

UDC 615.12:615.242 (477)

DOI <https://doi.org/10.32782/health-2025.3.15>**COMMODITY AND CONSUMER COMPLIANCE ANALYSIS OF WHITENING ORAL CARE PRODUCTS IN THE UKRAINIAN PHARMACEUTICAL MARKET****Pokotylo Olena Oleksandrivna,**

Candidate of Pharmaceutical Sciences, Associate Professor,
Associate Professor at the Department of Pharmacy Management, Economics and Technology
Ivan Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine
ORCID: 0000-0003-3671-9212

Budniak Liliia Illivna,

Candidate of Pharmaceutical Sciences, Associate Professor,
Associate Professor at the Department of Pharmacy Management, Economics and Technology,
Ivan Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine
ORCID: 0000-0002-4869-1344

Hasiuk Petro Anatoliiovych,

Doctor of Medical Science, Professor,
Head of the Department of Orthopedic Dentistry
Ivan Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine
ORCID: 0000-0002-2915-0526

Dub Anastasia Ihorivna,

Candidate of Pharmaceutical Sciences, Associate Professor at the Department of Pharmacy
Management, Economics and Technology
Ivan Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine
ORCID: 0000-0002-6945-2422

Barna Oksana Mykhailivna,

Candidate of Pharmaceutical Sciences, Associate Professor,
Associate Professor at the Department of Pharmacy Management, Economics and Technology
Ivan Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine
ORCID: 0000-0002-5047-1359

Oral health and dental aesthetics play a crucial role in shaping social interactions and self-perception. This has also led to an increasing demand for effective and safe teeth-whitening products. It has been studied, the whitening toothpastes are the most accessible and widely used oral care products, occupying a leading position in the pharmaceutical market.

The aim of the study was to conduct a commodity and compliance analysis of whitening oral care products available on the Ukrainian market. A structural assessment of the assortment was carried out using data from the online platform Tabletki.ua and leading beauty and personal care e-retailers. Assortment breadth and depth coefficients (C_b , C_d) were calculated to evaluate product availability and diversity, while consumer activity coefficients ($C_{c.a.}$) were applied to assess the level of interest across different age groups.

The results demonstrated that whitening toothpastes account for 35% of the total assortment of adult toothpastes. The mass-market segment exhibited the highest breadth coefficient ($C_b = 54\%$), followed by the professional segment ($C_b = 31,5\%$), underscoring substantial consumer demand for effective whitening solutions. Assortment depth varied considerably across brands: White Glo demonstrated complete specialization ($C_d = 100\%$), whereas Parodontax exhibited only minimal emphasis on whitening ($C_d = 8\%$).

The highest consumer activity coefficient ($C_{c.a.} = 0,53$) was observed among individuals under 25 years of age, reflecting their aesthetic orientation and the pronounced influence of social media. In contrast, older age groups demonstrated more cautious behavior, prioritizing safety and suitability for sensitive teeth.

In conclusion, whitening oral care products occupy a distinct niche within the Ukrainian pharmaceutical market, characterized by clear differentiation in brand strategies and consumer preferences. The results of this study may provide valuable insights for manufacturers, pharmacists, and marketers in optimizing product portfolios and developing targeted marketing strategies tailored to diverse consumer segments.

Key words: whitening toothpastes, commodity analysis, assortment breadth, assortment depth, consumer activity, oral hygiene products.

Олена Покотило, Лілія Будняк, Петро Гасюк, Анастасія Дуб, Оксана Барна. Товарознавчий та споживчий компласнс-аналіз вибілювальних засобів для догляду за порожниною рота на фармацевтичному ринку України

Підтримання гігієни порожнини рота й естетики зубів стало невід'ємним складником сучасного самодогляду, що зумовлює зростання попиту на ефективні та безпечні засоби для вибілювання зубів. Вибілювальні зубні пасти, як найбільш доступні та широкоживані продукти, посідають провідне місце на ринку засобів догляду за порожниною рота.

Метою нашого дослідження було проведення товарознавчого та компласнс-аналізу вибілювальних засобів для догляду за порожниною рота (переважно зубних паст), представлених на українському ринку. Структурне оцінювання асортименту – зокрема його ширини та глибини – здійснено на основі даних платформи Tabletki. ua та провідних онлайн-ритейлерів засобів гігієни та краси. Для оцінювання наявності та різноманітності вибілювальних засобів були розраховані коефіцієнти ширини та глибини асортименту, а для аналізу рівня зацікавленості споживачів у різних вікових групах – коефіцієнт споживчої активності.

