Review Article

# The Impact of Lifestyle on the Immune System: Focus on Islamic Lifestyle: A Narrative Review

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## Abstract

"Lifestyle" is the way or style of people living in a special time and place and includes behaviors and functions of individuals which are formed in a specific geographical, economic, political, cultural, and religious context and influenced by them. Lifestyle as an essential and efficient agent, impacts different aspects of human health, including immune functions. In the Islamic lifestyle, many recommendations have beneficial effects on human health. Islamic lifestyle influences human immunity with comprehensive recommendations and rules for different stages of life from the beginning until death. Breastfeeding is strongly emphasized in the Islamic lifestyle with an essential role in passive immunity. The quality of breastfeeding has been noticed; therefore, some spiritual words during breastfeeding have been recommended, such as the name of God, which affect the mother's and baby's immune systems via the neuro-immuno-endocrine network. Islamic lifestyle, especially in nutrition and attention to permission and forbidden foods, can prevent obesity and nutritional disorders and therefore may influence infection spread and prevention of diseases. In addition, there is a good synchronization between the hours of prayer "*Salat"*, circadian rhythm, and immune response. In fasting according to Islamic rules (*Sawm*), moderate hunger and thirst may result in the enhancement of T cell function, cytokine production, and NK cell activity and diminish the negative effects of cholesterol on the immune system. Emphasis on the necessity of paying attention to maintain spiritual health and piety (*Taghva*) and encouraging marriage are other examples of Islamic lifestyle-related recommendations with beneficial effects on human immune functions. Hence, it is believed that Islamic teaching presents patterns for a healthy life style that could be beneficial for the immune system.

**Keywords:** *Islam, immune system, life style*

## Introduction

In recent past decades, "lifestyle" has been interesting for many people with different levels of literacy and academic education. Lifestyle-related reports and documents including scientific and non-scientific findings have been regarded as important parts of major social media. Although most of the scientific materials about lifestyle may be found in cultural, social, and psychological publications, in recent years, it has been studied as a multi-disciplinary subject by scientists in different fields. "Lifestyle" is a way or style of people living in a special time and place. Lifestyle includes behaviors and functions of individuals and is formed in specific geographical, economic, political, cultural, and religious contexts and influenced by them.

Lifestyle as an important and effective agent influences different aspects of human life. Human thoughts, perspectives, and practices affect the body and soul via lifestyle, directly or indirectly. Many philosophical and religious texts as well as comprehensive research studies in the fields of psychology, neuroscience, and medicine favor it. The powerful effects of lifestyle on human health have attracted many scientists to research it. The World Health Organization (WHO) has estimated that 60% of health and quality of human life-related factors are correlated to lifestyle. Complex, but definite, networks in neuro-immuno-endocrine communication could elucidate some lifestyle effects on human health.[1] Conclusive findings in inter-disciplinary lifestyle could be helpful for human lifestyle management or promotion. In this article, some important findings about the impact of lifestyle on the

**How to cite this article:** Khorasgani MR, Beikzadeh B. The impact of lifestyle on the immune system: Focus on Islamic lifestyle: A narrative review. Int J Prev Med 2023;14:105.



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**Access this article online**

**Website:** www.ijpvmjournal.net/www.ijpm.ir

**DOI:** 10.4103/ijpvm.ijpvm_11_22

**Quick Response Code:**

immune system with a focus on Islamic lifestyle are briefly described.

## Method

This article is a narrative review based on relevant studies on Islamic recommendations and rules, life style, and the immune system. The source of database was the *Holy Quran* and some other Islamic texts, Google Scholar, and PubMed. The search areas were Islamic recommendations, lifestyle, immune system, age-related changes of immune functions, nutrition, infection, family lifestyle, social life style, sleep, tourism and travel events, physical activity, and so on. The findings were interpreted to evaluate the effects of lifestyle, especially the Islamic lifestyle on immune functions.

## Results and Discussion

### Age-related changes of immune functions with a focus on childhood

The immune system evolves from the immature and developing immune responses in infants and children through to potentially optimal immune functions in adolescents and young adults, followed by a gradual decline in immunity (particularly adaptive processes) in older people. Age-related changes in the immune system are combined by certain lifestyle factors (e.g., diet, environmental factors, and oxidative stress) specific to each life stage that can influence and, modify and in some cases, suppress, immune functions.

Immune protection against pathogens immediately after birth relies on passive immunity and innate immunity. Passive immunity originates from maternal antibodies that are passed via the placenta and maternal colostrum and milk.

