



Fluoride content of beverage drinks containing collagen

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Abstract

Objective: To determine the amount of fluoride in beverage drinks containing collagen.

Materials and methods: Twelve healthy beverage drinks containing collagen were used to measure fluoride by using fluoride electrode.

Results: The mean±SD fluoride content of the 12 beverage drinks was 0.107±0.015 mg/L with a range from 0.015 to 0.334 mg/L. The highest amount of fluoride content was B-ing collagen® (0.334 ± 0.110 mg/L) and the least fluoride content was Mansome® (0.015 ± 0.001 mg/L).

Conclusion: The beverage drinks containing collagen available in Bangkok, Thailand contain a differing concentration of fluoride, but within a safe range for consumption without acute and chronic fluoride toxicity.

Key words: beverage, collagen, drinking water, fluoride, toxicity, Thailand

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Introduction

In the present, most of Thai people are focused on their health care by exercising and eating a healthy diet, including supplements that aim to provide a healthy and beauty. It causes the development of food products and beverages. As a result, many health and beauty products begin to have the role in the Thai society. Collagen drink is the one of health and beauty drinks that has become very popular as a way of replenishing the body with this vital ingredient. This is a reason a lot of people are now including collagen drinks and other sorts of collagen supplements to their daily diet. One of the key ingredients is a collagen peptide which is a high purity natural bioactive product, supplied in a form which can easily be used and digested by the human body, as was shown by scientific analysis¹. This drink is one of the products that contain fluoride as a component. The fluoride is naturally beneficial and may cause toxicity if consumed in excessive quantities².

Fluoride is an important for bones and teeth by stimulating the growth and strength including the prevention of tooth decay. Fluoride not only brings benefits but it also causes tooth enamel with white or brown or enamel cracking (dental fluorosis) if given the too much high volume of fluoride³. It also affects the bones, causing conditions fluoride toxicity bones (skeletal fluorosis) and causes bone abnormalities such as leg movement difficult, pain or disability clause⁴.

Fluoride's adverse effects depend on total fluoride dosage from all sources. In 2015, recommended fluoride levels in the United States were changed to 0.7 ppm from 0.7-1.2 ppm to reduce the risk of dental fluorosis⁵. Long term consumption of water containing excessive amounts of fluoride can lead to fluorosis of the teeth and bones⁶. Many Studies have shown that major of the Kidney diseases have a great inclination of toxicity of fluoride^{7,8}. Long

term consumption of excessive fluoride level, various disease such as osteoporosis, arthritis, brittle bones, cancer, infertility, brain damage, Alzheimer syndrome, and thyroid disorder can occur⁹.

Fluoride can be found in the general environment. The fluoride in the water will have an impact on health than any other sources. Especially in tropical regions such as Thailand that people consumed in relatively high volume of water that will have a chance to get fluoride into the high volume.

The previous studies of the fluoride content in beverage drinks such as soft drinks ready-to-drink green tea and fruit juices in Thai market had varied in each product^{10,11,12}. Sales of beverage drinks containing collagen have increased and different types and brands of beverage drinks are available in Bangkok supermarkets. There have never been reports about fluoride content of beverage drinks containing collagen in Thailand. The objective of this research was to measure the fluoride content of the beverage drinks containing collagen.

Materials and Methods

Twelve randomly selected commercial brands of beverage drinks containing collagen were obtained from supermarkets in Bangkok, Thailand. Five bottles of each brand, each with a different batch number were purchased. All bottles were stored in their original closed plastic containers at room temperature until the fluoride analysis was made. 10 ml. of each sample was added with TISAB III for buffer to maintain an appropriate ionic strength and pH and was measured using a fluoride-ion-selective electrode (Orion Model, Cambridge, MA, USA, 96-09). A set of standards containing 0.1, 1 and 10 ppm were prepared. Three readings were taken for each sample then the average was recorded. To assess the reliability of the method, one of five for each of the samples was

randomly selected and the samples were re-analyzed. Measurement of fluoride content were made in milligrams/L (mg/L) which is equivalent to parts per million (ppm).

