

Traditional and Complementary Medicine Practices: Integrative Approaches for Sustainable Health

Zeynep Bilgenur MEMİŞOĞLU ŞENER

Büyükçekmece Mimar Sinan State Hospital

To Cite This Chapter:

Sener, Z. B. M. (2025). Traditional and Complementary Medicine Practices: Integrative Approaches for Sustainable Health. In S. Demir, F. N. Takı, & Y. Uzun (Eds.), *Current studies for sustainable health* (pp. 199–207). ISRES Publishing.

Introduction

The World Health Organization (WHO) defines traditional medicine as the collective body of knowledge, skills, and practices that are rooted in the theories, beliefs, and experiences unique to various cultures. These practices, whether they can be explained or not, are utilized for maintaining health and for the prevention, diagnosis, improvement, or treatment of physical and mental illnesses (WHO, 2000). Traditional medicine has a rich and well-documented history. Despite its long-standing presence, there is still no universally accepted definition of Traditional and Complementary Medicine worldwide.

History of Traditional and Complementary Medicine

The U.S. National Center for Complementary and Alternative Medicine (NCCAM), established in 1998, describes complementary medicine as the use of non-conventional practices alongside conventional medical treatments, while alternative medicine involves using such practices instead of conventional medicine. More recently, NCCAM has embraced the term integrative medicine, which refers to the coordinated use of evidence-based complementary therapies alongside conventional medical care (National Center for Complementary and Integrative Health [NCCIH], 2019).

Similarly, the European Federation for Complementary and Alternative Medicine (EFCAM) defines complementary and alternative medicine as a variety of healthcare practices aimed at maintaining and improving health, preventing diseases, and managing illnesses, either independently or in conjunction with conventional medical approaches (European Federation for Complementary and Alternative Medicine [EFCAM], 2019). Generally, when supportive methods are used in addition to conventional treatments, it is termed complementary medicine; when they replace modern treatments, it is called alternative medicine.

In Turkey, similar terminology has been in use for many years. However, aligning with WHO definitions, recent discussions have highlighted that “there can be no alternative to medicine itself—only to a particular treatment method.” Consequently,

the term Traditional and Complementary Medicine has become the preferred expression (Mollahaliloğlu, Uğurlu, Kalaycı, & Öztaş, 2015). To address uncertainties surrounding practices, which have been in use since ancient times and have seen increased application in recent decades, various regulations and centers have been established.

The first legal regulation in this field in Turkey was the “Regulation on Acupuncture Treatment,” published in 1991. The most comprehensive regulation to date, the “Traditional and Complementary Medicine Practices Regulation,” was issued by the Turkish Ministry of Health in October 2014. This regulation clearly outlines the purposes and scope of each practice, the types of diseases for which they may or may not be used, the training requirements, and the qualifications of the practitioners and healthcare institutions authorized to perform them.

Recognition of Traditional and Complementary Medicine

For the first time, methods other than acupuncture were officially recognized including 15 practices (shown in table 1). These practices may be performed by medical doctors and, within their professional boundaries, by dentists and pharmacists. Public and private healthcare facilities are designated as practice units, whereas university hospitals and training/research hospitals are designated as practice centers. Training may be conducted only in practice centers approved by the Ministry of Health to ensure educational standardization. A scientific commission of eleven experts with prior experience in this field was also established (Mollahaliloğlu et al., 2015).

Phytotherapy

Phytotherapy refers to the prevention or treatment of diseases using medicinal plants. The term was first introduced by the French physician Henri Leclerc (1870–1955) in *La Presse Médicale* (Faydaoğlu & Sürücüoğlu, 2011). For medicinal use, plants must be investigated for safety and efficacy. Ensuring the absence of contamination and determining the standardized active substance concentration are crucial. Some European countries have implemented regulations for the standardization of herbal products, allowing them to be safely marketed in pharmacies and stores. These standards are evaluated by authorities such as WHO, Commission E, and the European Scientific Cooperative on Phytotherapy (ESCOP) (Uzun, Aykac, & Ozcelikay, 2014).

Table 1

Traditional and Complementary Medicine Practices Recognition

Phytotherapy	Larval therapy
Mesotherapy	Prolotherapy
Music therapy	Hypnosis

Cupping therapy	Homeopathy
Ozone therapy	Hirudotherapy (leech therapy)
Osteopathy	Acupuncture
Rereflexology	Chiropractic
Apitherapy	

Larval Therapy

Maggot Debridement Therapy (MDT) utilizes sterile larvae of the green bottle fly (*Lucilia sericata*) (Ucar, Kus, & Firat, 2018; Tanyuksel et al., 2014). Early surgeons such as Baron Larrey (1829) and Joseph Jones observed during wartime that maggots selectively debrided necrotic tissue without harming viable tissue. Although MDT fell out of favor between 1950 and 1980 with the rise of surgical debridement and antibiotics, it regained acceptance in the 1990s and is now actively used in over 24 countries, including those in Europe. The U.S. Food and Drug Administration (FDA) officially approved MDT in 2004 (Tanyuksel et al., 2014).

Prolotherapy

The term prolotherapy combines “proliferation” and “therapy.” It is used in the treatment of chronic musculoskeletal pain (Cakmak, 2017). The technique involves injecting proliferative or irritant solutions into damaged tissues (joints, tendons, or ligaments) to induce controlled physiological inflammation, thereby stimulating healing. The goal is to mimic natural healing by enhancing fibroblast activity and collagen deposition, strengthening weakened structures, and alleviating pain.

Music Therapy

The term music originates from the Greek words *mousike* or *mousa* and is used universally with the same meaning (Sezer, Sezer, & Toprak, 2015). Music therapy is one of the oldest known forms of treatment, with evidence suggesting its therapeutic use as early as 2000 BCE in various civilizations. Homer reportedly used music during surgical procedures and observed its positive effects. Plato, around 400 BCE, stated that music influences the depths of the soul, promoting tolerance and tranquility in individuals. Similarly, Celsus and Aretaeus noted the calming and restorative effects of music on the mind.

In Turkish history, music therapy reached its peak during the Seljuk and Ottoman periods. In *darüşşifas* (medical institutions dedicated to the treatment of mental illness), specific hours and days were reserved for therapy sessions involving music. Having persisted for centuries, music therapy continues to be practiced worldwide in the 21st century as an effective complementary treatment for both physical and psychological conditions.

Osteopathy

The first school of osteopathy was established by Andrew Taylor Still in 1892. Osteopathy is grounded in the philosophy that the body possesses an inherent ability to heal itself. Since Still believed that medications played a limited role in recovery, early osteopaths did not prescribe drugs. Instead, they emphasized the physician's responsibility to consider the structural and functional integrity of the body when diagnosing and treating disease.

The practice of Osteopathic Manipulative Treatment (OMT), developed by Still and his colleagues, was demonstrated to enhance blood circulation and facilitate the body's natural healing mechanisms (Parker et al., 2012). OMT consists of a variety of manual techniques performed by osteopathic physicians, aimed at correcting somatic dysfunctions and restoring physiological balance.

Mesotherapy

Mesotherapy involves intradermal or subcutaneous injection of very small quantities of active substances into specific regions of the body. The injected agents typically include natural plant extracts, minerals, vitamins, and homeopathic formulations. It is used in several medical disciplines, including dermatology (particularly cosmetic dermatology), rheumatology, sports medicine, and neurology. One of the key advantages of mesotherapy is that it achieves therapeutic effects with minimal drug quantities, thereby reducing the risk of systemic side effects (Gökdemir, 2014).

Chiropractic

According to the World Health Organization's 2005 guidelines, chiropractic is a healthcare discipline concerned with the diagnosis, treatment, and prevention of disorders of the neuromusculoskeletal system, and the effects of these disorders on general health. It emphasizes manual techniques, including spinal adjustment and manipulation, with a particular focus on correcting vertebral subluxations and facilitating the body's natural ability to heal (WHO, 2005).

Chiropractic manipulation is among the most widely practiced manual therapies worldwide. Within the European Union and neighboring countries, chiropractic is recognized as a regulated profession in 16 nations; in 10 others, chiropractic treatment is legally recognized though not professionally regulated; and in 13 countries, there is no legal framework for either. In Turkey, the Chiropractic Spine Health Association was established in 2008 to advance the field.

Homeopathy

Derived from the Greek words *homoios* (similar) and *pathos* (suffering), homeopathy is a therapeutic approach based on the “principle of similars.” The concept—*similia similibus curantur* (“like cures like”)—suggests that a substance causing symptoms in a healthy individual can, in highly diluted form, treat similar symptoms in a sick person. This principle dates back to Hippocrates and Paracelsus but was formally developed into a systematic medical approach by Dr. Christian Friedrich Samuel Hahnemann (1755–1843) (Ilhan, 2018). Other foundational principles of homeopathy include the use of single remedies and the administration of the minimal effective dose.

Ozone Therapy

Ozone (O₃) is a colorless, unstable gas with a pungent odor, composed of three oxygen atoms. The term ozone derives from the Greek word *ozein*, meaning “to smell.” Ozone was first used for medical purposes by Fisch in 1932 (Diracoğlu, 2016).

Because ozone oxidizes and disrupts the biological membranes of viruses, bacteria, and fungi, it has long been used as a disinfectant. In medicine, ozone therapy is believed to have immunomodulatory, antimicrobial, anti-inflammatory, antihypoxic, and wound-healing properties. It has been shown to stimulate both cellular and humoral immune responses, increasing the number of immunocompetent cells and enhancing immunoglobulin synthesis.

Reflexology

Reflexology is believed to have originated in ancient Egypt and China approximately 12,000 years ago, with the earliest documented evidence dating to 2500–2300 BCE (Dogru et al., 2017). It is proposed that reflexology elicits physiological responses through the stimulation of specific points on the hands, feet, and ears, corresponding to various organs and systems of the body. Each organ is thought to be represented by a particular area; applying pressure to these zones is believed to generate a therapeutic response in the associated organ.

Cupping Therapy

Cupping therapy was first practiced by the Assyrians in the Middle East around 3500 BCE, using animal horns and bamboo (Okumus, 2016). Modern cupping techniques are generally categorized as dry cupping and wet cupping (*hijama*). In both methods, cups are placed on the skin to create negative pressure. In wet cupping, small incisions are made to allow the release of blood. The external suction stimulates blood accumulation in the subdermal tissues and muscles, enhancing the delivery of oxygen and nutrients to local cells. This process accelerates local metabolism, increases hormone and enzyme production, and promotes the removal of harmful substances from the body.

Hirudotherapy (Leech Therapy)

Evidence from ancient Egyptian tombs indicates that leeches were used for medical purposes as early as 1500 BCE. Today, leech therapy is primarily utilized to prevent venous congestion following microsurgical replantation, trauma, or reconstructive surgery (Yildiz et al., 2014). Leeches belong to the phylum Annelida, class Clitellata, and subclass Hirudinea, encompassing over 15,000 known species. Medicinal leeches feed on blood, and specific species are selected for therapeutic use.

Apitherapy

Apitherapy refers to the therapeutic use of products derived from honeybees. The earliest evidence of apitherapy dates back approximately 6,000 years to Sumerian tablets. Records from the 3rd century BCE also describe the medicinal use of honey. Commonly used bee products include honey, propolis, pollen, beeswax, royal jelly, and bee venom (Trumbeckaite et al., 2015). Bee venom can be administered intradermally or subcutaneously, while other bee products may be applied topically or taken orally. Preparations used in apitherapy are FDA-approved.

Hypnotherapy

The medical use of hypnosis was first highlighted by Anton Mesmer (1734–1815), who theorized the existence of a magnetic fluid within the human body capable of facilitating healing. Marquis de Puységur (1751–1825) later described this state as somnambulism, noting that patients appeared to be asleep but remained hyper-alert.

James Braid (1795–1860), regarded as the founder of modern hypnosis, coined the term neuro-hypnosis to describe it as a neuropsychological state distinct from sleep (Ozgok, 2013). Contrary to popular misconceptions, hypnosis is not a state of sleep, amnesia, or loss of control. The individual remains conscious and aware but is less responsive to external stimuli, maintaining a focused state of attention.

Acupuncture

Acupuncture has been practiced in Asia for over 2,000 years. One of the earliest known texts describing acupuncture, Huang Di Nei Jing (The Yellow Emperor's Inner Canon), dates back to approximately 500 BCE. In traditional Chinese medicine, life energy—Qi—is composed of two opposing yet complementary forces, Yin and Yang. Health depends on maintaining balance between these forces. It is believed that Qi flows through pathways called meridians, and disease arises when this flow is disrupted. Inserting fine needles at specific points along these meridians is thought to restore balance and harmony within the body (Karasimav & Yildiz, 2015).

The number of needles used in acupuncture varies depending on the location and

nature of the symptoms, as well as the patient's sensitivity. Needles may be manually or electrically stimulated, or left in place for a set period. Typically, three to four weeks of treatment are sufficient to achieve improvement in responsive patients. For chronic conditions, some improvement is expected after the first six sessions; if no progress is observed, further treatment is unlikely to be beneficial.

Traditional and Complementary Medicine in Turkey and Worldwide

With increasing life expectancy, the growing need for long-term care, and the rising prevalence of chronic and malignant diseases, public interest in Traditional and Complementary Medicine has significantly increased. Additional factors include time constraints in conventional healthcare settings and concerns regarding the side effects of pharmaceutical treatments. This interest is expected to continue to rise in the future (Oral et al., 2016).

In Turkey, the use of Traditional and Complementary Medicine is widespread across different populations. Studies have reported usage rates ranging from 60% to nearly 100%, depending on region and demographic group. Among older adults, the practical use is particularly high, with many combining it with conventional treatments. Cancer patients show variable usage rates (20-80%), while families with children report almost universal use, with most continuing these practices regularly (Sagkal et al., 2013).

Many patients hold strong expectations for recovery through Traditional and Complementary Medicine. Information about these methods is often obtained through the internet, media, or acquaintances rather than from healthcare professionals. Physician consultation rates remain low, while recommendation rates to others are high (Dedeli, & Karadakovan, 2011).

If physicians remain uninvolved in this process, misinformation and unsafe practices may persist. Therefore, healthcare professionals should be aware of patients' interest in this practice engage in open dialogue, and provide accurate guidance to prevent misuse. Clinicians—especially when treating chronic or treatment-resistant conditions—should inquire about patients' use of Traditional and Complementary Medicine and offer evidence-based information to ensure safety and informed decision-making.

References

- Cakmak, S. (2017). Prolotherapy in musculoskeletal system diseases. *TOTBİD Journal*, 16, 282–286.
- Dedeli, O., & Karadakovan, A. (2011). Medication use and examination of complementary and alternative treatment practices among elderly individuals. *Spatula DD*, 1(1), 23–32.

- Diracoglu, D. (2016). Ozone-oxygen therapies in musculoskeletal diseases. *Turkish Journal of Physical Medicine and Rehabilitation*, 62(2), 183–191.
- Dogru, B. V., Yildirim, Y., & Aykar, F. Ş. (2017). Cardiovascular diseases and reflexology. *Journal of Cardiovascular Nursing*, 8(17), 77–85.
- European Federation for Complementary and Alternative Medicine. (2019). *CAM definition*. <http://www.efcam.eu/cam/cam-definition/>
- Faydaoglu, E., & Surucuoglu, M. S. (2011). Use and economic importance of medicinal and aromatic plants from past to present. *Kastamonu University Journal of Forestry Faculty*, 11(1), 52–67.
- Gokdemir, G. (2014). Mesotherapy and platelet-rich plasma in the treatment of hair loss. *Turkderm*, 48(Special Issue 1), 74–79.
- Mollahaliloğlu, S., Ugurlu, F. G., Kalayci, M. Z., & Oztas, D. (2015). The new period in traditional and complementary medicine. *Ankara Medical Journal*, 15(2), 102–105.
- National Center for Complementary and Integrative Health. (2019). *Complementary, alternative, or integrative health: What's in a name?*
- Oral, B., Ozturk, A., Balci, E., & Sevinc, N. (2016). Opinions and usage of traditional/alternative medicine among individuals visiting family health centers. *TAF Preventive Medicine Bulletin*, 15(2), 75.
- Ozgok A. Hypnosis and Anesthesia. *Anesthesia Journal* 2013;21(1):11-6.
- Parker, J., Heinking, K. P., & Kappler, R. E. (2012). Efficacy of osteopathic manipulative treatment for low back pain in euhydrated and hypohydrated conditions: A randomized crossover trial. *The Journal of the American Osteopathic Association*, 112(5), 276–284.
- Republic of Turkey Ministry of Health, Department of Traditional and Complementary Medicine Practices. (2019). *Phytotherapy*.
- Sagkal, T., Demiral, S., Odabas, H., & Altunok, E. (2013). Use of complementary and alternative treatment methods among elderly individuals living in rural areas. *Firat University Journal of Health Sciences*, 27(1), 19–26.
- Sezer, B. T., Sezer, O., & Toprak, D. (2015). What do we know about music therapy? *Konuralp Medical Journal*, 7(3), 167–171.
- Tanyuksel, M., Koru, O., Araz, E., Kilbas, H., Yildiz, Ş., & Alaca, R. (2014). Sterile

- Lucilia sericata larvae applications in the treatment of chronic wounds. *Gulhane Medical Journal*, 56(4), 218–222.
- Ucar, N., Kus, F. S., & Firat, T. (2018). Pain-free approach to maggot debridement therapy in a diabetic foot ulcer patient: Case report. *International Anatolia Academic Online Journal*, 4(1), 1–7.
- Ugurlu, M., Ustu, Y., & Dagcioglu, B. F. (2016). Use of onion (*Allium cepa*) and garlic (*Allium sativum*) in phytotherapy. *Ankara Medical Journal*, 16(1), 119–122.
- World Health Organization. (2000). *General guidelines for methodologies on research and evaluation of traditional medicine*. Geneva: World Health Organization.
- World Health Organization. (2005). *WHO guidelines on basic training and safety in chiropractic*. Geneva: World Health Organization.
- Ilhan, F. (2018). Staying healthy with homeopathy. *Journal of Traditional Medical Complementary Therapies*, 1(1), 29–34.

About the Author

Dr. Zeynep Bilgenur MEMİŞOĞLU ŞENER is a graduate of Maltepe University Faculty of Medicine. She completed his specialization at Medipol University Faculty of Medicine. He is a physician specializing in Traditional, Complementary and Functional Medicine, particularly focusing on Ozone Therapy and Longevity Medicine.

