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A Review of the Effects of Lifestyle and Nutrition on Infertility in Couples

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***Abstract*---**Infertility is one of the most important life crises that leads to numerous psychological problems and stressful experiences. Investigating the factors affecting infertility is of high significance to help these people in the midwifery profession. One of these important factors is lifestyle. The purpose of present study is to review the studies conducted on the effects of lifestyle on infertility in couples. This systematic review was conducted by searching the keywords including infertility, lifestyle, nutrition and couples in valid databases such as Google Scholar, Web of Sciences, PubMed and Scopus from 2010 to 2021; a total of 198 articles were found. As many as 22 articles were extracted from these articles. Inclusion criteria included originality, the article's being either in English or Persian, and consistency with the purpose of the study. Exclusion criteria included the lack of access to the full text of the article. Among the reviewed articles, 6 articles (27.27%) had been published in Persian and 16 articles (72.73%) had been published in English. In 16 studies, the effect of lifestyle and its dimensions (exercise and physical activity, diet, tobacco and alcohol use) on infertility of couples had been confirmed.

***Keywords*---**couples, infertility, life crises, lifestyle, nutrition.

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Introduction

Fertility and reproduction are the foundations of human life (Karimi et al., 2016), and infertility is one of the major problems in societies affecting significant percentage of couples around the world (Komijani et al., 2018). According to the World Health Organization, infertility is defined as the inability to conceive after one year of regular intercourse or artificial insemination without using methods of contraception or failing to have a successful pregnancy; the reason of infertility can be either the man or his wife (Vander Borght & Wyns, 2018). Infertility is one of the most important life crises leading to psychological problems and serious stressful experiences for the affected individuals (JANATI et al., 2019). Inability to be fertile is also of special social and family significance, and in traditional societies such as Iran, childbearing is so important that it can play a significant role in strengthening family and preventing divorce (Ayazi et al., 2021). According to the World Health Organization, more than 70 million couples worldwide and more than 1.5 million couples in Iran suffer from infertility (JANATI et al., 2019; Sun et al., 2019). Today, one in six couples in the world is affected by infertility for at least one time in their lifetime. As many as 20-30% of infertility problems are related exclusively to men, 20-35% are related to women, and 40-40% are common between men and women. The prevalence of infertility varies in different regions and in some regions its prevalence has been reported up to 30%. In Southern Asia, Africa, the Middle East, Central and Eastern Europe and Central Asia, the prevalence of infertility has been reported to be high (Komijani et al., 2018). The lowest and the highest prevalence rate of infertility are respectively related to Australia and Africa, and the trend of infertility has been reported to be increasing in recent years in most parts of the world (Khalilian & Rezaei, 2020). Infertility can be either primary or secondary. Primary infertility refers to people who have never been pregnant, and secondary infertility is used for those who have had a successful or unsuccessful history of fertility (JANATI et al., 2019).

Various causes can cause infertility; feminine factors include ovarian dysfunction, tubal and peritoneal diseases, and uterine diseases. Masculine factors include decreased sperm count, varicocele, history of genital infection, testicular damage and immunological problems that can affect fertility (Karimi et al., 2016). As many as 3-10% of the problems are associated with unexplained factors. Some factors are more common in some countries. For example, sexually transmitted infections and diseases are more common in Africa (JANATI et al., 2019). Moreover, some other factors such as alcohol abuse and smoking are considered as factors that can affect infertility (Coppeta et al., 2020). Finally, factors such as changing the role of women in social activities, delayed marriage, delayed age of having children, increased use of contraceptive methods, freedom of abortion, and unfavorable economic situation have reduced fertility in industrialized countries (Stevenson et al., 2021). One of the important concepts and factors that can predict infertility is the lifestyle of individuals (Pereira et al., 2021).

Lifestyle-related measures not only help prevent and protect against health problems, but they can also reduce its effects. Thus, giving due attention to lifestyle and its promotion as well as having a healthy lifestyle is a favorable strategy to control the cost of care and improve the quality of life (Samiei Siboni et al., 2021). The World Health Organization has identified lifestyle modification as a

comprehensive strategic approach to address the risk factors for non-communicable diseases, especially in developing countries, and the Iranian Ministry of Health has integrated the promotion of a healthy lifestyle into general health policies (Tabrizi et al., 2018). Lifestyle is the general way of life and behavioral patterns of an individual that may be beneficial or detrimental to one's health and includes behaviors that an individual adopts in relation to diet, eating habits, leisure time, smoking, physical activity, and using health-medical services (Xiao et al., 2018).

