerging countries alike, obesity is a pandemic with devastating health, social, and economic effects. Obesity prevalence has nearly quadrupled since 1975, with more than 1.9 billion persons overweight and more than 650 million obese in 2016. Obesity is one of the primary causes of early mortality, and its consequences do not just affect adults; in 2016, over 340 million children and adolescents aged 5 to 19 were overweight or obese (44).

Obesity affects 34% of women of reproductive age in the US. Obesity raises the risk of infertility and subfecundity, which is caused by a malfunction of the hypothalamic-pituitary-ovarian (HPO) axis, low oocyte quality, and a change in endometrial receptivity. Obese women have inferior reproductive results regardless of how they conceive, and a greater BMI is linked to a poorer fertility prognosis (45). PCOS is the most common endocrine condition among women of reproductive age, making it one of the primary reasons for infertility. Hyperandrogenism, oligoanovulation, and polycystic ovary shape are all diagnostic criteria for PCOS, however many women with this condition are also overweight or obese. Obesity has a major influence on the treatment of symptoms and reproductive outcomes in different PCOS phenotypes (46).

2.2.3. Obesity and Female Fertility

The HPO axis is altered in obese women, making it difficult for them to conceive. Obesity is a major component of metabolic syndrome. Obesity is often linked to increased insulin levels in the blood, which leads to an increase in ovarian androgen production. The aromatization of these androgens to estrogen is caused by excess adipose tissue, which causes negative feedback on the HPO axis and inhibits gonadotropin production (47). Ovulatory dysfunction and menstrual abnormalities are caused by these changes.

The etiology of PCOS, which is characterized by oligomenorrhea and hyperandrogenism, is complicated by hyperinsulinemia. Obesity raises insulin resistance and exacerbates the symptoms of PCOS when it is present. Increased androgen production in PCOS, on the other hand, produces visceral fat deposition, which exacerbates insulin resistance and hyperinsulinemia, further fuelling the vicious cycle (48).

Obesity has been linked to a longer period between conception and birth in several studies. An unfavorable connection between rising BMI and fecundability ratios was identified in two large cohorts of Danish women contemplating pregnancies (49). Obese women, for example, can have subfertility even if they don't have ovulatory dysfunction. Fertility was shown to be lower in a large US cohort of over 7,000 women with eumenorrhea and obesity (50). The likelihood of spontaneous conception reduced linearly with a BMI of more than 29 kg/m^2 in a Dutch cohort of over 3000 women with regular menstrual periods. After correcting for any confounding variables, women with a high BMI had a 4% lower pregnancy rate per BMI unit increase (51).

Obesity appears to have a deleterious impact on the results of ART, according to several lines of data. Obesity can lengthen ovulation induction, increase gonadotrophin doses, increase the number of mature follicles and oocytes recovered, and increase the rate of cycle cancellation. In addition, obesity may also have a detrimental impact on the quality of oocytes and embryos. Fertilization, embryo transfer, implantation, and pregnancy rates have all been shown to be adversely related to BMI categories (50, 51). Additionally, Obesity makes oocyte retrieval and embryo transfer more difficult (45). Obese women taking ART had a higher chance of miscarriage, according to several studies. A meta-analysis of these studies found that women with a BMI of 25 kg/m^2 had considerably greater risks of miscarriage regardless of the mode of conception (52).

In response to the hypothesis that extremes in maternal BMI may diminish reproductive intervention success rates and increase mother-fetal morbidity, a number of providers have created BMI cutoffs for fertility therapy (45, 38).

2.2.4. Metabolic Syndrome and Infertility

Diabetes, hyperlipidemia, and high blood pressure are usually linked to obesity. Metabolic syndrome is a term used to describe a group of risk factors. Because many of their abnormalities are comparable, it's thought that metabolic syndrome and PCOS have the same pathophysiology, particularly hyperinsulinemia and glucose intolerance (53). In addition to the detrimental effects of obesity and insulin resistance on female fertility, metabolic diseases can directly or indirectly disrupt female fertility by influencing pituitary-hypothalamic or ovarian function. Specifically, Diabetes mellitus (DM) of both types 1 and 2 has been related to detrimental effects on the reproductive axis of women. Low estradiol, LH, and FSH levels have been associated with insufficient insulin secretion and poor metabolic syndrome management in people with diabetes mellitus and primary or secondary amenorrhea. In addition, Chronic hyperglycemia's "glucotoxic" impact on hypothalamic neurons might explain why LH responsiveness to GnRH stimulation is reduced (54).

Ovarian function is also affected in women with hyperglycemia. Insulin resistance develops in the peripheral when blood glucose levels rise. Additionally, by accumulating advanced glycation end products, hyperglycemia might affect ovarian function. Nutrients, particularly glucose availability, are important metabolic regulators for reproductive function (39). Diabetes type 1 is connected to fewer live births and pregnancies. Studies of fertility therapies for diabetic women, on the other hand, show that metabolic management is the most essential component in achieving a healthy pregnancy. In addition, in vitro fertilization procedures for women with type 1 diabetes who have good metabolic control are equivalent to those for women who do not have diabetes.

A frequent metabolic syndrome symptom, dyslipidemia, has been related to reproductive issues and pregnancy complications (55). According to a recent meta-analysis, infertile women had statistically greater BMI, total cholesterol, low-density lipoprotein (LDL) cholesterol, and triglycerides than fertile women (42). Total cholesterol, high-density lipoprotein (HDL)-cholesterol, fasting glucose, and fasting insulin were only elevated in women with PCOS compared to fertile women, while BMI, triglycerides, and LDL-cholesterol were significantly elevated in women with any cause of infertility compared to fertile women. On the other hand, the connection between dyslipidemia and infertility has not yet been demonstrated (53).

Women with PCOS or infertility might benefit from a weight reduction strategy: Given the impact of obesity and metabolic problems on fertility, it's understandable that losing weight would be beneficial. However, existing research on the impact of weight loss on conception in obese women, on the other hand, is mixed. Participants in a trial of 67 obese anovulatory infertile women who engaged in a 6-month weight reduction program dropped an average of 10 kg, and ovulatory function was restored in 60 (90 percent) of the women, with a miscarriage incidence of 18% (57).

Short-term weight loss was linked to an increase in the number of metaphase II oocytes recovered in a group of 170 women undergoing IVF. This link was more pronounced among women who were overweight or obese at the start of the research. However, short-term weight loss had no link to a positive -hCG test, clinical pregnancy, or live birth rates (58). 52 overweight or obese infertile women were referred for weight reduction counseling in a second retrospective cohort study. Patients who lost 10% of their body weight had significantly greater conception rates and live birth rates (59).

A total of 49 obese women having reproductive therapy were randomly allocated to either a 12-week intensive lifestyle intervention or a control group in a study involving 49 obese women undergoing IVF treatment. The intervention group dropped an average of 6.6 kg and had a considerably higher live birth rate (44 percent against 14 percent) than the control group. They also required fewer treatment cycles (2 versus 4) than the control group (60).

In a major randomized trial, 290 women were allocated to a 6-month lifestyle-intervention program before receiving 18 months of infertility therapy (intervention group), while 287 women received timely infertility treatment for 24 months (control group) (61). When compared to immediate clomiphene medication, delayed fertility therapy combined with lifestyle changes enhanced ovulation and live birth rates. Although weight loss by diet and exercise is the first-line treatment for PCOS, it is well recognized that obese women with PCOS usually fail to diet and stick to dietary habits. Thus, dietary changes aimed at weight loss seldom result in long-term weight loss and have little impact on metabolic and reproductive consequences (62).

2.2.5. Obesity Treatment

For several reasons, some people find it difficult to reduce weight. An individual's dietary, physical activity, and exercise habits all have a role in the development of obesity. Fortunately, even modest weight reduction may help alleviate or even avoid obesity-related health issues in the long run. A better diet increased physical exercise, and behavioral adjustments may all help you lose weight. Prescription medications and weight-loss therapies may also be used to treat obesity (63).

