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Brief Report

Assessment of Micellar Water pH and Product Claims

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Abstract: Micellar waters are widely used skincare cleansing products. It is commonly considered that micellar waters do not need to be rinsed off. Products left on the skin can affect its pH, which typically ranges from 4.1 to 5.8. and plays a vital role in maintaining the integrity of the skin barrier. Our objective was to evaluate the pH of micellar waters and investigate product claims, and differences according to target skin type. The pH of 30 samples of different micellar waters was tested. The products were categorized into groups based on target skin type. Statistical analysis was performed on both quantitative and qualitative data. In addition to descriptive statistics, the Shapiro–Wilk test, Fischer's Exact test, and the Kruskal–Wallis test were used considering the minimal significance level of 95%. The pH of the tested micellar waters ranged from 4.25 to 7.87. Most samples, 21 (70%), claimed to have a no-rinse formula. Most products, 18 (60%), also reported some type of testing having been performed. There were no statistically significant differences in pH between target skin types but products "for all skin types" were the most likely to lack rinsing instructions. In conclusion, most micellar water samples had skin-friendly pH levels and providers should carefully consider product characteristics for patients with skin conditions.

Keywords: micellar water; pH; skin care; skin type; cleansing; rinsing

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1. Introduction

Micellar water is a skincare product that utilizes micellar technology to effectively cleanse the skin of impurities, including makeup, sunscreen, and dirt. It typically consists of water mixed with surfactants (surface-active agents), such as cetrimonium bromide or other gentle detergents [1]. In a micelle, the hydrophilic parts of the surfactant molecules are oriented towards the surrounding water, while the hydrophobic parts are sequestered in the core of the micelle, away from the water. When micellar water is applied to the skin, the micelles can encapsulate hydrophobic compounds (like oils and fats), making it easy to remove them without the need for harsh rubbing or excessive friction [2] (Figure 1).

Consumers might use micellar water in a variety of ways: it can be utilized as a standalone cleansing step or as a pre-cleansing step before using a traditional cleanser. Additionally, it serves as a precision correction tool in makeup application, as a tool for refreshment throughout the day, and as a helpful cleansing tool in situations where clean water is not available or its use on the skin is undesirable [3,4].

Products left on the skin for a prolonged time have the potential to affect the skin's barrier function [5]. The barrier function is maintained by the outermost layer of the epidermis called the stratum corneum. An essential component of this barrier is the acid mantle that helps to preserve the skin's natural pH, which is slightly acidic, typically ranging from 4.1 to 5.8 with slight variation depending on location and ethnicity [6]. Interestingly, some research suggests that skin with a pH below 5 tends to be in better overall condition [7]. The skin's acidity is a result of natural acids, such as lactic acid,

produced by the skin's microbiome. Disruptions to this natural pH balance can impair the skin's barrier function, resulting in dryness, flakiness, and increased vulnerability to environmental irritants and allergens. Additionally, an imbalanced pH can create a more favorable environment for certain types of bacteria, viruses, and fungi [5].

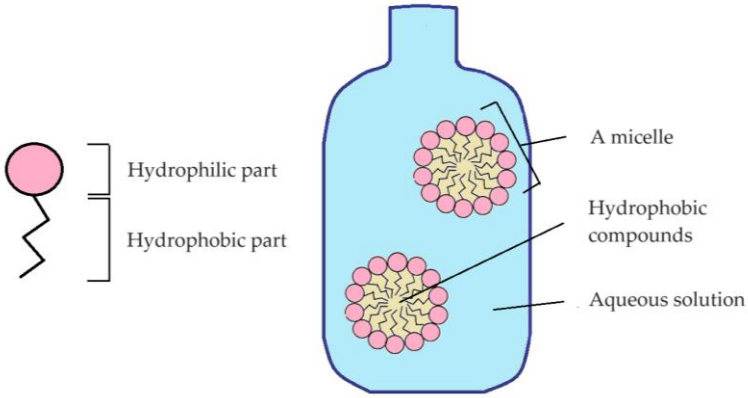

Figure 1. Micellar structure and composition in an aqueous solution.

The available research on micellar water products is extremely limited; studies on cleansing agents mostly focus on traditional cleansing methods such as soap and syndets [8] or do not provide information that would aid readers in selecting the most suitable products [9]. Despite a notable lack of information, these products are very popular among consumers with their market only continuing to grow [10].

