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The Effect of Magnesium on Ball-Game Players' Performance

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Abstract. Due to the ignorance and underestimation of Magnesium(Mg)'s position and the threat of Mg deficiency to athletes, this article collects and summarizes the previously conducted studies that are of reference value aiming to illustrate the effect of Mg on ball-game players' performance. The current process of research is quite abundant and original, particular in Mg's physiologic mechanism within cell and the risk of Mg deficiency among patients and normal people. However, only a small number of researches focus on the relationship between Mg and ball-game players performance on different ball games and the concrete supplementation of Mg in different ball games are unclear. This systematic review summarizes the physiological functions of Mg and the adverse effects of Mg deficiency on the nervous system (stroke), circulatory system (sudden cardiac death), and bone health (osteoporosis). It then focuses on ball-game players, showing that Mg supplementation (240–413 mg/d) can prevent muscle damage in basketball players, enhance neuromuscular performance in volleyball players, and improve strength in handball players. The review also discusses that athletes have higher Mg requirements than the general population, and factors such as dosage, bioavailability, and a faster dosing strategy may influence supplementation effectiveness. This systematic review provides a theoretical basis for nutritional support in this athletic population.

Keywords: Exercise performance, magnesium supplementation, magnesium deficiency, ball game

1. Introduction

There are numerous exercise performance are required among ballgame players, including speed, agility, power, strength, aerobic and anaerobic endurance. However, a ballgame player's athletic performance result from a variety of factors, which contain nutrition, sleep, emotion, mentality, and natural environment and so on.

Among these factors, nutrition is of vital importance for the overall physical health of athletes. Good nutrition provide adequate energy for athletes to maintain their speed and endurance in high intensity games. What's more, nutrition help athletes recover from injury and stimulate their muscle grow and their strength increase as well. Much more importantly, the nerve system and immune system will be stabilized so that the mindset, the recognition of making better decisions in game can be improved. Magnesium (Mg) as a necessary mineral metal for human, plays an irreplaceable role

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in nutrition. Mg participates in numerous enzymatic reactions, acts as a core of energy metabolism, adjusts the muscle function and nerves conduction, stabilizes the nerves system and sleep quality and maintains bone health and combats inflammation.

There are studies show that many ball-game athletes, including rugby players, and elite female gymnasts, don't always reach the recommended Mg intake level, revealing active people lack of Mg generally [1]. What's more, evidences based on marginal Mg deficiency weakening athletic performance and causing hurtful influence of strenuous exercise are clear especially like oxidative damage, arrhythmia, muscle weakness and hypomagnesemia.

As for ball game players, engaging in oxygen uptake, energy production and electrolyte balance, Mg acts irreplaceable role in normal muscle function. Therefore, proper Mg supplementation can provide various benefits among different ball-game athletes. For basketball players, related tissue of muscle injury can be decreased if Mg was provided across the whole seasons of games [2]; For volleyball players, the capability of neuromuscular function can be dramatically enhanced due to extra Mg offered [3]. For handball players, their strength performance will be highly improved with the intake of Mg which strengthen the muscle function [4]. Hence, it is necessary to ensure that Mg levels are sufficient in the diet of athletes as well as supplementation, particularly in high-performance athletes, as a result of the greater consumption and subsequent greater requirements for Mg.

Although quantities of research have made huge progress on Mg's effect on neuromuscular function and the bad situation caused by Mg deficiency, there is still a long way to go for a clear relationship between specific ball game athletes' performance and supplement of Mg. Therefore, this systematic review aims to sort out the related research and summarize them on the point of Mg supplement and ball game sports performance, hoping provide certain theoretical references for subsequent related research.