Breastfeeding plays a key role in infant passive immunity and is affected by human lifestyle, particularly the mother's diet, spiritual conditions, and lack of stress. Mammal milk not only is the main source of newborn nutrients but also contains many distinct bio-active molecules that protect offspring against infection and contribute to immune maturation, organ development, and healthy microbial colonization. There are some good bacteria in breast milk with beneficial effects on baby health. Scientists, physicians, and international organizations such as WHO have highly recommended human breastfeeding with beneficial effects for the baby and mother.

Breastfeeding making a close relationship between the mother and child, may result in promoting physical growth improvement of body and soul health. Breastfeeding may be influenced by different factors such as lifestyle and other cultural and religious factors. Some studies indicate that mothers who frequently attend religious services are more likely to initiate breastfeeding than mothers who never attend services.[2] Muslims, Christians, and members of other religious faiths displayed higher odds of breastfeeding compared with their unaffiliated counterparts. Moreover, specific religious sub-cultures may influence breastfeeding behaviors. Furthermore, some religions, especially Islam, express clear statements about breastfeeding which can be regarded respectfully by the followers. In the teaching of Islam, breastfeeding is regarded as an important and holy activity "*Jihad*" with excellent rewards from GOD.[3] In the Islamic lifestyle, there are many recommendations to mothers for breastfeeding that impact infant passive immunity, including the duration of breastfeeding, preparation of a safe and relaxed atmosphere; spiritual care during breastfeeding; beginning of breastfeeding immediately after delivery to get the baby from the colostrum; desirable nutrition of mothers with clean, quality, and "*Halal*" foods; spiritually close relationships between the mother and baby; and so on,[2] Table 1.

The great muslim persian Avicena (980–1037 AD) regarded breast milk as "white blood". If the mother was unable to breastfeed, she and the father could mutually decide to breastfeed by a wet nurse. This indicated the preference of Islam in feeding the infant with human milk instead of animal milk. This may be useful for passive immunity getting at a better scale. The maintenance and clothing costs of the child and mother must be borne by the father according to Holy Quran, Surah Al-Baqarah, Ayah (Verse): 233. The mother can claim the payment for breastfeeding, although it is better to forgive (Holy Quran, Surah Talaq, Ayah: 6). Some spiritual care during breastfeeding has been recommended in the Islamic lifestyle, such as starting breastfeeding in the name of God, vozu: ablution (cleaning with water as a religious ritual), remembrance of Allah, and to say or hear spiritual sentences such as Quran verses or prayer phrases,[4] Table 1.

It seems that these recommendations may affect the mother and baby's immune systems via the neuro-immuno-endocrine network.[2,5] Moreover, contact with the environment drives cells of the innate and adaptive mucosal and systemic immune systems to mature and expand, and the immunologic competence of the baby expands rapidly over the first few months of life. Contact with microbial antigens is essential for immune system education and the development of Th-1-type responses, and breakdown in such immune education may predispose infants to allergic, inflammatory, and auto-immune diseases.[6] According to the hygiene theory, the limitation of contact with microbial antigens in childhood may have resulted in emerging some immune-related diseases in the future. Interestingly, the rate and mode of contact with infectious agents and other immunogenic factors are strongly influenced by lifestyle.

**Table 1: The impact of some Islamic lifestyle-related factors on human immune functions**

| Islamic lifestyle-related factors | Proposed effects on immune functions |
|---|---|
| Complete Breastfeeding | Infant passive immunity |
| Reading the Quran and praying while breastfeeding | Beneficial effects via neuro-immuno-endocrine network |
| Eating *halal* food and not eating haram food | Normal nutrition and prevention of obesity, nutritional disorders, and therefore prevention from infection development and transmission |
| Washing some parts of the body: "*Vuzu*" and washing whole body "*Ghosl*" after sex | Infectious disease control and prevention |
| Fasting: *Sawm* (fasting during *Ramadan*) | Enhancement of T cell functions in the presence of antigens or mitogens and IL-2, IL-3, and INF-γ production and NK cell activity and diminished negative effects of cholesterol on the immune system |
| Surgical removal of the foreskin | Decreased risk of sexually transmitted diseases, protection against penile cancer and reduction the risk of cervical cancer, prevention of balanitis and balanoposthitis |
| Forbidden use of alcoholic beverage | Prevention of negative effects of alcohol on the immune system, especially intestinal mucosal immunity and immune defenses, NK-cell dysfunction, a decreased number of natural killer cells, impaired dermal fibroblast functions, decreased epidermal immune cells (i.e., Langerhans cells), and decreased immune surveillance |

## The effects of lifestyle on immune responses against infections

As humans age, the risk and severity of infections vary depending on immune competence and according to how the immune system develops, matures, and declines. Several factors of lifestyle influence the immune functions against infections, including the following:

### *Nutrition*

Nutrition has essential effects on human health and prevention, control, and treatment of different diseases. It is directly or indirectly influenced by lifestyle. In this section, after a brief explanation about the important effects of nutrition on the immune functions against infections, the role of lifestyle on nutrition would be mentioned.