Results

The concentrations of fluoride in the 12 different types of beverage drinks containing collagen are shown in Table 1 and figure 1. For each sample, the concentration is shown in mg/L. The mean \pm SD fluoride content of the 12 beverage drinks was 0.107 \pm 0.015 mg/L with a range from 0.015 to 0.334 mg/L. The highest amount of fluoride content was B-ing collagen[®] (0.334 \pm 0.110 mg/L) and the least fluoride content was Mansome[®] (0.015 \pm 0.001 mg/L). All beverage drinks per container had fluoride levels below 0.1 mg/L as shown in Table 2.

Discussion

The mean fluoride content in the beverage

drinks containing collagen was 0.107 \pm 0.015 mg/L. All beverage drinks per container had fluoride levels below 0.1 mg/L. For optimal dental health, the World Health Organization recommends a level of fluoride intake varies, depending on climate¹³. The American Dental Association continues its endorsement of fluoridation of community water supplies in order to adjust the natural level of fluoride to a concentration sufficient to protect against tooth decay, a fluoride level 0.7 mg/L⁵. Recommended the optimal level of fluoride content in the drinking water for warm countries like Thailand should be 0.5 ppm, due to the larger amount of water consumption in the hot climate compared to the temperate countries¹⁴. Adverse effects become possible at fluoride levels far above this recommended dosage.

Acute ingestion of a large fluoride dose can provoke gastric and kidney disturbances, and can be lethal¹⁵. Acute excess fluoride intake

Table 1 The mean and standard variation of the fluoride contents of beverage drinks containing collagen

Product Company	Location	Type of collagen drinks	Fluoride concentration (mg/L)
			Mean \pm S.D.
Toyo seikan (Thailand) CO., LTD. under control of The Red Bull Beverage CO., LTD.	Ayutthaya	Mansome [®]	0.015 \pm 0.001
Sappe Public CO., LTD.	Pathum Thani	Beuti Drink [®]	0.020 \pm 0.001
	Bangkok	Beuti Shot [®]	0.092 \pm 0.001
	Bangkok	St.Anna [®]	0.048 \pm 0.004
General Beverage CO.,LTD. under control of Singha Corporation CO., LTD.	Nakhon Pathom	B-ing collagen [®]	0.334 \pm 0.001
Pan Siam Food Products CO., LTD. under control of T.C. Natural CO., LTD.	Samut Prakan	Bee Water [®] lemon flavor	0.056 \pm 0.003
	Samut Prakan	Bee Water [®] apple flavor	0.026 \pm 0.0003
	Samut Prakan	Blink [®] CoQ10	0.105 \pm 0.025
	Samut Prakan	Blink [®] Collagen	0.332 \pm 0.110
	Samut Prakan	Pink [®]	0.050 \pm 0.003
Besta international.CO., LTD. under control of Dr. Tobi CO., LTD.	Prachinburi	Dr.Tobicolly [®] Lychee flavor	0.127 \pm 0.022
Chokemahachail Beverage CO., LTD. under control of Dr. Tobi CO., LTD.	Samut Sakhon	Dr.Tobicolly [®] Strawberry flavor	0.113 \pm 0.012

