

Levels of Serum Magnesium, Potassium and Sodium in Patients with Reactive Arthritis

U.A. Al-Sari

Department of Internal Medicine, College of Medicine, University of Wasit, Wasit, Iraq

Email: usamaalsari@uowasit.edu.iq

Abstract

Diagnosis of reactive arthritis is difficult due to absence of a specific test, and deficiency in some minerals may increase the risk that the disease will not quickly resolve. Hence, the aims of current study were to estimate the levels of serum magnesium (Mg), potassium (K) and sodium (Na) in reactive arthritis patients, and evaluate their associations with age and gender. The findings of patient population were revealed an insignificant reduction in Mg with significant decreases in K, and increases in Na. Regarding age, insignificant variation between both age groups, ≤ 30 years and ≥ 31 years, were showed in Mg and Na but not in K that decreased significantly in ≤ 30 years age group when compared to those of ≥ 31 years group. Concerning gender, the findings showed an absence of significant differences between males and females in all elements; Mg, K and Na.

In conclusion, this study demonstrated that the serum Mg and K concentrations have an inverse relationship with reactive arthritis, but not for serum Na that having a positive association with the disease. Further research and interventional trials are needed to establish the causal or effect association between serum vitamins / minerals and reactive arthritis since there is real lack of enough information locally and globally.

Keywords: Reiter's syndrome, Mg, K, Na, Iraq

Introduction

Reactive arthritis or Reiter's syndrome is typically defined as an inflammatory arthritis which is not directly caused by culture-proven infection of joint tissue, but rather after infection at another site ([Mathew and Ravindran, 2014](#)). Throughout years, the findings showed that reactive arthritis is a subset of spondyloarthropathies which usually subjected for initially care physician, with different attention involving infectious diseases and rheumatology ([García-Kutzbach et al., 2018](#)). Worldwide, the disease occurs as sporadic cases with the possibility for occurrence of outbreaks and arising of infection of genitourinary, respiratory or gastrointestinal pathogens like *Chlamydia trachomatis*, *Mycoplasma pneumonia*, *Chlamydia pneumonia*, *Salmonella* spp., *Escherichia coli*, *Clostridium difficile* and *Campylobacter jejuni* ([Eastmond, 1990](#); [Buxton et al., 2002](#); [Pope et al., 2007](#)). Recently, it has been identified that reactive arthritis represent a complicated interplays between the pathogens and different host factors which resulting in tissue damage, inflammation and autoimmunity ([Schempp et al., 2019](#); [Bentaleb et al., 2020](#)).

The onset of clinical signs may continue for months post starting of infection and resolve at time of onset of musculoskeletal signs that occurs typically in lower extremities and less commonly in upper extremities, axial skeleton, and cervical spine ([Schmitt, 2017](#); [Pogreba et al., 2021](#)). For diagnosis, the disease can be detected by the application of the suitable advanced assays that compatible clinical syndromes ([Selmi and Gershwin, 2014](#)); however, physical examination and careful history can reveal symptomatology of past infections and yielding evidences of musculoskeletal infections ([Plesca et al., 2013](#); [Bentaleb et al., 2020](#)). In different cases, treatment is difficult because pathognomonic data for the clinical signs of the disease might absent. Therefore, the appropriate management of reactive arthritis should be considered the treatment of underlying infections and manifestations of a disease ([Zeidler and Hudson, 2022](#)).

Vitamins and minerals have great importance in maintain the health status of a body, but obtaining the required amounts of certain elements are even more critical task during arthritis. Magnesium (Mg) is one of the most important minerals which strengthens the muscles and bones, maintaining nerve functions, regulating the levels of blood sugar and heart rhythm, and helping the health of joint cartilage ([Glasdam et al., 2016](#)). Sodium (Na) can help the function of the nerve impulses as well as the muscle contractions, with

regulation of body fluids and affects blood pressure (Bie, 2018). Potassium (K) is a vital micronutrient in health as it helps regulate fluid balance, muscle contraction and nerve signaling, and supporting the normal blood pressure (Palmer and Clegg, 2019).

In Iraq, online searching detect very low studies that related to reactive arthritis patients (Jassim et al., 2015; Galeef and Salloom, 2016; Al-Bayati et al., 2020; Gorial and Farah, 2021), with full absence of information about serum minerals. Hence, this study was aimed to estimate the level of Mg, Na and K in patients diagnosed to be infected with reactive arthritis.