Результати дослідження показали, що вибілювальні зубні пасти становлять 35% від загального асортименту зубних паст для дорослих, водночас найбільший коефіцієнт ширини асортименту зафіксовано в мас-маркет-сегменті (54%). Друге місце посів професійний сегмент із показником 31,5%, що свідчить про високий інтерес споживачів до ефективних засобів. Глибина асортименту значно варіювала між брендами: White Glo продемонстрував повну спеціалізацію (100%), тоді як Parodontax – мінімальний фокус на вибілюванні (8%).

Найвищий коефіцієнт споживчої активності (0,53) спостерігався серед осіб віком до 25 років, що відображає їхню орієнтацію на естетику та вплив соціальних мереж. Натомість у старших вікових групах переважає більш обережна поведінка, орієнтована на безпечність продуктів та їхню придатність для чутливих зубів.

Отже, вибілювальні засоби для догляду за порожниною рота займають помітну нішу на українському ринку, що характеризується чіткою диференціацією у стратегіях брендів і споживчих перевагах. Отримані дані можуть бути корисними для виробників, фармацевтів і маркетингологів для оптимізації товарного портфеля та розроблення цільових маркетингових стратегій для різних сегментів споживачів.

Ключові слова: вибілювальні зубні пасти, товарознавчий аналіз, ширина асортименту, глибина асортименту, споживча активність, засоби гігієни порожнини рота.

Introduction. Since antiquity, human societies have devoted significant attention to preserving health, physical appearance, and personal hygiene, including the care of the body, hair, skin, and teeth [1–3]. Historical evidence suggests that in Ancient Egypt, members of the upper classes utilized oral hygiene preparations composed of powdered ox hooves, myrrh, eggshells, pumice, and water. Subsequently, Greek and Roman civilizations refined these formulations by incorporating crushed oyster shells, charcoal, ash, and tree bark, thereby laying the foundation for the first abrasive toothpastes. To improve their sensory and organoleptic characteristics, aromatic herbs, most notably mint, were also added to these preparations [4].

Throughout history, fair skin and white teeth have been perceived as markers of elevated social status and caste «purity», frequently associated with success, authority, and privilege [5].

In the context of modern life, coupled with the accelerated pace of industrial and technological development in the 21st century, substantial transformations have occurred not only in the composition, manufacturing technologies, and assortment of oral care products, but also in the approaches to achieving dental aesthetics, particularly tooth whitening [6–8]. Among the most commonly employed whitening solutions are toothpastes.

As defined in regulatory documentation [9; 10], toothpastes are the multicomponent, gel-like systems typically comprising abrasives, binding agents, humectants, and various organoleptic modifiers such as flavoring, aromatic, and coloring agents. Their composition largely determines their functional properties, whether hygienic, preventive or therapeutic [11]. In addition, formulations may incorporate biologically active substances or their complexes, including vitamins, tinctures, plant extracts, bee products, salts, trace elements, and enzymes, along with antiseptics (chlorhexidine, triclosan, or cetylpyridinium chloride), surfactants, preservatives, and other excipients [8; 9]. The inclusion of such components not only facilitates targeted prevention and management of dental caries, periodontal pathologies, and oral mucosal disorders, but also ensures that toothpastes possess the requisite physicochemical and organoleptic characteristics for consumer acceptability [6; 12].

In line with the definitions established by regulatory documentation [9; 10], toothpastes must meet technical requirements regarding safety, usefulness, quality stability throughout the shelf life, and resistance to microbial growth and oxidation. Their production must comply with approved technological regulations and formulations [10].

Organoleptic requirements stipulate that toothpastes must have a uniform gel-like consistency

without granules, along with a pleasant smell, taste, and color [9]. With approval from the Ministry of Health of Ukraine, the production of special therapeutic and prophylactic toothpastes with a pH of 4,5–5,5 is allowed, provided they pass enamel demineralization testing. The metal content must not exceed 5,5–10,5% of the total volume, and fluoride content must not exceed 0,002% (or 300 mg per package). Microbiological safety is ensured by the absence or permissible levels of pathogenic and sanitary-indicative microorganisms. The primary safety criterion is the compliance of ingredient composition with national sanitary regulations and cosmetic product safety standards [9; 10].

The classification of toothpastes is based on various criteria, including consistency, content of biologically active substances, pH level, presence and concentration of surfactants (SAA), abrasives, solvents, and other components [9; 13]. Depending on their use, toothpastes are divided into those for household and professional application; the latter have increased abrasiveness and are used exclusively by dentists during cleaning or polishing procedures [14; 15].

According to DSTU 2472:2006 [9], based on consistency, toothpastes are categorized as creams, gels, or pastes, depending on the presence of gelling agents, adhesives, and the content of the liquid phase [8; 16].