This study aimed to evaluate the pH of commercially available micellar waters to verify whether they are slightly acidic and, therefore, consistent with the maintenance of the barrier function of human skin. Additionally, we strived to investigate whether the instructions for use on the labels of these products direct the consumer to forego rinsing and leave the product on the skin for a prolonged time, what testing was declared on the labels, and whether there are notable differences depending on the target skin type.

2. Materials and Methods

This was an observational, analytical, cross-sectional, quantitative study. Products from 23 different brands of micellar water were purchased from a popular cosmetics and household goods store chain in Riga, Latvia (European Union). The researchers manually selected the products with the aim of including at least one sample from every brand that carried micellar water in their product selection at the time of conducting the study (February 2023). Samples included in the study represent a variety of price points and market shares, from local brands to large international conglomerates, brands sold widely in both department stores and in pharmacies: Algotherm®, Avene®, BABE®, Bioderma®, Dzintars®, Eucerin®, Eveline®, Garnier®, Isana®, Isispharma®, La Roche Posay®, L'Oréal®, Lumene®, Madara®, Marence®, Mixa®, Mossa®, Neutrogena®, Nivea®, Seal®, SVR®, Uriage®, and Vichy®. The pH of 30 samples of micellar waters was analyzed, target skin types were identified based on the information provided on the product labels, and subsequently the products were categorized into several different groups. Additionally, we noted the instructions of use, the presence of product testing claims, and whether the labels mention use around the eyes. This study did not require the ethics committee's approval, as it did not involve human subjects but only the biochemical analysis of micellar waters. The samples were paid for using the researchers' personal funds to avoid any conflicts of interest.

The pH of all the micellar water samples was measured using the Vernier LabQuest2 pH meter calibrated to a pH of 4, at room temperature (approximately 21 degrees Celsius) without dilution. Each sample was tested 3 times with a time interval of 10 min. For statisti-

cal analysis, mean values of the three measurements were used as the discrepancy between measurements did not exceed the accuracy range of the measuring device (±0.2 pH units).

Data were stored in a Microsoft Office 365 Excel® spreadsheet and evaluated using the IBM SPSS Statistics 29.0 software platform. The normality of quantitative data was assessed using different methods including the Shapiro–Wilk test, and non-parametric tests were chosen as the assumptions necessary for parametric tests were not met. Since we compared 4 (≥3) independent sample groups, the Kruskal–Wallis H test was utilized to look for differences in pH values between the groups. Qualitative data were assessed using Fischer's Exact test as the data did not fit the conditions of the Pearson Chi-Square test. Summary measures used in descriptive statistics were median, interquartile range, minimum, and maximum values. The test results were considered statistically significant if the $p < 0.05$.

3. Results

The pH of the micellar waters ranged from 4.25 to 7.87. Seven (23.3%) had a pH < 5, fourteen (46.7%) micellar waters had a pH between 5 and 5.99, three (10.0%) had a pH between 6 and 6.99, and seven (23.3%) had a pH above 7. Eleven (36.6%) samples tested above the pH of normal skin (Table 1).

Table 1. Micellar waters according to their target skin type and tested pH.

For all Skin Types	
Algotherm® algoessential comfort	4.90
Madara Cosmetics®	5.05
Dzintars® Roja 3-in-1	5.22
Eveline cosmetics® purifying	5.27
Mossa® Juicy clean hyaluronic acid	5.46
Babe®	6.09
Marence®	6.93
Garnier® Hyaluron Aloe	7.33
Eucerin® DermatoCLEAN [hyaluron] 3in1	7.53
For sensitive skin	
Neutrogena® Hydro Boost triple	4.25
La Roche Posay® laboratorie dermatologique ULTRA	4.80
Bioderma® Sensibio H2O	4.88
Avene® micellar lotion	5.33
Isispharma® dermatologie Aquaruboril soothing	5.40
Isispharma® Neotone aqua	5.43
Lumene® pure arctic miracle 3-in-1 micellar	5.48
Seal cosmetics®	5.52
Uriage® thermal	5.67
SVR® Sensifine AR	5.88
Garnier® Skin Naturals	7.02
Mixa® anti-redness	7.09
Vichy® mineral sensitive skin	7.61
Eucerin® DermoPure oil control	7.87
For dry/dehydrated skin	
Isana® 3in1	4.85
Bioderma® Hydrabio H2O Moisturising	5.37
Nivea® MicellAIR Skin Breathe	6.74
For normal/combination to oily skin	
Vichy® mineral combination to oily skin	4.44
Bioderma® Sebium H2O Purifying	4.89
Isispharma® Teen derm aqua	5.62
Loreal Paris®	7.03