Materials and methods

Ethical approval

This study was licensed by the Scientific Committee of the Department Internal Medicine in the College of Medicine (University of Wasit, Wasit, Iraq).

Study population and samples

Totally, 100 individuals involved 50 patients and 50 healthy were selected as the study population and subjected to the present study that carried out in Wasit province (Iraq) during April to December (2021). A 2.5 ml of venous blood was collected from each participant under aseptic conditions into free-anticoagulant glass tubes, centrifuged (5000 rpm / 3 minutes), and the sera were kept into labeled 1 m Eppendorf tubes.

Laboratory estimation

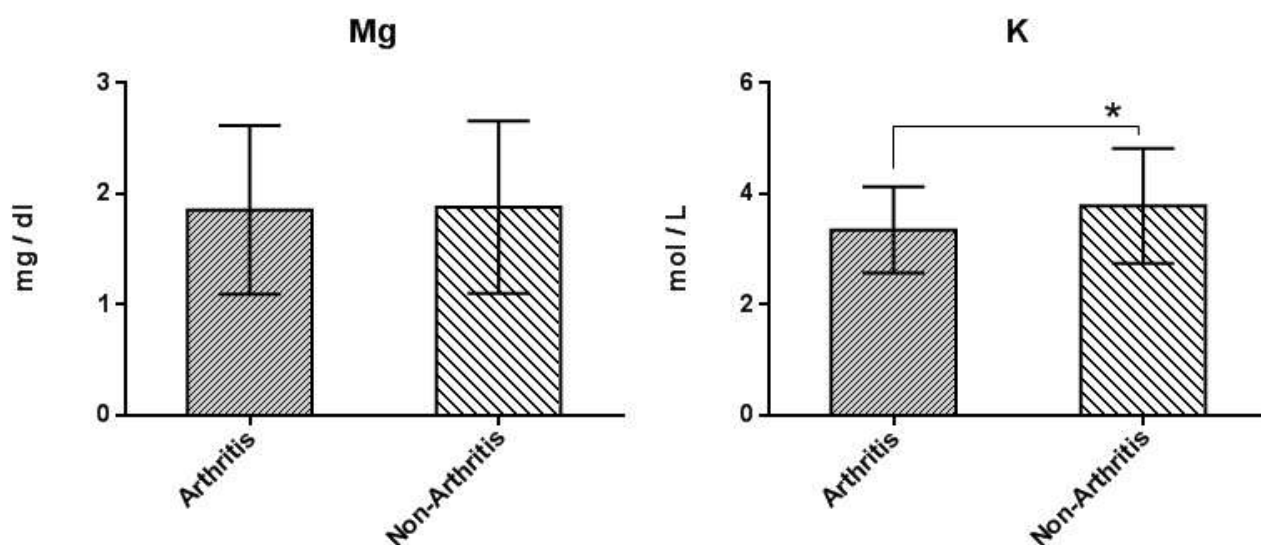
Full automatic immunological analyzer, Cobas e411 system (Roche, Germany) was applied to detect the level of Mg, Na and K in sera of study population.

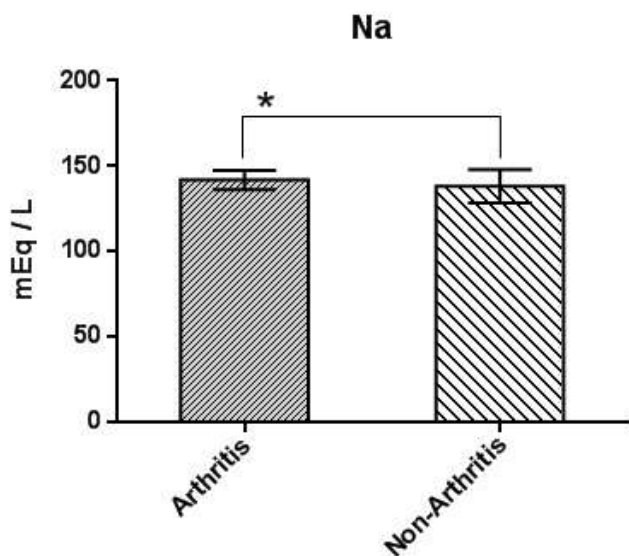
Statistical analysis

All obtained results were statistically analyzed by the GraphPad Prism (6.01) Software throughout the *t-test* that applied to detect significant differences between both study groups (patient and healthy control) as well as between both age groups and gender groups of the reactive arthritis patient group at $P < 0.05$. Values were expressed as Mean \pm Standard Deviation (M \pm SD).