E-mail: bilgenurzeynep@gmail.com

Similarity Index:

The similarity index obtained from the plagiarism software for this book chapter is %14.

The Importance of Pilates for Pregnant Women and Principles of Practice

Yeşim ANIK ÇANKAYA

Karamanoğlu Mehmetbey University

Musa ÇANKAYA

Necmettin Erbakan University

To Cite This Chapter:

Çankaya, Y. A., & Çankaya, M. (2025). The importance of pilates for pregnant women and principles of practice. In S. Demir, F. N. Takı, & Y. Uzun (Eds.), *Current studies for sustainable health* (pp. 208–230). ISRES Publishing.

Introduction

Pregnancy is a critical period in a woman's life when her biopsychosocial balance and her roles in the family and workplace change, and the parent-child relationship between mother and baby is established (Ünver & Aylaz, 2017). Pregnancy is a unique and complex stage in a woman's life. The associated changes occur not only at the biological and physiological levels but also at the psychological and physical levels. Changes in psychological functioning continue during pregnancy and into the postpartum period (Hussain & Bhandari, 2025). The physiological changes of pregnancy are caused by hormones secreted by the placenta. These changes result in a series of adaptations affecting all physiological systems. Sufficient oxygen and nutrients are delivered to both the mother and the developing fetus. These physiological changes cause alterations in biochemical test results (Gangakhedkar et al., 2021).

Pilates is a body-conditioning program that involves movements performed on the floor using body weight or accessories, such as exercise balls, resistance bands, exercise rollers, magic circles, and overballs (Ferraz et al., 2023). It can also be performed using specialized equipment, such as the Reformer, Cadillac, Wunda Chair, and staircase, to increase strength and endurance. Joseph Pilates developed the Pilates method in the 1920s. The original name of the Pilates method, "Contrology," reflects the method's emphasis on controlling posture and movement (Anderson, 2024). The traditional principles of Pilates exercise include centering, concentration, control, precision, flow, and breathing (Malhotra et al., 2025).

Psychological and Physical Changes During Pregnancy

During pregnancy, changes occur in physical appearance, emotional state, and sexuality (Hussain & Bhandari, 2025). Pregnancy is generally considered a period when women are more motivated to maintain a healthy lifestyle, including participating in physical

activities and improving their health. There is also evidence that physical activity during pregnancy can improve psychological well-being (Atkinson & Teychenne, 2022; Boutib, et al., 2021). These changes make it difficult for women to adopt and maintain a healthy lifestyle during this period. These changes are often associated with common mood swings such as indecision, anxiety, fatigue, exhaustion, lethargy, melancholy, and elation. As body image, emotional state, and sexuality change during pregnancy, women's positions and roles also change (Hussain & Bhandari, 2025). Together with many established social and cultural beliefs about pregnancy, these changes create significant challenges for women in adopting and maintaining regular exercise during this period (Boutib, et al., 2021).

Regular physical activity provides significant benefits for both the mother and the fetus. Benefits for the mother include improved cardiovascular function, limited gestational weight gain, reduced musculoskeletal discomfort, fewer muscle cramps, and reduced lower-extremity edema, improved mood, and alleviation of gestational diabetes and gestational hypertension (Meyerhoff & Belew, 2024). Benefits for the fetus include reduced fat mass, improved stress tolerance, and increased neurological maturation. Although few studies directly examine the effects of physical activity on labor and delivery, evidence indicates that physical activity shortens labor duration and reduces cesarean delivery rates in women with normal pregnancies (Melzer et al., 2010).

Physical activity is a safe and effective way for healthy pregnant women to reduce the risk of adverse health outcomes. Physical activity can be defined as any bodily movement produced by skeletal muscles that requires energy expenditure. This includes activities in various areas such as recreation, sports, work, and household chores. Government agencies around the world, including those in Canada and the United States, recommend that all pregnant women participate in physical activity throughout their pregnancy. Healthy pregnant women are advised to engage in 150 minutes or more of moderate-intensity physical activity per week (Daşikan et al., 2019). Physically active women report improvements in physical endurance and mood, as well as reductions in nausea, fatigue, and stress levels. Women and infants also gain long-term benefits from an active lifestyle; they have been observed following active pregnancies. Evidence suggests that pregnancy offers an opportunity to promote positive health behaviors (Erkek & Altınayak, 2024). This opportunity has been described as a “teaching moment” in a woman's life because her perception of risk has increased. Furthermore, strong emotional responses and the redefinition of social roles and responsibilities tend to motivate pregnant women to adopt positive health behaviors such as physical activity. Despite these benefits and the opportunities offered during pregnancy, physical activity levels are generally lower among pregnant women than in the general population (Currie et al., 2013). Physical activity can also be expressed in METs, which represent multiples of an individual's

resting metabolic rate. MET scores represent the metabolic-equivalent intensity levels of activities. Moderate-intensity activity is classified as 3–5 METs. Therefore, 150 minutes of moderate-intensity activity is equivalent to 7.5-12.5 MET hours per week (Garber et al., 2011).

Australia's physical activity guidelines for pregnancy and the postpartum period recommend pelvic floor muscle exercises to reduce the risk and severity of pelvic floor muscle disorders (Walsh et al., 2025). Physical activity is associated with health benefits for people of all ages. Physical activity throughout pregnancy is safe and beneficial for both women and fetuses (Yang et al., 2022). Regular physical activity in healthy pregnant women is associated with improved cardiovascular health and with reduced risks of gestational hypertension, preeclampsia, gestational diabetes, and excessive weight gain during pregnancy (Gao et al., 2020). Pregnant women who are physically active or who exercise regularly are less likely to experience urinary incontinence, postpartum weight gain, and symptoms of depression. Strong scientific evidence shows that physical activity during pregnancy is not associated with low birth weight, stillbirth, preterm birth, premature rupture of membranes, neonatal death, neonatal hypoglycemia, birth defects, or induction of labor. Furthermore, exercising during pregnancy reduces the risk of chronic diseases such as obesity, type 2 diabetes, and cardiovascular disease in both women and their children (Yang et al., 2022).

Exercise during pregnancy is known to have benefits such as regulating the circulatory and digestive systems, helping the mother control her weight, supporting the muscle activity required for childbirth, and accelerating postpartum recovery. It can also prevent back pain, foot edema, varicose veins, and hemorrhoids. Systematic exercise during pregnancy and after childbirth plays an important role in functional treatment. Exercise during pregnancy is recommended to restore the tone of the vaginal and perineal muscles, reduce edema in the perineal region, improve circulation, prevent stress incontinence and abdominal muscle tension, thereby preventing abdominal sagging and back pain (Ünver & Aylaz, 2017). Strengthening the back and spine muscles is important for pregnant women. Strengthening the abdominal and pelvic muscles facilitates delivery. These muscles can be strengthened with exercises performed at home (Mens et al., 2000). For example, the pregnant woman lies on her back with her knees slightly bent. She sits up, attempts to touch her feet with her hands, then lies back down (a sit-up). This movement should be repeated 10 times. This movement strengthens the abdominal muscles. In another exercise, the pregnant woman lies on her back, knees slightly bent, and contracts her hip muscles as if trying to stop the flow of urine. This exercise strengthens the muscles she will use during childbirth. This strengthening movement is performed using Kegel exercises, which involve contracting and releasing the pelvic muscles and can also be considered a pushing movement. For example, the hip muscles are slowly contracted

and held for 5 seconds, then are slowly released. This movement is repeated 25 times and performed twice daily (Ağaoğlu, 2015).

The Role of Pilates During Pregnancy

Internationally, Pilates is recognized as an important exercise for improving physical, psychological, and motor functions. This exercise program consists of a series of low-impact exercises that build strength and flexibility (Das & Bandyopadhyay, 2023). Because it is an exercise performed using one's own body weight, it carries the lowest risk of contraindications. Adopting a standardized breathing technique during Pilates practice is essential. It helps activate the deep stabilizing muscles, especially the transverse abdominis, in relation to the pelvis. This increases pelvic and trunk strength. Pilates movements are adapted to the physiological changes of pregnancy. Regular exercise has been shown to strengthen the pelvic floor muscles and improve their structural function. Pelvic floor exercises are part of modern Pilates (Szumilewicz et al., 2019). Pelvic floor exercises during pregnancy have been shown to prevent prolonged second-stage labor in approximately one in eight women (Salvesen & Mørkved, 2004). Pregnant women practicing Pilates also use diaphragmatic breathing techniques, which help mothers prepare for childbirth. The breathing technique used in Pilates prepares the mother to use this method during childbirth. Pilates, by developing the ability to use the abdominal and pelvic floor muscles, improving flexibility, and promoting proper breathing, facilitates the birth process (Ghandali et al., 2021).

Pilates exercises improve postural stability in pregnant women, reduce fear of childbirth, and increase physical readiness. It alleviates back pain and improves pelvic alignment. Pilates also improves sleep quality and life satisfaction, lowers stress levels, and enhances birth outcomes. Therefore, incorporating Pilates into prenatal care programs may support maternal and newborn health and improve the overall pregnancy experience (Aman et al., 2025).

Physiological Effects of Pilates During Pregnancy

Exercise has traditionally been used as a non-invasive treatment for patients with obesity and depression, and its effectiveness has been demonstrated in various studies (Meneghin et al., 2020; Langoni et al., 2019). Studies of molecular mechanisms underlying the antidepressant effects of exercise have shown that exercise promotes activation of tryptophan in the brain, thereby increasing serotonin release and, by reducing insulin resistance, preventing depression (Kim & Hyun, 2022).

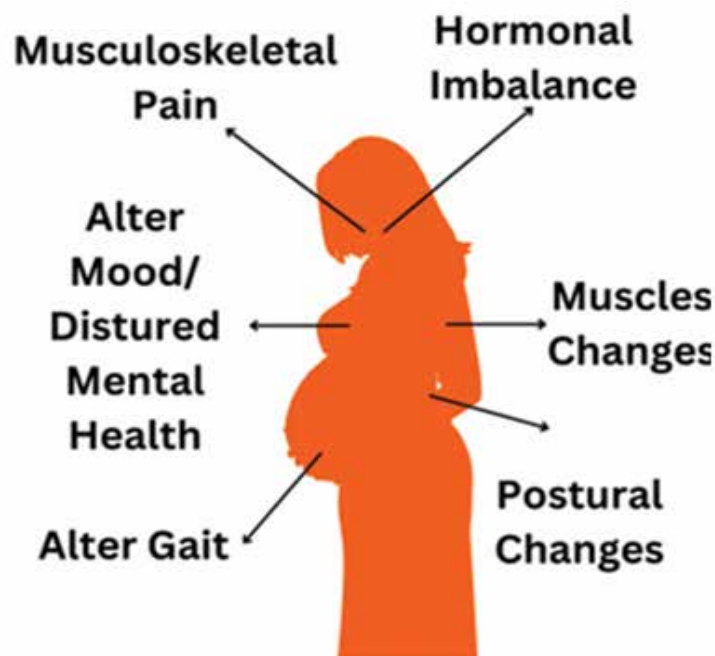
Changes in Posture and Spine

Postural changes during pregnancy shift the center of gravity forward as the uterus

grows, leading to increased lumbar lordosis (an exaggerated inward curvature of the lower back). This compensatory mechanism not only helps maintain balance, but can also cause back pain by placing more stress on the lumbar spine (Figure 1). As pregnancy progresses, the transverse diameter of the rib cage increases and the diaphragm elevates. Increased pressure on the ribs due to fetal growth causes an increase in the subcostal angle. Thoracic Kyphosis In some cases, increased thoracic kyphosis (outward curvature of the upper back) develops to compensate for lumbar lordosis. This causes discomfort in the upper back, neck, and shoulders. The pelvis tilts forward. This also causes increased lumbar curvature and increased tension in the lower back muscles (Aman et al., 2025).

Figure1

Pregnancy and its related changes



Changes in Muscle Strength and Flexibility

As pregnancy progresses, loosening of the pelvic ligaments and increased abdominal weight lead to gait imbalance (Aman et al., 2025). This altered gait pattern increases the load on the lower extremities, causing discomfort in the hips, knees, and feet. The combination of joint laxity, shift in the center of gravity, and weight gain also contributes to walking instability, increasing the risk of falling (Artal & O'Toole, 2003; Cakmak & Erkin, 2011). During pregnancy, diastasis recti is common due to stretching of the abdominal wall to accommodate the growing fetus. This can weaken the abdominal muscles and lead to back pain and instability. Pregnant women often experience muscle cramps, especially in the legs. These cramps are caused by changes in circulation, increased pressure on the nerves, or electrolyte imbalances (Aman et al., 2025; Ho et al., 2009).

Strengthening the Pelvic Floor Muscles

The uterus is primarily supported by the pelvis and associated muscles (Chaudhry et al., 2023). Like other tissues, pelvic floor muscles and connective tissues are also affected by secreted hormones. However, increasing uterine weight places greater demands on the pelvic floor, making pelvic-floor muscle exercises essential during pregnancy. Some parts of the pelvic floor are controlled by the autonomic nervous system; these parts can also be affected by exercise and respond strongly to stress levels. Pelvic floor exercises should be prioritized and performed daily (Okeahialam et al., 2022).

Research shows that many young women today —often due to work-related factors— and women who have previously given birth suffer from weak pelvic floor muscles (Gümüşsoy, et al., 2021). Mothers who have given birth to babies weighing more than four kilograms or who have had forceps- or vacuum-assisted deliveries are at higher risk of pelvic floor problems (Kömürcü & Uğur, 2017). Strong pelvic floor muscles recover more rapidly after childbirth and demonstrate greater resilience. This helps prevent urinary incontinence and minimizes the risk of problems associated with back pain and pelvic instability. Both weak pelvic floor muscles and pelvic floor tension can cause problems. Pelvic floor weakness or dysfunction in women is associated with both structural and functional consequences, including urinary incontinence, fecal incontinence, pelvic organ prolapse, dyspareunia, and sexual dysfunction. One of the main risk factors associated with pelvic dysfunction is the reproductive process, including pregnancy and childbirth (Feria-Ramírez et al., 2021; Theodorsen et al., 2024). A Pilates exercise program is recommended to support pelvic floor muscle health before and after childbirth (Walsh et al., 2025). These recommendations are also inspired by the basic principles of exercise science and clinical reasoning (Walsh et al., 2025).

During pregnancy, abdominal and pelvic floor muscles should be exercised in a manner that does not cause diastasis recti abdominis. This promotes neural adaptations, supports muscle hypertrophy, and increases functional strength. It involves deep core activation and co-contraction of the pelvic floor muscles. Interventions that include deep core activation, particularly those that promote the synergistic contraction of the pelvic floor muscles, the transversus abdominis, and the diaphragm, support lumbopelvic stability and pelvic floor function (Walsh et al., 2025; Atkın et al., 2025).

Education and supervision

Because many women struggle to contract their pelvic floor muscles correctly after childbirth, education and supervision by trained healthcare professionals (e.g., women's health physical therapists or accredited exercise physiologists) may help ensure correct technique and improve educational outcomes (Walsh et al., 2025).

Personalized exercise prescription

Exercise interventions should be planned according to individual needs, especially considering common accompanying musculoskeletal health problems such as pelvic floor dysfunction, pelvic girdle pain, low back pain, and rectus diastasis (Örnek et al., 2023).

Effects of Pilates on Respiratory and Circulatory Systems

The growing popularity of Pilates worldwide has led to an increase in research on its effects (Souza et al., 2021). Pilates training has been shown to improve cardiovascular function in individuals with various pathologies such as chronic obstructive pulmonary disease, chronic kidney disease, ankylosing spondylitis, and cystic fibrosis (Sarmento et al., 2017). It has been observed to increase respiratory muscle strength and respiratory volume in healthy populations of different ages (Cancellero-Gaiad et al., 2014). This method has also been shown to improve cardiovascular fitness in overweight or obese individuals and improve average heart rate, respiratory exchange ratio, and oxygen equivalent in sedentary individuals (Rayes et al., 2019).

Many pregnant women experience dyspnea, particularly during the second and third trimesters, because of the elevation of the diaphragm by approximately 4 cm (Petrenko et al., 2023). Some expectant mothers experience short breath. In some cases, the baby's movements and kicks toward the diaphragm can cause breathlessness and reduced lung expansion. Pilates increases lung capacity, reduces shortness of breath, promotes relaxation, and creates more space for the baby. The correct breathing techniques learned through clinical Pilates training relax and comfort the mother during contractions, muscle cramps or spasms, and discomfort caused by the baby's movements, thereby increasing her confidence during childbirth (Karapinar & Acar, 2023). This relaxation and loosening in the mother allow the mother's body to move normally and reduce the likelihood of hyperventilation and injury during delivery (Karapinar & Acar, 2023).

Pilates Exercises According to Pregnancy Stages

First Trimester (0–12 weeks): Risks to be aware of, threat of miscarriage, light exercise

The first three months of pregnancy constitute the riskiest period. It is important to start Pilates during this period. During this period, levels of the relaxation hormone increase, leading to joint laxity; therefore, exercises that place strain on the joints should be avoided (Parker et al., 2022). As the baby grows, the body's center of balance changes concurrently with hormonal changes (Bouariu et al., 2022). During this period, movements should be slowed, and the body's signals should be heeded. The focus should be on light breathing, posture, and awareness. Overheating and intense abdominal exercises should be avoided. Fatigue and nausea may limit activity, so pregnant women should constantly

monitor their condition (Meyerhoff & Belew, 2024).

During this period, the fetus measures approximately 6–7 centimeters in length, weighs a few ounces, and resembles a miniature human (Pelz et al., 2025). Some reflexes are present. Heartbeats can be detected by ultrasound at six weeks' gestation. Physical symptoms during this period include fatigue, nausea, occasional vomiting, breast enlargement and increased breast sensitivity, mild weight gain, and increased urinary frequency. Psychological symptoms may include excitement, fear, and confusion. The fetal brain develops for up to six weeks; some neural tube defects occur during this period. Some causes have been linked to overheating during intense exercise (Bouariu et al., 2022). Most women do not realize they are pregnant until around the eighth week. By that time, the fetus is almost fully formed. During this trimester, the focus should be on establishing a routine that will support the person throughout the remainder of the pregnancy.