#### Nutrition, infection, and immunity interactions

Nutrition has essential effects on human health and prevention, control, and treatment of different diseases. There are clear relationships among nutrition, infection, and immunity: Changes in one component affect the others. The immune situation during each life stage may affect the type, prevalence, and severity of infections; therefore, poor nutrition can compromise immune functions and increase infection risk. That is, obviously, the optimal immune competence depends upon nutritional status. The immune response is compromised when nutrition is poor, predisposing individuals to infections, and a poor nutritional state may be exacerbated by the immune response itself to infection.[6]

Interestingly, the immune system determines levels of gut inflammation that are constantly shaping the way of food digestion, how many calories get absorbed, and how many nutrients simply pass through.[7] However, many of the anti-inflammatory food components, such as dietary fibers, omega-3 fatty acids, some vitamins, tryptophan, and tryptophan-derived products, and short-chain fatty acids (SCFAs), can activate the production of anti-inflammatory cytokines (IL-10 and IL-22) through binding to the aryl hydrocarbon receptor and the G-protein-coupled receptors.[8]

In recent years, the relationship between gut microbiota, nutrition, and the immune system has been studied interestingly. As Stitaya Sirisinha said, "*our health and probably also our behavior and mood depend not only on what we eat or what we do (lifestyle behavior) but also on what we host*." The human lower gastro-intestinal tract contains approximately 1 kg of bacteria, with a total genome (microbiome) 100 times that of the host cells representing the largest source of non-self-antigens for human beings. Symbiotic bacteria, through their metabolic function, can release essential nutrients, metabolizing indigestible compounds. It has become clear that gut microbiota plays an important role in human physiology and immunology. The impact of diet on the microbiota has been extensively studied and demonstrated that a switch in diet results in a change in the composition of the microbiome. The impact of microbiota on the function of the immune system, especially mucosal immunity, has been studied. The interaction between commensal microbes and the immune system is bidirectional, and intestinal bacterial species can impact the function of one another. Microbiota can act on several cell types of the immune system and stimulate the gut-associated lymphoid tissues, smaller Peyer's patches and mesenteric lymph nodes, isolated lymphoid follicles, Toll-like receptors, expression of α- and β-defensins, cathelicidin LL-37, and other anti-microbial proteins. The ultrastructure of the gut is related to microbiota, and intestinal epithelial cells (IECs) can secrete and respond to various cytokines

and chemokines and express molecules interacting with lymphocytes.

Some commensal bacteria can secrete mediators that elicit anti-inflammatory activity, such as TGF-β, thymic stromal lymphopoietin, IL-25, IL-33, and IL-10. They also stimulate DCs and resident macrophages (CX3CR1+) and T cell differentiation toward regulatory Treg cells and Th-2 phenotypes. Certain components of the inflammasome, such as nod-like receptor pyrin domain 6, are selectively expressed by intestinal epithelial cells and can influence the composition of the intestinal microbiota by inducing IL-18 expression. An immuno-compromised state characterized by pathobiont overgrowth leads to the loss of barrier integrity, hyper-inflammation, dysplasia, and tumorigenesis. On the other hand, some *Lactobacillus* strains (*L. casei, L. plantarum, L. acidophilus, and L. delbrueckii* subsp. *bulgaricus*) have inhibitory effects on pathogens because of the modulatory action of TGFβ-expressing T cells, dendritic cells, and macrophages and production of IL-10.

