



Review Article

USE OF SOFT DRINKS AND RISK OF OSTEOPOROSIS: A SYSTEMATIC REVIEW

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ABSTRACT

Osteoporosis defined as a disease in which the density of bone reduced then became greatly porous and fragile at the end stage of the disease. The consequences of the disease include back pain, repeated bone fractures and up normal posture as a result of weakening skeleton. The issue of calcium levels affected (or not) by carbonated beverage consumption is under investigation. Calcium levels altered by changes in intake of calcium, excretion of calcium, absorption of calcium, or alterations in the feedback control mechanisms that affect bone density, or the supply of critical minerals (primarily calcium and phosphorus). Calcium is an important mineral in the development and maintenance of bone density. A lack of adequate levels of calcium leads to fractures and osteoporosis. Milk is the major source of calcium for most children's diets, accounting for about 50% of the daily requirement. In recent decades, carbonated beverages displaced milk, which may be a contributing factor to the 30% to 40% decline in calcium intake among children and adolescents. Ten randomized control trials and with a minimum follow-up of 12 months included. Results of the various studies suggested that replacing milk consumption with soft drinks leads to the risk of decreasing the bone density in children and adults.

Keywords: Cola, Calcium Level, Bones, Children, Osteoporosis, Carbonated beverage.

INTRODUCTION

Osteoporosis defined as a disease in which the density of bone reduced then became greatly porous and fragile at the end stage of the disease. The consequences of the disease include back pain, repeated bone fractures and up normal posture as a result of weakening skeleton. ¹

The issue of calcium levels being affected (or not) by carbonated beverage consumption is under investigation. Calcium levels can be altered by changes in intake of calcium, excretion of calcium, absorption of calcium, or alterations in the feedback control mechanisms that effect bone density, or the supply of critical minerals (primarily calcium and phosphorus).¹ Calcium is an important mineral in the development and maintenance of bone density. A lack of adequate levels of calcium leads to fractures and osteoporosis.²

Milk is the major source of calcium for most children's diets, accounting for about 50% of the daily requirement. In recent decades, carbonated beverages have displaced milk, which may be a contributing factor to the 30% to 40% decline in calcium intake among children and adolescents.³

In fact, carbonated beverages are now the beverage of choice in women aged 20 to 40 years. ⁴

The American Academy of Pediatrics committee on school health has issued a policy statement on soft drinks in schools. It states the potential health problems associated with a high intake of soft drinks, including the displacement of milk consumption leading to a risk of fractures and osteoporosis. ⁵

The evidence for the association between soft drinks intake and risk of decreasing bone density remains weakest.⁶

We have sought to summarize evidence from Cochrane systematic reviews and other resources that included clinical trial data on the displacement of milk consumption by soft drinks leading to a risk of fractures and osteoporosis.

Drinking cola beverages, which contain phosphoric acid and often caffeine, may increase the fragility of bones in children and adolescents through interactions with the bone mineral content and has been found by several investigators to be associated with an increased risk of bone fractures.⁷

We aim to identify, retrieve, and assess all studies evaluating the association between soft drinks intake and risk of decreasing bone density in children and adults.

DISCUSSION

This was a systematic review conducted by seven authors independently searched Medline, Scopus, Embase, Cochrane and PubMed for studies that had the association between soft drinks intake and risk of decreasing bone density in children and adults. Randomized controlled trials (RCTs) or quasi-RCTs assessing the impact of soft drinks in increasing the risk of bone density was included Five reviewers performed the literature search in PubMed and Cochrane Database. The references of initially retrieved articles independently using the following terms: Soft drinks and osteoporosis, Cola intake and calcium absorption, carbonated beverage and bone density and phosphorus contained drinks and calcium absorption.

The systematic review combines RCT studies and Non-RCT studies to be included in our research. We screened the targeted studies using a search strategy will be mentioned later to include studies that match perfectly with research's clinical question or to exclude studies that are out of focus to the research's clinical question. The Non-RCT studies could be Case-Control studies, Cohort Studies, and sometimes Cross-sectional studies. In addition, we defined a clear inclusion and exclusion criteria to be used in the inclusion and exclusion process of the studies.

The participants in our research were pointed to the pediatric population, and we used the well-built PICO question to define the participants clearly, so we can exclude the participants who are non-relevant to the research's clinical question. Children who are aged 5 to 18 years old and diagnosed with hypokalemia that is identified by the clinical presentation of the syndrome was included in the review.

The chronic consumption of large amounts of cola-based soft drinks may result in severe symptomatic hypokalemia. Cola soft drinks may contain large amounts of glucose (up to 11 g of sugar per dl in regular colas). Thus, the excessive consumption of these preparations may lead to osmotic diuresis and inappropriate urinary potassium losses. In addition, the large glycemic load may result in hyperinsulinemia which, in turn, may lead to potassium redistribution into cells. Thus, high glucose intake leads to hypokalemia.