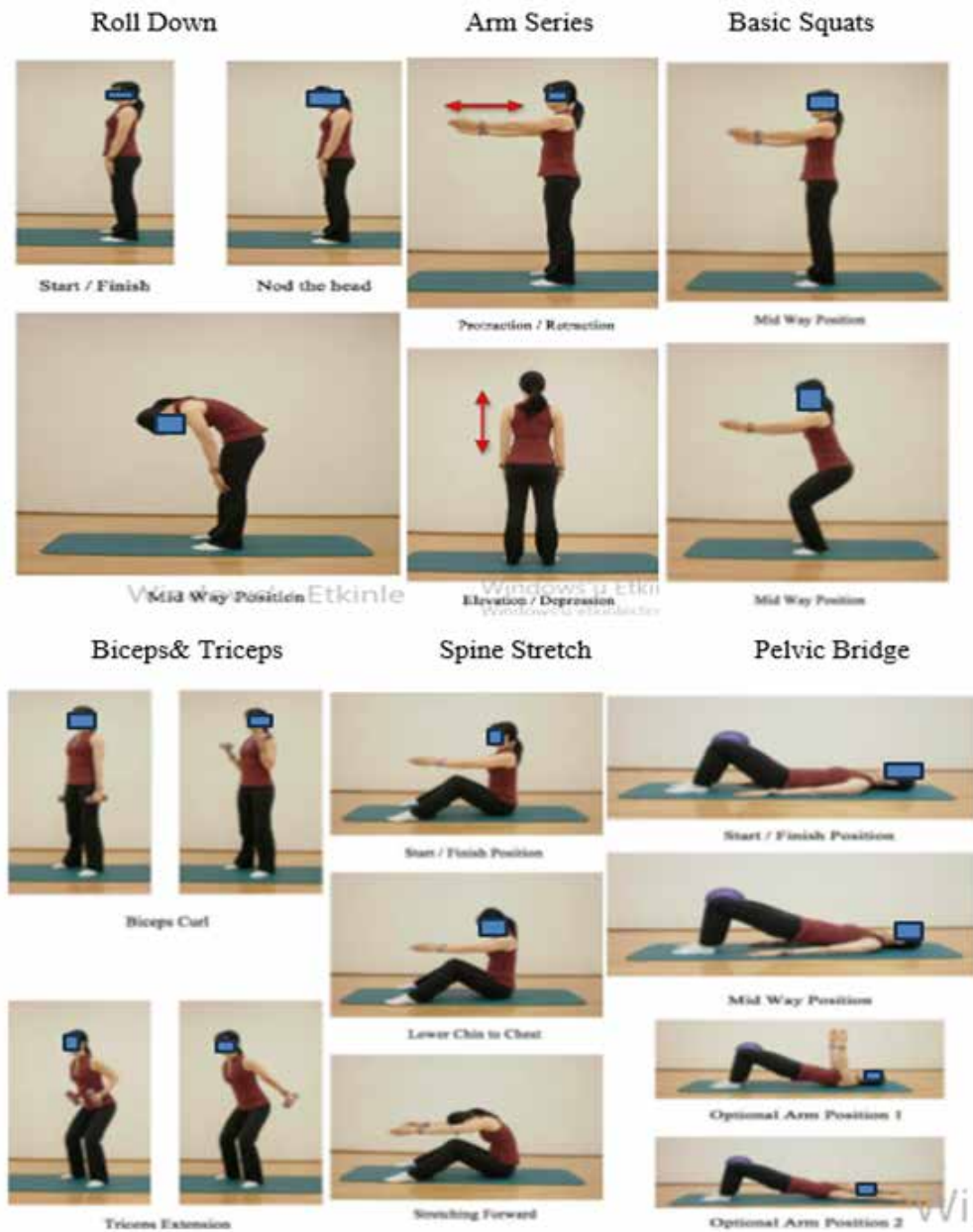
The first trimester of pregnancy is often an exciting yet intense period for expectant mothers. Stress can arise from the physical demands of the rapidly growing placenta and fetus, as well as from the psychological challenges of adapting to pregnancy (Wu et al., 2021). The risk of birth defects and miscarriages is highest during the first trimester of pregnancy. During this trimester, the fetus cannot regulate its own body temperature and is therefore dependent on the mother's body temperature. Expectant mothers should be cautious if they exercise intensely, engage in endurance training, or exercise in high temperatures during this period. However, body temperature changes significantly during pregnancy (Sexton et al., 2021). Body temperature typically decreases at the beginning of pregnancy. Hormones secreted during pregnancy increase cutaneous blood flow, leading to elevated skin temperature in certain body regions (Filipec & Đurin, 2025). This change in skin temperature increases body heat loss. Additionally, pregnancy lowers the body's sweat threshold. Pregnant women begin sweating earlier, thereby improving the body's cooling mechanism. Studies have shown that pregnant women who exercise cope better with heat than do non-pregnant women. Therefore, the risk is extremely low if long and intense training sessions and exercise in very hot weather are avoided.

Breathing and relaxation exercises

Breathing is one of the most fundamental functions of the human body. The way you breathe significantly affects how your body functions and, ultimately, your health and well-being. Joseph Pilates called proper breathing “fundamental” (Osar & Bussard, 2016). He believed that increased blood flow would activate the cells in your body and remove waste products associated with fatigue. Pregnant women need to learn to perform breathing and relaxation exercises correctly to make the process more comfortable. Sample exercises are provided for the first trimester (0–12 weeks) (Figure 2).

Figure 2

1st Trimester Sample Plate Exercises



Second Trimester (13–27 weeks): Balance and posture-focused exercises

The third through sixth months of pregnancy are the most comfortable for pregnant women. Abdominal muscle exercises and pelvic floor exercises should be started during this period (Liu et al., 2022). Supports, such as small Pilates balls, can be used during exercises. During this period, when the baby begins to grow and gain weight, changes in your body become more pronounced. Back and spine pain may begin during this period. Avoid overly strenuous movements. The second trimester is the most suitable period for regular exercise (Ribeiro et al., 2022). Energy levels return, nausea decreases, and Pilates movements can be performed safely with appropriate adjustments. As the

umbilical region begins to enlarge, positions that normally require lying on your back for long periods are adopted. Exercises performed on your hands and knees, while sitting, or while lying on your side are ideal. Pelvic floor and abdominal stability exercises were initiated (Nipa et al., 2022).

During the second trimester, the mother generally feels better and experiences increased energy (Krzepota et al., 2018). For most women, morning sickness has subsided. However, some women experience nausea throughout the entire nine months. This can be quite challenging because it is sometimes difficult to eat enough. Therefore, fatigue and reduced energy levels become contributing factors. As the uterus rises into the abdominal cavity, the pregnancy becomes more noticeable. This causes round ligament pain. The mother feels the baby move at around 18–22 weeks. Normal weight gain by the end of this trimester ranges from 8 to 12 kg (Drehmer et al., 2013). Psychological symptoms are as follows: the mother is more relaxed about the pregnancy and begins to feel excited. There is generally a greater sense of well-being during this period.

The fetus is approximately 35 cm long and weighs 0.5–1.0 kg. By the end of this trimester, the mother looks quite pregnant (Islam et al., 2024). She may complain of feeling large, but this is not comparable to how she will feel at the end of her pregnancy. At about five months' gestation, the uterus typically extends beyond the pelvic cavity, sometimes causing round ligament pain. The round ligament helps the uterus attach to the pelvis. When the uterus expands rapidly, it stretches these ligaments, causing some pain. Stretching the hips may provide some relief. Breathing becomes shallower, and the rib cage begins to expand (Ejikeme et al., 2025). Back and lateral chest breathing techniques are used to stretch the intercostal muscles, allowing the uterus to enlarge and shift upward. Women experiencing their second or subsequent pregnancy reach this stage more quickly than first-time pregnant women. Supine hypotension syndrome becomes a problem during this trimester. This occurs when the inferior vena cava is compressed while the patient is supine (Hendem et al., 2023). Symptoms in the mother include shortness of breath, dizziness, and nausea. This is a period during which blood flow to the fetus is reduced. Turning the mother onto her side corrects the syndrome. If the mother has no obvious signs of compression, short periods of supine exercise are permitted. This can be alternated with side-lying exercises. The mother may begin to experience back pain at this stage. Pelvic exercises are one way to alleviate this problem.

Basic exercises for the second trimester (Figure 3)

Neutral/anterior pelvic alignment

At this point, the pelvis begins to tilt forward. It tries to maintain balance with the surrounding muscle groups.

Lateral flexion

This exercise is included in the program to help maintain intercostal muscle tone and accommodate the expansion of the rib cage.

Thoracic extension

Strength in the upper body and arms continues to be maintained. As the pelvis moves forward, the body tends to lean backward to counteract gravity.

Obliques and transversus

These become increasingly tense at this point. Continue performing light exercises that incorporate breathing techniques.

Pelvic floor

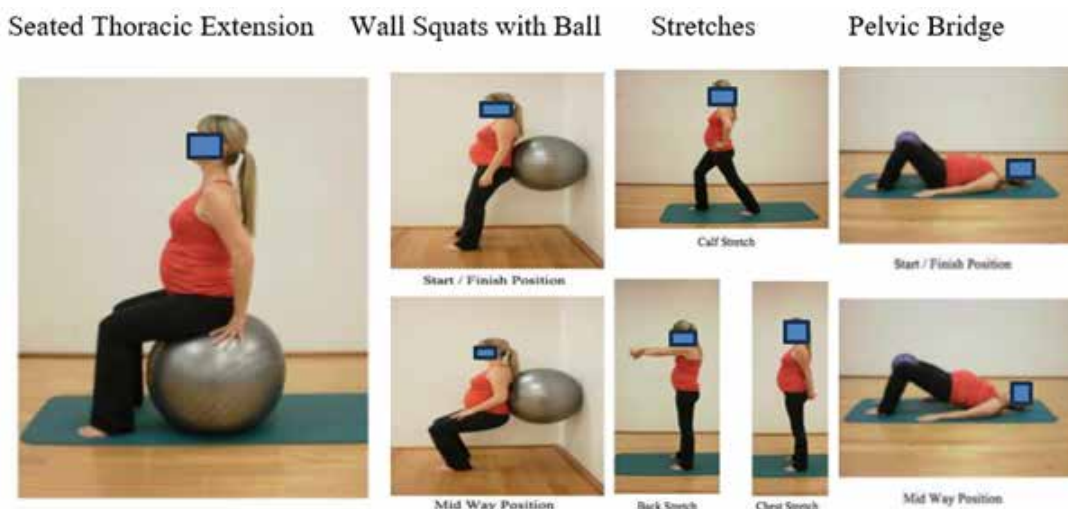
Continue with the pelvic floor series and related exercises.

Breathing

Use lateral and posterior chest breathing to stretch the intercostal muscles. When exhaling, try to release your body rather than tensing it.

Figure 3

2nd Trimester Sample Pilates Exercises



Third Trimester (28–40 weeks): Relaxation, breathing exercises, and preparation for childbirth

During the final three months of pregnancy, focus on exercises that facilitate delivery. Focus on maintaining gentle mobility, balance, and comfort. Avoid deep stretching exercises that put pressure on the abdomen or require strength. Physical Symptoms in the Third Trimester: As the baby's weight and height increase, the mother may begin to tire more easily (Aman et al., 2025). The infant will require increased caloric intake during

this period to mobilize fat reserves. Swelling of the hands, ankles, and feet is likely to occur. Shortness of breath and faintness may occur. Braxton Hicks contractions may occur. Psychological Symptoms: The mother may feel hopeless and wish the pregnancy to end as soon as possible. She may experience excitement and fear of childbirth. Towards the end of this trimester, she may experience a feeling known as the “nesting instinct” (Kersting et al., 2009).

Immediately before birth, the baby is 40-55 cm long and weighs 3.3-4 kg (Subhan, 2013). Most women experience fatigue during the third trimester; therefore, exercise must be adjusted accordingly. Infants are currently experiencing rapid growth. Balance is impaired because the center of gravity has changed significantly. Although the scientific literature provides no details about falls, an instructor should pay particular attention to clients who are in unstable positions. Exercising up to shortly before delivery is not harmful to pregnant women. However, many women stop earlier because any additional movement becomes excessively tiring and uncomfortable. Towards the end of their pregnancy, women can plan the program that will be implemented after childbirth. Postpartum exercises to strengthen the deep abdominal muscles and the pelvic floor can be started immediately after childbirth.

Blood Pressure

Blood pressure is a measure of the pressure exerted by blood on the walls of the arteries. Standing can temporarily affect blood pressure. For example, if a pregnant woman stands for prolonged periods, blood may pool in the lower extremities, causing dizziness. During pregnancy or childbirth, when a woman lies on her back, maternal blood pressure may fall owing to the weight of the uterus compressing the aorta and inferior vena cava (or iliac veins) (Salles et al., 2015). The aorta carries oxygen-rich blood from the heart to the systemic circulation, while the vena cava carries oxygen-depleted blood from the lower half of the body back to the heart. Both blood flows pass through the spinal canal and can be affected by the additional weight of the uterus when lying on your back.

This can impede blood flow to the uterus and heart. Hypotension (a drop in blood pressure) should be monitored while lying on your back.

Balance

Women typically gain 25–30% of their pre-pregnancy body weight during pregnancy. Most of this weight is concentrated in the abdominal area, shifting the center of gravity. Additionally, pregnant women have relatively higher estrogen and lower testosterone levels. Testosterone facilitates balance, spatial orientation, and hand-eye coordination. Pilates-based exercises can help regulate hormonal balance, limit the turmoil caused by

physical and emotional changes, and thus contribute to the expectant mother's physical and emotional relaxation (Sancar et al., 2021).

Fluid Retention

Approximately 70% of the human body is water. During pregnancy, hormone secretion causes the walls of the blood vessels and lymphatic vessels to relax, significantly increasing the volume of fluid in the blood and body tissues, including cells. As a result, toward the end of pregnancy, a woman's body can retain several liters of fluid. About half of the weight gained during pregnancy is usually attributable to excess fluid, which is distributed throughout the body. This fluid is found in the blood, organs, tissues, and muscles, where it aids pregnancy (Demir, 2022). Pilates-based exercises can help prevent swelling (edema) resulting from interstitial fluid accumulation in the subcutaneous tissue by promoting circulation and redistribution of excess fluid.

Basic exercises for the third trimester

Emphasis should be placed on exercises that stretch the pelvic floor muscles. At this stage, breathing is usually shallow and confined to the chest cavity. You should try to take deep abdominal breaths.

Pelvic mobility

Pelvic tilts, hip circles, and bridge movements are used to maintain flexibility in this area.

Spine and pelvic stability

Light abdominal exercises should be performed in conjunction with breathing.

Stretching

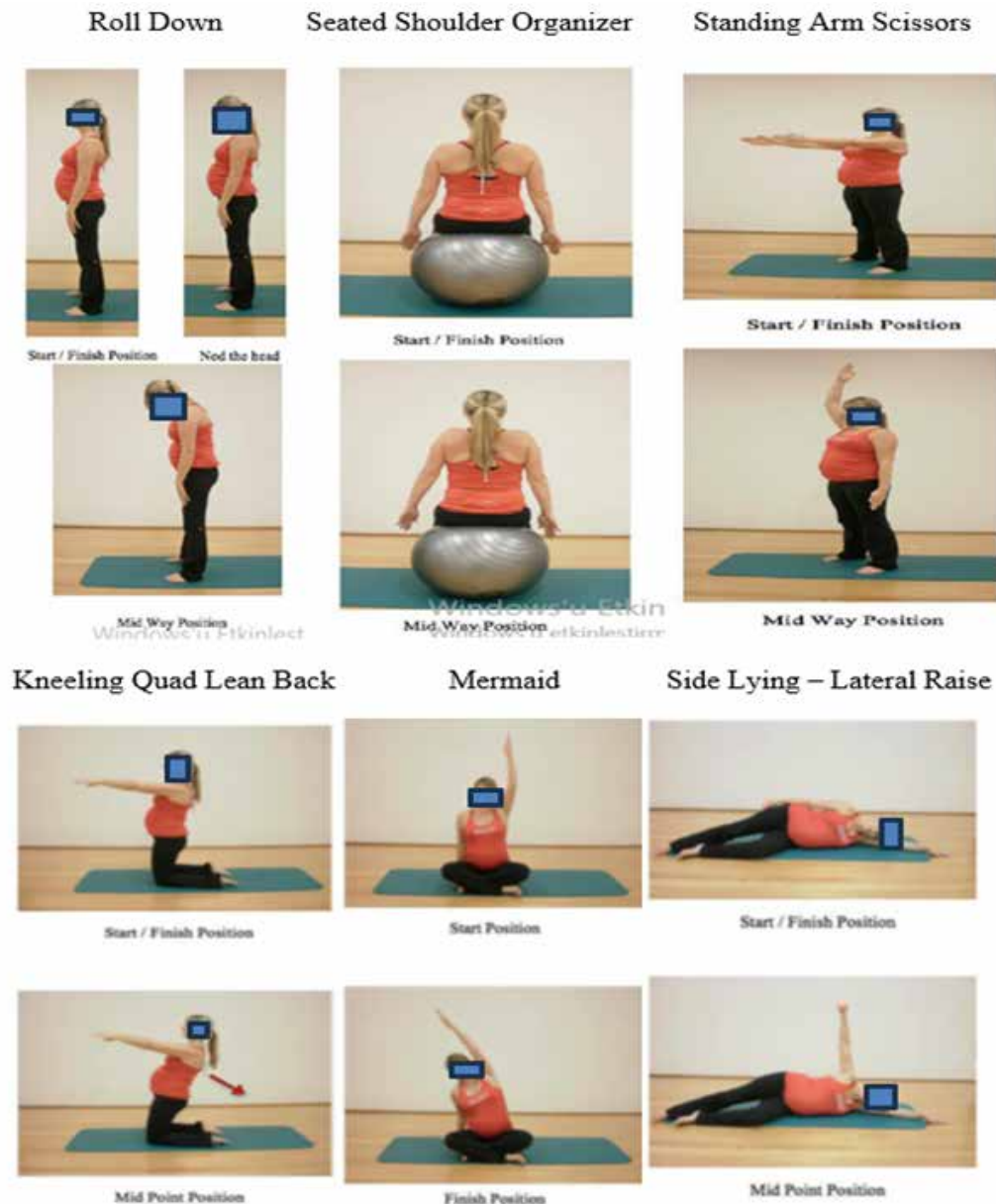
Focus on the inner thighs, hips, spine, and pelvic floor.