2.2.5.1. Nutritional Treatments

Popular weight-loss programs have attracted widespread interest and fierce debate. While energy balance (i.e., calories still important) remains the cornerstone of weight control, new diets and books promising weight loss by restricting certain foods or macronutrients rather than calories continue to surface and top the bestseller lists. Their names and methods may change over time, but their basic premise stays the same. They define "success" as losing a considerable amount of weight in a short amount of time with minimal effort. Obese and overweight people are constantly on the search for the next "best" diet due to the allure of a quick fix. The public's willingness to accept a range of dietary alternatives, some of which have received insufficient research, shows the public's long-standing difficulty with weight control and the need for more effective methods to help establish an energy deficit. Understanding the efficacy, health consequences, and long-term viability of present dietary weight-loss approaches is crucial for designing more effective treatments (63).

2.2.5.2. Treatment with Exercise

When paired with calorie restriction, most studies demonstrate that exercise has minimal effect on body weight loss. When combined with calorie restriction, exercise has a synergistic effect that boosts weight loss beyond the effect of diet alone. Exercise has been shown to have significant good effects on cardiovascular and metabolic risk factors independent of actual weight loss, and even a little amount of weight loss may have a substantial beneficial effect. Individuals who include physical activity in their daily routine have been shown to alter genetic factors connected to obesity. Even if they do the recommended amount of exercise each week, people who spend more time sitting and watching television have worse metabolic profiles. Continuous moderate-intensity aerobic exercise provides a weight-loss synergistic effect when combined with a healthy diet. In the obese population, high-intensity interval training has been demonstrated to be a safe, effective, and well-tolerated style of exercise, with more compliance than continuous moderate-duration exercise. Resistance exercise has significant cardiovascular and metabolic effects independent of weight loss. High-intensity interval training is effective, time efficient, and well tolerated in the obese population (64).

2.2.5.3. Psychological Treatment

Obesity is a complex condition having a genetic component (inherited) that interacts with individual, familial, behavioral, cultural, and environmental factors to cause a wide variety of symptoms and results (65). In order to treat obesity, a biopsychosocial strategy is needed, which includes medical and lifestyle therapies, psychological support, self-management programs, and medication. If required, bariatric surgery may be used as well (66). Obesity is connected to psychological problems, and therapeutic psychological treatments and psychotherapies can help patients modify their lives and lose weight with the help of multidisciplinary teams. Old and new cognitive-behavioral techniques are useful strategies among other medical procedures and rehabilitation therapies. In addition, clinical and health psychology may be able to aid patients in sticking to long-term, effective weight loss plans (67).

2.2.5.4. Surgical Treatments

All patients with a BMI of more than 40 kg/m^2 and those with a BMI of more than 35 kg/m^2 with concomitant obesity-related disorders should consider bariatric operations or weight reduction surgery if conventional therapy has failed (68).

2.3. Mediterranean diet pyramid

Immunomodulation is a word that refers to any method of altering the immune response. Immunity is in its infancy when a newborn is born, but it develops with age, antigen exposure, and a balanced diet. Diet is critical for immune cell maintenance and good function. It is generally understood that nutrients and nutritional variables may influence many areas of human biology by integrating food metabolism, gut microbiota, and the immune system, so contributing to the preservation of good health.

Essential fatty acids (EFAs), for example, are crucial immunological regulators. The parent n-6 polyunsaturated fatty acid (PUFA) linoleic acid (LA) is converted to arachidonic acid (AA) in the mammalian body, from which pro-inflammatory lipid mediators may be derived (eicosanoids). In contrast, Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), both n-3 PUFAs, are produced by ALA and transformed into anti-inflammatory and/or pro-resolving lipid mediators (resolvins and protectins).

Because n-3 and n-6 PUFAs compete for the same metabolic pathways, increasing n-3 PUFA instead of n-6 PUFA improves anti-inflammatory response. Vitamins and trace elements help to keep the immune system in good shape. The Mediterranean food pattern is a scientifically confirmed strategy that helps to maintain human health and protect against major chronic illnesses. A Mediterranean-style diet is recommended for the prevention and/or treatment of obesity, type 2 diabetes, and inflammatory illnesses (69). The phrase "Mediterranean diet" (MED) refers to the eating pattern that was common in the olive-growing nations bordering the Mediterranean Sea in the 1960s, mainly Greece/Crete and southern Italy. During that time, The Seven Countries Study found that coronary heart disease mortality in the Mediterranean area was two to three times lower than in North Europe and the United States during that time period (70). Many of these nations' diets have evolved since then, becoming more similar to the so-called "Western diet" popular in the United States and Northern Europe.

The Mediterranean Sea is bordered by more than sixteen nations, each with its own unique diet based on cultural, social, or religious customs. Nonetheless, a Mediterranean dietary pattern can be identified, which includes a high intake of fruits, vegetables, and salad, as well as bread and whole grain cereals, potatoes, legumes/beans, nuts, and seeds. Low to moderate amounts of dairy products, such as cheese and yogurt, fish, shellfish, and chicken are consumed, but red and processed meats are taken in tiny amounts, and eggs are consumed up to four times per week. The use of herbs and spices to flavor foods minimizes the quantity of salt and fat necessary. Wine and/or other fermented drinks are taken in modest to moderate amounts with meals.

In all varieties of the MED, olive oil, which is predominantly constituted of monounsaturated fatty acids, is utilized as the major source of fat (70).

2.3.1. Health Outcomes and the Mediterranean Diet

Dietary patterns rather than individual foods or substances are the focus of current nutritional epidemiology studies. When creating dietary patterns, various food categories and their relationships, as well as any synergistic or antagonistic effects, are taken into account. Longitudinal studies have connected the MED to a variety of health benefits (reduced risk of all-cause mortality, cardiovascular disease, cancer, and other chronic diseases). Olive oil is the primary source of fat in this pattern, which also includes a high intake of plant-based foods (fruits, nuts and vegetables, legumes, grains, and seeds), frequent eating of fish, moderate wine consumption with meals, and low consumption of meat, dairy, and sweets. Since the MED was first described, a number of other ratings for assessing this eating pattern have been presented (71, 72).

2.3.2. Mediterranean diet

2.3.2.1. Mediterranean diet pattern

Food selection recommendations are provided by the MED pyramid, which shows the quantities and frequency of intake of the key food categories in the Mediterranean diet pattern (MDP). A healthy or unhealthy eating pattern is purely based on the kind of foods and cooking methods utilized, and also the frequency and amount of meals taken daily. The pattern includes all food categories. The nutritional deficit may be prevented by eating a wide range of foods. In fact, the MDP has been linked to a superior nutritional profile, with reduced rates of micronutrient deficiency in comparison to other dietary patterns, such as the Western diet (73).

Foods originating from plants make up the main structure of the pyramid. A well-balanced diet requires regular consumption of these foods since they are rich in key nutrients including fiber, antioxidants, and anti-inflammatory compounds. Plant-based meals make up the heart of this diet, which helps people lose weight and avoid many chronic illnesses (73,74).

Foods that offer a lot of energy, such as fruits and vegetables, are at the bottom; those that are heavy in carbohydrates and fats, like meat and dairy products, are at the top. These foods should be taken in moderation and kept for special occasions. The new image emphasizes the significance of meals in the MED, which is why the meal itself and content are highlighted. When the primary meals are composed of fruits, vegetables, and cereals, the daily calorie intake is less likely to be dominated by other plant foods, dairy products, and sources of protein, and micronutrient deficiencies are less common than in other designs, such as the Western pattern (73,74).

Foods that offer a lot of energy, such as fruits and vegetables, are at the bottom; those that are heavy in carbohydrates and fats, such as meat and dairy products, are at the top. These foods should be taken in moderation and kept for special occasions. The new image emphasizes the significance of meals in the MED, and that's why the dish and its content are highlighted. Fruits, vegetables, and grains should make up the majority of the daily calorie intake, while other plant-based foods, dairy foods, and protein sources should be consumed in moderation. In order to ensure a healthy and balanced diet on a daily, weekly, and sometimes basis, the pyramid gives nutritional advice (73).

Meals must consist of three main components that are ingested throughout the day:

– Cereals: one or two pieces of bread, pasta, rice, or couscous each meal. Ideally, the grain should be unprocessed, as the removal of fiber and other essential nutrients is common in processing like Fe, Mg, vitamins, etc.

– Vegetables should make up at least half of each meal. To get enough vitamins and minerals, eat at least one serving (one meal) a raw day.

