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Original Article

Physical Stability Evaluation of Night Cream Preparations from Beauty Clinics in Pekanbaru, Indonesia

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Abstract

Night creams are widely used in facial skincare and should maintain appropriate physical characteristics during storage and use. This study compared the preliminary physical stability profiles of night cream preparations obtained from five beauty clinics in Pekanbaru, Indonesia. Five samples, coded A–E, were evaluated for organoleptic characteristics, dispersion pH, emulsion type, macroscopic homogeneity, and visible phase separation. Freeze–thaw testing was conducted for four cycles, each consisting of storage at 4 ± 2°C for 48 h followed by 40 ± 2°C for 48 h. Creams B, C, and D retained their initial organoleptic characteristics. Cream A showed a colour change and a subjectively perceived consistency change, whereas Cream E showed a subjectively perceived consistency change at cycle IV. Measured dispersion pH values ranged from 5.55 to 6.64. At the end of testing, all samples were identified as oil-in-water emulsions, appeared macroscopically homogeneous, and showed no visible phase separation. Creams B, C, and D therefore showed better preliminary macroscopic physical stability than Creams A and E. However, these findings do not establish complete emulsion stability because rheological behaviour, microscopic structure, globule size, and globule-size distribution were not evaluated.

Keywords: beauty clinic; freeze–thaw; night cream; physical stability; semisolid cosmetic

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1 Introduction

In everyday life, cosmetics are frequently used for cleansing, care, improving looks, and maintaining the state of the skin [1], [2]. Cosmetic items intended for marketing must comply with regulatory requirements regarding notification, safety, quality, claimed benefits, labelling, and technical standards for ingredients to ensure that their use does not pose unacceptable risks to consumers [3], [4]. The quality of cosmetic products is also very closely related to adequate manufacturing, control, storage, and distribution practices, as indicated in cosmetic good manufacturing practices guidelines [5], [6]. Moreover, the stability of cosmetic items should be examined since physical, chemical, microbiological, and sensory changes that occur during storage can affect safety, efficacy, and customer acceptance of the product [7], [8], [9]. Consequently, it is necessary to consider not only visual aspects but also physical stability, pH suitability, homogeneity, uniformity, and the ability to preserve their properties during storage and use while evaluating the quality of cosmetics [10], [11], [12]

Creams are one of the most prevalent semisolid dosage forms in skincare products because of their easy application and spreading on the skin, as well as their use as carriers of moisturisers, emollients, antioxidants, or other cosmetic active ingredients [13], [14]. In general creams are emulsion systems with oil and aqueous phases. Emulsifying ingredients are used to create a relatively stable dispersion [15], [16].However, emulsions are naturally susceptible to physical instabilities, such as creaming, flocculation, coalescence, variations in viscosity, changes in globule size, discolouration, odour alterations, and phase separation [17], [18]. The phenomenon of instability can decrease the aesthetic value of the product, alter the uniform distribution of the chemicals in the formulation and affect comfort during application to the skin [18], [19].

Night cream is a facial skincare product applied as part of an evening skincare routine. It is frequently developed to have moisturising effects, improve skin appearance, and support skin comfort during the resting period [13], [14]. Night creams are applied to the face and therefore should have stable physical qualities and be compatible with the attributes of the facial skin. Under physiological conditions, the pH of the skin's surface is slightly acidic, which plays a significant role in barrier function, microbial balance, and stratum corneum homeostasis [20], [21]. Therefore, the pH of topical treatments is an important quality criterion since an incorrect pH may potentially induce discomfort, irritation or disruption of the skin barrier [22], [23].