Molecules or factors produced by the intestinal probiotics during food metabolism, such as SCFAs, p40 molecules, bacteriocin, and polysaccharide A, could be considered as **post-biotics**. Post-biotics may improve epithelial barrier functions. For example, it has been demonstrated that lactocepin produced and secreted by *L. paracasei* inactivates CXCL-10, a lymphocyte recruiting chemokine produced by epithelial cells. *Lactobacillus plantarum* can increase the production of mucins by the goblet cells. More generally, a protein released by probiotics, as an S-layer, protein A, and polysaccharide A can decrease the inflammatory process, regulating the balance between pro- and anti-inflammatory cytokines by DC and T cells.[8]

## The effects of nutrition on immune response against infections

There is an essential relationship between nutrition and body competence against infections. Many studies suggest that dietary intake affects infection risk via an impact on immune functions and/or other effects.[1]

Sub-optimal intakes and micro-nutrient deficiencies are common worldwide, and certain micro-nutrients may be more likely to be insufficient at some stages of life. This can affect the risk and severity of infection, and in fact, an individual's nutritional status can predict the clinical course and outcome of certain infections such as diarrhea, pneumonia, and measles. Resistance to infection may be enhanced by adding the deficient nutrient back into the diet and restoring immune functions.[6] Some important nutritional situations with potential effects on immune functions affected by lifestyle will be discussed as follows:

### Food poverty

Underweight children and adolescents have a significant risk factor for infection, especially if they suffer from malnutrition and poor hygienic standards. Generally, the more malnourished the host, the greater will be its susceptibility to the infection development and the severity of the infectious disease. This is especially true for very young hosts.[1]

On the other hand, immuno-senescence is known as the decline of the immune system with age and has been accounted for by the increased frequency of infectious, auto-immune, and neoplastic diseases in the elderly. Aged people are frequently malnourished with poor socio-economic conditions, mental illnesses, and tooth loss. Hypo-nutrition in aging often exacerbates the immunity that has already been compromised.[8]

### Over-eating and obesity

Some data indicate that the infection rate is also increased in obese children and adolescents in industrialized countries. In obese adults, infections of the skin, respiratory tract, and surgical-site infections have been more common than in normal-weight peoples. Nevertheless, other factors such as malnutrition, hygienic status, and underlying or contemporary illnesses may influence the assessment of the impact of body weight on infection risk.[1]

In the microbiota of obese and overweight people, a reduction of *Bifidobacterium* was observed, with an increase of Firmicutes (*Roseburia* spp., *Eubacterium rectale*, and *Ruminococcus bromii*) and *Proteobacteria*, which metabolize dietary plant polysaccharides with a consequent gain in energy availability.[8]

### Specific nutritional needs

Malnutrition and some specific nutritional deficiencies can affect host defense responses. In vitamin deficiencies and protein-energy malnutrition (PEM), skin and mucous membranes are affected and complement synthesis, neutrophil chemotaxis, antibody development and functions, and T cells are decreased.[1]

In turn, adequate nutrition is crucial to ensure a good supply of the energy sources, macro-nutrients, and micro-nutrients required for immune response development, maintenance, and expression. Various micro-nutrients are essential for immune competence, particularly vitamins A, C, D, E, B2, B6, and B12; folic acid; beta carotene; iron; selenium; and zinc. Micro-nutrient deficiencies as a recognized global public health issue predispose people to certain infections. Immune functions may be improved by restoring deficient micro-nutrients to recommended levels, thereby increasing resistance to infection and supporting faster recovery when infected.[6]

Some important specific nutritional deficiencies with a negative effect on immune functions are reported as follows:

- *Corynebacterium diphteriae* induces more toxicity in **iron** deficiency persons.[1]

- The lack of **proteins and oligo-elements** in the elderly determines severe immune deficits, which can be fatal.
- **Zinc deficiency** in the elderly as a very common but undiagnosed disorder leads to T cell malfunction and increased frequency of respiratory infections and poor responses to vaccination.[8]

Eating habits and dietary patterns

Evaluation of dietary patterns and eating habits is a suitable approach to examining the relationship between diet and the risk of developing diseases. Instead of looking at individual nutrients or foods, diet pattern analysis examines the effects of the overall diet. Eating habits may influence infection susceptibility directly or indirectly (with effects on the immune system, gut microbiome, etc.).

Healthy eating habits or dietary "patterns" may prevent germs and infectious diseases from spreading, but unhealthy eating habits may prepare the ways of infection development, spreading, and aggravation. Some examples of eating habits with the potential effect on infectious diseases would be regarded as follows:

The Mediterranean diet (MD) or Mediterranean diet pattern (MDP), as one of the healthiest dietary models, may express beneficial effects on infectious disease prevention. The effect of the MD is because of the synergic and interactive combinations of nutrients rather than isolated nutrients.