2. The physiological functions of Mg

Mg almost participate in numerous metabolic process within every cell, resulting in various influence to the function of body, inclusive of bone development, neuromuscular connection, metabolism of glucose, lipid and protein, energy storage, and nucleic acid stability as well [5].Mg^{2+} plays an important role in preserving genetic stability, supporting the natural DNA conformation, serving as a cofactor for enzymes associated with nucleotide and base excision repair and mismatch repair [5].Mg^{2+} stimulate osteoclast multiply [5]. Mg^{2+} serves as a physiological antagonist of Ca^{2+} inside cells by competing with Ca^{2+} for binding sites on proteins and Ca^{2+} transporters. This competitive behavior underlies the regulatory effects of Mg on the cardiovascular system, skeletal muscle, and the brain [5]. Creatine kinase, which catalyzes the reversible conversion of creatine phosphate and ADP into creatine and ATP, is highly sensitive to changes in the concentration of free Mg^{2+}. Under conditions of high demand, such as during heavy workloads on muscles or the heart, this enzyme facilitates ATP production. It can be found both in the cytosol and within mitochondria [5].

3. Mg deficiency

There are several forebodings indicating Mg deficiency, such as a poor appetite, nausea or vomiting these kinds of gastrointestinal symptoms, and weakness and fatigue. When Mg deficiency get worse, muscle symptoms will appear, like muscle contractions without control, numbness, tingling, and

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abnormal heart function including unstable heart rhythms, coronary spasms, as well as seizures and personality changes which related to our central nervous systems.

What's more, Mg deficiency can result in hypocalcemia or hypokalemia due to electrolyte disturbance. Since high intensity exercise increases Mg needs attributing to inflammation and damage to muscle, athletes may have higher Mg requirements in comparison with sedentary individuals. According to the findings, the use of diet analysis software resulted in an overestimation of intake by 159% to 181%, suggesting that food records may not provide a dependable measure of actual Mg consumption [6].

3.1. Nervous system-stroke

In a multicenter study, acute ischemic stroke patients whose serum concentration of Mg <0.82mmol/L had double possibility in the increasing risk of in-hospital mortality. In patients with acute ischemic stroke, those who succumbed within seven days exhibited lower Mg concentrations in the cerebrospinal fluid compared to survivors [7].

There are a number of meta-analyses summarized in a recent stroke-related publication, and together they suggest that Mg offers a dose-dependent protective benefit against stroke. According to most of these analyses, increasing daily Mg intake from food by 100 mg could reduce the risk of total stroke by somewhere between 2% and 13%. What's more, an updated meta-analysis that covered 40 prospective cohort studies revealed a stronger association: individuals with the highest level of dietary Mg consumption had a 22% lower stroke risk than those with the lowest level. As for how Mg works to influence these conditions, the mechanisms appear to be diverse and have yet to be fully clarified [8].

3.2. Circulatory system-sudden cardiac death

There are a number of earlier reports, which have been summarized in several reviews, showing that Mg status is negatively associated with various heart-related conditions, including hypertension, arrhythmia, coronary artery calcification, heart failure, and even cardiac mortality.

What's more, when Mg is lacking inside the body, intracellular calcium levels go up. This rise in calcium can cause the contraction of vascular smooth muscle and heart muscle cells to become stronger, and also increases vascular tone. As a result, altered vascular tone may lead to hypertension, and if coronary vascular tone is affected, it can play a role in the occurrence of myocardial infarction [9].

In a separate study conducted under controlled metabolic unit conditions, postmenopausal women were given a typical Western diet that provided only 101 mg of Mg per 2000 kcal for 78 days. After that, their diet was supplemented with an additional 200 mg of Mg per 2000 kcal [10]. Among the fourteen women involved, five developed abnormal heart rhythms during the period of Mg deprivation. These abnormalities included atrial flutter, atrial fibrillation, ventricular premature beats, and second-degree heart block, all of which raised the hazard of sudden cardiac death.

As for the Atherosclerosis Risk in Communities (ARIC) study, it looked at heart disease risk factors and serum Mg levels in a group of 14,232 white and African American men and women aged 45 to 64 at the start. After an average follow-up of 12 years, the results showed that people whose serum Mg stayed within the normal physiological range (at least 0.88 mmol/L) had a 38% lower risk of sudden cardiac death compared to those with serum Mg at or below 0.75 mmol/L. Nevertheless, the amount of Mg consumed from food did not show any clear link to the risk of sudden cardiac death in this study [11].