One of the important components of lifestyle is having a healthy diet and especially consuming micronutrients. This food group contains vitamins and minerals that are needed in small quantities as dietary components. Although micronutrients do not contain energy, they are essential for catabolic and anabolic processes of one's body, and they are also important for neural tube defects, genetic abnormalities, and pregnancy consequences (Paknahad et al., 2021). Failing to receive some nutrients can affect one's pregnancy. On the other hand, having harmful foods can also play a role in infertility. In the study conducted by Balanian et al, it has been reported that chips and puffs, sausages and cold cuts, grilled foods, reusing oil, and being exposed to cigarette and hookah smoke are associated with infertility, and antioxidants such as coffee and green tea were associated with female fertility (Balanian et al., 2019). According to the American College of Obstetricians and Gynecologists, pregnant women generally need to use a variety of food groups to receive extra calories and a balanced diet. Receive 4 units or more of fruits and vegetables, 4 units or more of fortified cereals or bread, 4 or more units of milk or dairy products, 3 units or more of red meat, chicken, fish, eggs, nuts and legumes, etc. are essential in a pregnant woman's diet to prevent the effects of nutritional deficiencies affecting both mother and her fetus (Bashirian et al., 2016).

Healthy lifestyle behaviors help to promote one's health, and unhealthy lifestyle behaviors have adverse effects on people's health (Shasaei & Sheibaei, 2015). Different aspects of lifestyle play a key role in determining reproductive health and can affect fertility either positively or negatively (Emokpae & Brown, 2021). Palomba et al. (2018), maintain that stress and quality of life are the factors affecting infertility. In response to the question whether inappropriate lifestyle is a barrier to male fertility, Leisegang & Dutta (2021), report that lifestyle modification is one of the factors that should be taken into account in treating couples' infertility and especially that of men. However, in some studies, lifestyle has not been reported to be effective; in their study, Azizi et al. (2019), have stated that there was no significant difference between the lifestyle of fertile and infertile couples.

Given the significance of fertility in human life and the effects of infertility on couples' lives, as well as the effects of lifestyle on human health and the important role of midwives in determining the factors affecting infertility and taking appropriate measures in this regard, the present study was conducted to review studies conducted on the effects of lifestyle and especially nutrition on couples' infertility.

Materials and Methods

This systematic review was conducted by searching the keywords including infertility, lifestyle, nutrition and couples in valid databases such as Google Scholar, Web of Sciences, PubMed and Scopus from 2010 to 2021; a total of 198 articles were found. As many as 22 articles were extracted from these articles. Inclusion criteria included originality, the article's being either in English or Persian, and consistency with the purpose of the study. Exclusion criteria included the lack of access to the full text of the article.

In the initial search, as many as 198 articles were found. After removing the duplicates, and implementing the inclusion criteria for the titles, 45 articles remained. Then, the abstracts of the remaining articles were reviewed, and at this stage, 9 articles were deleted. In the next step, the full texts of 36 articles were reviewed and 5 articles were deleted for the lack of access to the full text of the article and 9 articles were deleted as they were not consistent with the title and aim of the present study (Figure 1).