– Fruit: As a rule of thumb, one to two portions are the most typical dessert choice. To provide a broad spectrum of antioxidants and beneficial substances in fruits and vegetables, the notion of "diversity in colors and textures" is stressed. Daily water consumption of 1.5–2.0 liters is recommended (six to eight glasses). Maintaining a healthy water balance in the body requires enough hydration, although individual demands based on age, activity level, personal factors, and climatic conditions. It must be drunk unrestricted, regardless of whether it is in a bottle or straight from the tap, as long as the circumstances are safe. As an alternative to plain water, sugar-free herbal extracts and tea may be used, as also low-sodium and fat-free broths (73). Low-fat dairy products, such as yogurt, cheeses, and other fermented products, should be taken in moderation (two portions per day). Dairy products, despite their calcium concentration, are a substantial source of saturated fat, which is bad for bones and the heart (73,75). As a result of its greater nutritional value, olive oil should be the main source of dietary lipids, especially extra virgin olive oil. As a result of its special composition, it is suitable for use in both cooking and dressing (73,76). A number of studies have shown that olive oil has a protective impact on blood lipids as well as cardiovascular health (73, 76, 77). A high concentration of omega-3 fatty acids and an abundance of antioxidant substances may be to blame for its health benefits. Olive oil is historically used to enhance the nutritional content of vegetables as well as other plant-based diets. Nutritional fats and protein, vitamins, minerals, and fiber may be found in olives, nuts, and seeds. A handful of olives, almonds, or seeds is a good source of healthy fats (73, 76).

As salt is one of the key contributors to the development of high blood pressure in genetically sensitive persons, spices, herbs, garlic, and onion is a wonderful methods to add diversity and increase the taste and palatability of foods while minimizing the quantity of salt. The micronutrients and antioxidant chemicals found in herbs and spices contribute to the distinct flavor profiles of Mediterranean cuisine. The MDP advises that wine and other fermented drinks be used in moderation at mealtime in accordance with religious and social norms. As a reference one glass for women and two glasses per day for men (73).

On a weekly basis, it is advisable to eat a mix of plant and animal proteins. Although animal-based protein is a common element in Mediterranean cuisine, it is mostly used as a flavoring factor. The recommended daily intake of animal protein is up to four portions of fish and seafood, two dishes of white meat, and up to four eggs. Fish, white meat like poultry, turkey, rabbit, etc., and eggs are examples of high-quality protein sources. Proteins and lipids can be found in abundance in fish and shellfish. It is advised to consume a variety of fish (including oily fish, lean fish, and shellfish). White meat, which lacks the high quantities of saturated fat seen in certain red meat cuts, is also a fantastic source of lean protein. Cooked and baked egg eating should occur no more than two to four times per week. Red meat intake should be restricted to no more than two servings per week, ideally from lean cuts, and processed meat consumption should be restricted to no more than one serving per week since these meats have been linked to a variety of chronic conditions (cancers and chronic heart diseases) (73, 78). Legumes and grains are an excellent source of plant-based protein and fat and should be regarded as a meat substitute in the diet of vegetarians and vegans. This vegetable is also included in the weekly food plan (three or fewer servings per week, ideally fresh) since it is used in many traditional meat and fish dishes. Because of their high glycemic index and the fact that they are frequently fried, they should be consumed in moderation (73). Occasionally Foods high in sugars and unhealthy fats are located at the apex of the pyramid (sweets). Moderation is key when it comes to sugar, sweets, pastries, and beverages like fruit juices and soft drinks. These foods are nutrient-rich (73).

2.3.2.2. Components of culture and way of life

In the MED when developing the pyramid cultural and lifestyle factors should be considered in addition to food intake guidelines. The MED and its cultural legacy can only be preserved if people adopt healthy lifestyles and protect their cultural heritage at the same time. Outside of the pyramid, but at its base, are the following concepts: Moderation Serving sizes must be based on prudence and moderation in order to meet the energy needs of urban and modern lifestyles. This is stressed since obesity is a public health concern. They should be ingested less often and in lesser amounts due to their higher fatty acid and sugar content. Serving sizes should reflect local traditions and regional preferences based on the distinct realities of each nation and area (73).

2.3.2.3. Socialisation

In addition to nutrient content, the meal's conviviality is a significant consideration for its social and cultural significance. Culinary practices and knowledge handed down through the generations, as well as the number of hours spent preparing and eating a meal in relation to a person's daily routine, should all be taken into account in this context. Cohesion, communications, and identity are all enhanced when these elements are present. Social support and a deep feeling of community are two things that may be found while having a meal together with friends and family. Companionship at dinner may have a good impact on food patterns and, by extension, health (73).

2.3.2.4. Cooking-related actions

Every culture's social reproduction of identity relies heavily on the advancement of culinary activities including cooking, handicraft, home space organizing, and other food-related practices. A lot of time and space must be set up for these culinary activities since they are so important in everyday meals, festivities, and religious holidays around the world (73).

2.3.2.5. Physique D'action

Moderate physical exercise (at a minimum of 30 min each day) supports nutrition by regulating energy intake, maintaining a healthy body weight, and delivering a wide range of additional health advantages (78). Sports like football, dancing, running, and cycling, as well as activities like walking, using the stairs instead of the elevator, cleaning and gardening are examples of physical exercise (73).

2.3.2.6. Adequate Rest

Daytime rest (napping) and enough nocturnal sleep are equally essential parts of a healthy and balanced lifestyle. Scientific studies have revealed that taking a short break after a meal is beneficial to one's health as well as traditional. Throughout Mediterranean and European countries, the trend of taking a post-meal sleep is on the rise (73).

2.3.2.7. Seasonality

Most of the time, choosing the season, fresh, and minimally processed meals increases vitamin and substance consumption that protects against disease. Fresh foods are being replaced by processed ones as a consequence of our current lifestyle. Progress in technology has reduced nutritional loss and provided nutritious substitutes, though. As a result, the nutritional content of food is affected by all choices and behaviors across the food system, from seed to table (73).

2.3.2.8. Traditional, regional, eco-friendly, and biodiversity-rich products

The preservation of the Mediterranean lands and seas is aided by the use of historic, local, eco-friendly, and biologically diverse goods wherever feasible. While the MED may be seen as a selection of foods, it should be understood as a cultural model for the whole food supply chain, including the methods used to choose, produce, prepare, and deliver food to customers in the first place. A plant-based diet is also an environmental benefit since it reduces animal consumption and hence animal production, which in turn reduces the demands on the environment's resources such as the use of fertilizer, water, and energy. The MED's long-term viability in a global era is shown by all these elements (73).

2.3.3. The Mediterranean diet and Infertility

MED-recommended diets have been shown to have good impacts on wellbeing, according to recent studies. When it comes to fertility, hyperinsulinemia, metabolic disturbances, and obesity risk reduction have been linked positively to the MED (79, 80). Med use and fertility were shown to be positively linked in a cohort study of 22,786 adults with an average age of 35 years (71). In addition, studies show that women taking ART may have a higher chance of having a live delivery if they follow a balanced diet (81,82). Pro-fertility diet adherence (equal to the MED) was linked with a lower risk of infertility due to ovulation disorder among 17,545 women who were either considering pregnancy or got pregnant during the research. Lower consumption of trans-fatty acids (TFAs) and greater consumption of monounsaturated fatty acids (MUFAs) and plant-based protein defined the pro-fertility diet. In addition, less animal protein, low glycemic index meals, higher fiber foods, and, surprisingly, high-fat dairy were consumed. Women who followed the pro-fertility diet consumed nonheme iron at least three times a week drank greater alcohol and coffee and engaged in greater physical activity (83).

2.3.3.1. Dietary compounds and female fertility

2.3.3.1.1. Carbohydrates

Ovulation and fertility in women may be significantly affected by insulin sensitivity and glucose metabolism. The glycemic index and load of carbs are especially essential considerations. Increased insulin resistance, dyslipidemia, and oxidative stress are all possible side effects of consuming foods high in glycemic index (81, 84).

Both hyperinsulinemia and ovarian steroidogenesis may be modulated by insulin, and both conditions are associated with both hyperandrogenism and abnormal ovulation. PCOS women's synthesis of sex hormone-binding globulin is mostly regulated by insulin (79).