Results

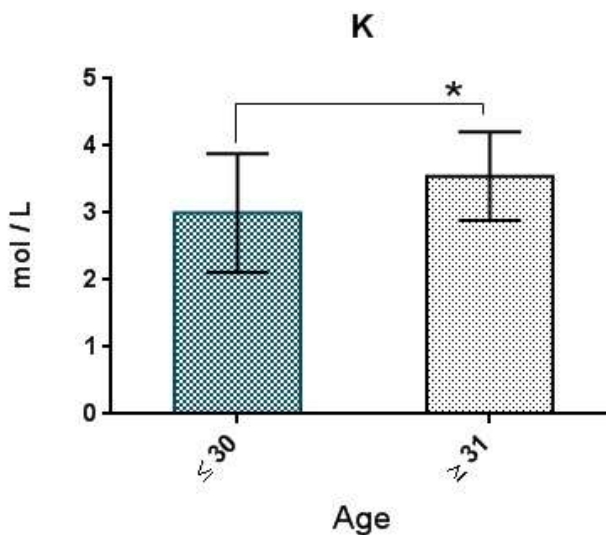
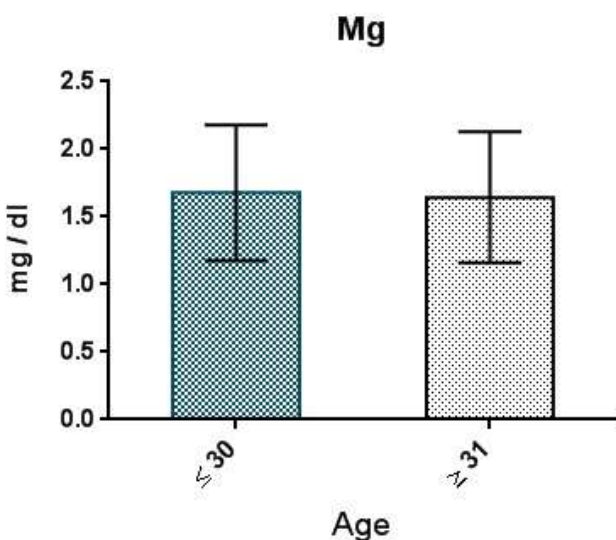
In this study, although the findings of reactive arthritis patients were showed an insignificant reduction in values of Mg (1.656 ± 0.0961 mg / dl), there were significant decreases ($P < 0.0294$) in values of K (3.352 ± 0.1557 mol/L) and significant increases ($P < 0.037$) in values of Na (141.9 ± 1.108 mEq/L) when compared to those of healthy control group; 1.776 ± 0.06592 mg / dl, 3.786 ± 0.1209 mol / L, and 138.2 ± 1.130 mEq / L, respectively (Figure 1).





Regarding age, insignificant variation ($P < 0.4346$ and $P < 0.3286$, respectively) between both groups, ≤ 30 years and ≥ 31 years, were showed in values of Mg (1.678 ± 0.1673 and 1.644 ± 0.1211 mg / dl, respectively) and Na (142.6 ± 2.328 and 141.5 ± 1.190 mEq / L, respectively). However, the findings of K were decreased significantly ($P < 0.045$) in ≤ 30 years group (3 ± 0.2953 mol / L) when compared to value of ≥ 31 years group (3.55 ± 0.1648 mol / L), (Figure 2).