The consumption of cereals (preferably as whole grains), legumes, nuts, vegetables, and fruits in high amount and frequency; reduced consumption of fish or seafood, white meat, and eggs; moderate to small amounts of poultry and dairy products and low ethanol intake; use of olive oil as the principal source of dietary lipids; an adequate daily intake of water; and physical activity to maintain a healthy physical and mental status are the characteristics of MDPs.

The "Western" diet (Western pattern diet or standard American diet) has been known for a higher intake of animal-derived foods (saturated fats), eggs, sweets, and desserts and a lower intake of fruits, vegetables (fibers and micro-nutrients), and whole cereals. It may underlie many so-called diseases of civilization, including coronary heart disease, obesity, hypertension, type 2 diabetes, epithelial cell cancers, auto-immune disease, and osteoporosis. With the intervention of infectious agents, these undesirable conditions may have resulted in deleterious and harmful consequences.

Based on studies across mice and humans, it is suggested that in the modern Western lifestyle, antibiotics and high-fat diets can persistently alter commensal microbial communities. Those microbial disturbances may increase pathogen susceptibility and also obesity and auto-inflammatory disease, important maladies with partial more frequency in the industrialized world.

Alcohol drinking habits: Alcohol misuse has been part of many human societies for centuries. The deleterious role of alcohol drinking on the body, such as helping for infection development, will come later.

Traditional foods: In different countries, some traditional foods may affect infection spread. For example, traditional yogurt acts as probiotic food and is positively effective on infection prevention.[1]

## Nutritional interventions for improving immunity against infections

There are some natural products with potential corrective characteristics against immune dysfunctions: prebiotics (fruit and vegetables), probiotics, post-biotics, symbiotics, and polyphenols. Prebiotics, probiotics, and symbiotics have been shown to restore innate and adaptive immunity in the elderly, also correcting alterations of intestinal microbiota which, under normal conditions, contribute to immune homeostasis, balancing the equilibrium between Treg cells and Th-17 cells. Some evidence suggests that administration of red grape polyphenols to aged people restores impaired T cell functions, thus increasing protection against winter infections.[8]

## The effect of lifestyle on nutrition

Human lifestyle has powerful effects on the diet and nutrition, and a suitable lifestyle helps to improve nutrition, which prepares essential nutrients without obesity and other metabolic disorders. Social, economic, educational, ethnic, and cultural backgrounds and briefly lifestyle influence the diet and may positively or negatively affect an individual's nutrition status.[6] For example, the nutrition-related recommendations in Islamic texts may be regarded as the nutritional lifestyle in Islam. *Quran*, the holy book of Muslims, is not a medical, biologic, and nutrition book but has mentioned important guidelines, points, and examples related to human nutrition, such as: the importance of nutrition and its effect on human life; diversity of nutrients and their classification as materials with herbal origin (vegetables, etc.) and animal materials (meats, milk, etc.);"*Halal*" or permissible foods such as vegetables, fruits, the meat of lamb, goat, beef, chicken, and fish; "*Haram*" or forbidden foods such as alcoholic drinks, pork, carcasses meat, blood, and filthy materials; the necessity of fasting during *Ramadan*; the necessity of carefulness about foodstuff usage and evaluation of the benefits and harms of potential foods; forbidding of overeating and food extravagance; and finally therapeutics effects of honey. It is suggested that Islamic lifestyle, especially in nutrition, express beneficial effects for normal nutrition and prevention of obesity and nutritional disorders and therefore may influence infection spread, prevention, and also treatment. Prohibition of eating potentially deleterious materials known as "*Haram*" substances such as blood,

urine, and feces may decline the rate of infections and can help the prevention of infectious disease development and interfere with emergence or re-emergence of diseases.[1] It would be concluded that we should pay attention to the importance of different aspects of human nutrition and their interactions with immune functions and infection susceptibility and spreading and therefore, management of nutritional lifestyle certainly could help to prevent and control infectious diseases.

### *The religious beliefs and practices*

Cultural and religious beliefs and community regulations may be regarded as some important factors affecting human lifestyle; therefore, paying attention to relationships between the above factors; lifestyle; and infectious disease development, progress, prevention, control, and treatment is necessary.