Based on their effect on blood sugar, carbohydrates are ranked on the Glycemic Index (GI). According to the GI, foods with high levels of carbohydrates are more likely to raise blood sugar levels than those with low levels of carbohydrates. Simple carbs boost blood glucose levels, but high-fiber diets reduce them, leading to a lower GI value. Simple carbohydrates are likely to elevate blood glucose levels. Dietary effects on the level of blood glucose may be more accurately predicted using the glycemic load (GL) technique, which accounts for the quality and amount of carbs. Low carbohydrate grade and high

GL have been connected to insulin resistance, which in turn has been linked to diabetes, heart disease, and PCOS. Ovulation function may be affected by insulin resistance, since higher insulin levels may enhance the generation of free testosterone, resulting in hyperandrogenism (85). The low-GI diet enhanced insulin sensitivity in a randomized control experiment in which obese and overweight women were randomized to either a low-GI diet or a typical healthy diet (86). Increased levels of insulin-like growth factor I (IGF-I) plus androgens, which may also cause endocrine disruptions and affect oocyte maturation, have been linked to greater fasting glucose, hyperinsulinemia, and insulin resistance in people with high glycemic index and load (79). Women who had never been infertile before the trial was shown to have an increased risk of ovulation disorder-related infertility if they ate a diet rich in carbs and low in natural fats and high on the glycemic index (87). A reduced chance of becoming pregnant was linked to increased consumption of high-glycemic-index foods and carbs, compared to low-fiber diets and simple sugars in another research (84). The ingestion of sugary, fizzy drinks, whether they are caffeine-free or not, may diminish the chances of ART effectiveness in reproducing. Consumption of carbonated beverages has also been linked to higher levels of free estradiol (88). In women with lipids and glucose metabolic disorders, both the amount and the kind of carbohydrates are very critical in a pro-fertility diet. However, women of reproductive age who want to have a family should also keep this in mind while planning their meals (89).

2.3.3.1.2. Fat

Fertility is influenced by the amount of fat in the diet. Menstrual cycle duration, reproductive hormone concentrations (e.g., LH), and embryo quality in ART cycles are all affected by a high-fat diet (90).

Furthermore, the type of fat seems to be more important than the amount of fat. Infertility owing to ovulation problems was shown to be significantly increased by merely a two percent increase in TFA consumption in the study of 18,555 women planned or already pregnant at the time of the investigation (91). Inflammatory qualities of TFAs have been linked to an increased chance of getting type 2 diabetes and other metabolic diseases, like as PCOS, which may affect fertility (90, 92). Peroxisome proliferator-activated receptor (PPAR) has been postulated to be a causal factor in the TFAs' direct harmful effects. Endometriosis was also shown to be linked to TFA usage (t). Global TFA usage in 2010 varied from 0.2% to 6.5% of total calories, according to the Global Burden of Diseases Study, with a global mean TFA consumption of 1.4% of total energy intake (s). TFA consumption is greatest in Bahrain, Mexico, Canada, Egypt, and Pakistan, despite the WHO's recommendation that it be limited to 1% of total caloric intake (93).

On the other hand, steroidogenesis and anti-inflammatory effects of TFAs have a beneficial influence on fertility. TFAs from fatty fish or supplements have been shown to increase oocyte development and maturation, minimize anovulation, enhance embryo shape, and raise progesterone levels, according to the studies currently available (92,93). Contrary to popular belief, the link between TFAs and infertility is a complex one. TFAs may be useful for the treatment of PCOS since they improve insulin sensitivity and lipid profile, but additional study is required (94). When TFAs are taken by women with normal BMIs, they have been shown to reduce FSH levels, however, this effect has still not been found in women with obesity. However, further study on women with a reduced ovarian reserve is necessary (92).

Higher levels of long-chain 3-PUFA in the blood were linked to an increased chance of medical pregnancy and birth after ART. Plasma long-chain 3-PUFA concentrations enhanced the chance of medical pregnancy and live birth by 8% (95 % confidence interval: 4% to 12%) and 8% (95 % confidence interval: 1% to 16%) for every 1% increase. It was the concentrations of EPA that were principally responsible for these beneficial relationships. One percent rise in serum EPA concentration was related to an increase in the chance of medical pregnancies and live birth of 10% and 15%, respectively, in the 95 percent confidence interval (95 percent CI) (95). Pregnancy outcomes may be improved by supplementing IVF procedures with Omega-3 FAs, according to recent research (96). Reducing inflammation and improving fertility are two of the many benefits of MUFAs' binding to a PPAR- receptor. Studies have shown a link between MUFA intake and fertility and the time it takes to conceive (92, 97).

2.3.3.1.3. Protein

Protein is the next component of a fertility diet. Due to the absence of ovulation, studies show that eating animal protein increases one's chances of becoming pregnant later in life. Women over the age of 32 who eat a diet high in plant protein are more likely to get pregnant. The gap may be a consequence of the different effects of animals and plant proteins on insulin and IGF-I production. Compared to animal protein, plant protein has a lower insulin response (93).

Healthy women's testosterone levels are adversely associated with a protein diet, especially animal protein. Female fertility and ovarian function seem to be regulated by androgens, particularly testosterone (98). Androgen-related reproductive diseases may be caused by excessive androgen signaling, which interferes with the mechanisms controlling ovarian follicular dynamics (93). Protein consumption had no effect on LH, FSH, progesterone, or estradiol concentrations. In addition, the research revealed no link between the number of antral follicles in infertile women and total protein consumption from plants and animals (excluding protein from dairy sources) (97). The importance of protein intake for women who are trying to conceive will have to be studied further. In truth, the quantity of protein necessary for a healthy diet for the majority of people should be determined by a variety of criteria, including physical activity. Additionally, a plant-based protein diet should be emphasized (93).

2.3.3.1.4. Micronutrients

Folate, vitamin B12, and vitamin B6 may have an effect on fertility. Supplementing with high amounts of vitamin B12 and folic acid before conception may boost the chances of conceiving and achieving a pregnancy via in vitro fertilization (IVF). While observational studies have shown that large doses of folate may lead to a beneficial response, no randomized controlled trials have been conducted to examine the effects of such high doses (93, 99). Folate, vitamin B12, and vitamin B6 reproductive impacts and homocysteine metabolism may be linked. The remethylation process is hampered by vitamin B12 deficiency, but cystathionine b-synthase is activated in the absence of vitamin B6. This results in a slowdown in the transsulfuration pathway, which transforms histamine into cysteine (100). In clinical investigations, the combination of hyperhomocysteinemia and folic acid deficiency has been linked to an increased risk of multiple miscarriages. Women who have repeated early pregnancy losses have been shown to have higher levels of homocysteine, which has been associated with defective chorion vascularity (100, 101). Homocysteine levels were linked to a 33 percent greater incidence of anovulation dysfunction in a study of 259 women who did not use hormonal contraception or dietary supplements. Additionally, a 10% reduction in the likelihood of anovulation was seen when the folic acid to homocysteine ratio was increased (102).

Women's reproductive processes may be influenced by vitamin D. Vitamin D receptors have been found in several reproductive organ tissues, including the ovaries, endometrium, placenta, pituitary gland, and brain (92, 103). Endocrine systems, as well as testosterone production, are also affected by vitamin D. In healthy people, there was no association between vitamin D and fertility. Proinflammatory cytokines are produced and secreted in excess when vitamin D levels are low, which disrupts the calcium balance. Insulin production and secretion are also stimulated, which in turn affects glucose metabolism. Numerous research has examined the role of vitamin D in inflammatory disorders, including diabetes and cardiovascular disease, as a result. By modulating glucose metabolism, vitamin D may play a key role in the development of PCOS (92).

The right mineral concentration is required for several physiological processes, including the maintenance of normal oocyte quality and embryonic fertilization, maturation, and implantation. Women should monitor their mineral intake and take supplements if necessary since a mineral shortage might affect fertility (92). Vitamin D, folate, iodine, iron, vitamin B12, calcium, and iron are among the nutrients that many women aren't getting enough of because they aren't getting enough of them through their diets, according to research (104). Magnesium, iodine, selenium, calcium, iron, and zinc all have a role in fertility (92).