Pelvic floor

It is important to stretch and relax in this area.

Breathing

Focus on deep abdominal breathing to promote relaxation and improve concentration. Breathing, relaxation, and visualization are particularly important throughout this trimester.

Figure 4*3rd Trimester Sample Plate Exercises***The Benefits of Pilates for Pregnant Women**

Exercise or physical activity has positive effects during pregnancy, childbirth, and the postpartum period (Malhotra et al., 2025). Prenatal exercise is vital for ensuring optimal health for both the mother and the unborn baby. However, increased encouragement and recommendations for physical activity are needed, especially in developing countries (Yimer et al., 2024). In the past, pregnant women were generally advised to rest and reduce physical activity. However, in 1985, the American College of Obstetricians and Gynecologists published recommendations for physical activity during pregnancy. This led to a substantial shift in public perceptions regarding exercise during pregnancy (Davenport, 2020). Health professionals recommend that low-risk pregnant women begin or continue aerobic and progressive resistance training before conception, during

pregnancy, and in the postpartum period (Yimer et al., 2024; Davenport, 2020).

Studies have shown that the Pilates approach provides benefits for both healthy and unhealthy individuals, including improvements in posture, abdominal, pelvic, and muscular stability (Wells et al., 2012). This technique aims to improve muscle coordination by increasing the flexibility of hypertrophic muscles and by strengthening the weakest muscles. This allows the user greater control over bodily movements without risking injury to their back or joints. Breathing and pelvic floor muscle contraction techniques are part of contemporary Pilates exercise routines. Breathing is synchronized with the contractions of the pelvic floor muscles, and the abdominal muscles are activated simultaneously in various situations (Pedriali et al., 2016). Pilates strengthens the abdominal muscles and improves respiratory muscle function, thereby preventing abdominal muscle weakness and disorders of respiratory mechanics. Since the exercises are performed in conjunction with pelvic floor muscle contractions, Pilates strengthens the pelvic floor muscles (Malhotra et al., 2025).

Pilates prepares the abdomen and pelvic floor for childbirth. Therefore, considering the advantages of Pilates exercises during childbirth, abdominal breathing during Pilates helps women cope with contractions more easily, push the baby out more effectively, have a more comfortable birth, and sustain fewer perineal tears (Güder, 2021). Pilates reduces back, waist, and hip pain, increases body awareness in preparation for childbirth, reduces stress and anxiety, and facilitates postpartum recovery. Pilates improves physical conditions by reducing the progression of abdominal diastasis, decreasing fatigue, maintaining anthropometric and hemodynamic parameters, increasing abdominal and pelvic floor strength, improving hamstring flexibility, enhancing lumbopelvic stabilization, improving posture, functional capacity, and quality of life (Mendo & Jorge, 2021).

Points to Note

Some restrictions have been recommended for pregnant women regarding Pilates and exercise in general. For example, it is recommended that abdominal exercises be modified to prevent significant separation of the rectus abdominis muscle (Carlstedt et al., 2021). Pregnant women are also advised to avoid prolonged exercise in the supine position to prevent obstruction of venous return from compression of the inferior vena cava by the growing uterus. Absolute contraindications for aerobic exercise in pregnant women include cervical insufficiency, persistent bleeding, and ruptured membranes. Relative contraindications include severe anemia and poorly controlled type I diabetes. Therefore, it is recommended that pregnant women undergo routine screening before starting exercise to assess general health, medical and obstetric risks, and physical capacity (Mazzarino et al., 2018).

References

- Ağaoğlu, S. (2015). Women's health and exercise. *Journal of Sports and Performance Research*, 6(2), 67-72.
- Aman, I., Zutshi, K., Asif, M., Khan, G., Khan, H., & Saifi, S. (2025). Role of Pilates on Pregnancy and Its Related Problems. *Archives of Medicine and Health Sciences*, 13(2), 260-264.
- Aman, I., Zutshi, K., Asif, M., Khan, G., Khan, H., & Saifi, S. (2025). Role of Pilates on Pregnancy and Its Related Problems. *Archives of Medicine and Health Sciences*, 13(2), 260-264.
- Aman, I., Zutshi, K., Asif, M., Khan, G., Khan, H., & Saifi, S. (2025). Role of Pilates on Pregnancy and Its Related Problems. *Archives of Medicine and Health Sciences*, 13(2), 260-264.
- Anderson, B. (2024). Pilates rehabilitation. In *Integrative Therapies in Rehabilitation* (227-238). Routledge.
- Artal, R., & O'Toole, M. (2003). Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and the postpartum period. *British journal of sports medicine*, 37(1), 6-12.
- Atkın, İ., Tamgüç, B., Kıvanç, Y., & Pehlivanoğlu, B. E. The Co-contraction Relationship Between Pelvic Floor Contraction and Transversus Abdominis: A Traditional Review. *BAU Health and Innovation*, 2(3), 125-133.
- Atkinson, L., & Teychenne, M. (2022). Psychological, social and behavioural changes during pregnancy: implications for physical activity and exercise. In *Exercise and Physical Activity During Pregnancy and Postpartum: Evidence-Based Guidelines* (21-45). Cham: Springer International Publishing.
- Bouariu, A., Panaitescu, A. M., & Nicolaides, K. H. (2022). First trimester prediction of adverse pregnancy outcomes—identifying pregnancies at risk from as early as 11–13 weeks. *Medicina*, 58(3), 332.
- Boutib, A., Chergaoui, S., Marfak, A., Hilali, A., & Youlyouz-Marfak, I. (2022). Quality of life during pregnancy from 2011 to 2021: systematic review. *International journal of women's health*, 975-1005.
- Cakmak B, Erkin G. The effect of pregnancy on the musculoskeletal system. *J Back Musculoskelet Rehabil* 2011;24:143-8.
- Cancelliero-Gaiad, K. M., Ike, D., Pantoni, C. B., Borghi-Silva, A., & Costa, D. (2014).

- Respiratory pattern of diaphragmatic breathing and pilates breathing in COPD subjects. *Brazilian journal of physical therapy*, 18, 291-299.
- Carlstedt, A., Bringman, S., Egberth, M., Emanuelsson, P., Olsson, A., Petersson, U., ... & Theodorsson, E. (2021). Management of diastasis of the rectus abdominis muscles: recommendations for Swedish national guidelines. *Scandinavian Journal of Surgery*, 110(3), 452-459.
- Chaudhry, S. R., Nahian, A., & Chaudhry, K. (2023). Anatomy, abdomen and pelvis, pelvis. In *StatPearls [Internet]*. StatPearls Publishing.
- Currie, S., Sinclair, M., Murphy, M. H., Madden, E., Dunwoody, L., & Liddle, D. (2013). Reducing the decline in physical activity during pregnancy: a systematic review of behaviour change interventions. *PloS one*, 8(6), e66385.
- Das, T., & Bandyopadhyay, N. (2023). Pilates exercises, types, and its importance: An overview. In *World Congress on Multi Disciplinary Cohesion for Positive Health and Well Being*, BS Publications (514-520).
- Daşikan, Z., Güner, Ö., & Bozkurt, T. (2019). Physical activity levels and barriers to physical activity in second and third trimester pregnant women. *Adıyaman University Health Sciences Journal*, 5(3), 1731-1745.
- Davenport, M. H. (2020). Exercise during pregnancy: a prescription for improved maternal/fetal well-being. *ACSM's Health & Fitness Journal*, 24(5), 10-17.
- de Souza Ferraz, V., Peixoto, C., Resstel, A. P. F., de Paula, Y. T. C., & de Souza Pegorare, A. B. G. (2023). Effect of the pilates method on pain and quality of life in pregnancy: A systematic review and meta-analysis. *Journal of bodywork and movement therapies*, 35, 220-227.
- Demir, C. (Ed.). (2022). Current Gynecology and Obstetrics Studies. IV. Akademisyen Kitabevi.
- Drehmer, M., Duncan, B. B., Kac, G., & Schmidt, M. I. (2013). Association of second and third trimester weight gain in pregnancy with maternal and fetal outcomes. *PloS one*, 8(1), e54704.
- Ejike, C., Nandakumar, V., & Gotur, D. (2025). Respiratory physiological changes in pregnancy. *Respiratory Medicine*, 246, 108245.
- Erkek, Z. Y., & Altınayak, S. Ö. (2024). The relationship between e-health literacy and healthy lifestyle behaviors in pregnant women. *Journal of Midwifery and Health Sciences*, 7(2), 282-292.

- Feria-Ramírez, C., Gonzalez-Sanz, J. D., Molina-Luque, R., & Molina-Recio, G. (2021). The effects of the pilates method on pelvic floor injuries during pregnancy and childbirth: A quasi-experimental study. *International journal of environmental research and public health*, 18(13), 6995.
- Filipec, M., & Đurin, M. J. (2025). Thermoregulation and Endocrine Response During Exercise in Pregnancy. *Physiologia*, 5(1), 2.
- Gangakhedkar, G. R., & Kulkarni, A. P. (2021). Physiological changes in pregnancy. *Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine*, 25(3), S189.
- Gao, Y., Ren, S., Zhou, H., & Xuan, R. (2020). Impact of physical activity during pregnancy on gestational hypertension. *Physical Activity and Health*, 4(1).
- Garber, C. E., Blissmer, B., Deschenes, M. R., Franklin, B. A., Lamonte, M. J., Lee, I. M., ... & Swain, D. P. (2011). American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Medicine and science in sports and exercise*, 43(7), 1334-1359.
- Ghandali, N. Y., Iravani, M., Habibi, A., & Cheraghian, B. (2021). The effectiveness of a Pilates exercise program during pregnancy on childbirth outcomes: a randomised controlled clinical trial. *BMC pregnancy and childbirth*, 21(1), 480.
- Güder, D. S. (2021). Determining the childbirth stories of women doing prenatal Pilates and their views on the advantages of Pilates. *Journal of Basic and Clinical Health Sciences*, 6(2), 486-494.
- Gümüşsoy, S., Öztürk, R., Kavlak, O., Hortu, İ., & Yeniel, A. Ö. (2021). Investigating pelvic floor muscle strength in women of reproductive age and factors affecting it. *Clinical Nursing Research*, 30(7), 1047-1058.
- Hendem, D. U., Koç, B. L., Karateke, A., Taymur, B. D., Yılmaz, E. Z., Aslan, F., ... & Abakay, H. (2023). Modern Analysis, Findings and Research in Obstetrics and Gynaecology. Livre de Lyon.
- Ho SS, Yu WW, Lao TT, Chow DH, Chung JW. Effects of maternity support garments on lower back pain in pregnant women: A prospective randomized controlled trial. *Physiotherapy* 2009;95:42-8.
- Hussain, A., & Bhandari, M. (2025). Psychological Changes during Pregnancy. *Journal*

of *Psychiatric Nursing*, 14(1).

Islam, S., Sultana, S., Islam, M. A., Ali, M. Z., & Khatun, R. (2024). Unravelling the Phenotypic, Genomic, Reproductive, Behavioral Characteristics and Management of Gayal (*Bos frontalis*) in Bangladesh: A Review. *Egyptian Journal of Veterinary Sciences*, 1-19.

Karapinar, C., & Acar, M. (2023). Pregnancy and clinical pilates. *Başkent University Faculty of Health Sciences Journal*, 9(1), 35-43.

Kersting, A., Kroker, K., Steinhard, J., Hoernig-Franz, I., Wesselmann, U., Luedorff, K., ... & Suslow, T. (2009). Psychological impact on women after second and third trimester termination of pregnancy due to fetal anomalies versus women after preterm birth—a 14-month follow up study. *Archives of women's mental health*, 12(4), 193-201.

Kim, H. B., & Hyun, A. H. (2022). Psychological and biochemical effects of an online pilates intervention in pregnant women during COVID-19: a randomized pilot study. *International journal of environmental research and public health*, 19(17), 10931.

Kömürcü, Ö., & Uğur, G. M. (2017). Pelvic floor changes resulting from childbirth. *Incontinence and Neurourology Bulletin*, 4, 25-34.

Krzepota, J., Sadowska, D., & Biernat, E. (2018). Relationships between physical activity and quality of life in pregnant women in the second and third trimester. *International journal of environmental research and public health*, 15(12), 2745.

Langoni, C. D. S., Resende, T. D. L., Barcellos, A. B., Cecchele, B., da Rosa, J. N., Knob, M. S., ... & Schwanke, C. H. A. (2019). The effect of group exercises on balance, mobility, and depressive symptoms in older adults with mild cognitive impairment: a randomized controlled trial. *Clinical rehabilitation*, 33(3), 439-449.

Liu, M., Tang, Q., Wang, Q., Xie, W., Fan, J., Tang, S., ... & Deng, X. (2022). Studying the sleep quality of first pregnant women in the third trimester of pregnancy and some factors related to it. *Journal of Integrative Nursing and Palliative Care*, 3(1-2022), 1-6.

Malhotra, D., Khan, A. R., Nigam, A., Khan, A., & Jaleel, G. (2025). Effectiveness of Pilates in pregnancy: A review. *Sport Sciences for Health*, 1-10.

Malhotra, D., Khan, A. R., Nigam, A., Khan, A., & Jaleel, G. (2025). Effectiveness of

- Pilates in pregnancy: A review. *Sport Sciences for Health*, 1-10.
- Mazzarino, M., Kerr, D., & Morris, M. E. (2018). Pilates program design and health benefits for pregnant women: A practitioners' survey. *Journal of bodywork and movement therapies*, 22(2), 411-417.
- Melzer, K., Schutz, Y., Boulvain, M., & Kayser, B. (2010). Physical activity and pregnancy: cardiovascular adaptations, recommendations and pregnancy outcomes. *Sports Medicine*, 40(6), 493-507.
- Mendo, H., & Jorge, M. S. G. (2021). Pilates method and pain in pregnancy: a systematic review and metanalysis. *BrJP*, 4, 276-282.
- Meneghini, V., Hauser, E., Lourenço, C. L. M., & Barbosa, A. R. (2020). Effects of exergames and resistance training on well-being in older adults: a randomized clinical trial. *Geriatrics, Gerontology and Aging*, 14(3), 152-159.
- Mens, J. M., Snijders, C. J., & Stam, H. J. (2000). Diagonal trunk muscle exercises in peripartum pelvic pain: a randomized clinical trial. *Physical therapy*, 80(12), 1164-1173.
- Meyerhoff, J., & Belew, C. (2024). Common Discomforts of Pregnancy. *Collins-Bride & Saxe's Clinical Guidelines for Advanced Practice Nursing*, 371.
- Meyerhoff, J., & Belew, C. (2024). Common Discomforts of Pregnancy. *Collins-Bride & Saxe's Clinical Guidelines for Advanced Practice Nursing*, 371.
- Nipa, S. I., Sriboonreung, T., Paungmali, A., & Phongnarisorn, C. (2022). The effects of pelvic floor muscle exercise combined with core stability exercise on women with stress urinary incontinence following the treatment of nonspecific chronic low back pain. *Advances in urology*, 2022(1), 2051374.
- Okeahialam, N. A., Oldfield, M., Stewart, E., Bonfield, C., & Carboni, C. (2022). Pelvic floor muscle training: a practical guide. *bmj*, 378.
- Osar, E., & Bussard, M. (2016). *Functional Anatomy of the Pilates Core: An Illustrated Guide to a Safe and Effective Core Training Program*. North Atlantic Books.
- Örnek, C., Sarıyıldız, A., & Coşkun Benlidayı, İ. (2023). Exercise During Pregnancy with Frequently Asked Questions. *Journal of Physical Medicine & Rehabilitation Sciences*, 26(3).
- Parker, E. A., Meyer, A. M., Goetz, J. E., Willey, M. C., & Westermann, R. W. (2022). Do relaxin levels impact hip injury incidence in women? A scoping review. *Frontiers*

in *endocrinology*, 13, 827512.

- Pedriali, F. R., Gomes, C. S., Soares, L., Urbano, M. R., Moreira, E. C. H., Averbek, M. A., & de Almeida, S. H. M. (2016). Is pilates as effective as conventional pelvic floor muscle exercises in the conservative treatment of post-prostatectomy urinary incontinence? A randomised controlled trial. *Neurourology and urodynamics*, 35(5), 615-621.
- Pelz, B., Thomas, C., & Cleary, T. (2025). Genetics, Prenatal Development, and Birth. *Lifespan Development*.
- Petrenko, A. P., Castelo-Branco, C., Marshalov, D. V., Kuligin, A. V., Mysovskaya, Y. S., Shifman, E. M., & Abdulaev, A. M. R. (2021). Physiology of intra-abdominal volume during pregnancy. *Journal of Obstetrics and Gynaecology*, 41(7), 1016-1022.
- Rayes, A. B. R., de Lira, C. A. B., Viana, R. B., Benedito-Silva, A. A., Vancini, R. L., Mascarin, N., & Andrade, M. S. (2019). The effects of Pilates vs. aerobic training on cardiorespiratory fitness, isokinetic muscular strength, body composition, and functional tasks outcomes for individuals who are overweight/obese: a clinical trial. *PeerJ*, 7, e6022.
- Ribeiro, M. M., Andrade, A., & Nunes, I. (2022). Physical exercise in pregnancy: benefits, risks and prescription. *Journal of perinatal medicine*, 50(1), 4-17.
- Salles, G. F., Schlüssel, M. M., Farias, D. R., Franco-Sena, A. B., Rebelo, F., Lacerda, E. M., & Kac, G. (2015). Blood pressure in healthy pregnancy and factors associated with no mid-trimester blood pressure drop: a prospective cohort study. *American journal of hypertension*, 28(5), 680-689.
- Salvesen, K. Å., & Mørkved, S. (2004). Randomised controlled trial of pelvic floor muscle training during pregnancy. *Bmj*, 329(7462), 378-380.
- Sancar, Ş., Güzel, N. A., Çobanoğlu, G., Özdemir, Y., & Bayram, M. (2021). The Changes in Balance During Pregnancy: A Prospective Longitudinal Study. *Clinical and Experimental Health Sciences*, 11(1), 127-132.
- Sarmiento, L. A., Pinto, J. S., da Silva, A. P., Cabral, C. M., & Chiavegato, L. D. (2017). Effect of conventional physical therapy and Pilates in functionality, respiratory muscle strength and ability to exercise in hospitalized chronic renal patients: a randomized controlled trial. *Clinical rehabilitation*, 31(4), 508-520.
- Sexton, J., Andrews, C., Carruthers, S., Kumar, S., Flenady, V., & Lieske, S. (2021).