Concerning gender, the findings showed that there were no significant differences ($P < 0.1864$, $P < 0.2896$ and $P < 0.1176$, respectively) between males and females in values of Mg (1.500 ± 0.1844 and 1.705 ± 0.1125 mg/dl, respectively), K (3.800 ± 0.5544 and 4.053 ± 0.1867 mol / L, respectively) and Na (139.5 ± 2.247 and 142.6 ± 1.257 mEq / L, respectively), (Figure 3)



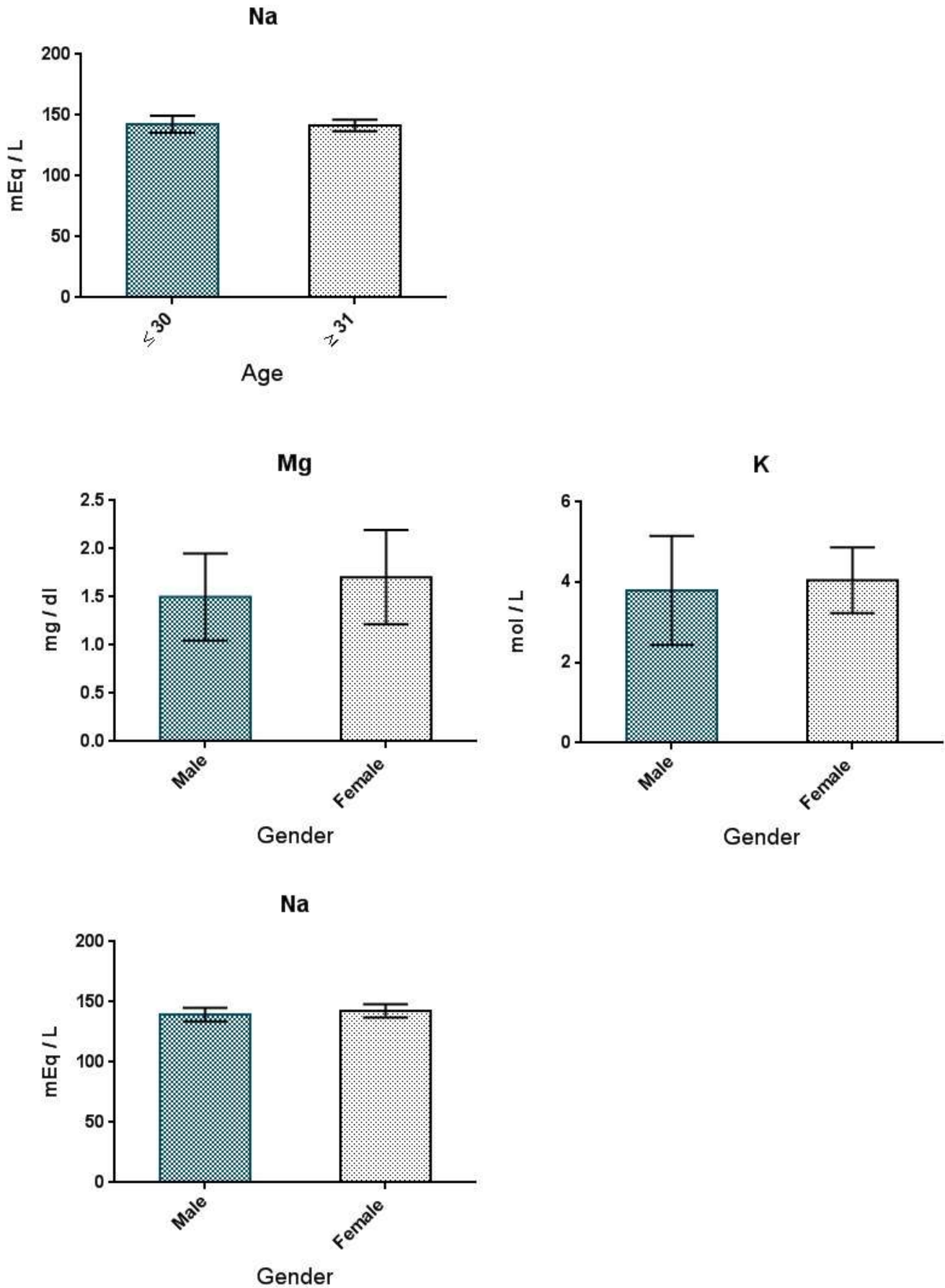


Figure (3): Relationship between reactive arthritis and gender among the targeted markers; Mg, K and Na