Calcium affects the function of the bloodstream, muscle contractions, nerve transmission, and hormone production. Pregnant women's bones provide the baby with calcium, which it utilizes to build its own bones. As a result, women of reproductive age need to consume the necessary amounts of calcium in their diet. Deficiency in calcium may lead to an increase in hypertension and pre-eclampsia risk (105).

Ferritin levels and fertility have been explored in a small number of studies. Both too much and too little iron, on the other hand, might have a detrimental influence on fertility. Fertility was not linked to complete or heme iron consumption among women at risk for iron insufficiency, such as those who had regular or heavy periods (92, 106). Another necessary ingredient is iodine, which influences thyroid gland activity and is crucial for fertility. There was a 46% decrease in the chance of becoming pregnant in each cycle among women with moderate or severe iodine deficit compared to those who were not deficient. Women with modest iodine insufficiency had a small but statistically significant correlation (92, 107). A one-month latency in pregnancy was linked to zinc and selenium levels in the blood. Infertility was also linked to low levels of selenium and copper, but not zinc. Additional studies are needed to better understand the impact of copper and zinc values on women's fertility based on a limited number of studies (92, 108).

The thyroid gland is similarly affected by selenium. The antioxidant properties of this supplement also help to reduce oxidative stress. Serum Selenium may affect the oocyte's growth and maturation. As a result, an adequate quantity of selenium is necessary (108).

Magnesium may be crucial to women with PCOS as well as medical complications because of its role in glucose metabolism. Increased insulin sensitivity may be linked to a healthy magnesium level in the bloodstream (109).

To meet one's daily nutrient requirements, one must eat a diversified and balanced diet. However, if you have a mineral shortage, especially iodine deficiency, you'll need to take supplements (92).

3. MATERIALS AND METHOD

The study was carried out between 12 weeks and is conducted on 30 female individuals who applied for pregnancy at The Bahçeçi IVF Center.

Women receiving IVF therapy (age 18-35) with a BMI between 25 and 40 kg/m^2 (IVF/ICSI) were included in these studies.

Ethics committee approval of the study was obtained, and a voluntary consent form was obtained from the participants before participating in the study (appendix 6.4.).

Endometriosis of a severe or chronic kind, early ovarian failure, endocrinopathies, pre-existing hypertension, diabetes, malabsorptive illnesses, or current usage of lithium medication were all considered contraindications.

The 30 participants were separated into two groups: the MED study group that completed a 12-week MED before commencing an IVF/ICSI cycle, whereas the control group did not.

Mediterranean diet screener (MEDAS) In 2011, Schröder H et al. produced a 14-item screening questionnaire, which Pehlivanoglu et al. adapted into Turkish in 2020 (110, 111). The MEDAS scale was applied to all participants at the beginning of the study. MEDAS is a questionnaire consisting of 14 questions, the type of basic oil used by the patients in meals, the amount of olive oil consumed daily, fruit and vegetable portions, margarine-butter and red meat consumption, weekly consumption of wine, pulses, fish-seafood, snacks, nuts, cake, olive oil tomato sauce consumption and whether white meat is preferred more than red meat. 1 or 0 points are taken for each question asked according to the amount of consumption, and the total score is calculated. A total score of 7 and above indicates that the individual has an acceptable degree of adherence to the Mediterranean diet, and a score of 9 and above indicates that the individual has a strict adherence to the Mediterranean diet (see appendix 6.2).

The target set for the MED study group was to lose 5-10% of their body weight in 12 weeks. Those taking part in the study were weighed. Dietitian supervision ensured that the diet was tailored to each person's specific needs. An important aim was to lower total daily caloric intake by at least 500–800 calories in comparison with before the intervention (but not below 1200 kcal/day). Dietary guidelines based on the 2010

Mediterranean Diet Foundation Guidelines were followed by the MED study group. Food from the Mediterranean region was utilized to create this nutritional plan. Total fat of 37 percent (20 percent MUFA, 9 percent polyunsaturated fatty acids (PUFA), 8 percent saturated fatty acids (SFAs)), 18 percent protein, and 45 percent carbohydrate energy are given by the MED diet. In this nutritional plan, seven nuts should be eaten daily, along with olive oil, as part of the daily diet.

This diet process started with the doctor's guidance after the application to Bahçeci IVF Center met the criteria and ended with the start of the transfer process in the IVF cycle.

During the study, weight loss was achieved with the MED applied throughout the study, and regular weight monitoring was carried out for 12 weeks.

One participant has not received the pregnancy test result during the analysis period therefore, the remaining results were conducted with 29 participants.

All analyses were performed using R (version 4.1.2) and R Studio (version 1.4.1106) software. Numeric variables: mean, standard deviation (SD), median, lower and upper values, and categorical variables are shown as numbers (S) and percentage (%). Distribution control of all parameters was done by the Kolmogorov-Smirnov test. Differences between groups of quantitative parameters were analyzed with one-way ANOVA and t-test in cases of normal distribution, and Mann-Whitney U and Kruskal Wallis tests in cases where normal distribution was not observed. Pearson's chi-square test was used to examine the differences between groups of qualitative parameters. The correlation coefficient was calculated for the analysis of the relationship between BMI and successful pregnancy outcomes. In all analyzes, the confidence interval was determined as 95% and the results for $p < 0.05$ were considered statistically significant.

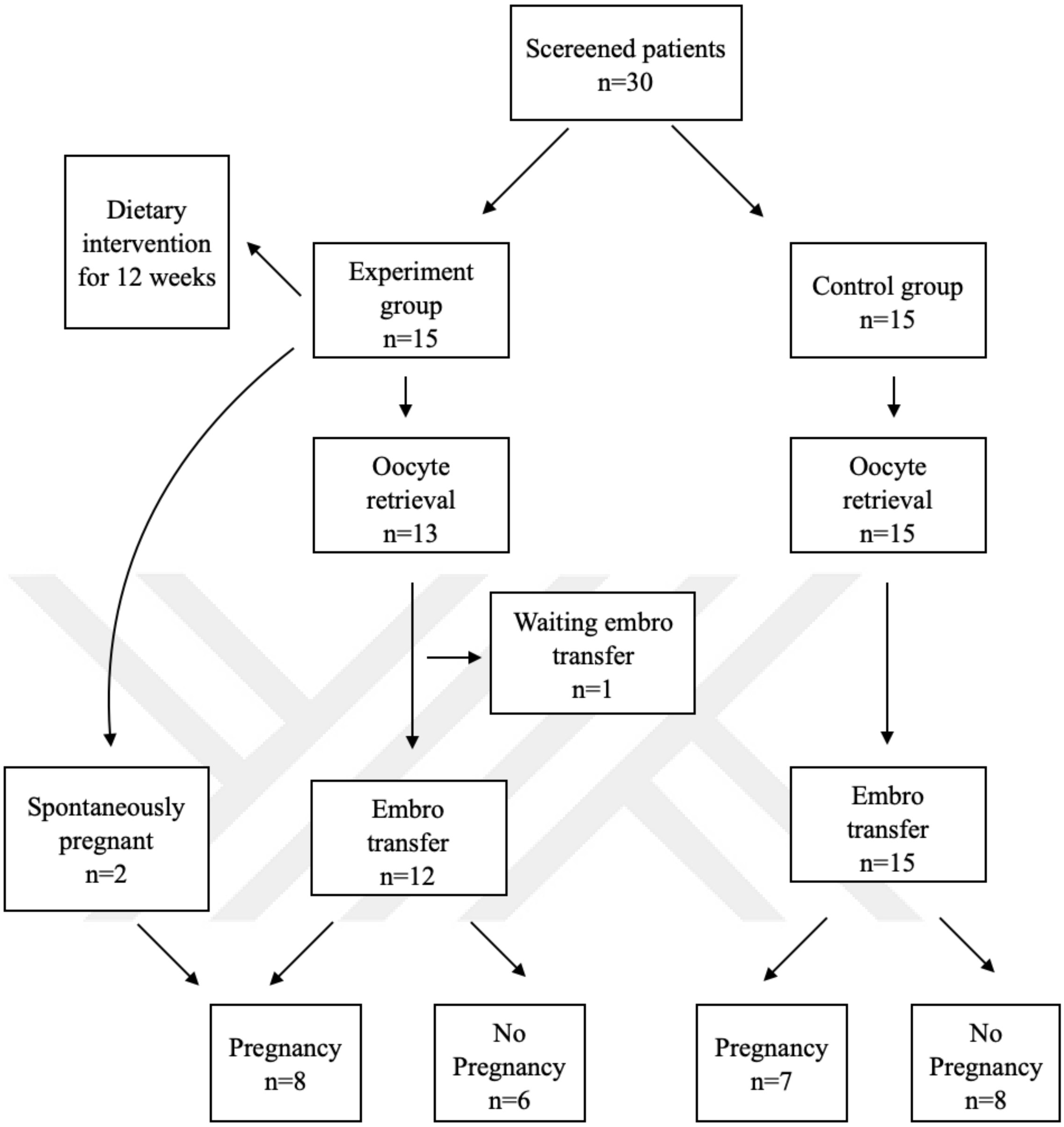

Figure 4.1. Figure Study Flow Diagram and Patient Outcomes

4. RESULTS

The data obtained as a result of the research, the effect of the weight loss achieved by the women as a result of the weight loss program planned in accordance with the Mediterranean diet, on the success status of the IVF application were examined. There were 30 participants in the study (see Appendix A for detailed information about participants).