Based on pH (25% suspension of the toothpaste), they are classified as acidic (pH 4,50–5,50), slightly acidic (5,51–6,80), neutral (6,81–7,20), slightly alkaline (7,21–8,30), alkaline (8,31–10,30), and strongly alkaline (10,31–10,50); the pH level is determined by the composition of abrasives, excipients, and BAS [8].

According to their intended purpose, toothpastes are classified as hygienic, therapeutic-prophylactic, or children's products [8].

Depending on their foaming ability, toothpastes are classified as foaming or non-foaming – based on the presence and concentration of SAAs, which enhance plaque removal. However, SAAs may suppress oral bacteriophages, potentially causing mucosal irritation and ulcer formation [8; 16; 17].

Based on abrasive content, toothpastes are categorized as abrasive or low-abrasive. The latter typically contain silicon compounds and are free of calcium [8; 17; 18]. According to the type of abrasive, toothpastes may be based on calcium carbonate, sodium bicarbonate, silicon dioxide, calcium phosphate, hydroxyapatite, etc., and often include combinations of multiple abrasives [8; 19].

By age group, toothpastes are divided into those for children and adults, considering fluoride content: 0,02–0,05% for children under 6 years old and 0,05–0,15% for adults [8; 20].

Modern toothpastes are classified by active ingredients into hygienic, therapeutic and prophylactic, children's, smokers', for sensitive enamel, with combined effects, whitening, anti-inflammatory, antiseptic, anticaries, fluoride-containing, pine-scented, and others [8; 20].

Specialized toothpastes are divided into whitening and smokers' pastes. Whitening products often contain chlorine and hydroperite, which gradually erode enamel. As a gentler alternative, some formulations use rhubarb, sorrel, or sour apple juice to remove dark enamel stains without harsh chemicals [8; 20].

Toothpastes for smokers aim to reduce the urge to smoke. These products contain silver nitrate, which remains in the oral cavity after brushing and, upon contact with tobacco smoke, triggers physiological reactions that diminish the taste for tobacco [8].

Given the growing consumer interest in oral care products that combine effectiveness, safety, and aesthetic value, the whitening segment of the market has gained particular prominence. Despite the wide availability of such products, comprehensive analyses addressing their assortment characteristics and consumer compliance within the Ukrainian pharmaceutical market remain limited. Therefore, the present study was designed to perform a commodity and compliance analysis of whitening oral care products, with an emphasis on toothpastes, in order to evaluate their structural assortment parameters and assess patterns of consumer demand across different demographic groups.

Therefore, the objective of this study was to conduct a comprehensive commodity analysis of whitening oral care products (with a primary focus on toothpastes) available on the Ukrainian pharmaceutical market. The analysis aimed to evaluate the structural characteristics of the assortment, including its breadth and depth, as well as consumer activity patterns, in order to identify key consumer preferences and compliance trends across different age groups.

Methods of Research. The materials for the study included the assortment of whitening oral care products, specifically toothpastes, mouthwashes, powders, and whitening strips, which presented on the online platform Tabletki.ua.

Analysis of the structure, breadth, and depth of the presented assortment of whitening oral care products, as well as the calculation of the consumer activity

coefficient for whitening toothpastes, includes the following key stages: analysis of the assortment structure (category identification, brand structure, dosage form), analysis of assortment breadth, analysis of assortment depth, analysis of consumer activity.

The breadth of the assortment was determined as the ratio of the number of product categories or brands represented within the whitening oral care segment to the total number of categories or brands in the general oral care assortment:

$$C_b = (N_w / N) \times 100\%, \text{ where:}$$

N_w – number of whitening oral care products categories;

N – total number of oral care categories.

The depth of the assortment was calculated as the ratio of the number of whitening modifications (different formulations, flavors, package sizes, etc.) within a specific brand to the total number of products in the brand's oral care portfolio:

$$C_d = (M_w / M) \times 100\%, \text{ where:}$$

M_w – number of whitening modifications in a brand;

M – total number of products within the brand's assortment.

Consumer activity ($C_{c.a.}$) was evaluated as the ratio of the number of consumer interactions (product reviews, ratings or demand indicators) with whitening products to the total number of interactions with all oral care products within the same age group:

$$C_{c.a.} = \frac{fm_i}{\sum_{i=1}^n fm_i}, \text{ where:}$$

fm_i – frequency of mentions of a specific activity indicator;

$\sum_{i=1}^n fm_i$ – total number of mentions of all indicators within the group.

Compliance with the use of whitening toothpastes among different age groups can be substantiated based on the calculated values of the consumer assortment usage coefficient.