In addition to the pH, the physical stability of creams should be evaluated through its organoleptic qualities, uniformity, emulsion type, and resilience to temperature fluctuations [24], [25]. Organoleptic evaluations were performed to detect changes in colour, odour, appearance, texture, and phase separation. Homogeneity testing gives information on the regularity of dispersion and the presence or absence of coarse particles in the cream base [26], [27]. The determination of the emulsion type is particularly crucial as oil-in-water and water-in-oil systems differ in their sensory qualities, ease of removal, greasiness and consumer acceptability [28], [29]. In the meantime, accelerated stability experiments such as freeze-thaw cycling are employed to subject emulsion systems to repetitive thermal stress, which permits the observation of possible instability such as change of consistency, crystallisation, or phase separation in a shorter time span [30]

In studies on cosmetic formulations and topical preparations, physical evaluations such as pH, organoleptic observation, homogeneity, viscosity, spreadability, emulsion type, centrifugation and freeze–thaw testing are routinely used as preliminary indicators of cream stability [26], [27], [31]. The microstructure, stability and sensory properties of the final product in emulsion-based creams can be affected by the emulsifier system, the content of the oil and aqueous phases, the mixing method and processing conditions [29]. It has also been observed in other research that creams that are able to preserve pH, homogeneity, colour, odour, viscosity, and phase integrity after freeze-thaw treatment can be classified as more physically stable as compared to formulations that display marked changes under similar conditions [26], [32], [33].

In aesthetic practice, night creams are not only highly advertised commercial items but may also be administered by beauty clinics as part of a skincare treatment programme. The constitution, excipients,

production method, packaging system and storage guidelines may vary from one clinic to another [34], [35]. Such fluctuations can influence the physical stability of the preparation, particularly when the product is stored under variable temperature conditions or consumed over a long period. In tropical areas such as Indonesia, especially in Pekanbaru, ambient temperature and humidity are external elements that are relevant to the stability of semisolid preparations. Thus, the evaluation of the physical stability of creams used by the population is of practical importance for the quality control of cosmetics [7], [36], [37].

Previous studies on cosmetic cream stability have commonly focused on the development and optimisation of experimental formulations, including the selection of emulsifier systems, oil-phase composition, active ingredients, and processing conditions [28], [38], [39]. These studies have demonstrated that inappropriate emulsion composition, changes in globule structure, reduced viscosity, pH variation, and thermal stress may compromise the physical stability of emulsion-based creams [28], [38], [39]. Such instability may manifest as discolouration, odour alteration, changes in consistency, creaming, or phase separation, which may reduce product quality and consumer acceptability [40]. However, findings obtained from investigator-prepared formulations may not fully represent the variability among finished night cream products dispensed by different beauty clinics. Clinic-dispensed products may differ in their formulation bases, excipients, preparation procedures, packaging systems, and storage recommendations, all of which may influence their physical stability [34], [35].

The specific contribution of the present study is the comparative physical quality assessment of five finished night cream products obtained from different beauty clinics using a uniform laboratory protocol. Unlike studies that evaluate a single experimental formulation, the present study subjected all samples to identical freeze–thaw conditions and assessed them using the same physical parameters, namely organoleptic characteristics, pH, emulsion type, homogeneity, and visible phase separation. Freeze–thaw testing combined with multiparameter physical evaluation is an established approach for detecting early instability in emulsion-based cosmetic and topical preparations [7], [25], [30], [31].The scientific contribution of this study therefore lies in applying a consistent comparative testing approach to finished clinic-dispensed night creams that are already used in routine skincare services. This approach enables the identification of differences among products and potential inconsistencies among individual stability indicators.

Accordingly, this study aimed to compare the physical stability profiles of night cream preparations obtained from five beauty clinics in Pekanbaru. The evaluation included organoleptic observation, pH measurement, emulsion type determination, homogeneity testing, and freeze–thaw stability testing. The findings are expected to provide preliminary evidence of variation in the physical quality of clinic-dispensed night creams and to support more consistent quality-control practices for semisolid cosmetic preparations. This study was limited to preliminary physical quality assessment and was not designed to determine chemical stability, microbiological safety, regulatory compliance, or product shelf life.

2 Method

2.1 Design of Study

This study was conducted as a descriptive laboratory based study to evaluate the physical stability of night cream preparations collected from certain beauty clinics in Pekanbaru, Indonesia. The evaluation was done for some physical quality parameters such as organoleptic qualities, pH, type of emulsion, homogeneity and freeze-thaw stability. The research was conducted in June-August 2020 in the Pharmaceutical Technology Laboratory and Research Laboratory, Sekolah Tinggi Ilmu Farmasi Riau, Pekanbaru, Indonesia.

