An Integrated Research Review - Can Baking Soda Slow Down Chronic Kidney Disease Progression?

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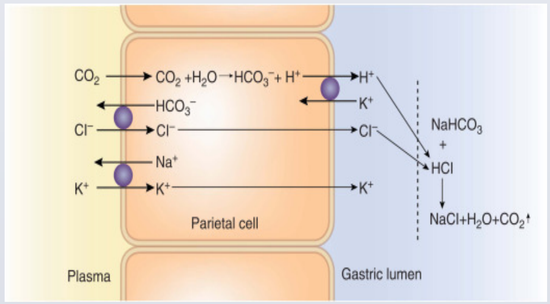
BACKGROUND & SIGNIFICANCE

- 30 million Americans have some stage of CKD; 96% of those people are unaware of having CKD (CDC, 2017).
- Referred to as a "silent disease" because kidney disease often has no symptoms and can go undetected until very advanced (NIDDK,2016).
- Epidemiological studies demonstrated lower serum bicarbonate is associated with increased risk of kidney disease progression (Chen et al., 2014).
- Lower levels of HCO_3 are associated with higher all causes of mortality in patients with moderated to severe CKD. (Ortega & Arora, 2012).
- Acidosis has been associated with muscle weakness, fatigue, weight loss, increase muscle protein breakdown, increased bone resorption leading to arrhythmias, impaired glucose homeostasis, and deranged thyroid function (Witham et al., 2015).
- Complication of metabolic acidosis growth retardation in children, exacerbation of bone disease, increased muscle degradation with resulting frailty, reduced albumin synthesis, and increased inflammation. (Susantitaphong et al., 2012).



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RESEARCH QUESTION

- Does oral sodium bicarbonate delay progression of Chronic Kidney Disease?

STAGES OF CHRONIC KIDNEY DISEASE

Stage	Description	GFR* mL/min/l. 73m^2
1	Slight kidney damage with normal or increased filtration	More than 90 & > 3 months of proteinuria
2	Mild decrease in kidney function	60-89 & >3 months proteinuria
3	Moderate decrease in kidney function	30-59
4	Severe decrease in kidney function (kidney failure)	15-29
5	ESRD	Less than 15

https://www.niddk.nih.gov/health-information/health-statistics/kidney-disease

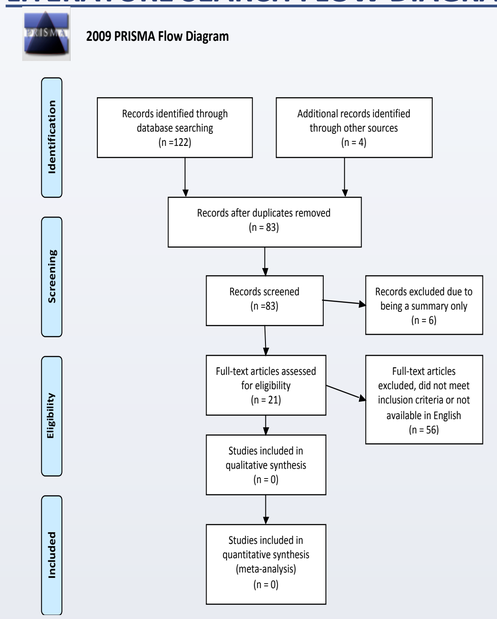
CKD AND METABOLIC ACIDOSIS

- Metabolic Acidosis (MA) common complication; present in 30-50% of individuals with eGFR <30 ml/min/1.73 m2 (Chen & Abramowitz, 2014).
- Associated with elevated serum chloride or unmeasured anions (Adeva-Andany et al. 2014).
- Correction of MA increase in serum albumin, decreased protein degradation rate and increased plasma concentrations of branched chains (K/DOQI, 2000).

METHODOLOGY

- An integrative research review of literature was conducted using the methodology described by Whittemore (2005) and Brown (2018).
- Cochrane, CINAH plus Full Text, MEDLINE Complete, HealthSource: Nursing/Academic Edition and PubMed were searched using terms; "sodium bicarbonate" and "Chronic Kidney Disease", full-free text with a five year period from 2012 -2017.
- Inclusion criteria included studies involving evaluation of the use oral bicarbonate in patients with CKD.
- Exclusion criteria included treatments including contrast induced nephropathy or care for End Stage Renal Disease .
- Findings from studies were synthesized for comparative analysis of results.

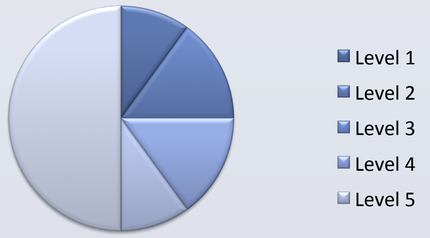
LITERATURE SEARCH FLOW DIAGRAM



RESULTS

- Eighty-three articles were initially identified; Twenty-one included in final sample.
- Level of evidence rated using evidence pyramid published by Long & Gannaway and Appraisal Guides by Brown (2015; 2018).

Levels of Evidence



LITERATURE SYNTHESIS

- Benefits and risk of correcting acidosis is very limited with no RCTs in pre ESRD patients, none in children and three in dialysis patients (Roderick et al., 2007; Gaggl, et al., 2013; Dobre, et al., 2015; Chen, et al., 2014; Witham, et al. 2015).
- Alkali therapy effective protective kidney adjunct to BP control with ACE inhibition by slowing the rate of eGFR decline and increasing eGFR (Mahajan, et al., 2010; Yaqoob, 2010; Goyra, et al., 2012).

LITERATURE SYNETHESIS CONT.

- Bicarbonate infusion improved metabolic acidosis but did not decrease rate of progression of CKD (Hasse, et al. 2013).
- Treatment using sodium bicarbonate due to loss is widely accepted where there is not enough evidence for benefit of treatment with sodium bicarbonate for symptomatic metabolic acidosis in chronic conditions (Adeva-Andany et al., 2014; deBrito, et al., 2009).
- Bicarbonate supplementation slowed the rate of GFR loss and reduced progression to ESRD requiring dialysis (Chen & Abramowitz, 2014; Jeong et al., 2014; deBrito, et al., 2015; Susantitaphong et al., 2012
- Sodium bicarbonate improved serum bicarbonate, improved LE muscle strength and reduced urinary nitrogen excretion (Abramowitz et al., 2013; Loniewski & Wesson, 2013).
- Patients with pre-ESRD that showed oral HCO_3 as a therapeutic option with minimal side effects, inexpensive and with potential benefit in delaying progression of CKD (Ortega & Arora, 2012; Goraya, et al., 2013; Simon & Hamm, 2013; deBrito-Ashurst, et al., 2015)

CLINICAL IMPLICATIONS

- Evidence suggest sodium bicarbonate is effective preventative treatment for slowing progression of CKD.
- Serum bicarbonate should be monitored regularly at monthly interval and correction of metabolic acidemia by maintaining serum bicarbonate at or above 22 mmol/L should be a goal of management (K/DOQI, 2000; deBrito Ashurst, et al., 2015).

CONCLUSION

- Sodium bicarbonate is effective treatment for slowing the progression of CKD.
- A need for a larger randomized control trial to determine when to initiate treatment, dosage and therapeutic level of serum bicarbonate for optimal care of CKD population.

References

Available upon request.

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