Discussion of the Results. To comprehensively examine consumer compliance regarding the use of whitening toothpastes, it was considered appropriate to analyze the assortment of this product category, focusing in particular on the popular Ukrainian online platform Tabletki.ua.

Study of the assortment breadth of whitening toothpastes. According to the available listings on the online platform Tabletki.ua, the total number of adult toothpaste trade names amounts to 534, of which 187 pharmaceutical product items are specifically represented by whitening toothpastes. Thus, the

assortment breadth coefficient for whitening toothpastes is 35%, as calculated using the formula:

$$C_b = (187 / 534) \times 100\% = 35\%.$$

Thus, approximately one-third of all adult toothpastes (excluding children's products) presented on the Tabletki.ua website belong to the category of whitening toothpastes. The high share of whitening toothpastes in the overall product assortment structure indicates considerable consumer interest in products aimed at improving the aesthetic appearance of teeth. This also reflects the availability of a wide range of such products, enabling consumers to choose options that align with their individual preferences, taking into account price range, quality characteristics, and ingredient composition.

The calculated assortment breadth coefficient of 35% reflects a notable presence of whitening toothpastes within the total assortment of adult dental care products available on the Tabletki.ua platform. This considerable share emphasizes the relevance and high demand for aesthetic oral care solutions among consumers and determines the direction of marketing strategies aimed at enhancing and diversifying product offerings.

According to the classification of whitening toothpastes presented on the Tabletki.ua platform, five distinct groups have been identified, the characteristics of which are presented in Table 1.

The highest assortment breadth coefficient for whitening toothpastes was

recorded in the mass-market category – 54%. This indicator can be explained by the orientation of this segment toward a broad consumer audience that prioritizes affordability and satisfactory quality. Accordingly, the assortment in this segment is formed with the aim of meeting diverse consumer needs in order to achieve maximum market coverage.

It is noteworthy that professional whitening toothpastes ranked second in terms of the assortment breadth coefficient ($C_b = 31,5\%$). This indicator indirectly reflects a growing level of compliance among consumers who prefer daily oral care products with characteristics close to professional-grade formulations. Such preferences are driven by a focus on high quality, strict requirements for efficacy and safety, and a willingness to invest in more expensive yet effective products.

Analysis of the assortment depth of whitening toothpastes. At the next stage of the study, the assortment depth coefficient was calculated for the TOP 10 most popular brands. Assortment depth refers to the number of variations (dosage, composition, etc.)

Table 1

Characteristics of the classification groups of whitening toothpastes

Group name	Pharmacy	Mass market	Mid-market	Natural	Professional
Price	Medium/high	Low/ medium	Medium	Medium/ high	High
Physical availability	Only in pharmacies	Supermarkets, retail chains, and online stores	Specialized stores, pharmacies, and online stores	Pharmacies, specialized stores of natural products	Dental and specialized clinics
Targeting audience	Consumers seeking quality, reliability, and pharmaceutical-grade products	A wide range of consumers	Rational decision-makers seeking price/quality balance	Supporters of natural and environmentally friendly products	Consumers willing to pay for professional solutions and high efficacy
Effectiveness	Higher than mass market	Moderate	Closer to professional	Lower than synthetic pastes	High
Trade names	Sensodyne, Health House, Dr. Wild Emoform, Parodontax, Apagard Premio etc.	Splat, Benefit, Colgate, Nasha Zubna Pasta, Blend-a-med, Dentissimo, Gum, White Glo, Fesco etc.	Dr. Organic containing tea tree extract	Natusana Bioactive Calcium, Ecobiz Denticmag, Forever Living etc.	Marvis, Brillante, Das experten Schwarz, White Glo, Pasta del Capitano, Vitis, FrezzyDerm etc.
Quantity	13	101	1	13	59
Assortment breadth coefficient (C_b)	7%	54%	0,5%	7%	31,5%

of a single brand within its overall product range. The evaluation was based on respondents' answers and the assortment offerings presented on the Tabletki.ua website. The results are presented in Figure 1.

The assortment depth of each brand of whitening toothpastes reflects their specific market strategy:

- the highest assortment depth is characteristic of White Glo products, which

are fully focused (100%) on oral care for sensitive teeth with whitening effects, indicating a clear niche specialization of the brand;

- a medium assortment depth is observed for Blend-a-med ($C_d = 53\%$), Colgate ($C_d = 46\%$), and Crest ($C_d = 44\%$). This indicates significant product diversity in terms of package volume (75, 100, 125 ml), composition of active ingredients (natural plant extracts such as mint and oak bark, activated charcoal, etc.), and functional properties (pearl shine, ultra-freshness, professional protection, gentle care, etc.), allowing these brands to effectively meet the key needs of consumers;

- a lower assortment depth is recorded for Sensodyne ($C_d = 27\%$) and Aquafresh ($C_d = 22\%$), which reflects a reduced focus on whitening properties and a greater emphasis on comprehensive oral care, including enamel protection and breath freshness;

- the minimum assortment depth is noted for Parodontax ($C_d = 8\%$), which can be explained by the fact that only one whitening product is available in the brand's portfolio. This is due to its primary focus

on the prevention and treatment of gum bleeding and inflammation.