Upon investigating the intended audience outlined on the labels of micellar waters, we identified five different target skin types (normal, combination, oily, dry, and sensitive). Based on the instructions on the labels, we categorized the tested products into four groups: 9 (30%) samples were intended for all skin types, 14 (47%) for sensitive skin, 3 (10%) for dry/dehydrated skin, and 4 (13%) for normal/combination to oily skin (Table 1). Both products labeled "for all skin types" and those "for sensitive skin" consider individuals with sensitive skin as part of their target audience, which adds up to 23 (77%) of the tested micellar waters.

Of the 30 samples, the labels of 21 (70.0%) samples claim to have a no-rinse formula, while the rest, 9 (30.0%), offer no instructions. Regarding the type of testing brands claimed to have conducted on their products, 10 (33.3%) claimed to have been both dermatologically and ophthalmologically tested, 8 (26.7%) were only dermatologically tested, and 12 (40.0%) did not report any testing having been performed.

Most of the product labels, 24 (80%), contained information stating that use around the eyes is acceptable.

There was no statistically significant difference in the distribution of pH values across categories of target skin types (Kruskal–Wallis test, H = 0.92, p = 0.822). The two groups with the largest sample size were also compared and the result remained the same.

The group targeting all skin types had a median pH value of 5.46 (IQR = Q1–Q3 = 5.22–6.93), the sensitive skin group had a median value of pH 5.50 (IQR 5.33–7.02), the dry/dehydrated group had a median value of pH 5.37 (IQR 5.11–6.06), and the normal/combination to oily group had a median value of pH 5.26 (IQR 4.66–6.33) (Figure 2).

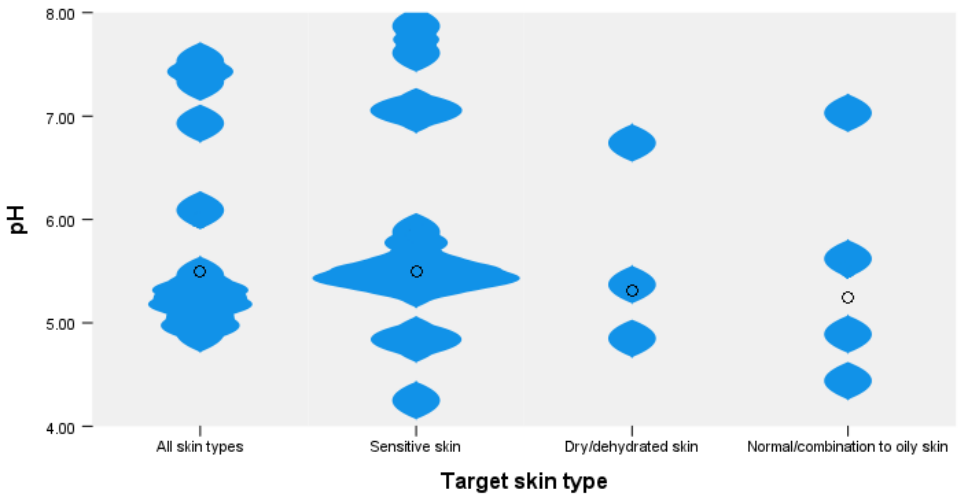

Figure 2. Variation in pH according to target skin type.

The products for sensitive skin tended to have directions claiming that rinsing is not necessary. Products for all skin types were the most likely to have no rinsing directions mentioned on the label; this association was statistically significant (Fischer's Exact test, df = 3, n = 30, p = 0.046) and strong (Cramer's V = 0.52) (Table 2).

Products for sensitive skin tended to not have any testing declared on the label. Products for dry/dehydrated skin tended to be dermatologically tested. The association between target skin type and testing reported on the label was not statistically significant (Fischer's Exact test, p = 0.241).

There was no statistically significant difference in the distribution of pH values across the different product testing groups (Kruskal–Wallis test, H = 2.315, p = 0.314).

Products for sensitive skin tended to be suitable for use around the eyes, but no statistically significant associations were found between product labels mentioning use around the eyes and the target skin types (Fischer's Exact test, p = 0.141). Similarly, no statistically significant associations were found between use around the eyes and the pH values (Kruskal–Wallis test, H = 1.075, p = 0.300).