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3.3. Bone-osteoporosis

Several consequences that come along with Mg^{2+} deficiency, among which accelerated bone loss and a decline in bone formation are the two major ones [12]. A lack of Mg may affect bone health through two different routes: directly, by reducing bone stiffness, increasing the number of osteoclasts, and decreasing osteoblasts; and indirectly, by interfering with parathyroid hormone (PTH) and vitamin D, as well as by promoting inflammation and oxidative stress, which in turn leads to further bone loss .

As for clinical evidence, a study carried out by Okyay et al. focused on postmenopausal women. A total of 728 participants were divided into two groups based on whether they had osteoporosis or not. After analyzing the serum levels of various minerals including Mg, the researchers found a significant link between low serum Mg concentrations and the presence of osteoporosis in both the lumbar spine (L1–L4) and the femoral region [13].

Another important aspect is the inflammatory response triggered by Mg deficiency. Once Mg levels are insufficient, leukocytes and macrophages become activated, followed by the release of inflammatory cytokines and acute-phase proteins, coupled with excessive production of free radicals [14].Among these cytokines, interleukin6 (IL6) is known to promote the growth of osteoclasts. Meanwhile, interleukin1 (IL1) acts as a powerful stimulator of bone resorption, and this process explains the accelerated bone loss commonly observed in both idiopathic and postmenopausal osteoporosis [14].

4. Mg supplement

In a case study of tennis play who have hypomagesemia, Liu et al. suggested that Mg supplementation might be responsible for fewer muscle cramps. Given that Mg alleviates cramping —a condition known to impair athletic performance—Mg supplementation may exert an indirect influence on performance outcomes [15].

According to a review conducted by Newhouse et al., all examined studies reported beneficial effects of Mg supplementation—at daily doses ranging from 240 to 413 mg—on sports performance [16].

4.1. In basketball player

In a study, twelve elite male basketball players from a team of Spanish Professional Basketball (PB) League participated. The control group (CG) comprised twelve university students who regularly practiced recreational basketball and competed in minor university leagues. The former group was supplemented with 400mg/d of Mg in the form of lactate Mg, the later was supplemented with no Mg. Through blood test, the serum concentrations of muscle damage parameters such as creatinine, urea, creatine kinase (CK), lactate dehydrogenase (LDH), aspartate transaminase (AST), alanine transaminase (ALT), aldolase(ALD), and total proteins (TP) were measured throughout the whole seasons. The data shows that serum concentration of these muscle damage parameters remain stable except for creatinine. It turns out that the supplement of Mg has a positive effect on athletes, which prevent related tissue damage between 240mg/d and 413mg/d [2].

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4.2. In volleyball player

A 4-week research on experiment group $n = 12$ and control group $n = 13$ was observed in pair regarding differences greater than 2.7 cm as a significant difference for countermovement jump. Plyometric exercises such as countermovement jump and the countermovement jump with arm swing were an excellent evaluation of neuromuscular capabilities. Three jump attempts were performed by each player, and the mean values of jump height (cm) and time (ms) of triplicate measurements were calculated. It showed that the countermovement jump and countermovement jump with arm swing values of players in the experimental group rose dramatically after supplementation period, while those of the control group remained unaffected. It turned out that the supplement of Mg will strengthen the neuromuscular capabilities of players [3].

4.3. In handball player

In a research,7 male elite handball players were engaged. The 7-day dietary record method was adopted, where athletes recorded their daily diet by themselves. Subsequently, a nutritionist conducted interviews for verification. The Food Processor SQL software was used to analyze energy and nutrient intake, with a focus on Mg intake and the calcium-to-Mg ratio (Ca: Mg). A linear regression model was employed to analyze the relationship between Mg intake and various strength indicators. Regression analysis indicated that Mg intake was directly associated with trunk flexion, trunk rotation, and handgrip maximal strength. Even after adjusting for energy intake, these relationships remained significant [4].