At the beginning of the study, the mean weight of the MED study group was 84.1±10.1, while the mean weight of the control group was 84.6±13.0. Independent sample t-tests were used to examine possible differences in the weight, age, and MEDAS scores that the two groups might have at the beginning of the study. The MED study group and control group were not significantly differed in their initial weight ($p = .905$), age ($t(28) = 0.14$, $p = .892$) and their score of MEDAS ($t(28) = 0.70$, $p = .492$). Furthermore, the mean weight of the MED study group was 76.2±11.0 as a result of the Mediterranean diet, while the control group remained at 86.6±12.9. T-test analysis revealed that the weight change at the end of week 12 was significantly different between the groups ($t(28) = 6.99$, $p < .001$) (Table 4.1). At the end of 12 weeks, it was considered that the study group was completely dependent on the Mediterranean type diet, without making a comparison of the medas score. No dietary intervention was applied to the control group.

Table 4.1 Age, initial MEDAS scores, and weight (week 1-12) according to to control and MED study groups

	Control group (n = 15)		MED study group (n = 14)		
	Mean (SD)	**Median (Min-Max)**	**Mean (SD)**	**Median (Min-Max)**	**p-value**
Initial MEDAS Scores	5.80 (1.37)	6 (4-9)	5.47 (1.25)	6 (3 – 8)	0.492
Weight Week 1	84.6 (13.0)	85 (62.0 – 105)	84.1 (10.1)	86 (66.0 – 98.0)	0.905
Weight Week 12	86.6 (12.9)	85 (65.0 – 105)	76.2 (11.0)	79 (56.0 – 92.2)	-
				Age	0.892
				Weight change	< .001

Individuals who lost 1 kilogram were 0.62 times more likely to get pregnant than individuals who did not lose any weight. Two patients in the MED study group were spontaneously pregnant. Finally, embryo quality did not significantly predict pregnancy success, p =.998 (Table 4.2, Table 4.3, Table 4.4, and Table 4.5).

Table 4.2 Binomial Logistic Regression Overall Model Statistics Predicting Pregnancy

Model Fit Measures

			Overall Model Test		
Model	Deviance	R^2_N	χ^2	df	p
1	19.6	0.644	17.8	4	0.001

The logistic regression analysis was conducted to investigate the impact of the Mediterranean diet, weight loss, and embryo quality on the success of pregnancy. The outcome variable was whether being pregnant was coded as 0 = participant did not get pregnant, 1 = participant got pregnant; and diet was coded as 0 = participant was in the control group, 1 = participant was in the MED study group.

The overall model was statistically significant, χ^2=17.18, p = .001, R^2_N = 0.64 suggesting that 64% of the variance in the success of getting pregnant was explained by diet, weight loss, and embryo quality. The model correctly classified 85% of cases. The MED study group and control conditions were marginally significantly different in their success of getting pregnant, OR = 0.02, β_1 = - 3.77, $CI_{\beta 1}$ = - 7.71 – 0.15, $SE_{\beta 1}$ = 2.00, p = .06. Further, weight loss was significantly predicted pregnancy success, OR = 0.62, β_1 = - 0.47, $CI_{\beta 1}$ = - 0.91 – -0.04, $SE_{\beta 1}$ = .22, p = .032.

Table 4.3 Binomial Logistic Regression Statistics Predicting Pregnancy

Model Coefficients - Pregnancy

		95% Confidence Interval				
Predictor	**Estimate**	**Lower**	**Upper**	**SE**	**Z**	**p**
Intercept	1.454	-0.173	3.0798	0.830	1.75173	0.080
Condition:						
MED study group–Control	-3.775	-7.705	0.1554	2.005	-1.88244	0.060
Weight Change	-0.476	-0.910	-0.0408	0.222	-2.14400	0.032
Embryo Quality:						
Bad-Good	-20.246	-13542.542	13502.0495	6899.257	-0.00293	0.998
Medium-Good	-21.314	-9262.321	9219.6941	4714.886	-0.00452	0.996

Note. Estimates represent the log odds of "Pregnancy = 1" vs. "Pregnancy = 0"

This table shows how many times the participants took part in the IVF trial before participating in the study (Table 4.4.).

Table 4.4 Frequency of IVF Trial by Control and MED study Groups

IVF Trial		
	Condition	
IVF Trial	**Control group**	**MED study group**
1	5	2
2	5	4
3	5	1
4	0	3
5	0	2
7	0	1

As a result of the study, embryo qualities obtained from the MED study group and control group were evaluated.The table below presents the embryo qualities obtained from the participants (Table 4.5).

Table 4.5 Frequency of Embryo Quality by Control and MED study Groups

Embryo Quality		
	Condition	
Embryo Quality	**Control group**	**MED study group**
good	12	10
bad	1	1
medium	2	2

5. DISCUSSION

Prior studies have shown that a MED may increase the chance of pregnancy during IVF/ICSI therapy (112, 113). Our results back up those findings. Studies have contrasted MDP to the "health conscious-less processed" dietary pattern (which includes high intakes of fruits, vegetables, fish, and whole grains, as well as modest intakes of snack foods and meats) using principal component analysis, for example (high intakes of vegetable oils, vegetables, fish, and legumes, and low intakes of snacks). Only the MDP was related to improvements in IVF pregnancy outcomes [odds ratio (OR): 1.4; 95 percent confidence interval (CI): 1.0–1.9], which may be ascribed to the stronger positive impact of this dietary pattern on vitamin B6 and folate levels and the high consumption of vegetable oils (112).

In a cohort study with 485 participants, the probability of infertility was lower among women who adhered to an MDP in the highest possible quartile compared to those who adhered to the lowest possible quartile (OR: 0.56, 95% CI: 0.35–0.95) (113). IVF success rates may be correlated to the MED's high intake of nutrients and food categories that have been linked to better fertility and treatment outcomes, such as whole grains (114). We hypothesized in our research that a MED would enhance embryo quality. To complement our findings, an additional screening trial was conducted, which indicated that MED improved fertility. When it comes to conceiving, individuals who adhered to a MED that contained a high consumption of vegetables, seafood, and polyunsaturated oils had a 44 percent reduced risk of seeking medical help than those who did not stick to the diet (115).

The results of this study indicate that Mediterranean dietary patterns may increase embryo yield by improving ovarian response or oocyte quality. In another prospective cohort study among 700 women about to undergo IVF treatment, MED enhanced female fertility and IVF success rate by improving ovarian response and oocyte quality (116). The MDP emphasizes a large consumption of vegetable oils, the majority of which consist of linoleic acid. Linoleic acid, one of the n-6 fatty acid compounds, is a precursor to prostaglandin, which is essential for maintaining endometrial receptivity. Therefore, it is plausible that MED might influence embryo implantation by altering endometrial function. In order to determine if MED affects embryos or endometrial receptivity, controlled studies in oocyte donation cycles may be developed (117). In case-control research done in a Spanish cohort of university graduates, MED was used to determine that women in the highest quartile of MDP adherence had a decreased risk of infertility (OR: 0.56, 95% CI: 0.35–0.95) compared to those in the lowest quartile (OR: 0.35, 95% CI: 0.25–0.95) (118).