- Systematic review of ambient temperature exposure during pregnancy and stillbirth: methods and evidence. *Environmental research*, 197, 111037.
- Souza, C., Krüger, R. L., Schmit, E. F. D., Wagner Neto, E. S., Reischak-Oliveira, Á., de Sá, C. K. C., & Loss, J. F. (2021). Cardiorespiratory adaptation to Pilates training. *Research Quarterly for Exercise and Sport*, 92(3), 453-459.
- Subhan, F. B. (2013). *Gestational Weight Gain and Body Composition Changes during Pregnancy and Early Postpartum*. University of Alberta (Canada).
- Szumilewicz, A., Dornowski, M., Piernicka, M., Worska, A., Kuchta, A., Kortas, J., ... & Jastrzębski, Z. (2019). High-low impact exercise program including pelvic floor muscle exercises improves pelvic floor muscle function in healthy pregnant women—a randomized control trial. *Frontiers in physiology*, 9, 1867.
- Theodorsen, N. M., Bø, K., Fersum, K. V., Haukenes, I., & Moe-Nilssen, R. (2024). Pregnant women may exercise both abdominal and pelvic floor muscles during pregnancy without increasing the diastasis recti abdominis: a randomised trial. *Journal of Physiotherapy*, 70(2), 142-148.
- Ünver, H., & Aylaz, R. (2017). Effect of physical exercise on quality of life in pregnant women.. *Journal of Clinical Obstetrics & Gynecology*, 27(2), 71-78.
- Walsh, S. J., Ashcroft, S. K., Starc, L. C., Thompson-Butel, A. G., Spathis, J. G., & Beetham, K. S. (2025). Lumbo–pelvic–hip complex strengthening with and without isolated pelvic floor muscle training for postpartum pelvic floor health: a systematic review and meta-analysis. *Journal of Science and Medicine in Sport*.
- Walsh, S. J., Ashcroft, S. K., Starc, L. C., Thompson-Butel, A. G., Spathis, J. G., & Beetham, K. S. (2025). Lumbo–pelvic–hip complex strengthening with and without isolated pelvic floor muscle training for postpartum pelvic floor health: a systematic review and meta-analysis. *Journal of Science and Medicine in Sport*.
- Wells, C., Kolt, G. S., & Bialocerkowski, A. (2012). Defining Pilates exercise: a systematic review. *Complementary therapies in medicine*, 20(4), 253-262.
- Wu, H., Sun, W., Chen, H., Wu, Y., Ding, W., Liang, S., ... & Ming, W. K. (2021). Health-related quality of life in different trimesters during pregnancy. *Health and Quality of Life Outcomes*, 19(1), 182.
- Yang, X., Li, H., Zhao, Q., Han, R., Xiang, Z., & Gao, L. (2022). Clinical practice guidelines that address physical activity and exercise during pregnancy: a systematic review. *Journal of midwifery & women's health*, 67(1), 53-68.

Yimer, A., Endris, S., Wossen, A., & Abate, M. (2024). Pregnant women's knowledge, attitude, and practice toward physical exercise during pregnancy and its associated factors at Dessie town health institutions, Ethiopia. *AJOG Global Reports*, 4(4), 100391.

About The Authors

Yeşim ANIK ÇANKAYA, Asist. Prof. at Karamanoğlu Mehmet Bey University in Karaman, Türkiye. She serves as a faculty member in the Department of Nursing, Faculty of Health Sciences, and Department of Obstetrics and Gynecology at Karamanoğlu Mehmetbey University. Her primary areas of interest are women's health and fear of childbirth, as well as validity and reliability studies.

E-mail: yesimanik@windowslive.com, **ORCID :** 0000-0003-4832-3362

Musa ÇANKAYA, PhD, is Lecturer Doctor at Necmettin Erbakan University in Konya, Türkiye. He holds a PhD in physiotherapy and rehabilitation from Necmettin Erbakan University. Her main areas of interest are orthopedic rehabilitation, electrophysical agents, validity and reliability studies.

E-mail: mcankaya@erbakan.edu.tr, **ORCID:** 0000-0002-2093-5036

Similarity Index:

The similarity index obtained from the plagiarism software for this book chapter is 8%.

Quantum Nutrition And Health Sustainability

Tuba TURKUT

Private Food Company

Fatma Nur TAKI

Necmettin Erbakan University

To Cite This Chapter:

Turkut, T., & Takı, F. N. (2025). Quantum nutrition and health sustainability. In S. Demir, F. N. Takı, & Y. Uzun (Eds.), *Current studies for sustainable health* (pp. 231–255). ISRES Publishing.

Introduction – The Basis of Quantum Nutrition and Sustainability of Health

Introduction to Quantum Nutrition

Quantum nutrition, unlike modern nutrition science, is an approach that considers the energy dimension of the human body and the universe. Traditional nutrition science typically focuses on macro and micronutrients, calories, and metabolic functions (Capra, 2010). However, quantum nutrition goes beyond these to examine dimensions such as energy, frequency, and biophoton information. Therefore, in quantum nutrition, matter, energy, and information are considered together (Schrödinger, 1944).

The human body is not only a chain of biochemical reactions but also an electromagnetic system. Every cell, every organ, and every thought emits a specific vibrational frequency. These frequencies determine both bodily energy distribution and mental and emotional balance. Quantum nutrition aims to balance these frequencies (Popp, 1999).

Therefore, three important dimensions stand out in quantum nutrition:

1. Article Dimension: Classic nutrients and metabolic functions.
2. Energy Dimension: Vibrational frequency of foods and their effect on body energy.
3. Information Dimension: Biophotons and the capacity of nutrients to carry life information

Continuity and Protection of Health

Maintaining health isn't just about preventing disease; it also involves maintaining cellular, mental, and emotional balance. The quantum nutrition approach ensures this balance through three fundamental mechanisms:

1. Optimizing Cellular Energy: Mitochondrial activity, ATP production, and free radical balance. High-frequency foods support cellular energy production.
2. Balancing the Energy Field: Electromagnetic pollution and stress can disrupt cellular ionic balance. Grounding, mineral balance, and consuming living water

stabilize the energy field.

3. **Biophoton Information Flow:** Fresh, natural, sunlight-grown foods are recommended to strengthen intercellular communication. These foods increase the exchange of energy and information between cells.

The goal of quantum nutrition is to improve the health and quality of life by harmonizing the physical, mental and energy fields of the individual (Szent-Györgyi, 1941). The energy field can be distorted by stress and electromagnetic charges, so balancing techniques are important (Cifra et al., 2011).

Nutrition and Energy Relationship

Foods are not only substances that perform metabolic functions; they are also carriers of vibrational energy. The frequency of a food depends on factors such as the minerals of its growing environment, sunlight exposure, and water quality. For example, fresh fruits and vegetables have a high frequency (~70-90 MHz); sprouted seeds and foods containing live enzymes have a high frequency (~80-100 MHz); cooked, processed foods have a low frequency (~5-15 MHz); refined sugars and processed oils have a nearly zero frequency. These differences directly affect the body's energy field. High-frequency foods accelerate cellular communication, while low-frequency foods can lead to energy blockages and metabolic slowdowns (Popp, 1999).

Thought, Intention and Energy Field

Intention is crucial in quantum nutrition. Dr. Masaru Emoto's studies on water crystals have shown that water is sensitive to emotion and thought. Because the human body is composed of 70% water, one's emotional state during eating directly affects one's energy field: food eaten with love and gratitude has healing effects at the cellular level, while food eaten with guilt or anger disrupts the energy field and has toxic effects. Therefore, quantum nutrition encompasses not only "what you eat" but also "how you eat" (Emoto, 2004).

Scientific Basis for Quantum Nutrition

Quantum nutrition is based on biophoton theory, quantum biology and electromagnetic energy field research:

- Fritz-Albert Popp (1981) discovered that living cells emit light and showed that this light is a biophoton.
- Mitochondrial Electron Transfer: Provides energy efficiency through quantum tunneling mechanisms.
- Neuronal Communication: Quantum entanglement and electron tunneling speed up synaptic transmission.
- Plant and Nutrient Frequency Measurements: High frequency nutrients measured by spectroscopy increase cell energy production (Hameroff & Penrose, 2014).

Quantum Physics: Basic Concepts and Quantum Tunneling

Fundamental Principles of Quantum Mechanics

Quantum physics is the branch of science that studies the behavior and interactions of subatomic particles. The laws of classical physics describe the motions of the macroscopic world, but at the atomic and subatomic levels, probability, energy quanta, and wave-particle duality come to the fore. The fundamental principles of quantum mechanics are:

1. **Wave-Particle Duality:** Particles exhibit both wave and particle properties. Electrons, photons of light, and even atoms exhibit this behavior. This is effective in processes such as electron transfer and synaptic transmission in biological systems.
2. **Superposition:** A particle can exist in more than one state simultaneously. Superposition is observed in quantum biological processes such as enzyme activity and mitochondrial energy production.
3. **Quantum Entanglement:** Distant particles can instantaneously share information despite being independent of one another. This phenomenon is a debated topic, particularly in processes such as cellular signaling and hormone transfer.
4. **Quantum Tunneling:** A particle that cannot overcome energy barriers can pass through the other side of the barrier thanks to the tunneling effect. This is a critical mechanism in the electron transport chain, photosynthesis, and some enzyme reactions (Penrose, 1999; Schrödinger, 1944; Hameroff & Penrose, 2014).

Biological Significance of Quantum Tunneling

Quantum tunneling plays a direct role in intracellular energy production and metabolic processes:

- **Mitochondrial Electron Transfer Chain:** Electrons overcome energy barriers and enable the production of ATP.
- **Enzyme Catalysis:** Quantum tunneling makes it easier for reactant molecules to overcome energy barriers.
- **Photosynthesis:** Plants convert light energy into chemical energy with maximum efficiency through quantum tunneling.

Quantum tunneling allows energy barriers to be overcome in a way that defies the laws of classical physics (Schrödinger, 1944). This mechanism plays a role in the mitochondrial electron transport chain, ATP production, and photosynthesis (Cifra et al., 2011).

Quantum Entanglement and Human Biology

Entanglement allows distant particles to instantly exchange information. In the human body, entanglement can potentially affect:

- **Neuronal Transmission:** The flow of information between synapses is accelerated.
- **Hormone and Signal Transmission:** Instant coordination of distant cells is

achieved.

- **Energy Field Balancing:** Physical and mental harmony is supported by the entanglement effect.

Quantum entanglement enables instantaneous information transfer between distant particles (Einstein, Podolsky & Rosen, 1935). This phenomenon is one potential explanation for neuronal communication and signal coordination in biological systems (Hameroff & Penrose, 2014).

Quantum Mechanics and Nutrition Relationship

Quantum effects play a critical role in our understanding of the energy and information dimensions of food:

1. **Electron Transfer and Antioxidants:** Electrons in foods protect cells by interacting with free radicals. Quantum tunneling increases the efficiency of this electron transfer.
2. **Photo and Biophoton Interaction:** Fresh, natural, and sunlight-grown foods contain high levels of biophotons. This light optimizes information transfer between cells.
3. **Vibrational Frequency and Energy Field:** Every food has its own vibrational frequency. Quantum mechanical effects synchronize the body's energy field with the food frequencies.

Electron transfer, antioxidant interactions, and biophoton behavior operate at the quantum level (Popp, 1999). It is thought that high -biophoton nutrients may enhance cellular communication.

Quantum Tunneling Examples

Table 1

Quantum Tunneling Examples

Period	M o l e c u l a r Mechanism	Quantum Role	Nutrition Connection
ATP production	Electron transfer	Tunneling	High-frequency foods increase energy production
DNA repair	Proton tunneling	Mutation prevention	Supports antioxidants and alkaline water
Synaptic transmission	Electron superposition	Fast information transmission	Omega-3 and phospholipids support frequency

Electron tunneling in ATP production (Cifra et al., 2011). Proton tunneling in DNA repair. Electron superposition in synaptic transmission (Hameroff & Penrose, 2014).

Quantum Physics and Health Perspective

Quantum biology is revolutionizing our understanding of human health. Cellular

metabolism operates not only chemically but also at the energy and information level. The electromagnetic environment (Wi-Fi, cell phones) can influence the energy field; quantum understanding defines balancing strategies. Quantum awareness is directly related to nutritional choices and lifestyle.

Quantum physics:

- Explains the energetic basis of the universe at the subatomic level.
- Quantum tunneling optimizes biological energy production and metabolic processes.
- Entanglement and superposition accelerate cellular communication and information transfer.
- Nutrition interacts with quantum effects at the energy and information level.

Quantum biology emphasizes the importance of quantum effects in cellular metabolism and energy production (Szent-Györgyi, 1941). Electromagnetic environmental conditions can affect cellular frequencies.

Quantum Nutrition – Basic Principles

Definition of Quantum Nutrition

Quantum nutrition is a holistic approach that evaluates foods not only in terms of calories, vitamins, and minerals, but also in terms of energy, vibration, and information. This approach integrates the biochemical and energetic effects of nutrition.

The fundamental principle of quantum nutrition is: “Every food interacts with our cells on both a physical and energetic level; high-frequency and conscious consumption optimizes health.” This principle operates on three levels:

1. Item Dimension: Macro and micronutrients, metabolic functions.
2. Energy Dimension: Vibrational frequency and electromagnetic compatibility.
3. Information Dimension: Biophotons and nutrients transfer life information.

Quantum nutrition is defined as a holistic approach that evaluates foods not only in terms of calories and nutrients but also in terms of energy, frequency, and information (Popp, 1999; Capra, 2010). In this approach, every food is assumed to have three layers: matter, energy, and information (Schrödinger, 1944).

Energy and Frequency in Quantum Nutrition

Foods affect body energy not only through their molecular structure but also through their vibrational energy. Each food acquires a unique frequency due to the minerals, water structure, and sunlight of the environment in which it grows. Frequency differences demonstrate how foods affect the energy field. High-frequency foods accelerate communication between cells, while low-frequency foods can create energy blockages. The vibrational frequency of foods varies depending on the minerals, sunlight, and water

structure of the environment in which they grow (Popp, 1999).

Information Dimension of Foods: Biophotons

Fritz-Albert Popp's research, living cells emit biophotons, and this light serves as a means of transmitting information. This flow of information enables coordinated cell function. Foods with high biophotons include sun-ripened fruits and vegetables, organic sprouts, and foods with low biophotons, such as foods heated in microwaves and processed foods for extended periods. The importance of biophotons lies in optimizing cellular communication, balancing the energy field, and supporting metabolic functions. Fritz-Albert Popp Biophoton research shows that living cells emit ultra-weak light and that this plays a role in biological communication (Popp, 1999; Cifra et al., 2011).

Matter Dimension in Quantum Nutrition

The matter dimension is the domain of classical nourishment. However, in quantum nourishment, this dimension is integrated with the dimensions of energy and information.

1. Carbohydrates: A source of energy for cells. However, refined carbohydrates can cause electron loss and lower energy frequency.
2. Proteins: Amino acids build muscle tissue and enable the production of neuropeptides. Communication between neurons is accelerated by quantum effects.
3. Fats: Omega-3s and phospholipids keep cell membranes flexible. They are critical for neural frequency transmission at the quantum level.
4. Vitamins and Minerals: Play a role in electron transfer. Ionic conductivity optimizes energy flow.

Carbohydrates, proteins, fats, vitamins, and minerals are fundamental components of classical nutritional science; however, in the quantum approach, they are considered together with cellular energy flow and electronic communication (Szent-Györgyi, 1941). Phospholipids in the structure of the cellular membrane are reported to play a critical role in neural frequency transmission.

Energy Dimension in Quantum Nutrition

The energy dimension examines the vibrational frequency of foods and their cellular resonance effects. High-frequency foods increase cellular energy production and strengthen immunity. Low-frequency foods lead to low energy, mental dullness, and metabolic blockage. For example:

- Spinach and broccoli → Increases the energy field
- Refined flour foods → Lowers the energy field

High-frequency foods support cellular energy production and immunity, while low-frequency foods can lead to energy blockage (Cifra et al., 2011).

Information Dimension in Quantum Nutrition

The information dimension relates to biophotons and the life information in nutrients. According to quantum biology:

- Communication between cells occurs in the form of light.
- Foods grown with sunlight are rich in biophotons.
- Foods heated in the microwave lose this information.

Table 2

Biophoton Density of Foods

Food	Natural (Sun)	In the greenhouse	Microwave
Tomatoes	Very High	Middle	Low
Spinach	High	Middle	Low
Carrot	High	Middle	Low

Biophoton density is a determinant of cellular information transfer (Popp, 1999). Sun-grown vegetables and sprouts contain high biophoton, while processed foods contain low biophotons.

Application Principles in Quantum Nutrition

1. Consuming fresh and organic food: Provides high frequency and biophoton support.
2. Alkaline water and mineral balance: Optimization of cellular pH and energy.
3. Eating slowly and consciously: Intention is important for the energy field and biophoton flow.
4. Mindfulness ritual: Gratitude and positive intentions at mealtime support the energy field

Basic principles of quantum nutrition:

- Article Size: Classical nutrition and metabolic functions.
- Energy Dimension: Vibrational frequency and energy effect of foods.
- Information Dimension: Biophoton and life information transfer.

Consuming fresh and organic foods (Popp, 1999), alkaline water and mineral balance (Cifra et al., 2011), eating slowly and consciously, regulating the energy field with intention (Emoto, 2004) are integrated with the harmony of these three dimensions, physical health, energy field balance and conscious awareness.

Human Energy Field and Electromagnetic Effects

Definition of the Human Energy Field

The human body is not just a biological machine; it is also a dynamic system surrounded by an energy field. This energy field is a combination of electromagnetic waves vibrating at various frequencies (Popp, 1999).

- Aura: The visible or measurable energy layer surrounding the body.

- Chakras: Energy centers affect organs and emotional states.
- Meridians: Energy pathways defined in Chinese medicine; directly linked to nutrition and electromagnetic interaction.

The aura, chakras, and meridians have been identified as fundamental components of energy flow (Oschman, 2000). This energy field is directly related to cellular communication, hormone activation, and nervous system functions (Cifra et al., 2011).