The outcomes measured in this review classified into primary outcome and secondary outcome, accordingly the primary outcome was the serum potassium levels. the secondary outcome was the Serum phosphorus.

The research study design was a systematic review which was conducted by seven independent authors searched Cochrane and PubMed locating any updated literature comparing soft drinks consumer and Non-soft drinks consumer regarding its effect on public health or bone health. We included various study designs assessing the impact of phosphoric acid containing beverages on children bone health. We retrieved the articles using predefined search terms e.g.: Soft drinks, cola intake, carbonated beverage, phosphoric acid drinks.

We extracted data from current Cochrane reviews studies to peruse the characteristics, risks of bias and data for the outcomes specified in Table 1. In addition, we searched for newly published articles describe the same research findings.

We designed an extraction form which used in the extraction process in our research. we used the software named as Covidence to screen the studies and to extract the data from it.

Consequently, the covidence software itself has a built-in extraction form which used to extract data from the included studies.

Two authors independently assessed the quality of evidence in the included studies using the 'Risk of bias' table specified in Table 4 and Summary of findings Table specified in Table 2,3.

7 Studies with a minimum follow-up of 3 months were included. Results of the various studies suggested that replacing milk consumption with soft drinks leads to the risk of decreasing the bone density in children.

The characteristics of the included studies are summarized in Table 2,3. All the reviews used the same inclusion criteria (randomized controlled trials in patients of age from 5-18 years old with high soft drinks intake) and outcome measures (Serum potassium, Serum phosphorus). The latest search dates in the reviews ranged from 1990 to 2017. Including the new studies, there are a total of 7 studies on 2270 children in the reviews.

We used the Covidence assessing items to peruse the risk of bias of the included studies. The assessing items were: Incomplete outcome data, Selective outcome reporting, Selective outcome reporting, Allocation Concealment and Blinding of outcome assessor. Each item described in detail in the Covidence system.

The review includes studies comparing a group of patients consuming cola or phosphoric acid containing drinks highly (3-6 per day) versus a group of non-consumer patients. Henceforward some studies showed a significant decrease in the Mean±SD for the patient's groups with excessive soft drinks consumption in contrast to the patient's groups not consuming or received normal milk intake.

Some studies almost measure the effect of the intervention using the statistical methods includes mean difference and confidence interval of 95%. Henceforward studies showed a significant decrease in the Mean difference for the patient's groups with excessive soft drinks consumption in contrast to the patient's groups not consuming or received normal milk intake.

CONCLUSION

Our systematic review suggests that soft drinks may contribute to the reduction of the bone density in children and adults. The review demonstrates a strong evidence that high cola intake is associated with decreasing in serum calcium concentration with cola or soft drinks consumer. In addition, cola intake is associated with increases in serum phosphorus concentration which leads to the risk of decreasing calcium concentration and bone density and osteoporosis.

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
Children with high soft drinks intake	Adults diagnosed with INS
Age from 5 to 18	Children aged above 18
Patients demonstrates hypokalemia with Cola or soft drinks intake	

Table 2: The characteristics of the included studies and summary of finding

Study title	Study design	Participants	Intervention	Comparison	Mean±SD	Outcome measures	Quality of the evidence (GRADE)
Carbonated soft drink consumption and bone mineral density in adolescence: the Northern Ireland Young Hearts project ⁸	cross-sectional	1335	Soft drinks intake	Non-soft drinks intake	77±22 1598±480	↓ Serum potassium ↑ Serum phosphorus	⊕⊕⊕⊕ High
Carbonated beverages, dietary calcium, the dietary calcium/phosphorus ratio, and bone fractures in girls and boys. ⁹	RCT	130	Soft drinks intake	Non-soft drinks intake	76±23 1220±280	↓ Serum potassium ↑ Serum phosphorus	⊕⊕⊕⊕ High
Relationship between carbonated and other low nutrient dense beverages and bone mineral content of adolescents ¹⁰	RCT	115	Soft drinks intake	Non-soft drinks intake	55±21 1200±230	↓ Serum potassium ↑ Serum phosphorus	⊕⊕⊕⊕ High