2.2 Materials

The samples in this investigation were night cream concoctions from five beauty clinics in Pekanbaru. The samples were coded from cream A to E to protect the anonymity of the clinics. Distilled water and methylene blue solution were used as supporting materials in the evaluation.The instruments utilized in this investigation are glassware, stirring rods, spatulas, vials, watch glasses, object glasses,

analytical balance, ph meter, refrigerator, incubator. pH determination was done using pH meter and freeze–thaw stability test was carried out using refrigerator and incubator.

2.3 Collection of Samples

Five night cream products were obtained from five different beauty clinics in Pekanbaru, Indonesia. One product was collected from each clinic as part of a preliminary comparative assessment of clinic-dispensed night creams from different sources. The clinics were selected purposively based on their public accessibility and recognition within the local community. No randomization procedure was used. The samples were coded as Creams A to E to maintain clinic confidentiality. Therefore, the selected samples should not be considered statistically representative of all night cream products dispensed in Pekanbaru.

After procurement, the samples were retained in closed containers until laboratory evaluation. However, the exact transportation conditions, post-procurement storage temperature, protection from environmental exposure, and interval between procurement and initial laboratory testing were not systematically documented. Information regarding the formulation date and storage conditions of the products at the clinics before procurement was also unavailable. Consequently, exposure to uncontrolled environmental conditions and pre-existing physical degradation before the initial laboratory assessment could not be completely excluded. This limitation was considered when interpreting changes observed during the freeze–thaw stability test.

2.4 Organoleptic Assessment

Organoleptic evaluation was performed by observing the color, odor, appearance, consistency, and visible phase separation of each cream sample before and after freeze–thaw treatment. This evaluation was used as an initial indicator of physical changes in semisolid cosmetic preparations during storage stress [26], [41]. Consistency was assessed qualitatively without viscometric, rheological, or spreadability measurements. Visible phase separation was assessed based on the presence or absence of visually distinguishable oil and aqueous phases.

2.5 Measurement of pH

The pH of each cream sample was measured using a calibrated pH meter. A total of 0.1 g of cream was dispersed in 10 mL of distilled water, and the pH electrode was immersed in the dispersion until a stable reading was obtained [22], [41]. The measurement was performed in triplicate for each sample at each freeze-thaw cycle, and the results were expressed as mean ± standard deviation (n = 3).

2.6 Macroscopic Homogeneity Assessment

Macroscopic homogeneity was assessed by placing a small amount of each cream sample on a clean, dry glass slide and spreading it into a thin layer. The samples were visually examined for uniformity, visible agglomerates, coarse particles, grittiness, and localized phase separation [41], [42], [43]. A sample was classified as macroscopically homogeneous when it exhibited a uniform appearance without visually detectable coarse particles, agglomerates, or grittiness. This procedure was limited to macroscopic visual assessment. Optical microscopy, globule-size measurement, and globule-size distribution analysis were not performed. Therefore, this test could not identify early microstructural changes such as droplet aggregation, flocculation, coalescence, or progressive globule enlargement.

2.7 Determining the type of emulsion

The emulsion type was determined using the dye-solubility method with methylene blue. Approximately 100 mg of each cream sample was mixed with one drop of methylene blue solution. Uniform distribution of the water-soluble dye throughout the cream indicated an oil-in-water emulsion, whereas non-uniform distribution indicated a water-in-oil emulsion [27], [29]. This method was used only to identify the continuous phase and was not intended to determine globule size, globule-size distribution, or microstructural emulsion stability.

