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The Effect of Islamic Fasting in Ramadan on Osteoporosis

Seyed Mohammad Amin Kormi[1,2], Shima Ardehkhani[3], Mohammad Amin Kerachian[1,4,5*]

1. Cancer Genetics Research Unit, Reza Radiation Oncology Center, Mashhad, Iran
2. Department of Biology, Faculty of Sciences, University of Zabol, Zabol, Iran
3. Institute of Social Security and Welfare Applied Science Higher Education Tehran Province, University of Applied Science and Technology, Tehran, Iran
4. Medical Genetics Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
5. Department of Medical Genetics, Faculty of Medicine, Mashhad University of Medical Sciences (MUMS), Mashhad, Iran

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ABSTRACT

Osteoporosis is considered as one of the most common diseases that women face after their menopause and is caused by both genetic and environmental factors. Dipeptidyl peptidase 4 (DPP-4) gene is one of the important genetic factors contributing in osteoporosis which has a direct and very important relationship with fasting. Fasting is one of the alternatives proved to reduce the DPP-4 level and activate the Dipeptidyl peptidase 4 inhibitors and so, prevent osteoporosis. On the other hand, the circadian rhythm has a direct relationship with osteoporosis. This has been found by the biochemical markers, indicating that fasting at certain hours of the day, especially during those hours of the day which are recommended as part of the Muslim tradition, is very effective in reducing the effects of osteoporosis.

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Introduction

Ramadan is one of the most basic traditions in Islam (1); Muslims around the world fast every year for a lunar month according to the instructions of Islamic (verses 183 &185 of Surah al-Baqara in the Holy Qur'an), which obliges fasting to the physically healthy people. Ramadan follows the lunar system and enters into a different season after every 9 years, so the length of fasting hours varies from 9 to 18 hours in different years (on average) (2,3). In Islamic fasting, the Muslim person avoids eating and drinking from the morning call for prayer (dawn) to the evening call for prayer (sunset) and instead, s/he can eat and drink at the time interval between sunset and dawn (4). As one of the main reasons of Muslims to do this tradition, we can mention the health and sympathy with the poor people. It has been shown that fasting, especially in Ramadan, could have a protective and preventive effect on several diseases (1,4). In this review, we are looking at the effect of Islamic fasting on osteoporosis.

Discussion

Osteoporosis, as defined by the American National Health Association, is a skeletal disorder that occurs more often in the old age and its obvious feature is to reduce the bone strength and subjecting the patient by the risk of fracture (5).

According to the latest figures in the United States, 1.5 million fractures per year is observed due to osteoporosis (6) among which, the largest number occurs in the vertebrates (700,000 cases), then in the radius bone(250,000 cases), and also in the pelvis (250,000 cases) and the rest in other bones (300,000 cases)(7). Pelvic fractures are the worst complication of osteoporosis and have a mortality rate of over 20% in the first year (8). Many of the patients with pelvic fracture are unable to return to their previous standing position and nearly 100% of them will need long-

* *Corresponding author:* Mohammad Amin Kerachian, Department of Medical Genetics, Faculty of Medicine, Mashhad University of Medical Sciences (MUMS), Mashhad, Iran. Email: Kerachianma@mums.ac.ir

term care facilities. Three-fourths of the pelvic fractures occur in women. After the age of 50, the risk of pelvic fracture during the life is 17% for white women and 6% for white men. If we take the bone mineral density as the criterion of judgment, 13 to 17 million women suffer from bone mass loss in the neck and femur and 4 to 6 million white menopausal women have osteoporosis (9,10).

