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Clinical effect and mechanism of alkaline reduced water

Clinical Effect and Mechanism of Alkaline Reduced Water

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ABSTRACT

Recently, alkaline ionized water (AIW) generated by water electrolysis has received increasing attention because of its shown benefits in treatment and prevention of diseases. The Korean and the Japanese governments officially acknowledged the efficacy of AIW as a novel material for the improvement of abnormal intestinal fermentation, chronic diarrhea, gastric hyperacidity and dyspepsia. It was reported that intake of AIW has various beneficial effects such as removal of reactive oxygen species, improving constipation, suppressed accumulation of body fats, early expulsion of melamine, reduction of ultraviolet radiation-induced skin damage, modulation of immune response and ameliorating diabetes. The effect of AIW is thought to be accounted to its negative oxidation reduction potential, and abundant dissolved hydrogen. The major role of AIW as an antioxidant due to its high content of hydrogen had long been established. Furthermore, drinking hydrogen water and inhaling hydrogen gas demonstrated protection against oxidative diseases. However, our recent study on alkaline reduced water (ARW) from spring water which exhibits different properties from AIW showed a salutary effect through oral administration and bathing. This finding led us to explore further the potential benefits of alkaline reduced water on health and its accompanying mechanism.

Key words: Alkaline ionized water, Alkaline reduced water, oxidation-reduction potential, hydrogen, spring

INTRODUCTION

Modern life is abreast on the rapid advancement in technology and life extension. Thus, there is an escalating prevalence of people who suffer from the so-called diseases of civilization such as senile diseases, lifestyle-related diseases, and immune-related allergic diseases[(1-3)]. Lifestyle such as rising consumption of Western food is positively correlated to the accumulation of fats and cholesterol in the body that could lead to burst in reactive oxygen species[(4,5)]. Although newly developed drugs for a therapeutic approach are rapidly growing. However, drugs are often inadequate and are usually accompanied with side effects[(6-8)]. Therefore, approaches on discovering effective and safer alternative medicine are still necessary to meet both requirements. Advocates on developing novel therapeutics against continuous rising number of various diseases had led to the use of alkaline ionized water (AIW). AIW exhibits special properties such as alkaline pH, micro-clustered water molecules, extremely negative ORP value, and high contents of dissolved hydrogen. Alkaline ionized water was first developed in Japan and explored its efficacy on the medical and agricultural fields. Consumption of alkaline ionized water is increasing collectively, and AIW has been acknowledged as novel medical treatment on various intestinal diseases in Japan and Korea, because of its known efficacy. Based on the extensive investigations on the potential benefits of AIW, it showed that supplementation of AIW improves the health of digestive tract[(9)], alleviates the severity of diseases *in vivo*[(10-12)], and improved body condition of aged subjects[(13)]. However, the precise mechanism of AIW on disease improvement and prevention are not fully elucidated, hence the necessity of studies addressing its broad effect on health status improvement and mechanism merit further studies. In line with this, our previous studies confirm the effect and suggest the mechanism of AIW on the animal preclinical model of metabolic related diseases, and its potential benefits in aged persons. In addition, its potential benefits on the immune response such as balance between Th1 and Th2 activation were also investigated. Moreover, we explore the effect of AIW through bathing, since there was no studies reported[(14)].

ORAL ADMINISTRATION OF ALKALINE IONIZED WATER

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Major health problems nowadays deal with the accumulation of ROS accompanied with abnormalities such as inflammation, and irregular lipid metabolism that are the primary risk factor for the increase prevalence of lifestyle metabolic diseases. From this analogy, studies into the relationship between scavenging of ROS and control of inflammation and lipid metabolism are important field to explore. Hence, previous investigation on the effect of oral administration of AIW on an animal model induced with metabolic related diseases showed that blood levels of glucose, total cholesterol and triglyceride were significantly reduced[11,15]. So far, these results further strengthened the findings of *Kim* and *Yokoyama*[16] and *Watanabe* and colleagues[17] that long term supplementation of AIW normalize the abnormal glucose and lipid levels of blood. In addition, recent study of *Li* and colleagues[18], reported that AIW can prevent apoptosis of pancreatic β-cells and long term ingestion of AIW alleviates the developing symptoms of a mice model of type 1 diabetes mellitus through ameliorating the alloxan-derived generation of reactive oxygen species.

Previous studies have demonstrated that AIW has the protective effect against the accumulation of lipid and cholesterol in the body[10,11,15]. Lee *et al.* (unpublished data) designed a study to confirm further the effect of AIW on diseases related with fat accumulation such as obesity. Mice model of obesity induced by feeding high-fat diet was used. In the study, supplementation of AIW showed protection from quickly gaining body weight of mice. This is further supported with the lipid profile, wherein oil red O staining revealed that mice fed with AIW controls the accumulation of body fats in liver. Moreover, molecular data showed that supplementation of AIW induced the expression of the gene CYP7A1 which encodes cholesterol 7a-hydroxylase, the first and rate limiting step in the bile acid synthetic pathway, the major site of regulation and primary mechanism for the removal of cholesterol from the body[19]. Based on these results, AIW suggests an anti-obesity effect via inducing the CYP7A1 that plays critical role in cholesterol homeostasis in the body. Further alternative mechanism on obesity provides a rationale to explore the supplementation of AIW as a novel therapeutic in humans.