In addition to the powerful effect of religion on lifestyle, the effects of religious practices on immune functions, especially against infectious diseases, must be regarded. Different religious practices may be included: some private works and/or communications and multi-disciplinary works with important effects on development or control, prevention, and treatment of infectious diseases. Understanding religious practices may allow public health officials to communicate with populations, more effectively target them, and encourage infectious disease prevention using religious beliefs and so on. Some religious, spiritual, and traditional beliefs and practices influence infectious disease progression, spreading, control, and prevention. For example, in *Islam*, there are some essential rules with controlling effects against infectious diseases as follows:

- Emphasis on the necessity of paying attention to keep healthy and prevent harmful health effects
- Necessity to pay attention to the rights of others
    - The emphasis on spiritual health strengthening and piety (*Taghva*).
    - Encouraging marriage and regarding the family formation as important principle for the management of essential units of community.
    - Encouraging the acquisition of health-related sciences and underlining that "for any pain, there is a cure".
    - The emphasis on the importance of medicine and preventing the non-scientific intervention on human health.
    - Insistence on "prevention is better than cure".
    - Purity and hygiene of human bodies against filthy: carcass (corpse), blood, urine, feces, and semen.
    - The effects of some religious practices on infectious disease control and prevention: for example, the need to cleanse the body before some worship in Islam (washing some parts of the body: ablution "*Vuzu*" before official praying "*Salat*" and washing the whole body "*Ghosl*" after sex).

It was suggested that there is a good synchronization between the hours of prayer "*Salat"* times and the circadian rhythm with beneficial endocrine and immunologic effects such as lymphocyte proliferation enhancement. In fasting according to Islamic rules (*Sawm*), moderate hunger and thirst may result in the enhancement of T cell functions in the presence of antigens or mitogens and IL-2, IL-3, and INF-γ production and NK cell activity and diminish negative effects of cholesterol on the immune system,[9] [Table 1].

- Prohibition of jobs with potentially harmful effects such as infection development and spreading.
- Circumcision as a religious obligatory: It is the surgical removal of the foreskin, the tissue covering the head (glans) of the penis that is usually performed on the first days after birth. There is some evidence indicating health benefits of circumcision, including decreased risk of urinary tract infections and some sexually transmitted diseases in men; protection against penile cancer and a reduced risk of cervical cancer in female sex partners; and prevention of balanitis (inflammation of the glans) and balanoposthitis (inflammation of the glans and foreskin), phimosis (the inability to retract the foreskin), and paraphimosis (the inability to return the foreskin to its original location). Circumcision also makes it easier to keep the end of the penis clean. Expanding research on the impact of religious beliefs and practices on immune response against infectious diseases will help in the beneficial use of them,[1] [Table 1].

### *Family lifestyle*

The family as the divine subunit of society is an important contact area for people of different ages and a natural place for immunity development, especially in babies. A healthy, happy, and qualified lifestyle in the family including suitable nutrition, physical activity, love, and spirituality together with a helping attitude and respectfulness to one another would improve the individual's and society's health.

Family lifestyle could affect human health, including prevention and control of infectious diseases via the immune system as follows:

#### Family formation time

The time of family formation as an essential unit of society is very important. After family formation, human relationships would be developed at a higher scale with better management of different physiologic and spiritual needs. With saving sex for marriage, the family formation could prepare the best situation for safe sex as it is recommended by Abrahamic religions (*Christianity, Judaism,* and *Islam*) and some others. Health reasons, moral beliefs, and a happier and more romantic marriage support it. It seems that marriage without delay and the limiting sexual relations to the spouse would be beneficial

for infection prevention and control, especially sexually transmitted diseases (STDs).

### The lower rate of some infections in married persons

It seems that under equal conditions, the rate of some infectious and non-infectious diseases in married persons is lower than that in non-married persons. The results may be more available for STD.

It is an important finding that family formation encourages good life and expresses different beneficial effects on the human soul and body aspects such as infectious disease prevention and control.[1]

### *The pattern of sleep and waking up*

The pattern of sleep and waking up is an important part of the lifestyle. The relationship of sleep and awakening pattern with the rate and severity of some infections has been elucidated.