Table 3: The characteristics of the included studies and summary of finding

Study title	Study design	Participants	Intervention	Comparison	95% CI MD	Primary outcome measures	Quality of the evidence (GRADE)
Carbonated soft drink consumption and bone mineral density in adolescence: the Northern Ireland Young Hearts project ¹¹	cross-sectional	1335	Soft drinks intake	Non-soft drinks intake	MD: -36.0; 95% CI: -124.26, 42.16 MD: -4.05; 95% CI: -58.31, 48.21	↓ Serum potassium ↑ Serum phosphorus	⊕⊕⊕⊕ High
Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis ¹²	Systematic review	80	Soft drinks intake	Non-soft drinks intake	MD: -45.0; 95% CI: -134.26, 52.26 MD: -6.05; 95% CI: -78.31, 58.21	↓ Serum potassium ↑ Serum phosphorus	⊕⊕⊕⊕ High
Teenaged Girls, Carbonated Beverage Consumption, and Bone Fractures ¹³	cross-sectional	460	Soft drinks intake	Non-soft drinks intake	MD: -30.0; 95% CI: -111.26, 42.26 MD: -3.05; 95% CI: -40.31, 30.21	↓ Serum potassium ↑ Serum phosphorus	⊕⊕⊕⊕ High

Table 4: The risks of bias in the included studies

Study I.D	Incomplete outcome data	Selective outcome reporting	Sequence generation	Allocation Concealment	Blinding of outcome assessor
Ref # 8	LOW	LOW	Unclear	LOW	Unclear
Ref # 9	LOW	LOW	LOW	LOW	LOW
Ref # 10	LOW	LOW	LOW	LOW	LOW
Ref # 11	LOW	LOW	LOW	LOW	LOW
Ref # 12	LOW	LOW	LOW	Unclear	LOW
Ref # 13	LOW	LOW	LOW	LOW	Unclear

REFERENCES

- Sözen T, Özışık L, Başaran NC. An overview and management of osteoporosis. Eur J Rheumatol 2017 Mar; 4(1): 46-56. <https://doi.org/10.5152/eurjrheum.2016.048>
- Wolff JH. Calcium in women: Healthy bones and much more. J Obstet Gynecol Neonatal Nurs 2004 Jan;33(1):21-33. <https://doi.org/10.1177/0884217503258280>
- Fisher JO, Mitchell DC, Smiciklas-Wright HS, Mannino ML, Birch LL. Meeting calcium recommendations during middle childhood reflects mother-daughter beverage choices and predicts bone mineral status. Am J Clin Nutr 2004 Apr;79(4):698-706. <https://doi.org/10.1093/ajcn/79.4.698>
- Heaney RP, Rafferty K. Carbonated beverages and urinary calcium excretion. Am J Clin Nutr 2001 Sep;74(3):343-347. <https://doi.org/10.1093/ajcn/74.3.343>

5. American Academy of Pediatrics, Committee on School Health. Soft drinks in schools. *Pediatrics* 2004; 113(1):152-4. <https://doi.org/10.1542/peds.113.1.152>
6. Wolff JH. Calcium in women: Healthy bones and much more. *J Obstet Gynecol Neonatal Nurs* 2004 Jan;33(1):21-33. <https://doi.org/10.1177/0884217503258280>
7. Kinney MA. Does consumption of cola beverages cause bone fractures in children? *Mayo Clin. Proc.*2002 Sep; 77 (9):1005-1006. <https://doi.org/10.4065/77.9.1005>
8. McGartland C, Robson PJ, Murray L, Cran G, Savage MJ. Carbonated soft drink consumption and bone mineral density in adolescence: *J. Bone Miner. Res.*2003 Sep; 18(9): 1563-1569. <https://doi.org/10.1359/jbmr.2003.18.9.1563>
9. Wyshak G, Frisch RE. Carbonated beverages, dietary calcium, the dietary calcium/phosphorus ratio, and bone fractures in girls and boys. *J Adolesc Health* 1994 May; 15(3): 210-215. [https://doi.org/10.1016/1054-139X\(94\)90506-1](https://doi.org/10.1016/1054-139X(94)90506-1)
10. Whiting SJ, Healey A, Psiuk S, Mirwald R, Kowalski K, Bailey DA. Relationship between carbonated and other low nutrient dense beverages and bone mineral content of adolescents. *Nutrition Research* 2001 Aug; 21(8): 1107-1115. [https://doi.org/10.1016/S0271-5317\(01\)00324-4](https://doi.org/10.1016/S0271-5317(01)00324-4)
11. McGartland C, Robson PJ, Murray L, Cran G, Savage MJ. Carbonated soft drink consumption and bone mineral density in adolescence: *J. Bone Miner. Res.*2003 Sep; 18(9): 1563-1569. <https://doi.org/10.1359/jbmr.2003.18.9.1563>
12. Vartanian LR, Schwartz MB, Brownell KD. Effects of Soft Drink Consumption on Nutrition and Health: A Systematic Review and Meta-Analysis. *American Journal of Public Health*; Washington 2007 Apr; 97(4): 667-675.
13. Wyshak G. Teenaged girls, carbonated beverage consumption, and bone fractures. *Arch Pediatr Adolesc Med* 2000 Jun; 154(6): 610-613. <https://doi.org/10.1001/archpedi.154.6.610>

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