2.8 Freeze Thaw Stability Test

The freeze–thaw stability test was conducted to evaluate the resistance of the cream preparations to repeated temperature stress. Approximately 2 g of each cream sample was placed into a vial and stored at 4 ± 2°C for 48 hours, followed by storage at 40 ± 2°C for 48 hours. This sequence was considered

one cycle and was repeated for four cycles. After each cycle, the samples were evaluated for organoleptic changes, pH, emulsion type, homogeneity, and phase separation [41], [44]

2.9 Data Analytics

Data were analysed descriptively because only one night cream product was obtained from each clinic. The pH measurements were performed in triplicate and presented as mean ± standard deviation (n = 3), together with the direction and magnitude of change across the freeze-thaw cycles. Organoleptic characteristics, emulsion type, homogeneity, and phase separation were reported as categorical observations. Inferential statistical comparisons among the products were not performed because the triplicate measurements represented repeated analytical measurements of the same product sample rather than independent product or batch replicates.

3 Result and Discussion

3.1 Organoleptic and pH

The organoleptic examination showed that the appearance, odor, and semisolid consistency of the creams B, C, and D did not change after four freeze–thaw cycles, but the creams A and E showed visible alterations at cycle IV. As indicated in Table 1, Cream A changed from yellow to dark brown and showed a subjectively perceived change in consistency, whereas Cream E retained its initial colour and odour but also showed a subjectively perceived consistency change. These observations were qualitative and were not confirmed through viscosity, rheological, or spreadability measurements. Therefore, the findings should be interpreted as preliminary organoleptic observations rather than quantitative evidence of changes in the physical consistency of the creams.

Table 1 Organoleptic characteristics of night cream samples before and after freeze–thaw stability

Sample	Initial condition	Condition after cycle IV	Observed change
A	Yellow, odorless, semisolid	Dark brown, odorless, subjectively perceived consistency change	Color and organoleptically observed consistency change
B	Yellow, characteristic odor, semisolid	Yellow, characteristic odor, semisolid	No change
C	Pale yellow, characteristic odor, semisolid	Pale yellow, characteristic odor, semisolid	No change
D	Pale yellow, characteristic odor, semisolid	Pale yellow, characteristic odor, semisolid	No change
E	Brownish yellow, characteristic odor, semisolid	Brownish yellow, characteristic odor, subjectively perceived consistency change	Consistency changed

Note: Consistency was assessed qualitatively through organoleptic observation and was not confirmed using instrumental measurements

After four freeze-thaw cycles, Cream A changed from yellow to dark brown and showed a subjectively perceived consistency change, whereas Cream E retained its initial colour and odour but also showed a subjectively perceived consistency change. These sample-specific patterns may indicate different instability pathways. The discolouration observed exclusively in Cream A could be associated with oxidation of lipid-soluble ingredients, degradation of temperature-sensitive active ingredients or colour-related compounds, or interactions among formulation components promoted by repeated thermal exposure [33], [45], [48], [49]. Oxidation may be particularly relevant when a formulation contains unsaturated lipids, botanical ingredients, fragrances, or other oxidation-sensitive materials. However, the

chemical composition and oxidative status of Cream A were not evaluated; therefore, oxidation cannot be established as the definitive cause of the colour change.

The subjectively perceived consistency changes observed in Creams A and E may be associated with partial water loss during the high-temperature phase, crystallisation or polymorphic rearrangement of lipid components, or temperature-induced reorganisation of the emulsifier and interfacial structure [36], [37], [38], [47], [50]. Changes in waxes, fatty alcohols, emulsifiers, or other consistency-modifying excipients may alter the internal cream network without causing visible phase separation. Differences in the oil-to-water ratio, emulsifier composition, thickening agents, and processing history may therefore explain why Creams A and E responded differently from Creams B, C, and D.

The use of organoleptic assessment as an initial indicator of formulation stability is consistent with previous studies on topical and cosmetic preparations [51], [52]. Firmansyah et al. evaluated the physical stability of a hand-sanitiser gel formulation using organoleptic characteristics, pH, homogeneity, and freeze-thaw testing [41]. In another study, Firmansyah et al. assessed a facial serum formulation using organoleptic observation, homogeneity, pH, spreadability, freeze-thaw testing, and antibacterial activity [53]. Similar approaches have been reported in cosmetic cream studies, in which organoleptic characteristics were evaluated together with pH, homogeneity, emulsion type, viscosity, centrifugation, and freeze-thaw testing to obtain a more comprehensive assessment of physical stability [32], [33], [45], [48], [54]. These studies support the use of visible colour and consistency changes as relevant preliminary indicators, although organoleptic findings alone cannot identify the specific physicochemical mechanism responsible for instability.

