The pH of Anti-hair loss shampoo

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ABSTRACT:

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Background: Shampoos can influence scalp condition. Patients with hair loss problems frequently ask physician which shampoo is suitable for their conditions.

Objective: To assess the pH of commonly available shampoos for recommendations to patients with hair loss problems.

Methods: Shampoos in the market were measured for the pH using a pH meter and pH-indicator strips.

Results: Mild shampoo samples gave the pH between 7 and 7.8. Shampoos for dry hair showed the pH range between 6.8 and 7.1. Except for one sample containing salicylic acid which gave a pH of 3, other medicated shampoos showed the pH between 6 and 7.5. Herbal shampoos gave the pH between 6.8 and 7.7. Shampoos labeled as anti-hair loss shampoos showed the pH between 6.3 and 8.

Conclusions: The pH of shampoo depends on the composition and formulation of that shampoo. Adding other active medical ingredients for treatment of scalp conditions is not the only factor causing variation of the pH. Many factors in shampoos besides the pH may cause scalp irritation, such as type of surfactants and amount of scalp surface residue.

Key word: pH, shampoo

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บทคัดย่อ :

สุธาสินี ภัทรวดี, สุเพ็ญญา วโรทัย, กมลวรรณ พงศ์ปริตร, กนกวลัย กุลทนันทน์ ค่าความเป็นกรดด่างของแชมพูต้านการหลุดร่วงของเส้นผม วารสารโรคผิวหนัง 2556; 29: 171-177.

ภาควิชาตจวิทยา คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล

ที่มา แชมพูสามารถส่งผลต่อหนังศีรษะได้ ผู้ป่วยที่มีปัญหาผมร่วงมักต้องการคำแนะนำจากแพทย์ในการเลือกใช้แชมพู

วัตถุประสงค์ ศึกษาความเป็นกรดด่าง (pH) ของแชมพูที่หาซื้อได้ง่าย เพื่อให้คำแนะนำแก่ผู้ป่วยที่มีปัญหาผมร่วง

วิธีศึกษา นำแชมพูในท้องตลาด มาวัดค่า pH โดยใช้ pH meter และแถบกระดาษวัดค่า pH (pH-indicator strip)

ผลการศึกษา แชมพูอ่อนมีค่า pH ระหว่าง 7 ถึง 7.8 แชมพูสำหรับผมแห้งมีค่า pH ระหว่าง 6.8 ถึง 7.1แชมพูยาส่วนใหญ่มีค่า pH ระหว่าง 6 ถึง 7.5 ยกเว้น แชมพู 1 ตัวอย่าง ซึ่งมี salicylic acid ให้ค่า pH 3 แชมพูสมุนไพรมีค่า pH ระหว่าง 6.8 ถึง 7.7 ส่วนแชมพูที่ติดฉลากว่าใช้สำหรับภาวะผมร่วงมีค่า pH ระหว่าง 3.6 ถึง 8

สรุป ค่า pH ของแชมพูขึ้นอยู่กับสูตรและส่วนประกอบของแชมพูนั้นๆ การเติมองค์ประกอบที่เป็นยา เพื่อรักษาปัญหาของหนังศีรษะไม่ใช่ปัจจัยเพียงอย่างเดียวที่ส่งผลต่อการเปลี่ยนแปลงค่า pH องค์ประกอบอื่นๆ ในแชมพูนอกเหนือจากค่า pH สามารถทำให้เกิดการระคายเคืองต่อหนังศีรษะได้เช่นกัน เช่น ชนิดของ surfactant, สารที่ตกค้างบนหนังศีรษะ

คำสำคัญ: ค่าความเป็นกรด-ด่าง แชมพู

Introduction

There are many types of shampoos available in the market. Shampoos can influence scalp condition i.e. restoration of alkaline neutralization (pH), dryness, seborrhea, scalp bacteria, scalp enzymatic activity and circulation.[1] Patients with hair loss problems frequently ask their physician which shampoo is suitable for their conditions. Some patients believe that they should use mild shampoos or natural herbal shampoos.

Shampoo is an aqueous mixture containing mild surfactants for cleansing, foaming power, and other ingredients which improve and condition the hair.[2] Surfactants remove greasy sebum and dirt away from the hair and scalp. Many shampoos also contain conditioners to improve the shine and the manageability of the hair. Some shampoos contain active ingredients for medical problems such as zinc pyrithione, selenium disulfide, polyvinylpyrrolidone-iodine complex, chlorinated phenols, piroctone olamine, ciclopirox olamine, ketoconazole, salicylic acid, sulfur and coal tar for anti-dandruff properties.[1,3,4] Other contents in shampoos include ingredients that control the viscosity of the shampoo, additives for controlling the pH, preservatives, antioxidants, moisturizers and

humectants, plus aesthetic additives to make shampoo pleasant for users such as colorants, fragrances, pearlescent agents or even chemical sunscreen.[1, 3, 4]