This distribution of assortment depth demonstrates how brands adapt to various consumer needs and confirms a high level of consumer compliance with the use of whitening toothpastes.

Study of consumer activity of respondents toward whitening toothpastes

The next indicator examined to assess the level of consumer interest across different age groups in whitening toothpastes was the consumer activity coefficient (Table 2). Overall, the analysis revealed that whitening toothpastes had the highest consumption coefficient among all categories of oral care products. All age groups of respondents demonstrated varying levels of consumer activity ($C_{c.a.}$), indicating the general popularity of this product category – there was no age group that completely refrained from using whitening toothpastes.

The highest consumer activity coefficient ($C_{c.a.} = 0,53$) was recorded among individuals under the age of 25. This can be attributed to the increased attention this demographic pays to aesthetic aspects of appearance, particularly the whiteness of teeth. Younger people tend to seek quick and affordable means to enhance their appearance and are active users of social media, where physical attractiveness plays a significant role. These factors collectively contribute to the high demand for whitening toothpastes among youth.

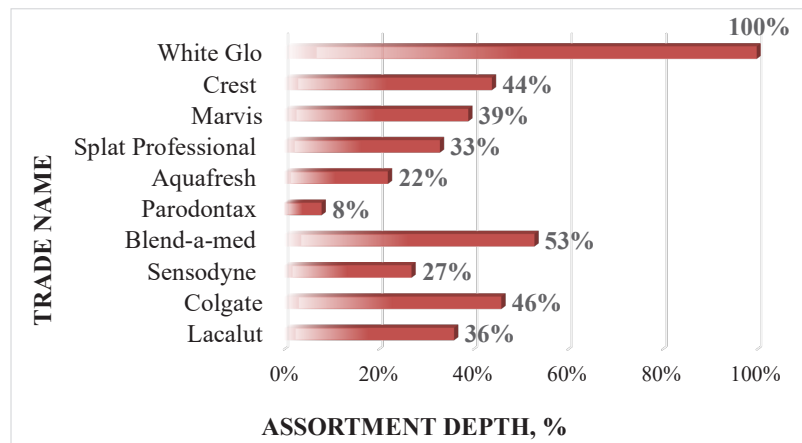


Fig. 1. Assortment depth coefficient (C_d) of the TOP 10 whitening toothpaste brands

Table 2

Analysis of the consumer activity coefficient

№	Whitening oral care products	$C_{c.a.}$ by age groups of respondents, years				
		18–25	26–35	36–45	46–54	55+
1.	Toothpastes	0,53	0,07	0,15	0,15	0,1
2.	Mouthwashes	1,0	–	–	–	–
3.	Strips	1,0	–	–	–	–
4.	Powders	–	–	0,5	0,5	–
5.	Systems	0,6	–	–	0,4	–

The next age group (26–35 years) demonstrates the lowest consumer activity coefficient ($C_{c.a.} = 0,07$), which can be attributed to several factors: a reduced focus on appearance compared to other priorities such as career and family; a possible lack of free time for regular use of additional hygiene products; and increased awareness regarding the safety and potential impact of whitening products on dental health.

A moderate level of compliance ($C_{c.a.} = 0,15$) observed among individuals aged 36–54 years may be explained by their desire to maintain a youthful appearance through a bright smile. People in this age group generally possess greater financial capacity to purchase high-quality oral care products.

A decline in consumer activity among individuals over the age of 55 ($C_{c.a.} = 0,1$) can be attributed to growing concerns about oral health and the potential adverse effects of whitening procedures. In this age group, aesthetic priorities are often less pronounced compared to younger consumers, and more frequent dental issues, such as gum disease and increased tooth sensitivity, that may limit the use of aggressive whitening agents.

Thus, consumer compliance with the use of whitening toothpastes is largely determined by age, aesthetic priorities, financial capacity, and overall attitudes toward oral health. Younger consumers

are primarily motivated by aesthetic considerations, whereas older age groups demonstrate greater caution, carefully balancing the expected outcomes with potential risks. These factors significantly influence both product selection and the frequency of whitening toothpaste use.