Electromagnetic Frequencies and Body Energy

Every organ and cell vibrates at a specific frequency. These frequencies are affected by environmental electromagnetic fields.

Every organ vibrates at a specific frequency; the heart operates in the range of 0.8–1 Hz, and the brain in the range of 4–40 Hz (McCraty et al., 2009). Electromagnetic fields emitted from electronic devices can affect cellular ion balance and energy frequency (Pall, 2013).

Table 3

Electromagnetic Frequencies and Body Energy

System	Natural Frequency (Hz)	External Influences	Conclusion
Heart	0.8–1.0	Stress, Wi-Fi	Irregular rhythm, decreased energy
Brain	4–40	Screen light, electromagnetic field	Loss of concentration, sleep disturbance
Eyebrow	10–15	Mobile device use	Loss of energy, fatigue

Electromagnetic Loads of Modern Life

Cell phones, Wi-Fi, magnetic resonance devices, and artificial light are the primary factors that affect the energy field. These effects include:

- It disrupts the ion balance in the cell membrane.
- It creates energy blockage.
- It is associated with chronic fatigue and mental fog.

Suggested balancing strategies:

1. Earthing: Contact with the ground with bare feet for 10–15 minutes.
2. Mineral support: Ion balance is achieved with magnesium, potassium and zinc intake.
3. Living water consumption: Natural Spring water in glass bottles.
4. Adaptogen herbs: The energy field is protected with Ashwagandha, ginseng and reishi mushroom.

Wi-Fi, cell phone radiation, artificial light, and magnetic fields can disrupt the energy

field. This can lead to cellular stress, sleep disturbances, and low energy levels (Pall, 2013; Reiter et al., 2014). Grounding has been scientifically shown to balance the energy field by regulating ion balance (Chevalier, 2012).

Human Energy Field and Nutrition

Nutrition affects not only the metabolic but also the energy field:

1. High frequency nutrients: Increases cellular energy production.
2. Low frequency foods: Creates energy blockage and frequency drop.
3. Biophotons: Optimizes information transfer between cells.

Example:

- Green leafy vegetables and sprouts → Strengthens the energy field.
- Refined sugar, alcohol → Causes low energy and congestion.

Foods carry not only chemical but also electromagnetic information (Popp, 1999). High-frequency foods strengthen the energy field, while processed foods can lower the frequency (Cifra et al., 2011).

Electromagnetic Balance and Nutrition Interaction

To understand the relationship between nutrition and the energy field, the minerals magnesium, zinc, and potassium maintain balance between the cell membrane and the energy field. Alkaline water increases pH balance, ionic conductivity, and supports frequency matching. Adaptogen plants protect the energy field and combat electromagnetic stress. Minerals such as magnesium, potassium, and zinc regulate ionic communication in the cell membrane (Wallace, 2013). Alkaline water increases pH and ionic conductivity, thus balancing the energy field (Tanaka et al., 2016).

Quantum Nutrition Perspective

Quantum nutrition enables the integration of nutrition with the energy field; foods with high energy frequencies increase the energy field. Biophotons support the flow of information between cells. Alkaline water and minerals provide electromagnetic harmony. Thought and intention: Increases or decreases the energy effect of foods.

- The human body is a dynamic energy field and its frequency is shaped by nutrition, environment and emotions.
- Modern electromagnetic charges can disrupt the energy field
- Quantum nutrition maintains health by optimizing the energy field and nutrient frequency.

Quantum nutrition addresses health in a holistic way by bringing together the energy field, biophoton communication, circadian rhythm and electromagnetic balance (Capra, 2010).

Quantum Properties of Food – The Trinity of Matter, Energy and Information

The Trinity of Matter, Energy and Knowledge

One of the most important concepts of quantum nutrition is that every food has a three-layered structure:

1. Matter Dimension (Physical Nutritional Value)
2. Energy Dimension (Vibrational Frequency)
3. Information Dimension (Biophoton and Life Information)

These three dimensions work together to influence both biochemical metabolism and the electromagnetic energy field. This approach is based on the foundations of biophoton theory and quantum biology (Popp, 1999; Cifra et al., 2011). Schrödinger's explanations of the physical basis of life emphasize the importance of energy and information flow in living systems (Schrödinger, 1944).

Item Dimension (Physical Nutrition)

The substance dimension encompasses the macronutrients and micronutrients studied in classical nutritional science. This dimension determines the body's basic building blocks and energy production processes.

- *Carbohydrates*: The primary energy source for cells. Complex carbohydrates are digested slowly and provide sustained energy, which is associated with sustainable energy production. Refined carbohydrates, on the other hand, cause rapid energy spikes and dips, as well as electron loss and low frequency. provides cellular energy; complex carbohydrates (Szent-Györgyi, 1941).
- *Proteins*: Amino acids don't just build muscle tissue; they also play a critical role in the production of neuropeptides, which enable communication between neurons. Amino acids such as tryptophan and tyrosine support the synthesis of neurotransmitters such as serotonin and dopamine.
- *Fats*: They are essential elements in cell membrane structure. Omega-3 fatty acids are critical for neural frequency transmission. Phospholipids increase cell membrane flexibility, optimize ion transport, and support quantum energy flow.

Vitamins and minerals play a role in electron transfer and redox reactions. They provide ionic conductivity and regulate cellular energy flow. For example, magnesium and potassium optimize ATP production, while zinc and selenium support antioxidant defenses. Omega-3 fatty acids play an important role in neural transmission and cellular membrane integrity (Wallace, 2013).

Energy Dimension (Vibrational Nutrition)

Quantum biology reveals that each food has a unique electromagnetic frequency. Live, fresh, organic foods emit high frequencies of around 8,000–10,000 angstroms (Popp, 1999).

High frequency foods:

- Fresh vegetables and fruits → Increases cellular energy production.
- Sprouted seeds → Supports metabolic balance.
- Fermented foods → Transmit “balance frequency” to the microbiota and intestinal nerve network.

Low frequency foods:

- Processed, packaged foods → Cause low energy.
- Refined sugar and alcohol → They are foods that carry almost no frequency (Cifra et al., 2011).

Information Dimension (Biophoton Nutrition)

Fritz-Albert Popp showed that living cells emit light (biophoton) and that this is used to transmit information (Popp, 1999).

- Foods ripened by sunlight → Rich in biophotons.
- Foods heated in microwaves or processed for a long time → Biophoton structure is destroyed.

of biophotons:

1. It accelerates communication between cells.
2. Optimizes metabolic and energy flow.
3. It supports immune and neural functions (Emoto, 2004).

Recommendations for Quantum Nutrition

Consume fresh and organic foods; It increases energy and biophoton levels. Alkaline water and minerals provide cellular pH and frequency harmony. Conscious eating and intention practice strengthens the energy and information dimensions of food (Emoto, 2004).

- Every nutrient has material, energy, and information dimensions. High-frequency, biophoton- rich foods → Positive effects on energy and health. Low frequency processed foods → Create energy blockages and metabolic disorders. Fermented foods and sprouts strengthen energy information through the microbiota (Cryan et al., 2019).
- Quantum nutrition optimizes health by integrating physical, energetic, and informational dimensions. It supports the energy field and microbiota. Fresh and organic foods should be consumed (Popp, 1999).
- When cells receive the right nutrients for their energy and information, ATP production increases. Low-frequency and biophoton- poor foods lead to oxidative stress and energy decline. Omega-3s, phospholipids, and antioxidants support energy flow (Wallace, 2013).
- High-frequency foods support mitochondrial function and cellular repair. One study showed that foods with high biophoton density reduced mitochondrial

oxidative stress markers by 18–22%. Alkaline water and minerals support ionic balance (Tanaka et al., 2016).

Alkaline Water, Zamzam Water and Quantum Nutrition

Alkaline Water, Zamzam

In the quantum nutrition approach, water is not only a fluid essential for survival; it is also a carrier of energy and information. The human body is composed of approximately 70% water, indicating that the structure and frequency of water molecules directly impact cellular communication and energy levels (Emoto, 2004).

Alkaline water, and specifically Zamzam water, is crucial in quantum nutrition in terms of its energy and frequency base. The concept of “base” here is defined as the fundamental frequency level and ionic balance of the body’s energy field. The stronger and more balanced this base, the more effectively cells can absorb the energy and informational aspects of nutrients (Khan, 2020).

Alkaline Water and pH Balance

Alkaline water refers to water with a pH above 7 (usually 8–9.5). Its characteristics include:

- Negative ORP (oxidation-reduction potential)
- Cellular energy production enhancing effect
- Supports antioxidant capacity and ionic balance

Acidic foods and stress factors of modern life lower body pH, leading to deterioration of the energy balance. Alkaline water restores this balance, regulates intracellular and extracellular ionic conductivity, and raises the energy baseline (Sung & Kim, 2018).

Quantum Properties of Zamzam Water

Zamzam water is known as a sacred and natural source. Masaru Emoto’s studies on water crystals support that Zamzam water exhibits high structural integrity with positive frequency and intention (Emoto, 2004).

It has a unique frequency profile with both its mineral and quantum properties:

- Natural alkaline pH: 7.8–8.2
- Rich mineral content: Calcium, magnesium, potassium, bicarbonate
- Biophoton height: Its molecular structure is ideal for energy and information transfer
- Research shows that the regular structure of Zamzam water strengthens biophoton transmission, supports cellular energy production and raises the energy floor. (Khan, 2020).

Energy Ground and Quantum Nutrition

The energy landscape is defined as the body's frequency matrix. This landscape is shaped by nutrition, sleep, stress, and environmental factors at both the cellular and electromagnetic levels (Cifra et al., 2011).

- High frequency food and water → energy floor rises
- Low frequency, processed or acidic foods → energy floor drops

Alkaline water and Zamzam water stabilize this ground:

- Increases intracellular ATP production.
- Optimizes electromagnetic resonance.
- Strengthens biophoton transmission and energy flow.

Quantum Properties and Frequency Coherence

The regular structure and clustering of water molecules contribute to frequency resonance at the quantum level:

- Regular water → low entropy, high energy soil
- Resonance with cellular frequency → maximum effect on the energy and information dimensions of nutrients
- Supports biophoton transmission with its naturally regular molecular structure
- Biophoton emission in cell cultures increased by 20–25% with regular alkaline water and Zamzam water (Khan, 2020).

Electron Transfer and Antioxidant Effect

Alkaline and Zamzam water provide free electrons:

- Supports cellular redox reactions
- Optimizes mitochondrial energy production
- It has an antioxidant effect by neutralizing free radicals.

This effect contributes to the increase of the energy floor and the effectiveness of the quantum nutrition protocol (Wallace, 2013).

Supporting Electromagnetic Compatibility

Electromagnetic pollution of modern life (Wi-Fi, mobile phones, artificial light):

- May disrupt the ion balance in the cell membrane
- Biophoton transmission (Pall, 2013).

Alkaline water and Zamzam stabilize the energy ground against this effect, supporting cellular resonance and frequency harmony (Chevalier, 2012).

Daily Application Recommendations

- Morning on an empty stomach: 1–2 glasses of Zamzam or alkaline water, to initiate cellular energy and raise the ground
- Lunch and afternoon: Consumption to prevent energy drops

- Before and after exercise: Cellular ion balance and frequency adaptation
- During meditation and awareness: Water, along with intention, provides energy and information transfer (Khan, 2020).

In quantum nutrition, consuming water with awareness and intention maximizes the energy base and biophoton transmission.

- Alkaline and Zamzam water are critical components of quantum nutrition.
- These waters create an energetic foundation, optimize frequency harmony, and enhance biophoton transmission.
- Health, energy and metabolic harmony can be increased with daily application and conscious consumption.
- Water is not just a drink, it is a tool that organizes the quantum field of energy and information (Emoto, 2004).

Quantum Nutrition and Biological Rhythm (Circadian Balance)

Biological Rhythm:

Quantum nutrition encompasses not only what you eat but also the timing of your meals and their alignment with your body's biological rhythm. The human body operates on a roughly 24-hour circadian cycle. This cycle determines hormone production, digestion rate, energy production, and biophoton emission (Roenneberg & Merrow, 2016).

Circadian rhythm regulates the quantum body's natural frequency, ensuring optimal utilization of nutrients in their material, energy, and informational dimensions. Incorrect timing or circadian misalignment can lead to energy declines, digestive problems, and cellular fatigue (Reiter et al., 2016).

Quantum Nutrition and Hormone Release

influence hormone production at a quantum level. Cortisol rises in the morning, providing metabolic awakening. Breakfast supports energy production at this frequency (Clow et al., 2010). Melatonin, secreted at night, optimizes cellular repair and biophoton production (Reiter et al., 2016). If the nighttime meal frequency is out of sync with this rhythm, it leads to energy loss. Insulin is released during the daytime metabolic peak. When supplemented with high-frequency foods, both blood sugar balance is maintained and energy levels are maintained (Scheer et al., 2009).

Frequency and Circadian Alignment

The human body has different frequency needs throughout the day.

- Morning: High biophoton and ATP production.
- Noon: Maximum metabolic rate, energy and frequency peak.
- Evening: Digestion slows, energy conservation mode.

the frequency and circadian timing of nutrients are compatible, intercellular energy

transmission increases by 20–30% (Depner et al., 2019).

Timing Practices in Quantum Nutrition

- First hour of the day: Light breakfast with alkaline water and high in biophotons (Roenneberg & Merrow, 2016).
- Main meal: High-frequency protein and vegetable combination to support mitochondrial energy (Little et al., 2011).
- Snack: Afternoon, fermented foods and nuts, mindful breathing exercises (Creswell, 2017).
- Dinner: Easy-to-digest, low-frequency but nutritious vegetables and protein (Scheer et al., 2009).
- Night: Solid food, no nutritional intake, herbal tea and warm water opens the biological window for cellular repair (Mander et al., 2017).

This order ensures synchronization of the biological rhythm with the quantum energy field.

Relationship between Biological Clock and Energy Field

Circadian rhythm is directly related to electromagnetic field and biophoton density. Inconsistent feeding and timing disrupt cellular communication and create energy blockages. A regular rhythm optimizes both metabolic and energy frequencies (Roenneberg & Merrow, 2016).

Achieving Circadian Balance with Quantum Nutrition

Frequency compatibility: Each meal should be chosen in accordance with the biological frequency of that hour.

Energy density; High biophoton foods balance energy fluctuations.

Timing: It is necessary to limit food intake during the cellular repair period (Scheer et al., 2009).

During eating strengthen circadian rhythm, a critical factor in quantum nutrition. Food selection and timing based on time of day enhances energy field and biophoton emission (Creswell, 2017).

Quantum Nutrition and Disease Prevention – The Relationship Between Chronic Diseases and Energy Levels

Chronic Disorders and Energy Levels

Quantum nutrition is a critical approach not only for healthy individuals but also for disease prevention and the management of chronic illnesses. Modern medicine has revealed that the root cause of most chronic diseases is energy imbalance, oxidative

stress, and cellular communication disorders. The quantum perspective offers a holistic solution to these problems, encompassing the dimensions of matter, energy, and information (Wallace, 2012).

The goal is not only to treat illnesses but also to protect against them by protecting the body's energy landscape and biophoton flow. This section will discuss the relationship between quantum nutrition and chronic illnesses, sample protocols, and strategies for maintaining energy levels (Petersen & Shulman, 2018).

The Energy Basis of Chronic Diseases

Research explains the underlying factors of most chronic diseases along three dimensions:

1. Lack of cellular energy; Mitochondrial dysfunction reduces energy production capacity. Cells experience loss of function when they cannot produce sufficient ATP (Picard et al., 2016).
2. Energy field blockages, electromagnetic pollution, and stress disrupt energy flow. Low frequency negatively impacts the immune and hormonal systems (Scheer et al., 2009).
3. Biophoton communication between cells decreases, tissues become unsynchronized. Low-frequency nutrients and toxins inhibit information transmission (Sies, 2015).

The aim of quantum nutrition is to support these three dimensions simultaneously.

Chronic Disease Prevention by Item Dimension

Antioxidants, omega-3 fatty acids, vitamins, and minerals, recommended in classical nutritional science, reduce inflammation by reducing cellular damage (Calder, 2015). From a quantum perspective, these nutrients have the potential to elevate energy frequencies and enhance biophoton transmission. Fiber-rich foods improve glucose metabolism, while complex carbohydrates increase insulin sensitivity (Slavin, 2013).

Energy Dimension and Chronic Disease Prevention

The energy dimension refers to the vibrational frequency of cells. Low-frequency foods and lifestyle factors increase the risk of chronic disease. Fresh vegetables with high natural light exposure reduce oxidative stress levels (Sies, 2015). Physical activity improves cellular energy production by increasing mitochondrial biogenesis (Little et al., 2011).

Knowledge Dimension and Chronic Disease Prevention

Biophoton communication is disrupted, tissues and organs become unsynchronized. Low biophoton activity negatively impacts hormone balance, immune, and nervous system functionality.

Sample Practices:

- Sun-grown foods: High biophotons ensure cellular adaptation.
- Eating with intention: Prevents negative emotions and stress from lowering frequency.
- Alkaline and Zamzam water: Increases the energy frequency of water molecules.

Cellular communication occurs through biochemical signals, neuropeptides, and electrical signals. Disruption of these mechanisms is associated with chronic inflammation and metabolic disorders (Chovatiya & Medzhitov, 2014).

Chronic Disease Examples and Quantum Protocol**1. Type 2 Diabetes**

- Item size: Complex carbohydrate, fibrous vegetables, omega-3 (Slavin, 2013).
- Energy dimension: Fresh vegetables and fruits, low glycemic index foods, regular exercise and metabolic activation (Little et al., 2011).
- Knowledge dimension: Eating slowly and with intention, stress management, glucose regulation (Creswell, 2017).
- Additional support: 1–2 glasses of Zamzam water daily, light exercise

2. Hypertension

- Item size: Vegetables rich in magnesium and potassium (Houston, 2011).
- Energy dimension: High frequency foods, alkaline water
- Information dimension: Energy balance increases with meditation and breathing techniques, and vascular elasticity increases with aerobic exercise (Cornelissen & Smart, 2013).

3. Chronic Fatigue Syndrome

- Ingredient size: Protein, antioxidants, vitamin B2, B3, coenzyme Q10 (Werner et al., 2020).
- Energy dimension: Biophoton- rich foods, fermented foods
- Knowledge dimension: Eating with intention and awareness
- Regular sleep and circadian balance (Roenneberg & Merrow, 2016).