Generally, release of cytotoxic proteins and production of ROS, inflammation or the dominance of immune cytokines are always in association with one another in intestinal infections. Lee and colleagues[12] examined the *in vivo* effect of AIW on mice infected with *Echinostoma hortense*. To examine whether AIW has an anti-inflammatory effect or could enhance the immune system brought by the helminth infection, cytokine expression in the spleen and intestine, change in goblet cell number, worm expulsion rate, number of leukocytes and mucin production in the small intestine were carried out in the study. Based on the cytokine profiling, feeding with AIW may selectively influence the immune response such that it may act on the local immune response affecting the decreased in expression of IL-1β and TNF-α in the small intestine, but not on the systemic immune response. Nevertheless, reduction in IL-1β and TNF-α expression indicates a protection against the production of Th1 cytokines and nitric oxide (NO) that leads to severe inflammatory condition, including tissue damage, implying that immunological effect of AIW merit further studies.

Until now, only few clinical trials were carried out on the efficacy of drinking AIW, thus Lee *et al.*[13] conducted a clinical test on several parameters related to oral AIW administration with senile disease treatment and recuperation hospitalized patients. There were neither distinct positive nor negative effects in aged patients. However, all the blood parameters conducted were within the normal range, including WBC, adiponectin, cholesterol, potassium levels and liver enzymes associated in lipid metabolism[13]. Hence, it could be implied that AIW does not induce adverse effects and might lead to a favorable body condition[13]. Moreover, *Huang* and colleagues explored the potential application of supplementation of AIW on ESRD patients undergoing hemodialysis[20]. Subsequently, patients who received hemodialysis session with AIW administration showed protection against the adverse effect of hemodialysis such as bursting of ROS. This study demonstrates that AIW could efficiently induce the H_2O_2 and HOCl-dependent antioxidant defense and reduce H_2O_2 and HOCl-induced oxidative stress[20].

Studies revealed that supplementation of AIW reduced abnormal intestinal fermentation, chronic diarrhea, and gastric hyperacidity[9,21]. AIW exhibits a high pH compared to the tap water, which plays an important role on its known efficacy. Alkaline pH neutralizes acids in the stomach. Since AIW has a high pH, it is justifiable that one mechanism of AIW against hyperacidity and other related accumulated acid and toxic caused diseases is via neutralization of the acids. Another beneficial effect of AIW drinking would be influence on blood pH. Secretion of acidic components in stomach to neutralize AIW increase blood pH to compensate acid base balance, thus help maintaining physiologic homeostasis in human body.

In addition, AIW showed beneficial effects in excreting melamine in the body and reduced the incidence of urinary bladder stone caused by melamine accumulation[22]. AIW exhibits high pH that affects the clustering of its water molecules hence producing reduced water cluster size. It is therefore suggested that this micro-cluster molecule makes the AIW efficiently enter and increase intracellular hydration, aid in flushing out and preventing wastes such as unnecessary materials from accumulating in the cell.

BATHING EFFECT OF ALKALINE REDUCED WATER

To elucidate further the efficacy of AIW on reactive

oxygen species, Lee *et al.*[14] used a mice model of UVB induced-skin injury. Bathing with AIW restored pro- and anti-inflammatory cytokine imbalance evoked by UV radiation. The level of interleukin of IL-1β, TNF- α and IL-12p70 in AIW group decreased whereas those of IL-10 increased. Collectively, immunologic data indicate that AIW bathing significantly reduces UVB-induced skin damage through influencing pro- /anti-inflammatory cytokine balance in hairless mice. This immunomodulatory effect might justify the clinical therapeutic usage for skin diseases characterized by cytokine imbalance. AIW bathing also reduced the number of mast cells in the dermis and induce glutathione peroxidase (GPx) activity. The increased in activity of GPx suggests skin protection of AIW bathing against the accumulation of ROS induced by UVB[14].

Moreover, the efficacy of alkaline reduced water produced from hot spring was conducted to verify the antioxidant effect both of drinking and bathing. Studies revealed that drinking and bathing in hot spring water significantly reduced the ROS in blood of human subjects[23,24]. Spring water exhibits a lower level of ORP values than tap water, and this is correlated to anti aging and anti oxidizing ability. This co-works with the dissolved hydrogen as a source of its antioxidant ability. Continuous effort is needed to further explore the clinical trial on ROS-related diseases of bathing with several alkaline reduced waters.

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