Effects of Alkaline Drinking Water on Hydration, Metabolism, and Physical Performance in Humans

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Abstract

Alkaline water, defined as water with a pH above 7, has gained popularity due to claims related to improved hydration, enhanced exercise recovery, and potential benefits for metabolic health. However, scientific evidence supporting these claims remains limited and inconsistent. This mini-systematic review synthesizes human studies published between 2000 and 2022 that evaluated the physiological effects of alkaline water on hydration, blood viscosity, metabolic risk factors, and physical performance. Evidence suggests that alkaline water may improve rehydration and lactate clearance in athletes during short-term interventions. However, for the general population, results are inconclusive, and long-term health benefits have not been clearly demonstrated. More rigorous longitudinal and randomized controlled trials are required to determine the true physiological role of alkaline water.

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Introduction

Water is fundamental to human physiology, particularly for maintaining metabolic activities, regulating body temperature, supporting blood circulation, and aiding in post-exercise recovery. Alkaline water, typically with a pH of 8.0–9.5, contains higher levels of alkaline minerals such as calcium, magnesium, sodium, and potassium (Arunloetsiri et al., 2023). Commercial and consumer claims suggest that alkaline water may neutralize excess acidity, enhance antioxidant capacity, improve hydration efficiency, and reduce fatigue.

Despite widespread marketing, such claims require scientific validation. While alterations in urine pH may occur following alkaline water consumption, the human body maintains systemic acid–base balance tightly through pulmonary and renal mechanisms. Thus, the extent to which alkaline water impacts measurable health outcomes remains unclear.

This review synthesizes peer-reviewed studies examining the physiological effects of alkaline water on human hydration, exercise performance, metabolic health, and other clinically relevant outcomes.

Methodology

A structured literature search was conducted in publicly available scientific databases (PubMed, Scopus, ScienceDirect) using the key-words: “alkaline water,” “alkaline drinking water,” “electrolyzed water,” “alkaline mineral water,” “hydration,” “metabolic response.” Inclusion criteria

• Human studies (randomized trials, intervention studies, and cross-sectional studies)

• Published between 2000–2022

• Investigated physiological or health-related outcomes

• Published in peer-reviewed journals

Exclusion criteria

• Animal or in-vitro studies

• Studies without clear descriptions of water composition

• Non-peer-reviewed reports or commercial white papers

Data extracted included study population, intervention characteristics, outcomes measured, results, and limitations. Due to the small number and heterogeneity of available studies, formal meta-analysis was not performed.

Results

1. Summary of Included Studies

Study Population Intervention Outcomes Key Findings Limitations

Weidman et al. (2016) 100 healthy adults Electrolyzed high-pH alkaline water after dehydration exercise Blood viscosity, plasma osmolality, body mass, bioimpedance Alkaline water resulted in a greater reduction in high-shear blood viscosity (−6.30%) compared with standard water (−3.36%) Short recovery period; no long-term follow-up

Chycki et al. (2017) 36 male soccer players 4 L/day for 7 days of low-mineral alkaline water vs. other water types Urine specific gravity, urine pH, lactate utilization after anaerobic exercise Improved hydration indices and faster lactate clearance in alkaline water group small sample size; limited to athletes

Chan et al. (2022) 304 postmenopausal women Habitual consumption of ≥1 L/day alkaline water for ≥2 months Fasting glucose, lipid profile, BP, waist circumference, sleep duration, handgrip strength Alkaline water consumers showed lower

metabolic risks and better sleep and strength measures Cross-sectional design; confounding factors cannot be excluded

Sunardi et al. (2022) Systematic review of 10 studies Alkaline, oxygenated, and demineralized water vs. mineral water Gut microbiota, urine parameters, fitness, metabolic markers No clear evidence that alkaline water provides superior health benefits over natural mineral water Heterogeneous studies; lack of long-term trials

Discussion

1. Potential Benefits Identified in Current Evidence

Hydration and Exercise Recovery two human studies demonstrated that alkaline water may enhance rehydration and post-exercise recovery in athletes.

• Improved blood viscosity recovery suggests enhanced plasma volume restoration after dehydration.

• Reduction in urine specific gravity and increased lactate clearance indicate improved hydration status and metabolic recovery.

These effects appear more relevant for physically active or dehydrated individuals rather than for the general population.

2. Metabolic and Health-Related Indicators

The cross-sectional study in postmeno-pausal women suggested associations between alkaline water intake and:

• lower fasting glucose

• lower TG/HDL ratio

• reduced diastolic blood pressure

• smaller waist circumference

• improved sleep duration

However, causality cannot be inferred due to potential lifestyle and dietary confounders. Controlled trials are needed to validate these findings.

3. Biological Considerations

The human body maintains systemic pH within a narrow range (7.35–7.45). Thus, while alkaline water may alter urine pH, it does not necessarily reflect changes in blood or tissue acid–base status. The minerals present in alkaline water (e.g., magnesium, calcium) may influence hydration and metabolic processes more than the pH itself.

4. Limitations Across Studies

• Small sample sizes

• Short intervention periods (1–7 days)

• Lack of standardized composition of alkaline water (pH, mineral content, ORP)

• Insufficient long-term controlled trials

• High variability in water source and production methods (ionized vs. mineral alkaline vs. bottled)

Conclusion

Current scientific evidence does not conclusively support the claim that alkaline water offers superior health benefits compared with standard mineral or drinking water.

Short-term studies indicate potential benefits for hydration and exercise recovery in athletes, but the relevance to the general population remains uncertain.

Long-term health effects are insufficiently studied, and existing literature is limited by methodological weaknesses.

Future research should include well-designed longitudinal randomized controlled trials with standardized descriptions of alkaline water composition and comprehensive metabolic and biochemical outcome measurements.

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