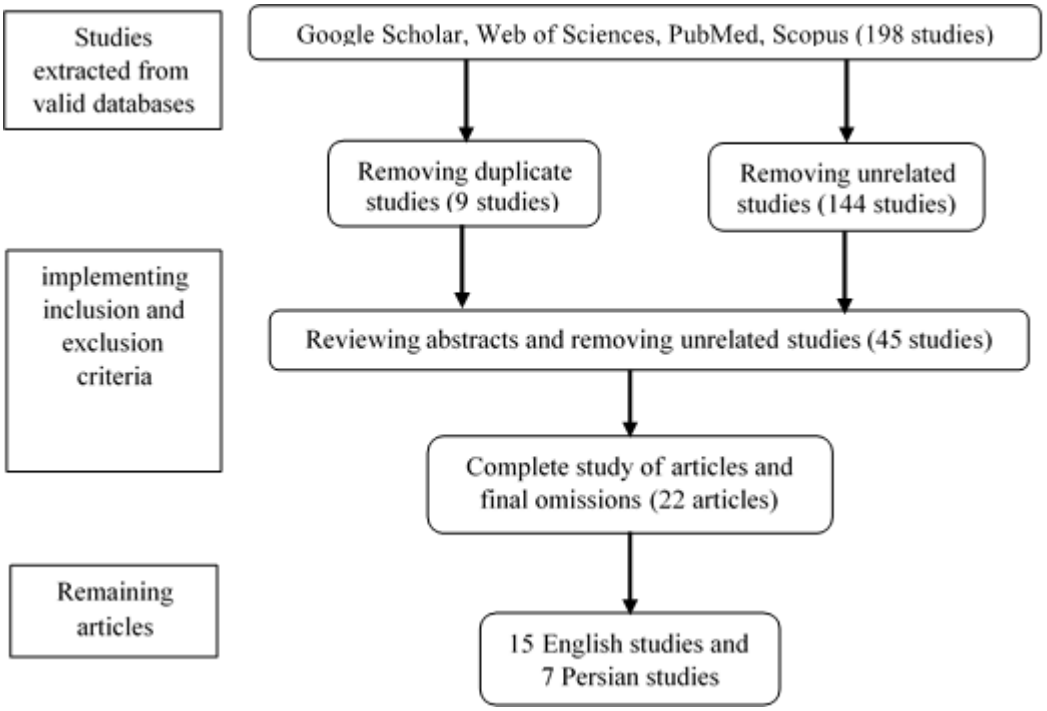


Figure 1. The process of searching and selecting the studies

Among the reviewed studies, as many as 7 articles (27.27%) had been published in Persian and 15 articles (72.73%) had been published in English. Regarding the research environment, among the Iranian studies, two studies had been conducted in Urmia and one study in each of the cities including Tehran, Isfahan, Yazd, Rasht and Sari. Among the English-language studies, two studies had been conducted in Turkey, two in India and one study had been conducted in each of the countries including Qatar, Egypt, Pakistan, Ghana, China, the Netherlands, Poland, the Czech Republic, the United States, France and the United Kingdom.

All articles were original, and they were either interventional (7 articles) or descriptive (15 articles). From the interventional studies, 6 were randomized clinical trial studies and 1 was a single-group interventional study. The sample size in the intervention studies varied from 28 (Oborna et al., 2011), to 547 individuals (Mutsaerts et al., 2016). In descriptive studies, the sample size varied from 68 (NEUPANE et al., 2013), to 26190 (Acharya & Gowda, 2017). The target groups in 10 studies were men, in 7 studies were women and in 5 studies were both men and women. As many as 10 studies used a questionnaire to measure the main information and 12 studies were conducted in vitro and sperm parameters had been measured according to the indicators of the World Health Organization. Lifestyle in 9 studies, diet in 8 studies, physical activity (body mass index and weight) in 4 studies, and alcohol and smoking in 4 studies had been investigated by the researchers. In 16 studies, the effect of lifestyle and its dimensions (exercise and physical activity, diet, smoking and alcohol) on infertility of couples had been confirmed, and in 6 studies, this effect had not been confirmed. Sperm parameters such as number, motility and morphology had been investigated in 8 studies (Table 1).

Table 1
The results of the selected conducted studies

	Title	Author, year, and place	Type of study and sample size	Method	Results
1	The Association between Physical Activity and Sperm Quality Parameters	Shirani et al. (2021), Iran, Isfahan	A descriptive-analytical cross-sectional study on 175 men	Measurement of sperm parameters, according to the indicators provided by the World Health Organization	No significant relationship was found between sperm quality indicators and physical activity pattern of infertile men. Moreover, there was no relationship between body mass index and sperm quality indicators (Shirani et al., 2021).
2	The relationship between Sperm Parameters and smoking in Men With Idiopathic Infertility	Mokhtari et al. (2020), Iran, Rasht	A descriptive retrospective study on 1744 infertile men	Measurement of sperm parameters, based on the indicators defined by the World Health Organization	Smoking can significantly reduce semen volume, but there is no significant relationship between smoking and sperm count, morphology and its motility in normal and abnormal volume (Mokhtari et al., 2020).
3	Relationship antioxidant consumption and female Infertility	Balanian et al. (2019), Iran, Yazd	A case-control study on 200 infertile women (case) and 400	Using food frequency questionnaire	Chips and puffs, sausages, grilled foods, reusing oil and being exposure to cigarette and hookah smoke are associated