Conclusions.

1. The commodity analysis demonstrated that whitening toothpastes account for 35% of the total assortment of adult toothpastes available on the Tabletki.ua platform, highlighting their considerable share within the product offering. The highest assortment breadth coefficient was observed in the mass-market segment ($C_b = 54\%$), reflecting its broad consumer accessibility. Professional products ranked second ($C_b = 31,5\%$), emphasizing their positioning around efficacy and high-quality oral care.

2. The analysis of assortment depth revealed distinct brand positioning strategies. White Glo exhibited complete specialization in whitening formulations for sensitive teeth ($C_d = 100\%$), whereas Parodontax offered only a single whitening product ($C_d = 8\%$). These findings illustrate a pronounced differentiation in brand policies, aligned with specific consumer demands.

3. Within the framework of the marketing analysis, consumer activity coefficients were

calculated across age groups. The highest activity was observed among individuals younger than 25 years ($C_{c.a.} = 0,53$), who prioritize aesthetic outcomes and exhibit high engagement through social media. In contrast, older consumers adopted a more cautious approach, focusing on product safety, quality, and suitability for individual needs.

4. The integrated application of commodity and marketing analysis provided a comprehensive

characterization of the current assortment of whitening toothpastes on the Ukrainian pharmaceutical market and enabled the identification of key consumer trends and determinants of product choice. The findings of this study may serve as a valuable resource for manufacturers, marketers, and pharmacists in refining product policies, optimizing assortment structures, and developing promotion strategies tailored to diverse consumer segments.

BIBLIOGRAPHY

1. Дуднікова М.О. Сучасні аспекти етіології дисколоритів зубів. *Молодий вчений*. 2015. Т. 6. № 3. С. 64–66.
2. Kugel G. Over-the-counter tooth-whitening systems. *Compendium of Continuing Education in Dentistry*. 2003. Vol. 24. № 4A. P. 376–383.
3. Rodríguez-Martínez J., Valiente M., Sánchez-Martín M. Tooth whitening: From the established treatments to novel approaches to prevent side effects. *Journal of Esthetic and Restorative Dentistry*. 2019. Vol. 31. № 5. P. 431–440.
4. L. Darriba I., Cabrita Melón P., García Sartal A., Ríos Sousa I., Alonso de la Peña V. Influence of treatment duration on the efficacy of at-home bleaching with daytime application: a randomized clinical trial. *Clinical Oral Investigations*. 2018. Vol. 23. № 8. P. 3229–3237.
5. Водоріз Я.Ю., Лемешко А.В., Марченко І.Я., Шундрік М.А., Ткаченко І.М., Коваленко В.В. Оцінка якості життя у пацієнтів із потребою у лікуванні зубів фронтальної групи. *Вісник проблем біології і медицини*. 2019. Т. 1. № 4 (153). С. 296–300.
6. Лемешко А.В., Коваленко В.В., Водоріз Я.Ю., Ткаченко І.М. Вплив різних методів вибілювання на структуру твердих тканин зубів. *Актуальні проблеми сучасної медицини: Вісник Української медичної стоматологічної академії*. 2019. Т. 19. № 4 (68). С. 136–140.