Table 2. Rinsing directions on the label of micellar water depending on target skin type.

Target Skin Type	Rinsing Directions on the Label		Total, n (%)
	Rinsing Not Necessary, n (%)	Not Mentioned, n (%)	
All skin	4 (44.4)	5 (55.6)	9 (100.0)
Sensitive skin	12 (85.7)	2 (14.3)	14 (100.0)
Dry/dehydrated skin	1 (33.3)	2 (66.7)	3 (100.0)
Oily/combination to normal skin	4 (100.0)	0 (0.0)	4 (100.0)
Total	21 (70.0)	9 (30.0)	30 (100.0)

4. Discussion

Micellar water is a gentle skincare product using micellar technology to cleanse the skin without harsh rubbing, thus making it an attractive option for those with sensitive skin. Prolonged exposure to skincare products as well as the act of cleansing itself can affect the skin's pH and hence also its barrier function [5]. In this study, the pH of 30 micellar water samples was measured and the claims made on product packaging were critically assessed.

While none of our samples had a very alkaline pH, almost a fourth had a pH above 7, and a third tested above the pH of 6, many of those from groups whose target skin type includes people with sensitive skin. This could indicate that the pH of the solution is not always intended to match that of the physiological skin pH but rather that of the eyes since micellar waters are often used for eye makeup removal. The physiological pH of conjunctival tear fluid ranges from 6.30 to 7.23 and that of the conjunctival mucous discharge from 7 to 8 [11]. These are essential in maintaining the health and functionality of the ocular system. However, in our study, most products did mention use around the eyes and this did not correlate with the tested product pH. Although similar results were observed in other similar studies investigating liquid cleansers, in a study looking at children's soap the results showed a pH range of 4.40–7.90 in syndets and liquid soap with a single outlier of 9.90 in the category of specifically antibacterial liquid soaps [8].

In our study, there were no substantial differences found in pH values between different target skin types, which leads us to believe that the pH of the solution might not be the main aspect of product formulation that is taken into account when determining who will benefit from it the most. Alternatively, it might be relevant to assess the types of surfactants used in the formula, the presence of hydrating and soothing ingredients, and the absence of common irritants such as fragrant components and colorants in micellar water products. This idea is reinforced by the results found in the previously published literature showing some cleansing agents with a more acidic pH to be more irritating than their neutral counterparts, suggesting the importance of considering the interaction of the ingredients with the skin under skin pH conditions [12].

Interestingly, most of the tested samples were confirmed to claim to have a no-rinse formula; a trend toward these claims was noted in the category of micellar waters aimed at sensitive skin. Patients with inflammatory skin conditions such as atopic dermatitis are known to sometimes find washing with water to be irritating, especially in areas with hard water, which leads to increased surfactant deposition when combined with conventional cleansing agents [4]. It could be that products marketed as no-rinse formulas are an attractive option to such patients as their use can help avoid using tap water.

When it comes to whether our results can be extended to other markets, most of the micellar waters examined in this study are imported into the Latvian market. While many of these products are associated with well-known global brands, it remains uncertain whether their chemical composition and pH levels are consistent across international markets. Nevertheless, since the study specifically chose brands that are readily obtainable in common stores both within and beyond Latvia and evaluated a comparatively wide

range of different brands, it is plausible that the findings can be extended to other European countries and the global market. Ideally, these outcomes should be reinforced by conducting further research in other geographical areas.

This research underscores that there might be a relative pH inadequacy in numerous products marketed as suitable for sensitive skin. Healthcare providers should be mindful of the qualities of products recommended to patients, especially those with skin conditions that increase their sensitivity to irritants.

Limitations of this study include the unbalanced sample sizes of micellar waters by skin type, which makes evaluating the correlations between the pH and target skin types of products challenging. Additionally, the sample size of 30 is rather low considering the overall number of products available globally.

5. Conclusions

Most of the micellar water samples were within the physiological pH of healthy skin, but a third of the tested products exceeded this level. The packaging of the micellar water products contained different instructions: most claimed to have a no-rinse formula, most were intended for sensitive skin, and the majority encouraged the use around the eye area. The only significant association was found to be between the product labeling "for all skin types" and the lack of rinsing instructions on the packaging.

Healthcare providers should consider the characteristics of products to be recommended for patients with skin diseases in order to achieve optimal treatment results. Product pH is not the only characteristic that should be looked at, so further research on the differences between available micellar water products is needed to be able to recommend the most suitable products for patients' individual needs.

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