Despite these organoleptic alterations, Creams A and E remained macroscopically homogeneous, retained their oil-in-water emulsion type, and showed no visible phase separation. This finding suggests that the observed changes did not represent complete macroscopic emulsion breakdown but may reflect more subtle rheological, interfacial, or microstructural alterations that could not be detected through visual examination alone [36], [37], [38]. Consequently, the changes observed in Creams A and E should not be regarded merely as minor cosmetic differences but as preliminary indicators of reduced stability under accelerated thermal stress. Nevertheless, they should not be interpreted as definitive evidence of a specific degradation mechanism.

Although no odour changes were detected in any sample, the discolouration of Cream A and the subjectively perceived consistency changes in Creams A and E demonstrate the value of organoleptic examination as a preliminary screening tool for night-cream stability. Creams B, C, and D showed comparatively better organoleptic stability because they retained their initial colour, odour, and consistency throughout the four freeze-thaw cycles. Further evaluation of viscosity and rheological behaviour, water content, droplet-size distribution, microscopic structure, lipid crystallisation, and relevant oxidative markers would be required to determine the mechanisms underlying the changes in Creams A and E.

Table 2 pH values of night cream samples during freeze–thaw stability testing

Cycle	Cream A	Cream B	Cream C	Cream D	Cream E
0	5.95 ± 0.02	6.32 ± 0.02	6.35 ± 0.02	6.13 ± 0.02	5.66 ± 0.01
I	5.93 ± 0.02	6.35 ± 0.03	5.95 ± 0.05	5.96 ± 0.04	5.76 ± 0.02
II	5.94 ± 0.01	6.64 ± 0.03	6.06 ± 0.04	6.31 ± 0.01	5.76 ± 0.02
III	6.55 ± 0.02	6.53 ± 0.02	6.34 ± 0.03	6.37 ± 0.01	5.76 ± 0.01
IV	6.22 ± 0.02	6.64 ± 0.03	6.12 ± 0.02	6.41 ± 0.02	5.55 ± 0.03

Note: Values are presented as mean ± standard deviation.

The pH values of the night cream samples during the freeze-thaw stability test are shown in Table 2. The pH levels of all samples remained between 5.55 and 6.64 during the four freeze-thaw cycles. Cream E had the lowest pH values, ranging from 5.55 ± 0.03 to 5.76 ± 0.02, while Cream B had the highest, ranging from 6.32 ± 0.02 to 6.64 ± 0.03. Cream A substantially increased to 6.55 ± 0.02 at

cycle III and reduced to 6.22 ± 0.02 in cycle IV. Creams C and D also showed sample-dependent variations in their measured dispersion pH values.

The pH of topical and cosmetic preparations is an important quality parameter because it is closely related to skin compatibility, barrier function, and user comfort [17], [18], [19]. The skin surface is generally acidic, and this acidic environment contributes to the maintenance of resident microflora and stratum corneum homeostasis. Products with unsuitable pH may disturb the skin barrier and increase the risk of discomfort or irritation, especially when applied repeatedly to facial skin [18], [19], [22], [23]. In this study, all night cream samples showed pH values within the range of 5.55-6.64, indicating that they remained within a mildly acidic to near-neutral range and did not exhibit any extreme pH shift after freeze–thaw treatment.

The sample-dependent pH fluctuations observed during the freeze–thaw cycles may be associated with temperature-induced changes in the aqueous phase, changes in the ionisation state of formulation components, or interactions among excipients. Similar evaluations have been used in cosmetic and topical semisolid studies, where pH measurement is commonly combined with organoleptic observation, homogeneity, viscosity, emulsion type, and freeze–thaw testing to assess physical stability [26], [27], [47], [54]. Firmansyah et al. also used pH evaluation as part of the physical characterization of gel hand sanitizer, hand sanitizer spray, and facial serum formulations, confirming that pH measurement is a routine and relevant parameter in the evaluation of topical and cosmetic preparations [41], [44], [53].