Discussion

Although, the natural history of reactive arthritis suggests that most patients have complete or near complete remission within a less than year, some flare and require treatment as a result of development of chronic illness or bad prognosis of disease (Van der Linden et al., 2010). In addition, the lack of diagnostic or classification criteria have been established suggesting that clinical picture and laboratory testing are fundamental for describing the suitable therapy. Other elements that can help in the treatment of reactive arthritis is estimation the levels of serum vitamins and minerals. In this study, relationship between serum Mg and reactive arthritis was not observed, and this might be attributed to early stage of disease, low degree of illness severity, and dietary Mg intake. Our results were in contrast with that detected in other types of arthritis such as rheumatoid arthritis (Chavan et al., 2015) and osteoarthritis (Zeng et al., 2015). Benliday et al. (2017) reported that the serum Mg concentration is inversely proportional to arthritis, and the patients with severe arthritis had significantly lower serum Mg levels than patients with mild arthritis. Different studies have been mentioned that Mg supplementation was able to mitigate chondrocyte apoptosis and to facilitate chondrocyte proliferation and differentiation (Dou et al., 2014; Zhang et al., 2016; Wu et al., 2022). It was found also that high concentration of extracellular Mg could inhibit the mineralization process during mesenchymal stem cells osteogenic differentiation (Díaz-Tocados et al., 2017).

The findings of this study observed that the level of serum K was decreased significantly in patients with reactive arthritis. Several experimental studies have demonstrated the role of K ion channels in abnormal pain signaling, and increasing the nerve stimulation and irritability as a result of K deficiency (Cameron et al., 2017; Bennett et al., 2019; McNeill et al., 2021). In reactive arthritis, although the possible link with the decreased level of serum K is unknown, it may be related to low dietary intake of K, pathophysiology events of the disease, increased metabolic demands and energy expenditure, renal disorders, chronic hepatic disorders, heart failure and other medical diseases that associated with initiation of reactive arthritis. Kianifard and Chopra (2018) mentioned that K can be used therapeutically to reduce joint pain and inflammation in patients having rheumatoid arthritis. In a previous pilot study carried out to evaluate the effect of K supplementation in the treatment of pain in arthritis patients, it was found that the elevated serum K value correlates negatively with the pain intensity (Rastmanesh et al., 2008).

In patients of this study, results showed that the level of serum Na was elevated significantly, and this might be related with the high Na diet consumed (Salgado et al., 2015), inhibition of renal prostaglandins by NSAID and resultant Na retention (Baker and Perazella, 2020) and external water loss due to fever or diarrhea (Qian, 2019). Afridi et al. (2012) indicated that levels of serum K and Mg were significantly lowered; while, the levels of Na were increased in biological samples (blood and urine) of rheumatoid arthritis patients when compared to non-rheumatoid referents. Minamino et al. (2018) concluded that Na restriction and K supplementation is a potential candidate for attenuating disease activity in arthritis patients. A recent study demonstrated that Na / K ratio can be of great value in the diagnosis and evaluation of arthritis patients, and concluded that these elements can be relied upon to provide indications of arthritis risk and the measurement of their levels can serve as a biomarker to monitor disease activity and severity (Khadim and Al-Fartusie, 2022).

The absence of significant association in levels of serum Mg between both age groups as well as both genders noted in this study might be explained by the fact that the extent quality of life, articular pattern and exposure to different infections seem to be similar for both males and females. These findings were conflicted with that reported by other studies carried out in osteoarthritis patients (Hunter et al., 2003; Qin et al., 2012). In study patients of ≤ 30 years, the levels of serum K were decreased significantly in comparison with the values of ≥ 30 years. It might belong to that the middle-aged persons are more likely to having a history of arthritis and difficulties were increased when these persons enter old age. These findings highlight the need to develop interventions and treatments that take a life-coarse approach to preventing the disabling effect of arthritis (Covinsky et al., 2008). In contrast to our results, many studies reported that the different types of arthritis are higher significantly in female compared to male due to deteriorating effect of sex hormones and menopausal state that responsible for the major part of differences in outcome (Weyand et al., 1998; Ikuni et al., 2009; Favalli et al., 2019).

Conclusion

Our findings showed that there was insignificant reduction in levels of serum Mg in patients with reactive arthritis; however, more research is needed to establish whether the Mg administration can be made to prevent or progression of the disease. The author advises to including Mg in therapeutic protocol of reactive arthritis, not for treatment of disease only but also for supporting of immune response. Also, this study was found a significant relationship between the levels of serum K and Na with the disease predicting their association with the pathogenesis of the disease. Nonetheless, there is a dire need to explore newer avenues to find safer management of reactive arthritis through detection the factors that contributing in pain and inflammation, and finding the suitable strategies for cure.

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