5. A reasonable way to supplement Mg

For the general healthy population, the Recommended Dietary Allowance (RDA) of Mg ranges from 400 to 420 mg per day for men and 310 to 320 mg per day for women aged 19–70 years. However, athletes are more likely to be Mg deficient, because they lose more Mg through sweat and urine while often failing to take in enough from their diet. What's more, the Mg RDA for athletes remains unknown and is actually questionable, since current recommendations are all based on nonathletic populations.

Regarding the effect of Mg supplementation on muscle fitness, insufficient dosage is not the only issue—the differences in bioavailability among various supplementation formulas may also have masked the real effect. Previous studies have used many different forms of Mg, including Mg oxide, Mgcreatine, Mg lactate dihydrate, Mg citrate, and even a cream (MagProTM). Nevertheless, only a few studies have been specifically designed to clarify whether the nonsignificant findings in athletes and physically active individuals resulted from too low a dosage and/or the varying bioavailability of different Mg formulas [17].

A recent study found that a faster dosing strategy of Mg supplementation might raise Mg levels more successfully than a chronic one. In that study, muscle strength showed statistically significant improvements in the fastdosing group (oneweek duration), with no decline in later performance when compared to the chronicdosing group (fourweek duration) [17]. These findings suggest that a faster dosing approach may be more effective at increasing Mg levels. This possibility is further supported by laboratory evidence, which indicates that chronic dosing of Mg—but not fast dosing—can lead to decreased expression of the extracellular Mg^{2+} transporter TRPM6 and, consequently, increased urinary excretion of Mg^{2+} [17].

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6. Conclusion

This article sorts and summarizes the physiological function of Mg, the risk of Mg deficiency, the different ball-game players' Mg supplement and proper supplementation of Mg. It is clear that Mg is in and irreplaceable position in patient, normal people and especially ball-game players. Mg supplementation holds promise for improving athletic performance and preventing deficiencyrelated disorders in ball game players. Proper Mg supplementation—at appropriate dosage, with high bioavailability, and possibly using a fast-dosing regimen—can help prevent Mg deficiency and improve performance outcomes. This review can be used as a reference for subsequent research. However, there is still a number of limitations in this field, such as the detailed function and requirements of Mg towards specific ball-game and various ways of Mg supplementation ranging from different ball games. Future research can focus on determining sportspecific Mg requirements, comparing different supplementation formulas, and optimizing dosing strategies to provide clearer guidance for athletes and coaches. This systematic review aims to serve as a theoretical reference for subsequent related studies in this field.

References

[1] Dominguez, L. J., Veronese, N., Ragusa, F. S., Baio, S. M., Sgrò, F., Russo, A., Battaglia, G., Bianco, A., & Barbagallo, M. (2025). The importance of vitamin D and magnesium in athletes. Nutrients, 17(10), 1655. https: //doi.org/10.3390/nu17101655

[2] Córdova Martínez, A., Fernández-Lázaro, D., Mielgo-Ayuso, J., Seco Calvo, J., & Caballero García, A. (2017). Effect of magnesium supplementation on muscular damage markers in basketball players during a full season. Magnesium Research, 30(2), 61–70. https: //doi.org/10.1684/mrh.2017.0424

[3] Setaro, L., Santos-Silva, P. R., Nakano, E. Y., Sales, C. H., Nunes, N., Greve, J. M., & Colli, C. (2014). Magnesium status and the physical performance of volleyball players: Effects of magnesium supplementation. Journal of Sports Sciences, 32(5), 438–445. https: //doi.org/10.1080/02640414.2013.828847

[4] Santos, D. A., Matias, C. N., Monteiro, C. P., Silva, A. M., Rocha, P. M., Minderico, C. S., Bettencourt Sardinha, L., & Laires, M. J. (2011). Magnesium intake is associated with strength performance in elite basketball, handball and volleyball players. Magnesium Research, 24(4), 215–219. https: //doi.org/10.1684/mrh.2011.0290

[5] Fiorentini, D., Cappadone, C., Farruggia, G., & Prata, C. (2021). Magnesium: Biochemistry, nutrition, detection, and social impact of diseases linked to its deficiency. Nutrients, 13(4), 1136. https: //doi.org/10.3390/nu13041136