Table 2 Fluoride content of beverage drinks in mg/L and mg per container

Product Company	Type of collagen drinks	Fluoride content	
		mg/L	mg/container
Toyo seikan (Thailand) CO., LTD. under control of The Red Bull Beverage CO., LTD.	Mansome® (450 ml)	0.015	0.007
Sappe Public CO., LTD.	Beauti Drink® (360 ml)	0.020	0.007
	Beauti Shot® (50 ml)	0.092	0.005
	St.Anna® (180 ml)	0.048	0.009
General Beverage CO., LTD. under control of Singha CO., LTD.	B-ing collagen® (350 ml)	0.334	0.117
Pan Siam Food Products CO., LTD. under control of T.C. Natural CO., LTD.	Bee Water® lemon flavor (300 ml)	0.056	0.017
	Bee Water® apple flavor (300 ml)	0.026	0.008
	Blink® CoQ10 (50 ml)	0.105	0.005
	Blink® Collagen (50 ml)	0.332	0.017
	Pink® (100 ml)	0.050	0.005
Besta international.CO., LTD. under control of Dr.Tobi CO., LTD.	Dr.Tobicolly® Lychee flavor (120 ml)	0.127	0.015
Chokemahachail Beverage CO., LTD. under control of Dr.Tobi CO., LTD.	Dr.Tobicolly® Strawberry flavor (120 ml)	0.113	0.014

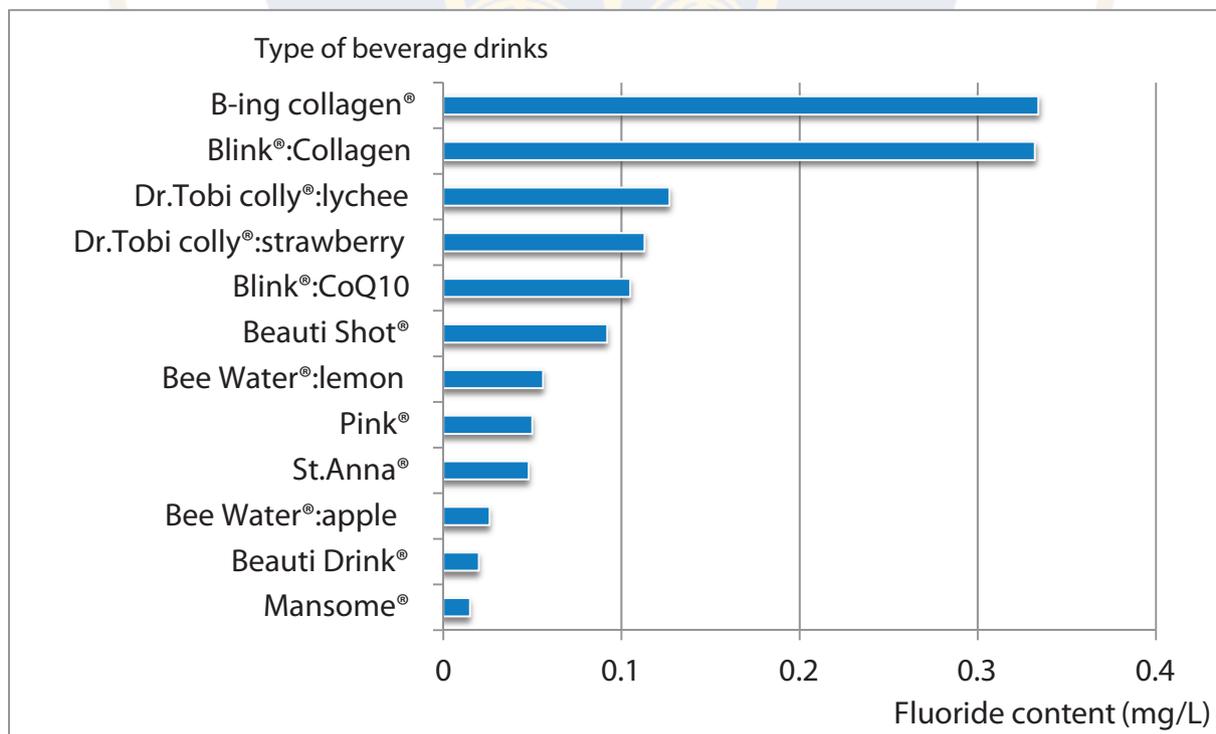


Figure 1 Fluoride content (mg/L) of beverage drinks containing collagen are shown in Bar chart