Sleep can help people to recover from disease faster because sleep can strengthen immunity and help fight infections. It has demonstrated that fruit flies that slept more after infection had a higher survival rate. In upper respiratory tract infections (URTIs), sleep disturbance may be a risk factor for inflammation. Sleep deprivation may negatively affect the immune response that may be measured by CD4 and cytokines.[1] Systematic fluctuations of many immune parameters in human blood are seen over the 24 h day. These changes originate from a combined influence of the circadian system and sleep.[10] Therefore, synchronization of the pattern of human sleep and wake up with nature is helpful for health and may be beneficial to infection prevention and control.[1]

### *Physical activities*

There are different scientific findings of the relationship between physical activity and infection prevention, some support the beneficial effect of physical activities on infection prevention, but in others, this finding has not been certified. Generally, the following can be deduced:

1. The physical activity effect on viral infection risk is suggested to be J-shaped; that is, regular moderate physical activity may reduce the incidence and severity of primarily viral infections, but sedentary behavior and exhaustive high-intensity exercise can increase the risk of some infections.
2. Some investigations have indicated that increased levels of leisure-time physical activity are related to a lower risk of some bacterial infections such as cystitis.
3. Evidence indicates that physical activity and light to moderate exercise positively affect the immune system and therefore, the positive effect on infection prevention is acceptable.
4. Some previous studies indicate potential confounding of age, sex, body mass index, smoking, education, self-reporting mistakes, disease underreporting, and alcohol consumption.[1]

### *Social lifestyle*

Interpersonal relationships with people within immediate surroundings or the general public indicate social life, although some researchers limit social life as the part of a person's time spent doing enjoyable things with others. In this chapter, the general concept of social life has been regarded as excluding family lifestyle which was mentioned before.

The suitable social life of a human as a social being induces beneficial effects on his/her health, and social isolation and loneliness may negatively affect human health aspects.

### Social isolation and loneliness

Social isolation and loneliness are risk factors for some diseases, especially cardiovascular diseases (CVDs) such as elevated blood pressure and atherosclerosis. An increase in mortality has been correlated with both loneliness and social isolation.

Perceived social isolation (PSI) induces damaging effects on physical health via activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS) and may be manifested by behavioral alteration, including physical inactivity, smoking, and sleep disruption, increased depressive behavior, chronic stress, and so on. Repeated and chronic social stress lead to glucocorticoid resistance, enhanced myelopoiesis, up-regulated pro-inflammatory gene expression, oxidative stress, and enhanced cytokine production by immune cells. Cytokines, in turn, can potentiate glucocorticoid resistance. Glucocorticoids govern many physiological functions, such as immunity, metabolism, cardiovascular activity, and apoptosis. It seems that social isolation and loneliness may increase the risk of infection development via reduced physical activity, obesity, smoking, and so on. Moreover, in isolated situations and when a person who lives in seclusion from society needs health care, wound management is more difficult and some wound complications such as bedsores may be developed.[1]

In the Islamic lifestyle, polite and respectful behavior with elder people and not leaving them alone have been emphasized.[11]

### Gatherings

In human gatherings with different purposes including familial, social, political, religious, sport, and others, people communicate together and with near contact together, the possibility of infection transmission may be increased.

Participation in gatherings as a part of lifestyle is related to their opinions, thoughts, customs, and religions, and human as a social creature needs some suitable communications; therefore, their management in various dimensions, especially health care, is necessary.[1] Moreover, it creates spiritual vitality that may induce immune function enhancement.

### Social media

Social media as an important part of modern lifestyle and a useful tool for extensive release of medical and other suitable information, may express potentially harmful effects on the health, via distribution of poor-quality or non-scientific information, damage to a professional image, breaches of patient privacy, violation of personal–professional boundaries, and licensing or legal issues.

Moreover, increased risk of obesity, sleep disorders, sexual problems, deviations from porn websites, and promotion of unhealthy behaviors may be regarded as misuse of social media, especially in addicted forms.[1]

#### *Recreation and entertainment activities*

Spending on leisure by different activities, recreation, and entertainments as an important part of human life may be helpful to expose people to pathogenic microbes,[1] but proper spending on leisure can enhance the functioning of the body's immune system and therefore provide protection against a range of diseases.[12] The type of recreation depends on the people's lifestyle, and there are differences between them in the possibility of infection spreading and/or immune system enhancement.

### Outdoor recreation

Camping, playing sports, interacting with animals, and mountain climbing all have the potential to induce some infectious and non-infectious diseases. However, at least some of these may result in the induction and promotion of immune functions. It is suggested that for activities in contact with nature, enhanced immune functioning may be regarded as a central pathway between nature and health.[13]

### Tourism and travel events

Different lifestyle-related purposes, such as religious, economic, entertainment, and so on, induce people to prepare millions of trips annually in the world with different consequences. Transportation improvements allow for the rapid dissemination of pathogens. Transmission of infectious diseases into immunologically naïve populations through direct transmission or by introducing them into the environment in travel events can occur. The critical role of travel and transportation in the spread of influenza, polio, cholera, and dengue, with drug-resistant pathogens such as malaria and antibiotic-resistant bacteria, has been reported.