7. Кирманов О.С., Лемешко А.В. Сучасні погляди на вибілювання зубів. *Український стоматологічний альманах*. 2020. № 4. С. 16–20.
8. Нартова В.М., Затевахіна Є.В., Четвертак Т.Ю. Вплив хімічного складу засобів догляду за ротовою порожниною на зубну емаль. *Інновації медичної освіти: перспективи, виклики та можливості* : матеріали II Всеукраїнської науково-практичної конференції, м. Запоріжжя, 23 січня 2023 р. Запоріжжя, 2023. С. 240–250.
9. ГОСТ 7983-99. Пасти зубні. Загальні технічні умови. Вид. офіц. 2000. 36 с.
10. Про технічні регламенти та оцінку відповідності : Закон України від 15.01.2015 р. № 124-VIII : станом на 19.04.2025 р. URL: <https://zakon.rada.gov.ua/laws/show/124-19#Text> (дата звернення: 22.04.2025).
11. Професійна гігієна порожнини рота : монографія / П.М. Скрипников та ін. Полтава : ТОВ «АСМІ», 2021. 108 с.
12. Животовський І.В., Силенко Ю.І., Хребор М.В. Вплив фактору суб'єктивності при визначенні кольору зубів за стандартною шкалою. *Вісник проблем біології і медицини*. 2019. Т. 2. № 2 (151). С. 232–236.
13. Silva, E.M. d., Maia, J.N. d. S.M.D., Mitraud, C.G., Russo, J. d. E.S., Poskus, L.T., Guimarães, J.G.A. Can whitening toothpastes maintain the optical stability of enamel over time? *Journal of Applied Oral Science*. 2018. Vol. 26. P. e 20160460.
14. Cvikl B., Lussi A., Moritz A., Flury S. Enamel Surface Changes After Exposure to Bleaching Gels Containing Carbamide Peroxide or Hydrogen Peroxide. *Operative Dentistry*. 2016. Vol. 41. № 1. P. E39–E47.
15. Mushashe A.M., Coelho B.S., Garcia P.P., Rechia B.N., da Cunha L.F., Correr G.M., Gonzaga C.C. Effect of different bleaching protocols on whitening efficiency and enamel superficial microhardness. *Journal of Clinical and Experimental Dentistry*. 2018. P. 0. Vol. 10. № 8. P. e772–e775.
16. Dvornyk A.V., Tkachenko I.M., Pysarenko O.A., Vodoricz Y.Y., Dvornyk V.M., Brailko N.M. Experimental study of changes in the chemical composition of tooth enamel when using hydrogen peroxide as the main chemical component in professional bleaching. *Wiadomości Lekarskie*. 2022. Vol. 75. № 7. P. 1683–1687.
17. Brailko N.N., Tkachenko I.M., Kovalenko V.V., Nazarenko Z.Y., Lemeshko A.V., Zelinska A.B. Laboratory methods of research of adhesive systems. *Wiadomości Lekarskie*. 2020. Vol. 73. № 8. P. 1726–1729.
18. Mazzolani M.R., Mantilla T.F., França F.M.G., Amaral F.L.B., Basting R.T., Turssi C.P. Multibenefit desensitising/whitening toothpastes: a study on abrasion and permeability of root dentine. *Oral Health & Preventive Dentistry*. 2019. Vol. 17. Issue 6. P. 579–584.
19. Mosquim V., Martines Souza B., Foratori Junior G.A., Wang L., Magalhães A.C. The abrasive effect of commercial whitening toothpastes on eroded enamel. *American Journal of Dentistry*. 2017. Vol. 30. № 3. P. 142–146.
20. Гаджула Н.Г. Ефективність вибілювання дисколоритів вітальних зубів через підвищення резистентності емалі та дентину. *Новини стоматології*. 2015. № 2. С. 60–64.