interferes with calcium metabolism and many enzyme activities, and can be fatal with doses of 5-10 g in adults and 500 mg in small children¹⁶. Chronic high intake of fluoride increases the risk of bone fractures and of the development of skeletal fluorosis in adults. Skeletal fluorosis occurs after many years of excessive fluoride intake (10-20 mg/day)¹⁷. Based on data from many studies, the upper limit of fluoride intake for older children and adults was set at 0.12 mg/kg body weight per day or 5 and 7 mg/day for children and adolescents aged 9-14 and 15 years and older, respectively¹⁸. Therefore, the fluoride content of all beverage drinks in this study found to be within the recommended fluoride level.

The fluoride content of beverage drinks containing collagen, each brand had a different fluoride value. It might be depended on various factors, including the water used and quantity of fruit and packing process¹⁹. Manufacturing facilities of beverage drinks containing collagen were in different areas including Bangkok, Ayutthaya, Pathum Thani, Nakhon Pathom, Samut Sakhon and Prachinburi province. Tangchareondee and colleagues reported the bottled water having fluoride more than 0.7 mg/L were found in Saraburi, Ratchaburi, Nakhon Pathom, Bangkok, Chiang Mai, Lamphun, Phayao, Chaing Mai, Mae Hungson, Phitsanulok, Samut Sakhon, Sumut Prakan, Ratchaburi, Nakhon Si Thammarat, Songkhla and Surat Thani province²⁰. The highest fluoride content of this study was produced by the manufacturer is located in Nakhon Pathom province.

The same manufacturer had the variation fluoride content of beverage drinks such as five beverage drinks from Pan Siam Food Products Co., Ltd. This variation of fluoride level of these drinks might be due to the type and amount of fruit used and collagen in each product¹². There are many potential sources variation in the fluoride content of fruit such as the type of soil

in which the fruit was grown and contamination via fertilizers or air sources²¹.

All samples were analyzed for fluoride using an Orion fluoride ion-specific electrode in conjunction with an ion analyzer using an acetic buffer system (TISAB). The ion selective electrode methods are simple to perform and have good precision and sufficiently sensitive^{22,23}. The method detects only free fluoride ions in solution. The fluoride selective electrode is used for the determination of fluoride in beverage drinks^{10-12,24,25}. Most of the fluoride in water is in the form of the free fluoride ion²⁶. The beverage drinks containing collagen in this study are more than 90 percent water (by volume). Therefore, the method in this study was for the analysis only free fluoride ions form in the solution.

Based on the results, beverage drinks containing collagen available in Bangkok, Thailand contain differing concentration of fluoride, but within a safe range for consumption without acute and chronic fluoride toxicity.

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Ethical approval: None (Laboratory study)

References

1. Asghar A, Henrickson RL. Chemical, biochemical, functional, and nutritional characteristics of collagen in food systems. *Adv Food Res* 1982; 28: 231.
2. Jha SK, Mishra VK, Sharma DK, Damodaran T. Fluoride in the environment and its metabolism in humans. *Rev Environ Contam Toxicol* 2011; 211: 121-42.
3. Wong MC, Glenn AM, Tsang BW, Lo EC, Worthington HV, Marinho VC. Topical fluoride as a cause of dental fluorosis in children. *Cochrane Database Syst Rev* 2010; 20: CD007693.
4. Solagi IB, Menon S, Bhangar MI. Removal of fluoride from aqueous environment by modified amberlite resin. *J Hazard Mater* 2009; 171: 815-9.
5. U.S. Department of Health and Human Services, Federal Panel on Community Water Fluoridation.