The amount of red meat consumed by our research group decreased when we implemented a MED. Results from a cohort research on infertility found that red meat intake was related to a lower likelihood of blastocyst formation during embryo development (OR: 0.81; 95% CI, 0.65, 0.99) (119). Although it has been shown that the diet of cereals, vegetables, and fruits significantly improves embryo quality in women who undergo IVF/ICSI therapy, increasing red meat consumption seems to have a detrimental effect on implantation and clinical pregnancy rates (120). Two of the women in our research group became pregnant on their own, despite the fact that they were not in the control group, and a MED encouraged spontaneous conception. Pregnancy growth in spontaneous pregnancies is favorably correlated with periconceptional mothers' "high fish and olive oil, low meat" dietary habits, while no meaningful link was found in IVF/ICSI pregnancies (121). An increase in insulin resistance is linked to greater visceral adiposity(122,123). Numerous obesity-related reproductive disorders have been associated with insulin resistance and secondarily hyperinsulinism, both of which may be contributing causes (124).

At the beginning of our study, we conducted a dependency survey on MED and divided them into two equal groups. As a result of this study, the associated weight loss may be connected with high dependence on MED. Another study supports our study. In that study higher adherence to the MED has been associated with a 2-times greater likelihood of maintaining weight loss (125).

The overall model was statistically significant, 64% of the variance in the success of getting pregnant was explained by diet, weight loss, and embryo quality. In another prospective cohort study, among women <35 years, a beneficial 5-point increase in the MEDAS has associated with ~2.7 times higher likelihood of achieving clinical pregnancy and live birth (126).

In our study, pregnancy rates were 0.62 times higher in women who dropped one kilogram than in those who did not reduce weight. As many as 40% more women became pregnant after taking the MED (127). Our findings are backed up by pilot research that looked at how MED and activity intervention before an IVF cycle affected the pregnancy rates of obese women. Study participants were shown to have a higher cumulative live fertility rate in the intervention group (128). Another research that looked at the connection between weight loss and IVF therapy found no benefit from it. There was, however, no MED in this study's weight loss method (129). Only a 10 percent weight decrease may have a good effect on infertility, according to this research (129).

Excessive weight is associated with an increased miscarriage rate. Another study showed that with BMI> 28 kg/m^2 miscarriage rate reported was 15% (130).
In the study group, there were 2 spontaneous pregnant women who were not in the control group due to weight loss and the effect of MED. Another study of 85 participants based on only calorie restriction found that weight reduction, in addition to ovulation induction therapy, leads to a high rate of spontaneous conception and improves pregnancy outcomes (131). At this point, more studies should be done to determine whether the MED or weight loss affects the pregnancy rate between these two groups. Studies in this area are very limited and insufficient. We believe that this small-scale study will shed light on future major studies.

In conclusion, infertility is an increasing health problem in the world. In Turkey, having a child has an important place from past to present. The number of couples applying for IVF treatment has become widespread. Evidence on the effects of general health and nutrition on fertility, which is one of the lifestyle factors, is increasing day by day. The results of our study, a woman's likelihood of becoming pregnant after IVF or ICSI therapy may increase if she maintains a high level of adherence to the "Mediterranean" eating pattern. These results are significant in light of the design of dietary treatments with the purpose of further enhancing fertility therapy and success rates.

For more significant results more studies should be done with more participants. In addition to this, the difference between the MED diet and other kinds of diets should be observed for the effect of weight loss on pregnancy rate.

For observing the effect of the MED diet on the pregnancy rate. Men should be involved in this kind of study because of the sperm quality

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7. APPENDICES

7.1. Results For Control And Med Study Group

Condition	First weight	Last weight	Weight Loss (%)	Age	Pregnancy(Yes=1, No=0)	Embryo quality	Number of IVF attempts	Profession	Education Level	Education Level (partner)	Smoking (Yes=1, No=0)	Smoking Frequency
Experiment 1	91.5	82.8	9%	34	1	good quality	5th attempt	worker	primary school	primary school	0	0
Experiment 2	88.6	73.5	17%	34	1	good quality	1th attempt	waiter	high school	high school	1	rearly
Experiment 3	90	85	%5,5	25	1 (spontaneously pregnant)	spontaneous	spontaneous	teacher	undergraduate	middle school	0	0
Experiment 4	92.7	90.7	2%	35	0	good quality	2th attempt	waiter	middle school	primary school	0	0
Experiment 5	94.5	92.2	%2,4	30	0	good quality	7th attempt	housewife	associate degree	undergraduate	0	0
Experiment 6	79	75	5%	24	0	medium quality	5th attempt	housewife	high school	high school	0	0
Experiment 7	79	69	%12,6	27	1	good quality	2th attempt	housewife	undergraduate	undergraduate	0	0

Experiment 8	75	61	%18,6	25	1	good quality	1th attempt	housewife	middle school	undergraduate	0	0
Experiment 9	86	80	%6,9	30	1	good quality	4th attempt	housewife	high school	high school	0	0
Experiment 10	85	83	%2,3	34	0	good quality	4th attempt	housewife	Primary school	Primary school	0	0
Experiment 11	66	62.5	%5,3	30	0	poor quality	5th attempt	housewife	undergraduate	undergraduate	0	0
Experiment 12	67.5	56	17%	34	0	medium quality	3th attempt	housewife	high school	high school	0	0
Experiment 13	98	85	%13,2	30	1	good quality	4th attempt	housewife	primary school	primary school	0	0
Experiment 14	74	68	%8,1	32	1 (spontaneously pregnant)	spontaneous	spontaneous	academician	undergraduate	undergraduate	0	0
Experiment 15	94.5	79	%16,4	35	waiting embryo	good quality	2th attempt	worker	undergraduate	degree	0	0
Control 1	62	65		33	0	good quality	1th attempt	nurse	associate degree	undergraduate	0	0
Control 2	95	100		26	0 (abort)	good quality	3th attempt	housewife	primary school	undergraduate	0	0
Control 3	90	92		35	0	good quality	1th attempt	housewife	high school	undergraduate	0	0

Control 4	68	70	25	0	medium quality	3th attempt	housewife	high school	undergraduate	0	0
Control 5	87	88	28	1	good quality	1th attempt	worker	associate degree	high school	0	0
Control 6	69	71	28	1	good quality	2th attempt	housewife	primary school	primary school	1	rearly
Control 7	80	80	35	1	good quality	3th attempt	worker	undergraduate	undergraduate	1	rearly
Control 8	78	78	33	1	good quality	3th attempt	worker	undergraduate	undergraduate	0	0
Control 9	100	102	24	1	good quality	2th attempt	housewife	primary school	middle school	0	0
Control10	105	105	27	0 (abort)	good quality	3th attempt	housewife	undergraduate	middle school	0	0
Control 11	85	85	30	1	good quality	2th attempt	housewife	high school	high school	0	0
Control 12	72	80	35	1	good quality	2th attempt	doctor	undergraduate	undergraduate	0	0
Control 13	100	105	35	0 (abort)	good quality	1th attempt	worker	primary school	high school	1	rearly
Control 14	93	93	33	0 (abort)	medium quality	1th attempt	housewife	high school	high school	1	rearly
Control 15	85	85	35	0	poor quality	2th attempt	worker	associate degree	undergraduate	0	0