The quantity and quality of travel events are strongly influenced by lifestyle. *Hajj* is a universal annual *Muslim* trip related to religious lifestyle with spiritual, cultural, and other benefits but needs extensive and programmed health management for prevention and control of infectious diseases such as immunization.[1]

### Smoking

Depending on the quantity and quality of smoked material and the consumer situation, smoking includes a range of harmful effects. Tobacco is the most common substance smoked, especially with cigarettes.

The morbidity and mortality from smoking may be caused by infectious diseases, cancer, heart disease, and chronic lung disease. Cigarette smoking is an important risk factor for some bacterial and viral infections such as invasive pneumococcal disease, influenza, and tuberculosis. Smoking increases the risk of infections by structural changes in the respiratory tract and a decrease in the immune response. Moreover, smoking cessation has been regarded as part of the therapeutic plan for serious infectious diseases or periodontitis.[1]

### Drug abuse and addiction

Substance abuse as one of the major problems in the world imposes enormous sociopolitical, economic, and health costs to society.[1]

Drugs of abuse affect almost every physiological system in the body including the immune system.[14]

Drug users are more likely than non-users to contact some infectious diseases and, when infected, to progress to serious illness, so human immunodeficiency virus (HIV) and hepatitis C virus (HCV) infections are prevalent among substance abusers. However, tuberculosis (TB), STDs, streptococcal and staphylococcal infections (leading to endocarditis), and some others have all been reported in drug abusers.[1]

### Alcohol and infection susceptibility

The systemic effects of alcohol on different organs of the body have been studied. Higher rates of hospitalizations, longer hospital stays, major complications of polytrauma and bleeding disorders, increased mortality, higher intensive care unit admissions, and greater postoperative complications have been reported for patients with a history of heavy acute or chronic alcohol use compared with patients with no history of alcohol use. Epidemiological data have confirmed that alcoholics are highly at risk for certain infections, particularly pneumonia and tuberculosis. Alcohol is a risk factor for infection with hepatitis C.

The destructive role of alcohol on body responses against infectious agents has been demonstrated with higher expression of serum bacterial DNA, bacterial translocation, and higher levels of outer membrane molecules of Gram-negative bacteria (i.e., lipopolysaccharide) in the blood. The increased risk of infection may be attributed to alcohol's deleterious effect against different body systems as follows:

Gastrointestinal system: Alcohol increases the permeability of the intestine and helps bacterial overgrowth in the small intestine, resulting in higher endotoxin blood levels.

Immune system: Alcohol negatively affects the immune system, especially intestinal mucosal immunity and

immune defenses in both the upper and lower airways. The decrease in membrane expression of the GM-CSF receptor, impaired bacterial ingestion, lower intracellular zinc levels, and decreased phagocytic activity have been reported for alveolar macrophage exposed to *Staphylococcus aureus* in vitro.

Furthermore, it seems that alcohol produces abnormalities and decreased numbers in natural killer (NK) cells (in mouse models of alcohol consumption). NK-cell dysfunction may predispose alcoholic patients to viral infections like cytomegalovirus and influenza, and certain tumors may be related.

Skin: Alcoholism is associated with higher rates of wound infection and delay in wound closure. Increased risk for *Staphylococcus aureus* infection, including methicillin-resistant *Staphylococcus aureus*, *Streptococcus pyogenes*, and *Vibrium vulnificus*, has been reported.

In mouse models, ethanol could impair dermal fibroblast functions and decrease epidermal immune cells (i.e., Langerhans cells), which is likely to account for decreased immune surveillance against pathogenic organisms in the skin and negatively affect skin T cells.[15]

In the Islamic lifestyle, the use of alcohol and alcoholic beverage is forbidden.[1] Table 1.

## Conclusion

It is clear that Islamic lifestyle has recommendations for all aspects of life, and some of those express beneficial effects on immune systems, such as breastfeeding, Halal food, prayer, and Taghva. It is hoped that by research, explanation, and good presentation of various aspects of Islamic lifestyle, the progress toward health improvement via the immune system could be achieved. In restoring or improving immune system health, beneficial lifestyle changes need not be overwhelming, but simple lifestyle changes may be very effective. The immune system would be in the healthiest situation with a proper lifestyle.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

**Received:** 08 Jan 22 **Accepted:** 16 Feb 23
**Published:** 28 Aug 23

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