- U.S. Public Health Service recommendation for fluoride concentration in drinking water for the prevention of dental caries. *Public Health Reports* 2015; 130: 1-14.
6. Jamodei AV, Sapkal VS, Jamode VS. Defluoridation of water using inexpensive adsorbents. *J Ind Inst Sci* 2004; 84:163-71.
 7. Wasana HM, Perera GD, De Gunawardena PS, Bandara J. The impact of aluminum, fluoride, and aluminum-fluoride complexes in drinking water on chronic kidney disease. *Environ Sci Pollut Res Int* 2015; 22: 11001-9.
 8. Dharmaratne RW. Fluoride in drinking water and diet: the causative factor of chronic kidney diseases in the North Central Province of Sri Lanka. *Environ Health Prev Med* 2015; 20: 237-42.
 9. Koteswara RM, Mallikarjun M. Effective low cost adsorbents for removal of fluoride from water: a review. *IJSR* 2014; 3: 120-4.
 10. Rirattanapong P, Vongsavan K, Surarit R, Sirapat M, Kupensaeng R, Thumvanit S, Guypunlerd A. Fluoride content in carbonated soft drink. *M Dent J* 2004; 24: 155-60.
 11. Rirattanapong P, Vongsavan K, Surarit R. Fluoride content in ready-to-drink green tea. *M Dent J* 2006; 26: 153-7.
 12. Rirattanapong P, Vongsavan K, Surarit R. Fluoride content in ready-to-drink fruit juice. *M Dent J* 2008; 28: 45-51.
 13. World Health Organisation Expert Committee on Oral Health Status and Fluoride Use. Fluorides and oral health. WHO technical report series no. 846. Geneva, Switzerland. *WHO* 1994.
 14. World Health Organization (WHO). Fluorine and fluorides. Environmental health criteria 36. Geneva, Switzerland. *WHO* 1984.
 15. Whitford GM. Acute toxicity of ingested fluoride. *Monographs in Oral Science* 2011; 22: 66-80.
 16. Lech T. Fatal cases of acute suicidal sodium and accidental zinc fluorosilicate poisoning. Review of acute intoxications due to fluoride compounds. *Forensic Sci Inter* 2011; 206: 20-4.
 17. NRC (National Research Council). Fluoride in drinking water: a scientific review of EPA's standards. Committee on fluoride in drinking water. Board on environmental studies and toxicology. Division on earth and life studies. National Academies Press, Washington DC, USA. 2006.
 18. EFSA (European Food Safety Authority). Opinion of the scientific panel on dietetic products, nutrition and allergies on a request from the commission related to the tolerable upper intake level of fluoride. *The EFSA Journal* 2005; 192: 1-65.
 19. Jimenez-Farfan MD, Hernandez-Guerrero JC, Loyola-Rodriguez JP, Ledesma-Montes C. Fluoride content in bottled waters, juices and carbonated soft drinks in Mexico City, Mexico. *Int J Paediatr Dent* 2004; 14: 260-6.
 20. Tangchareondee N, Visalseth W, Reabreing K, Sanoiemhoey C. Fluoride content of bottled water in Thailand. 2005 *Thai J Dent Public Health* 2005; 10: 51-60.
 21. Adair SM, Wei SH. Fluoride content of commercially prepared strained fruit juices. *Pediatr Dent* 1979; 1: 174-6.
 22. Fouskaki, M, Sotiropoulou S, Koci M and Chaniotakis N.A. Morpholinoethanesulfonic acid-based buffer system for improved detection limit and stability of the fluoride ionselective electrode. *Anal Chim Acta* 2003; 478: 77-84.
 23. Malde MK, Bjorvatn K, Julshamn K. Determination of fluoride in food by the use of alkali fusion and fluoride ion-selective electrode. *Food Chem* 2001; 73: 373-9.
 24. Jin C, Yan Z, Jianwei L. Fluoride in the environment and brick-tea-type fluorosis in Tibet. *Fluorine Chem* 2000; 106: 93-7.
 25. Warnakulasuriya S, Harris C, Gelbier S, Keating J, Peters T. Fluoride content of alcoholic beverages. *Clin Chim Acta* 2002; 320: 1-4.
 26. IPCS. Fluorides. Geneva, World Health Organization, International Programme on Chemical Safety (Environmental Health Criteria 227), 2002.