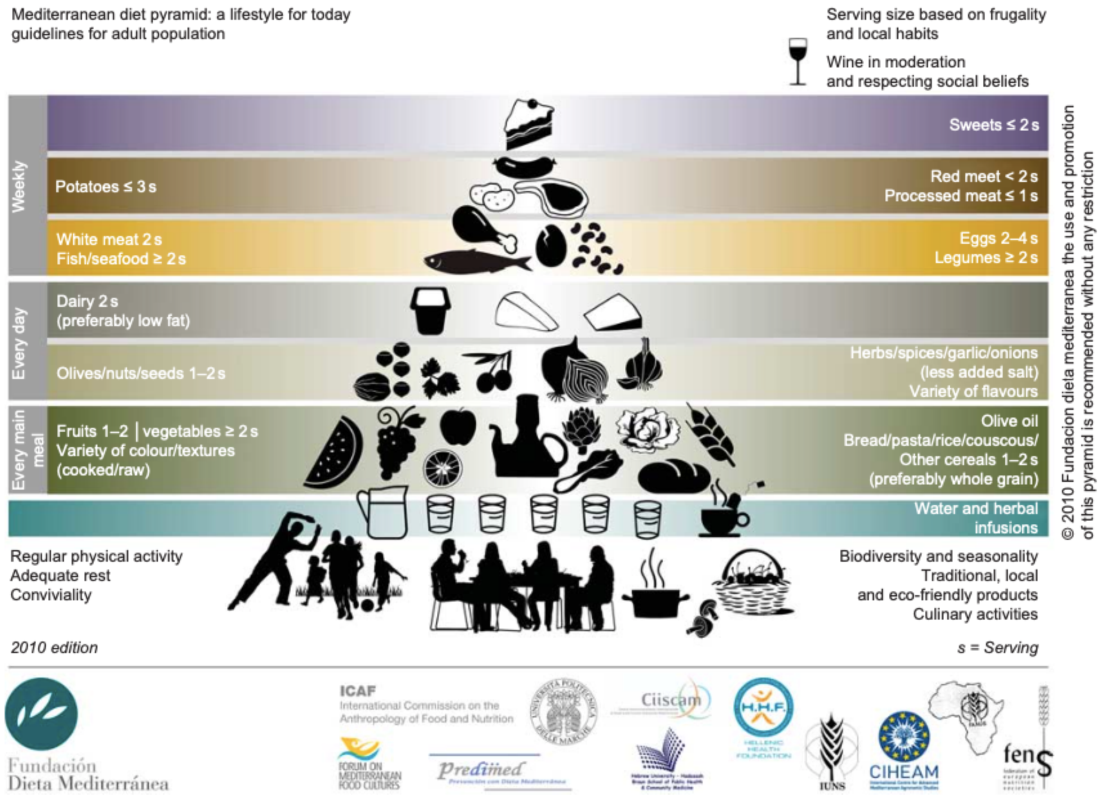
7.2. Mediterranean Diet Adherence Screener

Akdeniz diyeti bağlılık ölçeği (MEDAS)

1.	Yemeklerde temel yağ olarak zeytinyağı kullanıyor musunuz?	Haftada en az 2 kez salata, sebze, et veya balık yemeklerinde kullanıyorsa 1 puan
2.	Günde ne kadar zeytinyağı tüketiyorsunuz? (Kızartmalarda, salatalarda, ev dışında yenilen yemeklerde kullanılanlarda vb.) (1 yemek kaşığı=13.5 g*)	Günde 48 g'dan fazla tüketiyorsa 1 puan
3.	Günde kaç porsiyon sebze tüketiyorsunuz? (1 porsiyon= 200 g)	Günde 2 porsiyon ve fazlası tüketiyorsa 1 puan
4.	Günde kaç porsiyon meyve (taze sıkılmış meyve suları dahil) tüketiyorsunuz? (Toplam meyve porsiyonu= Total meyve g/80) (Taze meyve suyu porsiyonu= Her 100 ml** için 1 porsiyon)	Günde 3 porsiyon ve üzerinde tüketiyorsa 1 puan
5.	Günde kaç porsiyon kırmızı et tüketiyorsunuz?	Günde 100 g altında tüketiyorsa 1 puan
6.	Günde kaç porsiyon tereyağı veya margarin tüketiyorsunuz? (1 yemek kaşığı=12 g)	Günde 1 porsiyonun altında tüketiyorsa 1 puan
7.	Günde ne kadar şekerli ya da tatlandırılmış içecekler tüketirsiniz? (1 porsiyon=100 ml)	Günde 1 porsiyonun altında tüketiyorsa 1 puan
8.	Şarap içer misiniz? Haftada ne kadar tüketiyorsunuz? (1 kadeh= 125 ml)	Haftada 7 kadeh ve fazlası ise 1 puan
9.	Haftada kaç porsiyon bakliyat tüketiyorsunuz? (1 porsiyon= 150 g)	Haftada 3 porsiyon ve fazlası ise 1 puan
10.	Haftada kaç porsiyon balık / deniz ürünü tüketiyorsunuz? (1 porsiyon = 100-150 g balık veya 4-5 adet veya 200 g kabuklu deniz ürünleri)	Haftada 3 porsiyon ve fazlası ise 1 puan
11.	Haftada kaç kez işlenmiş tatlı ya da hamur işi (ev yapımı olmayan) tüketiyorsunuz?	Haftada 3 den az ise 1 puan
12.	Haftada kaç defa fındık (yer fıstığı dahil) tüketiyorsunuz? (1 porsiyon = 30 g)	Haftada 3 porsiyon ve fazlası ise 1 puan
13.	Sığır eti, domuz eti, hamburger veya sosis yerine tavuk, hindi veya tavşan eti yemeyi mi tercih edersiniz?	Beyaz et tüketimi, kırmızı et tüketiminden gramaj olarak fazla ise 1 puan
14.	Haftada kaç kere haşlanmış sebze, makarna, pilav veya diğer yemeklerinize domates, sarımsak, soğan veya pırasa soslu zeytinyağı kullanırsınız?	Haftada 2 defa ve daha fazla ise 1 puan ver

**g: gram*
***ml: mililitre*

7.3. Mediterranean Diet Pyramid



6.4. Ethics Committee Approval Form

T.C. YEDİTEPE ÜNİVERSİTESİ

Sayı : 37068608-6100-15- 1939 **20/08/2020**
Konu: Klinik Araştırmalar
Etik Kurul Başvurusu hk.

İlgili Makama (Nur Pınar Doğan)

Yeditepe Üniversitesi Tıp Fakültesi Beslenme ve Diyetetik Bölümü Dr. Öğr. Üyesi İrem Kaya Cebioğlu'nun sorumlu araştırmacı olduğu **"IVF Uygulanan Fazla Kilolu ve Obez Kadınlarda Akdeniz Tipi Beslenme İle Sağlanan Vücut Kompozisyonundaki Değişimin Başarılı Gebelik Oranlarına Etkisinin Araştırılması"** isimli araştırma projesine ait Klinik Araştırmalar Etik Kurulu (KAEK) Başvuru Dosyası **(1931)** kayıtlı Numaralı KAEK Başvuru Dosyası , Yeditepe Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından **19.08.2020** tarihli toplantıda incelenmiştir.

Kurul tarafından yapılan inceleme sonucu,yukarıdaki isim belirtilen çalışmanın yapılmasının etik ve bilimsel açıdan uygun olduğuna karar verilmiştir. **(KAEK Karar No:1271)**

Prof. Dr. Turgay Çelik

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7. CURRICULUM VITAE

Özgeçmiş

Kişisel Bilgiler

Adı	Nur Pınar	**Soyadı**	Doğan

Öğrenim Durumu

Derece	**Alan**	**Mezun Olduğu Kurumun Adı**	**Mezuniyet Yılı**
Doktora			
Yüksek Lisans			
Lisans	BESLENME VE DİYETETİK	**YEDİTEPE ÜNİVERSİTESİ**	2016
Lise	SAYISAL	**BODRUM ANADOLU LİSESİ**	2011

Bildiği Yabancı Dilleri	**Yabancı Dil Sınav Notu (#)**

Başarılmış birden fazla sınav varsa(KPDS, ÜDS, TOEFL; EELTS vs), tüm sonuçlar yazılmalıdır

İş Deneyimi (Sondan geçmişe doğru sıralayın)

Görevi	**Kurum**	**Süre (Yıl - Yıl)**
DİYETİSYEN	SAYASA	2016-2020
DİYETİSYEN	AKA DİYET	2020- aktif

Bilgisayar Bilgisi

Program	**Kullanma becerisi**
WINDOWS OFFICE	ORTA

*Çok iyi, iyi, orta, zayıf olarak değerlendirin

Bilimsel Çalışmaları

SCI, SSCI, AHCI indekslerine giren dergilerde yayınlanan makaleler

Diğer dergilerde yayınlanan makaleler

Uluslararası bilimsel toplantılarda sunulan ve bildiri kitabında (*Proceedings*) basılan bildiriler

Hakemli konferans/sempozyumların bildiri kitaplarında yer alan yayınlar

Diğer (Görev Aldığı Projeler/Sertifikaları/Ödülleri)