REFERENCES

1. Dudnikova, M.O. (2015). Suchasni aspekty etiologii dyskolorytiv zubiv [Modern aspects of the etiology of tooth discoloration]. *Molodyi Vchenyi*, 6 (3), 64–66.
2. Kugel, G. (2003). Over-the-counter tooth-whitening systems. *Compendium of Continuing Education in Dentistry*, 24 (4A), 376–383.

3. Rodríguez-Martínez, J., Valiente, M., & Sánchez-Martín, M. (2019). Tooth whitening: From the established treatments to novel approaches to prevent side effects. *Journal of Esthetic and Restorative Dentistry*, 31 (5), 431–440. <https://doi.org/10.1111/jerd.12519>
4. L. Darriba, I., Cabrita Melón, P., García Sartal, A., Ríos Sousa, I., & Alonso de la Peña, V. (2018). Influence of treatment duration on the efficacy of at-home bleaching with daytime application: a randomized clinical trial. *Clinical Oral Investigations*, 23 (8), 3229–3237. <https://doi.org/10.1007/s00784-018-2744-z>
5. Vodoriz, Ya.Yu., Lemeshko, A.V., Marchenko, I.Ya., Shundryk, M.A., Tkachenko, I.M., & Kovalenko, V.V. (2019). Otsinka yakosti zhyttia u patsiientiv iz potreboiu u likuvanni zubiv frontalnoi hrupy [Assessment of quality of life in patients with a need for treatment of anterior teeth]. *Visnyk problem biologii i medytsyny*, 1 (4 (153)), 296–300.
6. Lemeshko, A.V., Kovalenko, V.V., Vodoriz, Ya.Yu., & Tkachenko, I.M. (2019). Vplyv riznykh metodiv vibiliuvannia na strukturu tverdykh tkanyv zubiv [Influence of different bleaching methods on the structure of hard dental tissues]. *Aktualni problemy suchasnoi medytsyny: Visnyk Ukrainскоi medychnoi stomatolohichnoi akademii*, 19 (4 (68)), 136–140.
7. Kirmanov, O.S., & Lemeshko, A.V. (2020). Suchasni pohliady na vibiliuvannia zubiv [Modern views on tooth bleaching]. *Ukrainskyi stomatolohichniy almanakh*, (4), 16–20.
8. Nartova, V., Zatievakhina, Ye., & Chetvertak, T. (2023). Vplyv khimichnoho skladu zasobiv dohliadu za rotovoiu porozhnynoiu na zubnu emal [Influence of the chemical composition of oral care products on tooth enamel]. *Innovatsii medychnoi osvity: perspektyvy, vykyky ta mozhlyvosti: Proceedings of the 2nd All-Ukrainian Scientific and Practical Conference, Zaporizhzhia, January 23, 2023* (pp. 240–250). Zaporizhzhia.
9. GOST 7983-99. (2000). *Pasty zubni. Zahalni tekhnichni umovy [Toothpastes. General technical specifications]*. Official edition, 36 p.
10. Zakon Ukrainy. (2015, January 15). *Pro tekhnichni rehlementy ta otsinku vidpovidnosti [On technical regulations and conformity assessment]: Law of Ukraine № 124–VIII (as of April 19, 2025)*. Retrieved from <https://zakon.rada.gov.ua/laws/show/124-19#Text>
11. Skrypnykov, P.M., Shnaider, S.A., Khmil, T.A., Pysarenko, O.A., Vyshnevskaya, H.O., Berezhna, O.E., & Lemeshko, A.V. (2021). *Profesiina hihiena porozhnyny rota [Professional oral hygiene]*. Poltava: ASMI LLC.
12. Zhivotovskiy, I.V., Sylenko, Yu.I., & Khrebor, M.V. (2019). Vplyv faktoriv sub'iektivnosti pry vyznachenni kol'oru zubiv za standartnoi shkaloju [Influence of subjectivity factor in determining tooth color using the standard scale]. *Visnyk problem biologii i medytsyny*, 2 (2(151)), 232–236.
13. Silva, E.M. d., Maia, J.N. d. S.M.D., Mitraud, C.G., Russo, J. d. E.S., Poskus, L.T., & Guimarães, J.G.A. (2018). Can whitening toothpastes maintain the optical stability of enamel over time? *Journal of Applied Oral Science*, 26. P. e 20160460. <https://doi.org/10.1590/1678-7757-2016-0460>
14. Cvikl, B., Lussi, A., Moritz, A., & Flury, S. (2016). Enamel Surface Changes After Exposure to Bleaching Gels Containing Carbamide Peroxide or Hydrogen Peroxide. *Operative Dentistry*, 41 (1), E39–E47. <https://doi.org/10.2341/15-010-1>
15. Mushashe, A.M., Coelho, B.S., Garcia, P.P., Rechia, B.N., da Cunha, L.F., Correr, G.M., & Gonzaga, C.C. (2018). Effect of different bleaching protocols on whitening efficiency and enamel superficial microhardness. *Journal of clinical and experimental dentistry*, 10 (8), e772–e775. <https://doi.org/10.4317/jced.54967>
16. Dvornyk, A.V., Tkachenko, I.M., Pysarenko, O.A., Vodoriz, Y.Y., Dvornyk, V.M., & Brailko, N.M. (2022). Experimental study of changes in the chemical composition of tooth enamel when using hydrogen peroxide as the main chemical component in professional bleaching. *Wiadomości Lekarskie (Warsaw, Poland: 1960)*, 75 (7), 1683–1687. <https://doi.org/10.36740/WLek202207114>
17. Brailko, N.N., Tkachenko, I.M., Kovalenko, V.V., Nazarenko, Z.Y., Lemeshko, A.V., & Zelinska, A.B. (2020). Laboratory methods of research of adhesive systems. *Wiadomości Lekarskie*, 73(8), 1726–1729. <https://doi.org/10.36740/wlek202008126>
18. Mazzolani, M.R., Mantilla, T.F., França, F.M.G., Amaral, F.L.B., Basting, R.T., & Turssi, C.P. (2019). Multibenefit desensitising/whitening toothpastes: a study on abrasion and permeability of root dentine. *Oral Health & Preventive Dentistry*, 17 (6), 579–584. <https://doi.org/10.3290/j.ohpd.a43001>
19. Mosquim, V., Martines Souza, B., Foratori Junior, G.A., Wang, L., & Magalhães, A.C. (2017). The abrasive effect of commercial whitening toothpastes on eroded enamel. *American journal of dentistry*, 30 (3), 142–146.
20. Hadzjula, N.H. (2015). Efektyvnist' vybilyuvannia dyskolorytiv vital'nykh zubiv cherez pidvyshchennya rezystentnosti emali ta dentynu [Effectiveness of whitening of vital teeth discoloration through increased resistance of enamel and dentin]. *Novyny stomatolohii*, 2 (83), 60–64.