			fertile women (control)		with infertility. Mantioxidants such as coffee and green tea are associated with female fertility (Balanian et al., 2019).
4	The comparative investigation of lifestyle items between infertile and fertile couples in Urmia	Azizi et al. (2019), Iran, Urmia	A descriptive-analytical study on 130 infertile couples and 130 fertile couples in Urmia	Miller-Smith lifestyle questionnaire	There was no significant difference between the lifestyle of fertile and infertile couples (Azizi et al., 2019).
5	The status of Smoking habit, Caffeine Intake and Body Mass Index in infertile and healthy women aged 25-40 years	Javadi et al. (2017), Iran, Tehran	A descriptive-analytical study was conducted on 144 infertile women and 144 healthy women..	General, nutritional and anthropometric information was collected using a questionnaire	There was no significant relationship between smoking and caffeine intake with infertility, but the prevalence of obesity was higher in infertile women (Javadi et al., 2017).
6	Assessment of health promoting lifestyle status and its socio-demographic predictors in women with polycystic ovarian syndrome	Mirghafourvand et al. (2017), Iran, Urmia	A descriptive-analytical study on 174 women	Walker Health Promoting Lifestyle Questionnaire	Encouraging individuals to have a health-promoting lifestyle along with other treatments are essential to improve fertility (Mirghafourvand et al., 2017).
7	The effect of smoking on sperm parameters	Aghamohammdi & Zafari (2013), Iran, Sari	A cross-sectional descriptive-analytical study on 18 men	Measurement of sperm parameters, based on the indicators defined by the World Health Organization	The effect of only smoking on sperm parameters was not confirmed (AGHAMOHARNMADI & ZAFARI, 2013).
8	Efficacy of antioxidant supplementation on men's semen	Arafa et al. (2020), Qatar	A clinical trial study of 148 men	Assessing morphology, motility and sperm count	Receiving the antioxidant supplement "FH PRO for Men" for three months improves morphology, motility and sperm count (Arafa et al., 2020).
9	Effectiveness of a therapeutic multiple-lifestyle intervention in	Dupont et al. (2020), France	A clinical trial study on 250 infertile couples	The measurement of satisfaction, body mass	Using a program that includes proper diet, activity and exercise, reduced smoking and

	the management of infertile couples			index, ovum and semen quality, pregnancy rate and incidence of complications	alcohol consumption and weight control can control the reproductive performance of infertile couples (Dupont et al., 2020).
10	Influence of Lifestyle and Environmental Factors on Semen Quality	Blay et al. (2020), Ghana	A descriptive-analytical cross-sectional study on 80 men	A questionnaire of lifestyle-related factors	Smoking and prolonged sitting are factors in low semen quality in men (Blay et al., 2020).
11	Antioxidant Supplement Improves the Pregnancy Rate in Patients Undergoing in Vitro Fertilization.	Ozdemir et al. (2019), Turkey	A retrospective study on 299 in vitro fertilized patients	Receiving omega Q10 for 135 as case group versus 164 individuals as the control group	The pregnancy rate was 49.6 in the case group versus 32.9 in the control group; antioxidant supplementation improved the pregnancy rate in these individuals (Ozdemir et al., 2019).
12	Relationship between smoking habit and sperm parameters among patients attending an infertility clinic	Rehman et al. (2019), Pakistan	A descriptive-analytical cross-sectional study on 211 fertile men and 165 infertile men	Cortisol, adrenaline, superoxide dismutase (SOD) and glutathione peroxidase (GPX) were analyzed with ELISA kits	Smoking significantly reduces sperm count and morphology, but has no significant effect on sperm motility (Rehman et al., 2019).
13	Dietary patterns and poor semen quality risk in men	Danielewicz et al. (2018), Poland	A descriptive-analytical cross-sectional study on 114 men	Semen computer software and food frequency questionnaire	The confirmation of the effect of dietary patterns on low semen quality in men calls for conducting further studies (Danielewicz et al., 2018).
14	The effect of personal lifestyle coaching using a mobile application on modifying the behavior of infertile women	Ng et al. (2018), England	A clinical trial study on 440 infertile women	Using semen computer software and food frequency questionnaire	Personal lifestyle coaching using a mobile applications has a greater effect on modifying the behavior of infertile women than health center programs (Ng et al., 2018).
15	Lifestyle factors associated with infertility in a rural area	Acharya & Gowda (2017), India	A descriptive-analytical cross-sectional	Infertility-related factors questionnaire	Lifestyle dimensions including frequency of sexual intercourse, body mass index,