Most shampoos are alkaline so they may cause hair shaft swelling and render it more susceptible to damage.[4] However, Gray, informed us that shampoos should be formulated to be slightly acidic, with a pH range between 3.5 and 4.5.[3] Patients with damaged or chemically treated hair with a fragment cuticle should avoid hair swelling by selecting a shampoo that has an acid added to balance the pH.[4]

Various conditions can cause excessive hair loss, including scalp conditions such as androgenetic alopecia, alopecia areata, telogen effluvium etc. Draelos, suggested that shampoos for persons with hair loss should be those for fine hair.[4] This type of shampoo cleans sebum modestly while not depositing much conditioner on the hair. Baby shampoo is an alternative choice.[4] Nowadays, various agents, including ketoconazole, zinc pyrithione, dexpanthenol, nicotinamide, triaminodil and TOS extract, have been added in shampoos for androgenetic alopecia.[5, 6] These ingredients may alter the pH of shampoos which might cause irritation to the skin and mucous membrane.

A soap with alkaline pH can irritated the skin and mucous membranes.[1] It is important for dermatologists to be aware of the irritation potential of products that are used for scalp cleansing. The aim of this study is to assess the pH of various commonly available shampoos to enable making good recommendations to patients with hair loss problems.

Materials and methods

Common available shampoos in the market labeled for individuals with hair loss problems were measured for the pH. For comparison, mild baby shampoos which people generally believe are suitable for the use on their scalp for hair problems due to their mildness as well as shampoo for dry hair, medicated shampoo and herbal shampoo were also measured.

Each shampoo portion was weighed at one gram and was made up to 5% solutions in tap water in order to resemble the actual usage condition. The pH was determined using a pH meter (Thermo Scien Oion 2 Star, USA) and pH-indicator strips (pH 0-14 Universal indicator strips, Merck, Darmstadt, Germany). Each sample was measured twice to acquire an average pH value.

Results

Mild shampoo samples gave a pH between 7 and 7.8. Shampoos for dry hair showed pH range between 6.8 and 7.1. Except for one sample containing salicylic acid which gave a pH of 3, other medicated shampoos containing ketoconazole, zinc pyrithione, selenium sulfide, ciclopirox olamine, coal tar, and sulfur showed pH between 6 and 7.5. Herbal shampoos gave pH between 6.8 and 7.7. Anti-hair loss shampoos showed pH between 6.3 and 8.

Table 1 Comparison of the pH of shampoo

Type of shampoo	Sample	Active ingredients	Average pH of diluted shampoo by pH-Indicator strips	Average pH of diluted shampoo by pH Meter
Mild shampoo	**1**		7.5	7.82
	2		7	7.08
	3		7	7.06
Shampoo for dry hair	**4**		7	7.11
	5		7	6.94
	6		7	6.85
	7		7	6.85
Medicated shampoo	**8**	Ketoconazole	7.5	7.51
	9	Zinc pyrithione	6.5	6.75
	10	Zinc pyrithione	7.5	7.56
	11	Selenium sulfide	6.0	6.21
	12	Ciclopirox olamine	6.5	6.27
	13	Tar	6.5	6.38
	14	Salicylic acid	3	3.02
	15	Salicylic acid	6.5	6.38
	16	Colloidal sulfur	7	7.1
Herbal shampoo	**17**	Ginger (*Zingiber officinale*)	7	7.03
	18	Snow lotus, ginseng, borneol, jasmine tea	7.5	7.66
	19	*Centella asiatica* extract	7	6.83
Anti-Hair loss shampoo	**20**		8	7.88
	21		7.5	7.21
	22		7	6.84
	23		7	6.84
	24		6.5	6.40
	25		7	7.10
	26	Chlorhexidine	6.5	6.31
Tap water (Bangkok, Thailand)			7.5	7.78

1: Kodomo (LION, Thailand), 2: Care (Colgate-Palmolive, Thailand), 3: Johnson (Johnson & Johnson, Thailand), 4: Rejoice (Procter & Gamble Manufacturing, Thailand), 5: Sunsilk (Unilever Thai Holding, Thailand), 6: Dove (Unilever Thai Holding, Thailand), 7: Coconut & Almond shampoo (Milott Laboratories, Thailand), 8: Nizoral (OLIC Limited, Thailand), 9: Clear (Unilever Thai Holding, Thailand), 10: Head & Shoulder(normal formula) (Procter & Gamble Manufacturing, Thailand), 11: Selsun (Interthai Pharmaceutical Manufacturing, Thailand), 12: Stieprox (Stiefel Laboratories PTE, Thailand), 13: Polytar (Stiefel Laboratories PTE, Thailand), 14: Salicylic acid (Siriraj Hospital, Thailand), 15: L'oreal (PT Yasulor, Indonesia), 16: Harrogate (The Harrogate Sulphur Soap, England), 17: Ginger shampoo (Chao Phya Abhaibhubejhr Hospital Foundation, Thailand), 18: Kokliang (Kokliang Pharmacy, Thailand), 19: Botanical shampoo (His Majesty Development Project Khaohinsorn, Thailand),20: Head & Shoulder(Antihair fall formula) (Procter & Gamble Manufacturing, Thailand) 21: Pantene (Procter & Gamble Manufacturing, Thailand), 22: Regro for Men (S & J International enterprise, Thailand), 23: Regro for lady (S & J International enterprise, Thailand), 24: Regro Hair protective (S & J International enterprise, Thailand), 25: BSC falless (LION, Thailand), 26: Bergamot (Vera Allied Manufacturing, Thailand)