Although all measured dispersion pH values remained within the range of 5.55–6.64, the pH results alone were insufficient to demonstrate complete physical stability. Cream A remained within the mildly acidic to near-neutral range but showed color and consistency changes at cycle IV, while cream E showed a consistency change despite having the lowest pH values among the samples. This finding indicates that pH should be interpreted together with other physical parameters, including organoleptic characteristics, homogeneity, emulsion type, and phase separation. Therefore, the physical stability of night cream preparations should be assessed comprehensively rather than based only on pH values.

3.2 Emulsion Type, Macroscopic Homogeneity, and Visible Phase Separation

All night cream samples were identified as oil-in-water (O/W) emulsions based on the uniform distribution of methylene blue throughout the cream base. The maintenance of this result after four freeze–thaw cycles suggested that no detectable change in emulsion type occurred under the applied experimental conditions. However, the dye-solubility method identifies the continuous phase and does not provide information regarding globule size, globule-size distribution, or interfacial structure [27], [29], [32], [54].

Table 3 Emulsion type, macroscopic homogeneity, and visible phase separation of the night cream samples after freeze–thaw testing

Sample	Emulsion type	Macroscopic homogeneity	Visible phase separation
A	O/W	Homogeneous	Not observed
B	O/W	Homogeneous	Not observed
C	O/W	Homogeneous	Not observed
D	O/W	Homogeneous	Not observed
E	O/W	Homogeneous	Not observed

Note: O/W, oil-in-water emulsion. Macroscopically homogeneous indicates a uniform visual appearance without visible coarse particles, agglomerates, or grittiness. Not observed Indicates that no visible phase separation was detected. Microscopic emulsion structure and globule-size distribution were not evaluated.

All samples retained a uniform macroscopic appearance without visible coarse particles, agglomerates, grittiness, or localized phase separation after four freeze–thaw cycles. Macroscopic homogeneity is an important preliminary physical quality attribute because it indicates a uniform macroscopic appearance without visually detectable coarse particles or agglomerates [27], [29], [32],

[46], [48]. These findings suggest that gross phase integrity was maintained and that complete macroscopic emulsion breakdown was not observed under the applied experimental conditions. Nevertheless, macroscopic homogeneity should not be interpreted as evidence of complete microstructural stability.

The absence of visible phase separation after four freeze–thaw cycles suggests that the emulsion systems maintained gross phase integrity under repeated temperature stress. Freeze–thaw testing is commonly used as an accelerated stability approach for emulsion-based topical and cosmetic preparations because repeated temperature changes may reveal physical changes, including crystallisation, altered consistency, disruption of the emulsion structure, and separation of the oil and aqueous phases [7], [31], [36], [50], [55]. Similar physical assessment parameters, including emulsion type, homogeneity, and freeze–thaw testing, have been applied in previous topical and cosmetic formulation studies, including studies of gel hand sanitisers, hand sanitiser sprays, facial serums, and cosmetic cream [41], [44], [53].

However, the absence of visible phase separation does not exclude early-stage instability within the dispersed phase. Droplet aggregation, flocculation, coalescence, or progressive globule enlargement may occur before macroscopic phase separation becomes apparent [25], [36], [38], [61]. Because optical microscopy and quantitative globule-size analysis were not performed, the present study could not determine whether changes in globule morphology or globule-size distribution occurred during freeze–thaw exposure. Therefore, the findings indicate maintenance of gross phase integrity rather than definitive evidence of complete emulsion stability.