			study on 26190 infertile individuals		alcohol and smoking use have significant effects on determining the fertility status of couples (Acharya & Gowda, 2017).
16	Effect of modifiable lifestyle factors and antioxidant treatment on semen parameters of men with *Oligospermia*.	Magdi et al. (2017), Egypt	A single group interventional study on 210 infertile men	Measurement of sperm concentration, total motility percentage and progressive motility after treatment	Antioxidant supplementation along with lifestyle modification significantly improved the essential parameters of semen (Magdi et al., 2017).
17	The effects of a lifestyle-based program in obese infertile women	Mutsaerts et al. (2016), the Netherlands	A randomized clinical trial on 574 individuals in two groups: intervention and control	Assessing the birth rate of a healthy singleton 24 months after the intervention	Despite a weight loss of 4.4 kg in obese women, this program did not lead to a higher birth rate after randomization (Mutsaerts et al., 2016).
18	Prevalence and risk factors of infertility at a rural areas of Northern China	Cong et al. (2016), China	A cross-sectional descriptive-analytical study on 4232 infertile women	Infertility-related factors questionnaire	Body mass index, exercise and movement were the main factors associated with infertility (Cong et al., 2016).
19	Adding antioxidant intake and time of pregnancy in infertile women	Ruder et al. (2014), the United States	A randomized clinical trial study on 437 infertile women	Measuring the duration of antioxidant use up to the end of pregnancy	Addition of antioxidants such as vitamins C and E, beta-carotene is effective in shortening the duration of use up to the end of pregnancy in infertile women (Ruder et al., 2014).
20	The protective role of vitamin C in infertile men	NEUPANE et al. (2013), India	A descriptive-analytical cross-sectional study on 30 fertile men and 38 infertile men	Measurement of semen, vitamin C and sperm count	The amount of vitamin C in semen plays an important role in protecting sperm, but its confirmation calls for clinical trials (NEUPANE et al., 2013).
21	Effect of lifestyle on quality of life of couples receiving infertility	Teskereci & Oncel (2013), Turkey	A descriptive-analytical cross-sectional study on 200	Quality of life assessment with SF-36 questionnaire	Lifestyle interventions improve the quality of life of infertile couples undergoing infertility

	treatment		couples undergoing infertility treatment		treatment (Teskereci & Oncel, 2013).
22	Evaluation of the effect of treatment with lycopene supplementation on the semen in normospermic men	Oborna et al. (2011), the Czech Republic	A randomized clinical trial study on 28 men in two groups	sRAGE test in semen and blood	Treatment with lycopene supplementation can somewhat improve the fertility of normospermic with (Oborna et al., 2011).

Discussion and Conclusion

Fertility is highly valued in most cultures and one's willingness and desire to have a child is one of the most basic human stimuli (Farrokh-Eslamlou et al., 2014). Infertility sometimes questions a woman's individual and social competencies. Moreover, physical and emotional problems, as well as difficult and sometimes exhausting medical tests on infertile couples, are generally worrying and unpleasant; they can sometimes adversely affect the overall dimensions of quality of life, especially the sexual relationship of infertile couples (Bokaie et al., 2020). There are several factors that are related to couples and can be involved in this regard. One of the important reasons is the possible side effects of quality of life, environmental factors and personal habits (Mokhtari et al., 2020). Therefore, the aim of this review was to investigate the effect of lifestyle and nutrition on infertility in couples.

The multiplicity of articles reviewed indicates the significance of the issue that should be taken into account in midwifery profession. Midwifery, as a specialized field and an independent profession in healthcare, plays an important role in reproductive health counseling and education not only for women but also for the family and society. According to the definition, a midwife is a responsible person and an important professional in the health care system, playing an important role in providing counseling, education, support, care and advice to couples, mothers at all stages including family formation, marital relations, pregnancy, childbirth and postpartum period. A midwife is also one of the four main principles of the model of providing midwifery care, counseling and individual education to clients (Andaroon et al., 2018). Numerous studies have considered the need for midwifery and nutritionists' education and counseling to be effective in solving problems, improving the conditions, and controlling and treating diseases (Sharifzadeh et al., 2018; Arasteh et al., 2020).