[6] Imamura, H., Iide, K., Yoshimura, Y., Kumagai, K., Oshikata, R., Miyahara, K., Oda, K., Miyamoto, N., & Nakazawa, A. (2013). Nutrient intake, serum lipids and iron status of collegiate rugby players. Journal of the International Society of Sports Nutrition, 10(1), 9. https: //doi.org/10.1186/1550-2783-10-9

[7] Wang, M., Peng, J., Yang, C., Zhang, W., Cheng, Z., & Zheng, H. (2023). Magnesium intake and all-cause mortality after stroke: A cohort study. Nutrition Journal, 22(1), 54. https: //doi.org/10.1186/s12937-023-00886-1

[8] Fang, X., Han, H., Li, M., Liang, C., Fan, Z., Aaseth, J., He, J., Montgomery, S., & Cao, Y. (2016). Dose-response relationship between dietary magnesium intake and risk of type 2 diabetes mellitus: A systematic review and meta-regression analysis of prospective cohort studies. Nutrients, 8(11), 739. https: //doi.org/10.3390/nu8110739

[9] Nielsen, F. H. (2024). The role of dietary magnesium in cardiovascular disease. Nutrients, 16(23), 4223. https: //doi.org/10.3390/nu16234223

[10] Nielsen, F. H., Milne, D. B., Klevay, L. M., Gallagher, S., & Johnson, L. (2007). Dietary magnesium deficiency induces heart rhythm changes, impairs glucose tolerance, and decreases serum cholesterol in postmenopausal women. Journal of the American College of Nutrition, 26(2), 121–132. https: //doi.org/10.1080/07315724.2007.10719593

[11] Peacock, J. M., Ohira, T., Post, W., Sotoodehnia, N., Rosamond, W., & Folsom, A. R. (2010). Serum magnesium and risk of sudden cardiac death in the atherosclerosis risk in communities (ARIC) study. American Heart Journal, 160(3), 464–470. https: //doi.org/10.1016/j.ahj.2010.06.012

[12] Zofkova, I., Davis, M., & Blahos, J. (2017). Trace elements have beneficial, as well as detrimental effects on bone homeostasis. Physiological Research, 66(3), 391–402. https: //doi.org/10.33549/physiolres.933454

[13] Rondanelli, M., Faliva, M. A., Tartara, A., Gasparri, C., Perna, S., Infantino, V., Riva, A., Petrangolini, G., & Peroni, G. (2021). An update on magnesium and bone health. Biometals, 34(4), 715–736. https:

DOI: 10.54254/2753-8818/2026.NL33948

//doi.org/10.1007/s10534-021-00305-0

[14] Ciosek, Ż., Kot, K., Kosik-Bogacka, D., Łanocha-Arendarczyk, N., & Rotter, I. (2021). The effects of calcium, magnesium, phosphorus, fluoride, and lead on bone tissue. Biomolecules, 11(4), 506. https: //doi.org/10.3390/biom11040506

[15] Reno, A. M., Green, M., Killen, L. G., O'Neal, E. K., Pritchett, K., & Hanson, Z. (2022). Effects of magnesium supplementation on muscle soreness and performance. Journal of Strength and Conditioning Research, 36(8), 2198–2203. https: //doi.org/10.1519/JSC.0000000000003827

[16] Veronese, N., Berton, L., Carraro, S., Bolzetta, F., De Rui, M., Perissinotto, E., Toffanello, E. D., Bano, G., Pizzato, S., Miotto, F., Coin, A., Manzato, E., & Sergi, G. (2014). Effect of oral magnesium supplementation on physical performance in healthy elderly women involved in a weekly exercise program: A randomized controlled trial. American Journal of Clinical Nutrition, 100(3), 974–981. https: //doi.org/10.3945/ajcn.113.080168

[17] Wang, R., Chen, C., Liu, W., Zhou, T., Xun, P., He, K., & Chen, P. (2017). The effect of magnesium supplementation on muscle fitness: A meta-analysis and systematic review. Magnesium Research, 30(4), 120–132. https: //doi.org/10.1684/mrh.2018.0430