There is a variety of factors contributing to the osteoporosis development as a risk factor which is divided into two categories of genetic and environmental factors. Some of the factors that can be outlined as the most important environmental factors affecting the progress of disease include aging, smoking, low physical activity, reduced vitamin D consumption, reduced dairy consumption, and reduced calcium food intake (11-13). On the other hand, one of the cases associating with osteoporosis is adenosine deaminase complexing protein 2 or CD26 also called Dipeptidyl peptidase-4 (DPP4) which is often coded on the surface of most body cells and plays a very important role in signaling pathways with other bio-molecules. It is also associated with the process of apoptosis and the regulation of the immune system by regulatory T cells (14). This protein has various substrates including proline or alanine amino acids existing in the growth factor, some neuropeptides, some chemokines, and vasoactive peptides. However, the most important role being played by this biomolecule is in glucose metabolism and is considered to be an important factor in the decomposition of various incretins such as Glucagon-like peptide-1 which is a prerequisite for osteoporosis. DPP4 gene is one of the important genetic factors contributing in osteoporosis which has a direct and very important relationship with fasting. This gene encodes the Dipeptidyl peptidase 4 protein and is dependent on the GCG gene expression which encodes glucagon-like peptide 1 (GLP-1) (15-17). DPP-4 is considered as a peptidase serine peptidase and contributes to the degradation of GLP-1 (18), and intensifies the osteoporosis symptoms. It has been observed that there is a strong correlation between DPP4 gene activity and the osteoporosis development risk and the pathogens such as inflammation and insulin resistance but the signaling pathways for insulin resistance and osteoporosis development risk are not the same (19). [It is proved that diabetes is, at the same time, associated with an increased risk of osteoporosis (due to the DPP4-inhibiting effect in both diseases) (20). In fact, the DPP4 inhibitors may have a protective effect on the bone (21). Also, the DPP4 inhibitors, i.e. Vildagliptin and Saxagliptin have a significant anti-inflammatory potential. The anti-inflammatory potential of the DPP4 inhibitor can lead to the increased cardiovascular complications of type 2 diabetes, apart from its hypoglycemic potential (22). For the first time, through a meta-analysis study, Monami et al., suggested that the positive action of DPP4 has a significant relationship with osteoporosis (23). Indeed, the increased DPP4 level increases the osteoporosis risk. Due to the pleiotropic effects of DPP4 activity, the interaction between the DPP4 activities and the other unknown factors may also contribute to the osteoporosis development among postmenopausal women (24). Due to the key role of suppression of DPP4 in the metabolism of the human body, the majority of new drugs to treat the type 2 diabetes mellitus (T2DM) are productions targeting this principle (25,26). Fasting plays a significant role in controlling diabetes as well as activating the DPP 4 inhibitors (27). And the reduced activity of DPP4 has a negative and direct relationship with osteoporosis (23). Therefore, controlling the DPP4 inhibitor provides us with an alternative therapeutic option in the fasting time (fasting can cause to decrease the DPP4 inhibitors' level) (28, 29). Fasting leads to a reduced osteoporosis development by reducing the DPP4 level. On the other hand, several studies indicated that the circadian rhythm has a direct relationship with the osteoporosis. This has been identified by the biochemical markers, so that: the biochemical markers (bone resorption), including the urinary excretion of pyridinium cross-link, the urinary cross-linked N-telopeptide of type I collagen (NTx), sex steroids, cortisol fluctuations, and PTH (parathyroid hormone) get the peak during the night and early morning, and get dropped in the late afternoon; so, the osteoporosis can be predicted and prevented by measuring these markers (30). The changes in this circadian rhythm (bone biochemical markers) have a significant relationship with fasting (and the nutrition type) and the fasting could change them dramatically (31), which

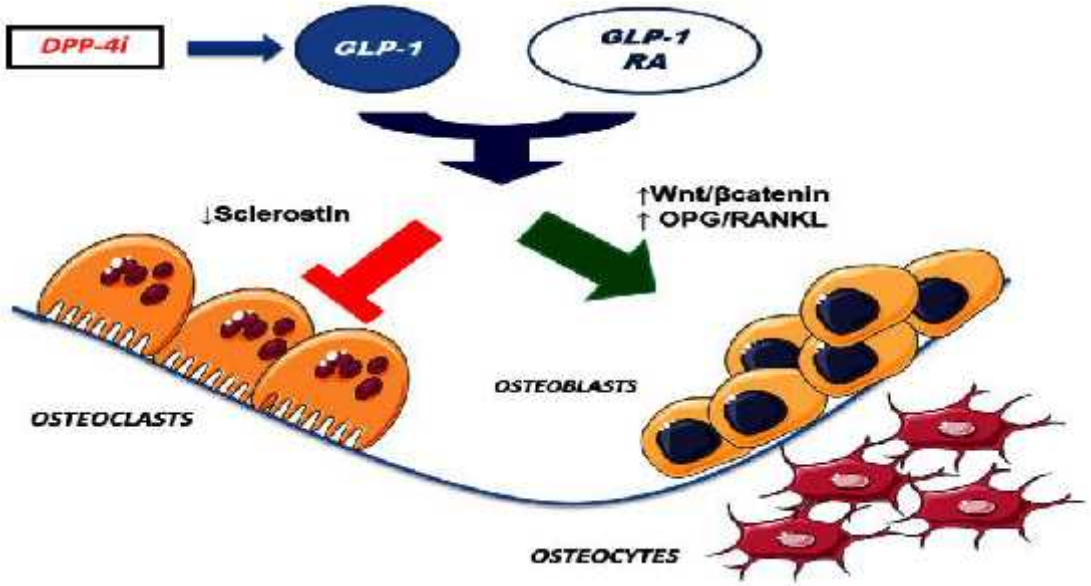

Figure 1. Effects of glucagon like peptide 1 (GLP-1) and GLP-1 receptor agonists (RA) on bone metabolism. Osteoblastogenesis stimulation has been hypothesized to occur via activation of Wnt/beta-catenin pathway and/or increased OPG/RANKL ratio. DPP4, Dipeptidyl peptidase 4 protein; DPP4i, dipeptidyl peptidase-4 inhibitors; OPG, osteoprotegerin; RANKL, receptor activator of nuclear factor kappa-B ligand (32)

confirms the fact that fasting is very effective in minimizing the osteoporosis effects.

Conclusion

Fasting has beneficial effects on the human body and on the basis of the new research results, it helps to control the type 2 diabetes as well as preventing the reduction of bone density and consequently, decreasing the probability of osteoporosis. Potentially, measuring the DPP4 level can help in early detection of osteoporosis.

Conflicts of interest

We have read and understood the Journal of Fasting and Health's policy on disclosing conflicts of interest, and we declare that we have none.

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