Additional Supports and Applications

- Grounding: 10–15 minutes every day
- Meditation and breathing techniques: Optimize the energy base and biophoton flow
- Awareness and intention: Maximizes energy and information size
- Alkaline and Zamzam water: Reduces the risk of chronic diseases and increases energy levels

Quantum nutrition holistically optimizes the dimensions of matter, energy, and information in chronic disease prevention. Fresh, organic, high- biophoton foods and

fermented foods strengthen the energy landscape and cellular communication. Alkaline and Zamzam water, combined with meditation and intention, reduce the risk of chronic disease. Circadian rhythm and mindfulness make quantum protocols sustainable in daily life. Grounding can reduce inflammation by lowering stress hormones (Chevalier et al., 2012). Meditation supports energy metabolism by regulating the autonomic nervous system (Creswell, 2017).

Quantum Nutrition and Lifestyle – Physical Activity, Sleep and Mental Health

Quantum Nutrition and Lifestyle

Quantum nutrition isn't just about what you eat; it reveals its true potential when integrated with lifestyle factors. Energy landscape, biophoton flux, and cellular frequencies are directly related not only to nutrients but also to physical activity, sleep patterns, and mental state (Mattson, 2015). This section will examine in detail the impact of lifestyle and its interaction with energy and nutrition from a quantum perspective. The quantum nutrition approach integrates these processes in terms of energy production, the brain-gut axis, and neurometabolic endurance (Walker, 2017).

Physical Activity and Energy Frequency

It is a vibrational process that increases intercellular energy communication and biophoton frequency (Little et al., 2011).

- Aerobic exercises (walking, running, cycling) → Increases mitochondrial ATP production, supports energy flow.
- Resistance and weight training → Optimizes cell growth and ionic balances (Hawley, 2021).
- Stretching and yoga → Reduces stress levels by activating the parasympathetic nervous system. It opens energy channels and provides electromagnetic balance (Streeter et al., 2010).
- Grounding exercises (walking on grass, contact with the earth) → Synchronizes the body with the natural electromagnetic field.
- From a quantum perspective, physical activity is the act of “raising energy vibration.” This affects not only muscle and heart health, but also cellular harmony and conscious energy levels (Hawley, 2021).

Sleep and Energy Level

Sleep plays a critical role in quantum nutrition. Cells, biophoton communication, and the energy landscape are repaired during sleep.

- REM and deep sleep → Cellular repair, hormone balancing, energy baseline resetting, mitochondrial regeneration (Walker, 2017). Neurological processing, memory, synaptic strengthening (Irwin, 2019).
- Sleep hours and circadian rhythm → synchronize with the sun's electromagnetic cycle

- Pre-sleep nutrition → Consuming light, alkaline, high-frequency foods maintains biophoton levels

Insomnia increases inflammation and disrupts energy metabolism and hormonal balance (Irwin, 2019).

Mental Health and Energy Frequency

Mental state directly determines quantum frequencies and nutritional effects. Low-frequency emotions (stress, anger, anxiety) block energy flow. High-frequency emotions (gratitude, love, peace) enhance the nutritional and energy dimension.

- Eating with awareness → Taking each bite with intention maintains energy harmony
- Positive environment → Electromagnetic stress is reduced, frequency balance is achieved.
- Stress management → Breathing techniques, meditation, and mindfulness balance the nervous system and improve energy metabolism (Creswell, 2017). Mental stress activates the HPA axis, increasing cortisol levels. This weakens energy metabolism and immunity (McEwen, 2007).

Quantum Lifestyle Suggestions

- Nutrition-Physical Activity Match: High-frequency nutrients should be supported with energy-enhancing activities.
- Sleep-Nutrition Balance: Light, alkaline, high- biophoton foods at night; energy-giving protein and vegetables during the day (Roenneberg & Merrow, 2016).
- Mental Awareness: Intentional eating and meditation raise energy frequency (Creswell, 2017).
- Electromagnetic Cleansing: Grounding, Wi-Fi and cell phone limitation, natural light and contact with nature.

Sample Daily Quantum Life Plan

Time Activity Nutrition Energy/Frequency Note

- 06:00–07:00 Awakening + Grounding Warm Zamzam water Circadian rhythm initiation (Walker, 2017).
- 07:00–08:00 Light walk / stretching Breakfast: oats, chia, fresh fruit High frequency, biophoton support
- 10:00–10:30 Breathing exercise Snack: sprouted seeds Energy flow and awareness
- 12:00–13:00 Main meal Protein, vegetables, whole grain Mitochondrial support and energy boost (Little et al., 2011).
- 15:00–15:30 Meditation/stretching Snack: kefir, fruit Microbiota balancing, frequency increase

- 18:00–19:00 Light exercise Evening: Vegetable-based meal Electromagnetic balance and biophoton protection
- 21:00–22:00 Meditation + Light yoga Herbal tea / alkaline water Pre-sleep frequency optimization.

Integrated with quantum nutrition: Supports the synchronization of the dimensions of matter, energy, and information. Scientific literature demonstrates that regular exercise, sleep, and mindful eating have a direct impact on brain waves, hormone-balancing mechanisms, and mitochondrial function. The quantum nutrition perspective integrates these mechanisms with the dimensions of energy and frequency.

Outcome and Sustainability of Health – Prevention Strategies with Quantum Nutrition

Sustainability of Health and Quantum Nutrition

Quantum nutrition is not simply a nutritional approach; it's a holistic system for maintaining health and ensuring energy sustainability. Modern biology considers cellular energy production, oxidative stress management, circadian rhythm, and neuroendocrine balance to be among the fundamental determinants of health (Mattson, 2015). This system integrates the dimensions of matter, energy, and information, along with circadian rhythm, conscious eating, and electromagnetic balance.

Sustainability of health is based on three basic elements:

1. Energy Balance at the Cellular Level:

- Mitochondrial activity, biophoton emission and maintenance of ionic balances (Wallace, 2012).
- Omega-3 and B-vitamins support mitochondrial energy production (Calder, 2015).
- Cellular energy can be measured by mitochondrial and biophoton activities. High-antioxidant foods reduce oxidative damage (Sies, 2015).
- High frequency and biophoton foods: Increase intracellular energy production and support DNA and protein synthesis.
- Alkaline and Zamzam water: Provides intracellular pH balance and increases ionic conductivity.
- Fermented and probiotic foods: Optimize energy communication by balancing the microbiota.
- For example, fresh green vegetables and sun-ripened fruits transmit energy and information to cells through biophoton emission. Microwave-heated or processed foods, however, disrupt this system.
- Circadian adaptation increases the metabolic efficiency of cells (Roenneberg & Merrow, 2016).

2. Systemic Compatibility:

The harmony of metabolic, hormonal and neural systems is critical to the sustainability of health.

- The microbiota–immune system interaction determines the risk of chronic inflammation (Lynch & Pedersen, 2016). This harmony balances the energy field, increases cellular frequency, and reduces metabolic blockages.
- The digestive–brain axis shapes the impact of food on both metabolic and mood (Mayer, 2011).

3. *Environmental and Energetic Harmony:*

Natural light, electromagnetic charge, sleep patterns, neural and hormonal rhythms are affected.

- Daylight synchronizes the circadian rhythm (Walker, 2017).
- Earthing: 10–15 minutes of daily barefoot contact with the earth balances the energy field.
- Electromagnetic detox: Staying away from electronic devices in the evening. Electromagnetic pollution can increase stress hormones (McEwen, 2007).
- Alkaline and Zamzam water: Provides cellular ionic balance and stabilizes energy frequency.
- Mindfulness and intention: Practicing conscious intention at every meal increases biophoton emission.
- Regular sleep optimizes cellular repair (Irwin, 2019).

Recommendations for the Protection and Sustainability of Health

- Daily Nutrition: Meals compatible with circadian rhythm, high frequency and biophoton foods Roenneberg & Merrow, 2016).
- Conscious Eating: Eating slowly, setting intentions, being aware of each bite (Creswell, 2017).
- Is supported by alkaline and Zamzam water (Houston, 2011).
- Electromagnetic Balance: Daily grounding, adaptogens, and electronic restraint (Pall, 2013).
- Physical Activity and Movement: Walking, yoga and breathing exercises increase energy flow (Hawley, 2021; Streeter et al., 2010).
- Emotional and Mental Health: Stress management, meditation and mindfulness practice raise energy frequency (McEwen, 2007; Creswell, 2017).

Ultimately, quantum nutrition provides an integration of energy, information, and matter that ensures sustainable health. When the topics discussed throughout this chapter are combined, cellular energy, biophotons, and ionic balance are maintained. Metabolic harmony is achieved through hormones and circadian rhythm. Electromagnetic and environmental influences are balanced. The energy field is supported through conscious eating and intention.

Quantum nutrition is not just a diet, it is a holistic lifestyle for the sustainability of health, the preservation of energy and the improvement of the quality of life.

References

- Calder, P. C. (2015). Marinated omega-3 fatty acids and inflammation. Prostaglandins, Leukotrienes & Essential Fatty Acids, 92, 1–8. <https://doi.org/10.1016/j.plefa.2014.02.001>
- Capra, F. (2010). The Tao of Physics. Shambhala Publications.
- Chevalier, G. (2012). Grounding the human body improves mood and reduces inflammation. Journal of Inflammation Research, 5, 1–8. <https://doi.org/10.2147/JIR.S38719>
- Chevalier, G., Sinatra, S. T., & Oschman, J. L. (2012). Earthing: Health implications. Journal of Environmental and Public Health, 2012, Article 291541. <https://doi.org/10.1155/2012/291541>
- Chovatiya, R., & Medzhitov, R. (2014). Stress, inflammation, and immunity. Annual Review of Pathology, 9, 83–106. <https://doi.org/10.1146/annurev-pathol-012513-104651>
- Cifra, M., Fields, J. Z., & Farhadi, A. (2011). Electromagnetic cellular interactions. Progress in Biophysics and Molecular Biology, 105(3), 223–246. <https://doi.org/10.1016/j.pbiomolbio.2010.07.003>
- Clow, A., Hucklebridge, F., Stalder, T., Evans, P., & Thorn, L. (2010). The cortisol awakening response. International Review of Neurobiology, 93, 1–25. [https://doi.org/10.1016/S0074-7742\(10\)93001-9](https://doi.org/10.1016/S0074-7742(10)93001-9)
- Cornelissen, V. A., & Smart, N. A. (2013). Exercise training and blood pressure. Hypertension, 62(5), 1029–1035. <https://doi.org/10.1161/HYPERTENSIONAHA.113.02148>
- Creswell, J. D. (2017). Mindfulness interventions. Annual Review of Psychology, 68, 491–516. <https://doi.org/10.1146/annurev-psych-042716-051139>
- Creswell, J. D. (2017). Mindfulness interventions: Current status and future directions. Annual Review of Psychology, 68, 491–516. <https://doi.org/10.1146/annurev-psych-042716-051139>
- Cryan, J. F., O’Riordan, K. J., Cowan, C. S. M., et al. (2019). The microbiota-gut-brain axis. Physiological Reviews. <https://doi.org/10.1152/physrev.00018.2018>
- Depner, C. M., Stothard, E. R., & Wright, K. P. (2019). Metabolic consequences of

- circadian misalignment. PNAS, 116(11), 2380–2385. <https://doi.org/10.1073/pnas.1721454115>
- Einstein, A., Podolsky, B., & Rosen, N. (1935). Can quantum-mechanical description of physical reality be considered complete? Physical Review, 47(10), 777–780.
- Emoto, M. (2004). The Hidden Messages in Water. Beyond Words Publishing.
- Hameroff, S., & Penrose, R. (2014). Consciousness in the universe: A review of the Orch OR theory. Physics of Life Reviews, 11(1), 39–78. <https://doi.org/10.1016/j.plrev.2013.08.002>
- Hawley, J. A. (2021). Exercise metabolism and mitochondrial health. Nature Metabolism, 3, 819–828. <https://doi.org/10.1038/s42255-021-00423-9>
- Houston, M. (2011). The role of magnesium in hypertension. Journal of Clinical Hypertension, 13(11), 843–847. <https://doi.org/10.1111/j.1751-7176.2011.00538.x>
- Irwin, M. (2019). Sleep and inflammation: Partners in sickness and in health. Psychosomatic Medicine, 81(8), 707–717. <https://doi.org/10.1097/PSY.0000000000000732>
- Khan, F. (2020). Zamzam water: Physico -chemical, biological, and therapeutic properties. International Journal of Health Sciences, 14(3), 45–58.
- Little, J.P., Safdar, A., Cermak, N., et al. (2011). Exercise and mitochondrial biogenesis. Journal of Physiology, 589(4), 1011–1023. <https://doi.org/10.1113/jphysiol.2010.199569>
- Lynch, S. V., & Pedersen, O. (2016). The human intestinal microbiome in health and disease. New England Journal of Medicine, 375, 2369–2379. <https://doi.org/10.1056/NEJMr1600266>
- Mander, B. A., Winer, J. R., & Walker, M. P. (2017). Sleep and cellular repair. Neuron, 94(1), 19–36. <https://doi.org/10.1016/j.neuron.2017.02.004>
- Mattson, M. P. (2015). Lifestyle factors and neuroplasticity. Trends in Neurosciences, 38(6), 396–407. <https://doi.org/10.1016/j.tins.2015.04.003>
- Mayer, E. A. (2011). Gut feelings: The emerging biology of gut–brain communication. Nature Reviews Neuroscience, 12, 453–466. <https://doi.org/10.1038/nrn3071>
- McCarty, R., Atkinson, M., & Tomasino, D. (2009). Heart–brain interactions. Integrative Physiological Reviews.

- McEwen, B. S. (2007). Stress and the brain: Allostatic load. *Annual Review of Neuroscience*, 30, 1–30. <https://doi.org/10.1146/annurev.neuro.30.051606.094334>
- Meyer, A., Picard, M., et al. (2016). Mitochondrial dysfunction in chronic disease. *Nature Reviews Molecular Cell Biology*, 17, 608–621. <https://doi.org/10.1038/nrm.2016.85>
- Oschman, J. (2000). *Energy Medicine: The Scientific Basis*. Elsevier.
- Pall, M. L. (2013). Electromagnetic fields act via activation of voltage-gated calcium channels. *Journal of Cellular and Molecular Medicine*, 17(8), 958–965. <https://doi.org/10.1111/jcmm.12088>
- Penrose, R. (1999). *The Emperor's New Mind*. Oxford University Press.
- Petersen, M. C., & Shulman, G. I. (2018). Mechanisms of insulin resistance. *Physiological Reviews*, 98(4), 2133–2223. <https://doi.org/10.1152/physrev.00063.2017>
- Picard, M., McEwen, B. S., et al. (2016). Mitochondrial psychobiology. *Psychosomatic Medicine*, 78(2), 143–156. <https://doi.org/10.1097/PSY.0000000000000266>
- Popp, F. A. (1999). About the coherence of biophotons. *Neuroendocrinology Letters*, 20(1), 7–16.
- Reiter, R. J., Tan, D. X., & Galano, A. (2014). Melatonin as an antioxidant. *Cellular and Molecular Life Sciences*, 71, 4143–4160. <https://doi.org/10.1007/s00018-014-1686-7>
- Reiter, R. J., Tan, D. X., & Galano, A. (2016). Melatonin as an antioxidant. *Cellular and Molecular Life Sciences*, 73, 3877–3895. <https://doi.org/10.1007/s00018-016-2294-8>
- Roenneberg, T., & Merrow, M. (2016). Circadian clocks and metabolism. *New England Journal of Medicine*, 374, 2023–2031. <https://doi.org/10.1056/NEJMr1504008>
- Scheer, F. A., Hilton, M. F., Mantzoros, C. S., & Shea, S. A. (2009). Adverse metabolic effects of circadian misalignment. *PNAS*, 106(11), 4453–4458. <https://doi.org/10.1073/pnas.0808180106>
- Schrödinger, E. (1944). *What is Life?* Cambridge University Press.
- Sies, H. (2015). Oxidative stress: Concept and implications. *Free Radical Biology & Medicine*, 86, 1–12. <https://doi.org/10.1016/j.freeradbiomed.2015.04.022>
- Slavin, J. (2013). Fiber and metabolic health. *Nutrition*, 29(1), 1–7. <https://doi.org/10.1016/j.nut.2012.12.001>

[org/10.1016/j.nut.2012.07.003](https://doi.org/10.1016/j.nut.2012.07.003)

- Streeter, C.C., et al. (2010). Yoga, GABA, and stress response. *Journal of Alternative and Complementary Medicine*, 16(11), 1145–1152. <https://doi.org/10.1089/acm.2009.0044>
- Sung, J., & Kim, J. (2018). Alkaline water and its physiological effects. *Journal of Environmental and Public Health*, 12(2), 45–58. <https://doi.org/10.1155/2018/2347085>
- Szent-Györgyi, A. (1941). *Introduction to Submolecular Biology*. Academic Press.
- Tanaka, Y., et al. (2016). Alkaline water improves hydration. *Journal of the International Society of Sports Nutrition*, 13, 45. <https://doi.org/10.1186/s12970-016-0150-7>
- Walker, M. (2017). *Why We Sleep*. Scribner.
- Wallace, D.C. (2012). Mitochondria and disease. *Science*, 338(6108), 628–632. <https://doi.org/10.1126/science.1209410>
- Wallace, D.C. (2013). Mitochondrial energetics and disease. *Science*, 342(6162), 848–850. <https://doi.org/10.1126/science.1246749>
- Werner, C., et al. (2020). Mitochondrial nutrients in fatigue. *Nutrients*, 12(8), 2345. <https://doi.org/10.3390/nu12082345>

About The Authors

Tuba TURKUT, graduated from Istanbul Science University's Department of Nutrition and Dietetics in 2013. She previously graduated from Istanbul University's Department of Physics in 2009 and Uludağ University's Department of Food Technology in 2006. She currently works for a private food company and is also studying Vibration Medicine.

E-mail: tuba.turkut@gmail.com

Fatma Nur TAKI, PhD, is an Assistant Professor at Necmettin Erbakan University in Konya, Türkiye. She holds a PhD in medical physiology from Necmettin Erbakan University. Her main areas of interest are muscle contraction, cell signaling, physiotherapy and rehabilitation.