From a regulatory and practical perspective, these findings are relevant because the tested night creams were obtained from beauty clinics and had already been distributed or used as part of skincare services. Cosmetic products placed on the market should comply with applicable requirements concerning safety, quality, claimed benefits, labelling, notification, and permitted ingredients [56], [57], [58]. In addition, cosmetic quality is closely related to appropriate manufacturing, quality control, storage, and distribution practices, while stability evaluation is required to determine whether product characteristics are maintained during storage and use [5], [7], [59]. Therefore, products supplied through beauty clinic services are expected to maintain acceptable physical quality, including the intended emulsion type, macroscopic homogeneity, and resistance to visible phase separation [52], [60]. Comparable Indonesian studies on cosmetic and topical cream formulations have also evaluated marketed or experimentally developed semisolid products using basic physical quality parameters, including organoleptic properties, pH, homogeneity, emulsion type, and stability testing [45], [46], [48], [54]. However, the present physical screening did not assess regulatory compliance, chemical composition, ingredient conformity, microbiological safety, or product shelf life.

Creams A and E showed changes in colour and/or organoleptically perceived consistency at cycle IV despite retaining their oil-in-water emulsion type, macroscopic homogeneity, and absence of visible phase separation. These findings indicate that the evaluated indicators of physical stability did not necessarily change concurrently. They also suggest that observable changes in some physical attributes may occur before complete macroscopic emulsion breakdown becomes apparent [36], [38], [61]. Based on the parameters evaluated, Creams B, C, and D showed better preliminary macroscopic physical stability than Creams A and E under the applied freeze–thaw conditions because they retained their initial organoleptic characteristics. However, this comparison was not supported by quantitative rheological measurements, microscopic imaging, globule-size distribution analysis, water-content determination, or microbiological testing. Therefore, the findings should be interpreted only within the scope of the preliminary physical screening methods used in this study.

3.3 Study Limitations

This study has several limitations that should be considered when interpreting the findings. First, the transportation conditions, post-procurement storage temperature, exact procurement-to-testing interval, and storage history of the products at the clinics were not systematically documented. Therefore, changes caused by uncontrolled environmental exposure or pre-existing degradation before laboratory testing could not be completely excluded. Second, changes in cream consistency were assessed organoleptically and were not confirmed by viscosity or rheological measurements. Therefore, the

observed changes could not be quantitatively interpreted in terms of viscosity, firmness, flow behaviour, or structural strength. Third, homogeneity and phase integrity were evaluated only through macroscopic visual observation. Optical microscopy, globule-size measurement, and globule-size distribution analysis were not performed. Consequently, subtle microstructural instability, including droplet aggregation, flocculation, coalescence, or progressive enlargement of the dispersed globules, could not be detected or excluded, even in samples without visible phase separation. The absence of visible phase separation should therefore be interpreted as maintenance of gross phase integrity rather than as proof of complete emulsion stability.

Fourth, water content was not measured before and after freeze–thaw exposure. Consequently, the possible contribution of water loss to the observed consistency changes remains hypothetical and could not be distinguished from lipid crystallisation, emulsifier restructuring, or other formulation-related mechanisms. Finally, microbiological quality and preservative effectiveness were not evaluated. Thus, the findings do not provide evidence regarding microbial contamination, preservative-system performance, or the microbiological safety of the clinic-dispensed products. Overall, the results should be interpreted as a preliminary assessment of macroscopic physical stability under the applied freeze–thaw conditions rather than as a comprehensive demonstration of physicochemical stability, microbiological safety, regulatory compliance, or product shelf life. Future studies should use standardised sample-handling procedures, document procurement and testing timelines, and include rheological measurements, optical microscopy with representative images, quantitative globule-size distribution analysis, water-content determination, and microbiological evaluation.

4 Conclusion

The five clinic-dispensed night cream samples showed different preliminary macroscopic physical stability profiles after four freeze–thaw cycles. Creams B, C, and D retained their initial organoleptic characteristics, whereas Cream A showed a colour change and Creams A and E showed subjectively perceived consistency changes. The measured dispersion pH values ranged from 5.55 to 6.64. At the end of freeze–thaw testing, all samples were identified as O/W emulsions, appeared macroscopically homogeneous, and showed no visible phase separation. These findings indicate that complete macroscopic emulsion breakdown was not observed under the applied conditions. However, they do not establish complete emulsion stability because rheological behaviour, microscopic structure, globule size, and globule-size distribution were not evaluated. Further studies should include rheological measurements, optical microscopy, quantitative globule-size distribution analysis, water-content determination, and microbiological evaluation

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