Based on the results and summary of studies, it was found that in 16 studies, i.e. over 76% of the studies, the effect of lifestyle and its dimensions (exercise and physical activity, diet, smoking and alcohol abuse) had been confirmed on infertility, and in 5 studies this effect had not been confirmed. It seems that differences in the type of study, the number of samples, method of intervention, content of the intervention, follow-up duration, environment and time of the research, research tools, and even racial and geographical differences can be the main causes for these different results. However, every person's lifestyle is such

that it can directly affect his/her health and illness. In fact, inappropriate lifestyle and inattention to health behaviors are factors that can lead to a variety of disorders and health problems (Shahriari et al., 2018). Although some studies had not confirmed the effects of smoking on infertility, the growing trend of smoking in the infertile male population is very worrying. In some studies, smoking has been reported to be associated with decreased semen quality (affecting sperm count, motility and cell morphology) and changes in hormone levels in men (Rehman et al., 2019). The inconsistency of the results of different studies indicates that further investigation is still required even in the present study. Although smoking does not seem to reduce fertility, men with semen quality problems can benefit from quitting smoking; some studies have reported that reduced fertility associated with smoking can be observed again within a year of quitting (Collodel et al., 2010). Infertile smokers are, thus, advised to consider smoking cessation as the first step in their treatment.

Diet is of high significance and many studies have investigated the effects of antioxidant diets in infertile couples (Arafa et al., 2020). Following a balanced diet is one of the promising and valuable interventions in maintaining reproductive health. However, identifying a proper reproductive diet is an important achievement in fertility management (Alizadeh et al., 2017). Fatty acids, carbohydrates, and proteins are involved in the physiological activities of the human body, and their improper intake and consumption disturb the metabolic balance and affect the fertility of couples (Shishehgar et al., 2016). One of the most important causes of sperm DNA damage having harmful effects in most types of male infertility is the increased level of oxidative stress. The increased oxidative stress in the semen of infertile results in structural disorders and affects functional capacities of sperm through various mechanisms (Arbabian et al., 2018). Thus, using antioxidants such as coffee and green tea, containing vitamins C, E and beta-cartene, is of high importance in this regard.

Movement, activity and daily exercise are other important factors in fertility that are one of the essential dimensions of lifestyle. Lack of physical activity and exercise is one of the factors affecting infertility. The possible mechanism of the effect of exercise on fertility can be through regulating the activity of the antioxidant defense system and reducing the production of inflammatory markers (Shirani et al., 2021). Therefore, physical activity and mobility can be used along with other treatments. In fact, exercise refers to a regular physical activity that is conducted to maintain or improve fitness or health. According to the Centers for Disease Control and Prevention, it is recommended that all adults exercise 150 minutes (at a moderate intensity) or 75 minutes (at a high intensity) during the week to prevent chronic diseases, control their weight, and increase their life expectancy (Murthy, 2015).

Lifestyle dimensions generally constitute a type of lifestyle that can have effects on fertility. However, one type of lifestyle that has been mentioned in the study conducted by Mirghafourvand et al. (2017), is a lifestyle that promotes health (Mirghafourvand et al., 2017). Health-promoting lifestyle focuses on promoting lifestyle through lifestyle and has 6 different dimensions including physical activity, nutrition, health responsibility, mental development, interpersonal relationships and stress management; it is likely to result in health promotion

and well-being, satisfaction, confidence and the feeling of being better (Mahboubeh Soleimanpouromran, 2018; Tol et al., 2013), self-actualization (Kaldi et al., 2014). It seems that paying due attention to this type of lifestyle can include the general healthy behaviors throughout one's life.

In general, it can be claimed that confirming the effect of lifestyle on infertility in couples, despite the support of numerous studies, calls for further investigation and especially clinical trials. However, having a health-promoting lifestyle and diet containing antioxidants can very useful and effective in this regard. One of the limitations of the present study was selecting studies that had been published only in English and Persian, and this reduces the power of its generalization; it is recommended to include all other articles (written in all languages) in future studies.

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