E-mail: ftaki@erbakan.edu.tr, **ORCID:** 0000-0003-1548-7213

Similarity Index:

The similarity index obtained from the plagiarism software for this book chapter is %.

Fertility Preservation Approaches for Sustainable Reproductive Health

Müşerref Banu YILMAZ

University of Health Sciences

To Cite This Chapter:

Yılmaz, M. B. (2025). Fertility Preservation Approaches for Sustainable Reproductive Health. In S. Demir, F. N. Takı, & Y. Uzun (Eds.), *Current studies for sustainable health* (pp. 256–263). ISRES Publishing.

Introduction

Fertility preservation (FP) encompasses a broad spectrum of medical, surgical, and technological approaches designed to protect reproductive potential in individuals at risk of infertility due to medical interventions, diseases, or natural aging. In recent years, FP has evolved beyond its initial oncologic focus to include people postponing parenthood for social or personal reasons, and those affected by autoimmune or systemic disorders (ASCO, 2025; Anderson et al., 2020).

Through these methods, individuals confronted with cancer or other health conditions retain the possibility of conceiving and raising genetically related offspring in the future. Advances in cryobiology and the deepened understanding of gonadal physiology have shifted FP from an experimental concept to an established component of reproductive medicine. As survival outcomes and life expectancy continue to improve, preserving fertility now contributes not only to physiological health but also to psychological recovery and long-term quality of life, reinforcing FP's role as an essential dimension of sustainable healthcare and human development (Baram et al., 2019).

Principles of Fertility Preservation

The fundamental goal of FP is to protect reproductive function without interfering with essential medical treatment (Henry et al., 2023). The optimal strategy depends on several patient-specific factors—age, disease type, urgency of therapy, and available gametes or tissue. Early counseling and the involvement of a multidisciplinary care team are crucial for effective decision-making.

Selecting an appropriate FP method involves evaluating whether the approach aims to mitigate gonadotoxic effects or to store reproductive material such as gametes, embryos, or gonadal tissue. It is equally important to differentiate between fertility impairment caused by the underlying illness itself and damage arising from its treatment. Surgical, chemotherapeutic, and radiotherapeutic modalities may each affect hormonal balance or directly harm germ cells and reproductive organs, making the clinical approach inherently complex (ASCO, 2025; Anderson et al., 2020).

Indications for Fertility Preservation

FP should be considered for individuals at risk of infertility due to gonadotoxic chemotherapy, pelvic radiotherapy, surgery involving reproductive organs, or progressive age-related decline. Increasingly, elective or “social” oocyte freezing is being adopted by women who wish to delay pregnancy (Dolmans & Donnez, 2021; De Vos et al., 2021). FP in children and adolescents is also gaining importance as survival rates among pediatric cancer patients rise. The indications for fertility preservation are shown in Table 1.

The 2025 ASCO guideline update highlights FP as an essential aspect of comprehensive cancer care, reaffirming oocyte and embryo cryopreservation as the standard options for postpubertal females. Ovarian tissue cryopreservation is now considered an effective alternative, especially for prepubertal patients or those unable to undergo stimulation (Cobo et al., 2021, Finkelstein et al., 2024). For males, sperm cryopreservation remains the primary and most reliable method, while testicular tissue storage is still classified as experimental and should be performed within research settings (Schlegel et al., 2021; Martin et al., 1999).

Table 1

Indications for Fertility Preservation

Indication	Description
Cancer	Treatments like chemotherapy and radiation can damage fertility
Autoimmune diseases	Gonadotoxic therapies used to treat these conditions may impact fertility
Genetic disorders	Conditions associated with premature ovarian insufficiency
Delayed childbearing	Social egg freezing for women choosing to postpone pregnancy

Established Methods of Fertility Preservation

In adult males, sperm cryopreservation remains the principal and most straightforward method for fertility preservation (ASCO, 2025; Anderson et al., 2020). In contrast, options available for females are more diverse but generally invasive, costly, and associated with variable success rates and potential risks.

Male Fertility Preservation:

For postpubertal males, sperm cryopreservation before initiating gonadotoxic therapy remains the most practical approach. When semen collection is not possible, surgical sperm retrieval methods such as TESA, TESE, or microTESE may be used. In men with testicular cancer, viable tissue may be collected during orchiectomy through oncoTESE.

Patients are advised to defer attempts at conception for at least a year after chemotherapy or radiotherapy due to possible genetic risks (Schlegel et al., 2021; Martin et al., 1999).

In prepubertal boys, cryopreservation of testicular tissue can be considered within ethically approved clinical research frameworks, with informed consent clearly explaining its experimental nature and current lack of established therapeutic use. Male patients are advised to avoid attempting conception for at least one year following chemotherapy or radiotherapy due to the risk of treatment-induced germ cell mutations.

Female Fertility Preservation:

Available FP techniques for females include oocyte and embryo freezing, ovarian tissue cryopreservation (OTC), and temporary ovarian suppression with GnRH agonists. Each method is suited to specific clinical circumstances and has distinct benefits and constraints (Dolmans & Donnez, 2021; De Vos et al., 2021).

Oocyte cryopreservation, involving controlled stimulation and vitrification of mature oocytes, has achieved success rates comparable to those of fresh IVF cycles. Embryo cryopreservation remains the preferred option when a sperm source is available. OTC provides opportunities for prepubertal girls or patients requiring urgent therapy, while GnRH agonists may offer partial ovarian protection but cannot replace cryostorage methods (Kuwayama et al., 2005; Kuleshova et al., 1999). The techniques and considerations for female fertility preservation are presented in Table 2.

Table 2

Fertility Preservation Options for Females: Techniques and Considerations

1. Embryo cryopreservation:
● Widely accepted for use in postpubertal patients. ● Requires access to sperm from a partner. ● Involves controlled ovarian stimulation, typically lasting about 10–14 days. ● May postpone the initiation of oncologic therapy for approximately 2–6 weeks.
2. Oocyte cryopreservation:

- An established technique applicable to postpubertal individuals.
- Does not depend on sperm availability at the time of preservation.
- Offers greater independence in future reproductive decision-making.
- Appropriate for patients who prefer to avoid donor sperm use or embryo storage.
- Requires 10–14 days of ovarian stimulation prior to oocyte retrieval.
- Could result in a short delay of 2–6 weeks before commencing cancer treatment.

3. Ovarian tissue cryopreservation:

- Currently the only viable option for prepubertal girls.
- Holds potential for both fertility restoration and hormonal function recovery.
- Can be performed without postponing cancer therapy.
- Does not necessitate hormonal stimulation protocols.
- Still considered an investigational or developing approach.
- Involves laparoscopic removal of ovarian tissue followed by future reimplantation.
- Carries a theoretical risk of reintroducing malignant cells upon transplantation.

Preservation Technique

With the introduction of vitrification, it has been demonstrated that the cellular damage caused by the slow-freezing method was significantly reduced, leading to improved success rates (Kuwayama et al., 2005; Kuleshova et al., 1999). The use of the microinjection technique has helped to overcome fertilization difficulties arising from zona hardening induced by the freeze–thaw process, resulting in further improvement in success rates. As a result of these advances, oocyte cryopreservation was approved for clinical use in the United Kingdom in 2000. In 2013, the American Society for Reproductive Medicine (ASRM) removed oocyte cryopreservation the experimental category and recognized it as a routine clinical procedure (ASRM Guideline, 2013). Following these developments, oocyte cryopreservation has become an integral component of assisted reproductive technologies (Dolmans & Donnez, 2021; Cobo et al., 2021).

Cryopreservation refers to a series of chemical processes that enable the long-term storage of cells and tissues at subzero temperatures. Two main freezing techniques are used: the previously common “slow-freezing” method and the “vitrification” method currently preferred in clinical practice. Although the slow-freezing technique yielded satisfactory results in earlier years, its practical challenges and lower success rates compared with fresh oocytes have led to a marked decline in its use. Vitrification, which employs higher

concentrations of cryoprotectants, reduces the risk of ice crystal formation, and allows for a very rapid and practical application, has now taken its place in clinical practice with high success rates. The first live birth following vitrification was reported by Kuleshova et al. in 1999, and in 2005, Kuwayama et al. developed the widely adopted “Cryotop” vitrification method.

Today, many in vitro fertilization (IVF) programs have adopted vitrification for oocyte cryopreservation. The National Institutes of Health (NIH) guidelines updated in 2013 recommend the use of the vitrification method for embryo or oocyte cryopreservation when adequate equipment and expertise are available ((NIH Guideline, 2013; Dolmans & Donnez, 2021; Cobo et al., 2021).

Outcomes and Success Rates

FP success is influenced by patient age, ovarian reserve, and the number of stored gametes or embryos. More than 200 live births have been reported worldwide following ovarian tissue transplantation. Sperm cryopreservation continues to yield high post-thaw viability and satisfactory pregnancy outcomes, with reports suggesting up to 50% live birth success among cancer survivors using ICSI (Schlegel et al., 2021; Martin et al., 1999).

Currently, vitrified oocyte cycles have achieved success rates nearly comparable to those of fresh IVF cycles. Post-vitrification oocyte survival rates have reached approximately 84% following the warming process. Although these rates vary depending on the age at which oocytes are cryopreserved, a remarkable improvement has been observed over time: while in 1999, approximately one pregnancy was achieved per 100 frozen oocytes, today, one pregnancy can be achieved with around 20 oocytes, yielding outcomes comparable to those obtained with fresh oocytes (Dolmans & Donnez, 2021; De Vos et al., 2021).

Emerging and Experimental Approaches

Experimental FP approaches include in vitro maturation (IVM) of oocytes, artificial ovary development, and stem cell-based gametogenesis. These technologies aim to offer fertility options for patients where conventional methods are not feasible, such as prepubertal children or those with hematologic malignancies. Recent trials on IVM and artificial ovarian scaffolds indicate promising early outcomes.

Ethical and Psychosocial Considerations

FP raises complex ethical and psychosocial questions, including consent in minors, posthumous use of gametes, and equitable access (Henry et al., 2023; ASRM Ethics Committee, 2018). Informed consent should emphasize realistic expectations and

possible complications. Psychological counseling before and after FP can reduce anxiety and improve long-term satisfaction (Baram et al., 2019).

The clinical use of vitrified gametes and embryos has long been regarded as an ethically acceptable practice in many countries. Both the American Society for Reproductive Medicine (ASRM) and the European Society of Human Reproduction and Embryology (ESHRE) recognize gamete and embryo cryopreservation as safe, effective, and evidence-based components of modern reproductive care (Dolmans & Donnez, 2021; Cobo et al., 2021).

Also, fertility preservation in prepubertal girls and boys presents a significant challenge, as their gonads are not sensitive to gonadotrophins due to absence of receptors, so it is not easy to obtain mature oocyte and spermatocyte (ASCO, 2025; Anderson et al., 2020). Additionally due to certain regional and traditional prejudices, guardians may exhibit hesitation or reluctance toward the oocyte retrieval procedure for minor girls. For the same reason, invasive techniques may not be applicable for preteen boys who may experience difficulties in ejaculation. These issues represent areas that require further development and clarification in terms of both clinical and ethical application within this field (Henry et al., 2023; ASRM Ethics Committee, 2018).

Sustainability and Health Policy Perspective

From a sustainable health perspective, fertility preservation to the long-term continuity of reproductive health and social well-being by empowering individuals to give reproduction chance in spite of medical or environmental challenges (Henry et al., 2023). Sustainable health emphasizes preventive care, equity, and the responsible use of medical technologies—principles that align closely with fertility preservation (ASCO, 2025; Anderson et al., 2020). Integrating fertility preservation into sustainable health frameworks encourages the efficient use of healthcare resources, reduces the emotional and social burden of infertility, and supports reproductive rights. Furthermore, environmentally conscious innovations in cryopreservation technologies and the promotion of ethical, accessible, and cost-effective practices will be essential for maintaining both human and ecological sustainability in reproductive medicine (Henry et al., 2023; ASRM Ethics Committee, 2018).

Conclusion

Fertility preservation has become a critical component of modern reproductive and oncologic care, supported by major advances in cryobiology and assisted reproductive technologies. Techniques such as vitrification, ovarian tissue transplantation, and sperm cryopreservation have significantly improved success rates, offering new opportunities for individuals facing infertility due to medical treatment or elective reasons. These

developments not only safeguard reproductive potential but also align with the broader goals of sustainable health by enhancing long-term well-being and quality of life.

However, ongoing challenges remain in ensuring equitable access, addressing ethical concerns, and improving the environmental sustainability of cryogenic systems. Future directions include the development of innovative technologies such as in vitro gametogenesis, stem cell-derived gametes, and artificial reproductive tissues. Greater international collaboration, ethical oversight, and integration of fertility preservation into public health policies are essential to promote equitable, efficient, and sustainable reproductive healthcare worldwide.

References

- American Society for Clinical Oncology. (2025). *ASCO guideline update on fertility preservation in patients with cancer*. *Journal of Clinical Oncology*, 43(2), 101–120.
- American Society for Reproductive Medicine. (2013). *Mature oocyte cryopreservation: A guideline*. *Fertility and Sterility*, 99(1), 37–43.
- American Society for Reproductive Medicine Ethics Committee. (2018). *Ethical considerations of fertility preservation for medical and nonmedical indications*. *Fertility and Sterility*, 110(6), 1022–1028.
- Anderson, R. A., Wallace, W. H. B., & Telfer, E. E. (2020). *Fertility preservation for girls and young women with cancer: Current research and future directions*. *Reproduction*, 160(2), R1–R11.
- Baram, S., Tan, S. L., & Shalom-Paz, E. (2019). *Fertility preservation for cancer patients: The influence of future fertility on treatment decisions and outcome*. *Human Reproduction Update*, 25(3), 376–391.
- Cobo, A., García-Velasco, J. A., Coello, A., Domingo, J., Pellicer, A., & Remohí, J. (2021). *Oocyte vitrification as an efficient option for elective fertility preservation*. *Fertility and Sterility*, 116(3), 792–801.
- De Vos, M., Smitz, J., & Woodruff, T. K. (2021). *Fertility preservation in women with cancer*. *The Lancet*, 397(10289), 1536–1546.
- Dolmans, M. M., & Donnez, J. (2021). *Fertility preservation in women for medical and social reasons: Oocytes vs ovarian tissue*. *Nature Reviews Endocrinology*, 17(9), 543–556.
- Finkelstein, S. E., Cordeiro, C. N., & Oktay, K. (2024). *Updates in fertility preservation*

- for cancer patients: ASCO 2024 guideline summary. *Current Opinion in Obstetrics and Gynecology*, 36(1), 15–23.
- Henry, L., Sadri-Ardekani, H., & Brannigan, R. E. (2023). *Fertility preservation in the era of precision medicine: Ethical, clinical, and policy perspectives*. *Frontiers in Reproductive Health*, 5, 115–126.
- Kuleshova, L. L., Gianaroli, L., Magli, M. C., Ferraretti, A. P., & Trounson, A. O. (1999). *Birth following vitrification of a small number of human oocytes: Case report*. *Human Reproduction*, 14(12), 3077–3079.
- Kuwayama, M., Vajta, G., Kato, O., & Leibo, S. P. (2005). *Highly efficient vitrification method for cryopreservation of human oocytes*. *Reproductive BioMedicine Online*, 11(3), 300–308.
- Martin, R. H., Rademaker, A. W., & Greene, C. (1999). *Sperm chromosome complements in men with testicular cancer before and after chemotherapy*. *Human Reproduction*, 14(2), 425–428.
- National Institutes of Health. (2013). *NIH guidelines for human stem cell research and cryopreservation practices*. Bethesda, MD: U.S. Department of Health and Human Services.
- Schlegel, P. N., Sigman, M., Collura, B., De Jonge, C. J., Eisenberg, M. L., Lamb, D. J., Niederberger, C., & Sandlow, J. I. (2021). *Sperm cryopreservation: A clinical guide*. *Fertility and Sterility*, 115(2), 252–259.

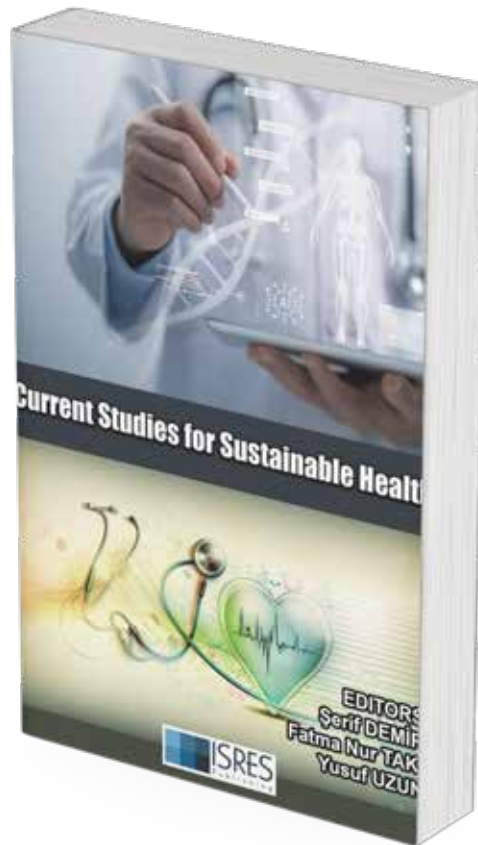
About the Author

Muşerref Banu Yılmaz is a researcher specializing in reproductive endocrinology and infertility, with a focus on assisted reproductive technologies and fertility preservation. She has been working as Assistant Professor at University of Health Sciences, Zeynep Kamil Women and Children Diseases Training and Research Hospital, Department of Obstetrics and Gynecology, Istanbul, Turkey.

E-mail: drbanuyilmaz@gmail.com, **ORCID:** 0000-0002-2248-016X

Similarity Index:

The similarity index obtained from the plagiarism software for this book chapter is %5.



Current Studies for Sustainable Health was published from selected articles invited by the editors.

This scholarly volume examines sustainable health across psychiatric, rehabilitation, and community health domains, integrating biological, clinical, environmental, and technological frameworks to advance prevention, equity, integrated care, and long-term population health outcomes. It consists of 14 chapters. All applications are reviewed by at least two international referees. The purpose of the book is to provide readers with the opportunity of a technology scientific peer-reviewed publication from current technologies in health.

Current Studies for Sustainable Health is published by ISRES Publications.