Discussion

Braun-Falco *et al.* reported the pH of normal skin ranged between 5.4-and 5.9.[7] Coles *et al*. reported the mean ocular surface pH of 133 normal volunteers was 7.11(SD 1.5).[8] Even though shampoos are not the common causes of cutaneous irritation or allergic contact dermatitis due to their relatively short contact time with the skin prior to rinsing[4], some surfactants in shampoos can cause skin or eye irritation.[9-11] Mild shampoo sometimes refers to "baby shampoo" which is non-irritating to the eyes. An ideal mild shampoo should not damage the scalp, the hair or the eyes and it should not remove the natural oils from the scalp, thus avoiding irritation to skin and mucous membrane. The amphoteric surfactants such as betaines, sultaines, and imidazolinium derivatives are commonly used in baby shampoo.[4] Amphoteric acetates/diacetates demonstrate excellent skin and mucous membrane tolerability.[12] In our study, except for salicylic acid which gave a pH of 3, other shampoos showed a pH between 6 and 8 when they were made up to 5% solutions in tap water (pH of 7.5 to 7.8) in order to resemble the actual usage condition.

Zirwas *et al.* reported that common allergens in shampoos included fragrance, cocamidopropyl betaine, methylchloroisothiazolinone/ methylisothiazolinone, formaldehyde-releasing preservatives, propylene glycol, vitamin E, parabens, benzophenones, iodopropyl butyl carbamate and methyldibromoglutaronitrile/ phenoxyethanol.[9]

Shampoos for dry hair or for damaged hair usually contain mild detergent and large amount of conditioners.[4] Detergents used in conditioning shampoos are generally amphoterics and anionis of the sulfosuccinate type.[4]

Medicated shampoos or anti-dandruff shampoos contain active ingredients in order to effectively remove scales and sebum, to act as an antifungal/antibacterial and to decrease scales formation by inhibit cellular replication.[4,13] Tar also has an anti-inflammatory property.[4]

Herbal shampoos contain botanical extracts that may affect the scalp and hair. Ginger was added in some herbal shampoos. Constituents of ginger have anti-inflammatory effect.[14] Thus, ginger shampoo can promote a healthy scalp. Some herbal shampoos claimed that they can prevent hair loss and revitalize hair growth, such as one shampoo in our study which contains snow lotus, ginseng, borneol and jasmine tea. *Saussurea* is used under the herbal name "snow lotus" which has pharmacological effect for the treatment of pain and inflammatory conditions.[15,16] Previous study has shown that snow lotus contains a wide variety of active ingredients, such as syringin and rutin, which have high antioxidant and anti-inflammatory activities.[15] Thus, snow lotus was added in shampoo according to this pharmacologic effect. According to ginseng, *Panax ginseng* has been reported to promote hair growth, prevent hair loss and accelerated recovery of hair medullary cells in mice study.[17-19] Ginseng extract can

enhance proliferation of human hair dermal papilla cells through anti-apoptotic activation.[17] Ginsenoside Ro, the predominant ginsenoside in the rhizome of ginseng has inhibitory activity against testosterone 5α-reductase and can induce hair regrowth by topical application.[20] So that topical administration including shampoo that contained ginseng extract might be a good candidate for adding to anti-hair loss shampoo. Borneol, one of the herbal ingredients in some shampoo, has anti-inflammatory effect.[21] *Centellar asiatica* was documented to having a stimulating effect on the epidermis, promoting keratinization and having anti-inflammatory property.[14] Thus, both borneol and *Centellar asiatica* extract can be used as ingredients in shampoo for relieving the scalp of inflammation causing dandruff. However, as far as we know, there has been no previous study about benefit of jasmine tea for hair or scalp problem.

Anti-hair loss shampoo or shampoos for persons with hair loss try to maximize the appearance of the remaining hair by grooming it to stand away from the scalp.[4] Some shampoos add active ingredients that might help regrowth of hair or prevent hair loss, such as 1% zinc pyrithione shampoo[22], 2% ketoconazole shampoo[23], shampoo containing combination of 0.6% zinc pyrithione, 0.5% dexpenthenol, 0.1% nicotinamide, 0.5% triaminodil and 0.17% TOS extract.[6]

The pH of shampoo depends on the composition of that shampoo. Adding other active medical ingredients for treatment of scalp conditions is not the only factor causing variation of the pH, which may also depend on the formulation of that shampoo. And besides the pH, many other factors in shampoos may also cause scalp irritation, such as type of surfactants and amount of scalp surface residue. Apart from pH, the benefit of other properties should be considered in the selection of proper shampoo.

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