

Variation of HPMC gelling agent concentrations in ethanol extract based setting spray of Goji Berry (*Lycium barbarum L.*) as a Moisturizer

Devina Chandra^{1*}, Monica Suryani², Yettie Simarmata³, Muhammad Irianto Napitupulu⁴,
Erwina Siburian⁵

^{1,2,4,5}Bachelor of Pharmacy Study Program, Faculty of Pharmacy and Health Sciences, Sari Mutiara
Indonesia University

³Bachelor of Pharmacy Study Program, Faculty of Pharmacy, Tjut Nyak Dhien University

Corresponding Author: Devina Chandra, e-mail: devinazchandra94@gmail.com

Published: January , 2026

ABSTRACT

The natural properties of the skin, which are constantly exposed to Ultraviolet (UV) rays and free radicals, can lead to various skin problems such as rashes, spots, and dryness. Natural antioxidants can provide moisturizing and brightening effects on the skin. One type of plant that contains natural antioxidants is goji berry (*Lycium barbarum L.*), which will be formulated into a gel-based setting spray with variations in the concentration of the HPMC gelling agent used as a moisturizer. This study aims to determine the effective concentration variations of the HPMC gelling agent that can be formulated into a gel setting spray preparation. This research used an experimental method consisting of sample collection, plant identification, sample processing, extract preparation, characterization tests, phytochemical screening, and formulation of the gel setting spray with variations of gelling agent concentrations of 0.1%, 0.2%, 0.3%, 0.4%, and 0.5%. The formulated products were then evaluated for quality, and moisturizing effectiveness. The results showed that the gel setting spray preparations were dark brown in color, had a characteristic fragrance, were homogeneous, and had a spreadability of 6.8533 to 5.6400 cm, viscosity ranging from 35,000 to 95,000 cPs, and pH values between 5.6500 and 3.7233. Moisture effectiveness on the skin increased over 4 weeks, ranging from 37.2% to 55.6%. In conclusion, variations in the concentration of HPMC gelling agent can be successfully formulated into a gel setting spray, and goji berry (*Lycium barbarum L.*) extract can be used as a moisturizer that meets the required physicochemical quality standards for a good gel setting spray preparation.

Keywords: Ultraviolet (UV), goji berry, gelling agent, HPMC, gel setting spray

© The Author(s). 2021 Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0>

INTRODUCTION

The skin is not merely the outermost organ covering the human body it is a complex structure composed of various specialized cells. Continuous exposure to ultraviolet (UV) radiation and free radicals can trigger multiple skin problems such as rashes, spots, lesions, eczema, and dryness (Potterat, 2010). Healthy and normal skin contains more than 10% water in its outer layer (Van & Dieullangard, 1986). When the skin's fluid balance is disrupted, sebum production decreases, and impairment of the epidermal layer results in increased evaporation of water into the atmosphere, thereby elevating Trans-Epidermal Water Loss (TEWL) and causing dryness due to reduced moisture in the stratum corneum (Hidayat, 1995).

Natural antioxidants help moisturize and brighten the skin, keeping it hydrated and radiant (Farnworth, 1996). They also contribute to skin care and enhance the skin's protective mechanisms (Witaatmadja, 1997). Antioxidants are categorized into synthetic and natural types. Synthetic

antioxidants such as Butylated Hydroxyanisole (BHA) and Butylated Hydroxytoluene (BHT) are widely used in cosmetic formulations but may pose health risks (Suardi et al., 2008). For this reason, the development of new cosmetic formulations using natural antioxidant ingredients is essential. One plant known for its natural antioxidant content is goji berry (*Lycium barbarum* L.) (Kulczynski & Michatowska, 2016). Goji berry contains a high level of bioactive compounds with strong antioxidant potential and has been used in traditional Chinese medicine for more than 1,000 years. According to Albrian (2013), goji berry contains flavonoids as antioxidant components. Rawlins (2003) reported that a 2.5% ethanol extract of goji berry demonstrated optimal activity in alleviating dry skin, increasing moisture by 33.21%. Reported that the antioxidant activity of *Lycium barbarum* extract showed an IC_{50} value of 30.4531 $\mu\text{g/mL}$ using the DPPH method. An IC_{50} value below 50 $\mu\text{g/mL}$ indicates a very strong antioxidant category. Thus, the lower the IC_{50} value, the stronger the antioxidant activity (Fidrianny et al., 2014).

Moisturizing cosmetics function to hydrate the skin primarily by reducing water evaporation. In recent years, practical cosmetic products, especially among adolescents, have become highly popular one of which is gel-based setting spray. This dosage form offers advantages over other cosmetics, including lower microbial contamination, longer contact time on the skin, and greater ease of use (Puspita et al., 2020). A spray gel typically contains 10–90% aqueous phase and is applied in fine droplets onto the face. Topical spray formulations have gained increasing popularity in medical and cosmetic applications due to their short application time and homogeneous distribution. Additionally, spray gels feel cooling, moisturizing, and absorb well into the skin (Ansel, 1989). The gelling agent plays a crucial role in spray gel formulation, with Hydroxypropyl Methylcellulose (HPMC) being one of the most widely used. HPMC is recognized as a non-toxic and non-irritating material, although excessive oral intake may produce a laxative effect (Harwood, 2006). Its advantages include clarity of the resulting gel, stable viscosity, solubility in both organic and inorganic solvents, and stability at pH 3–11. Concentrations below 1% produce gels that are too fluid; thus, concentrations above 1% are preferred (Suardi et al., 2008). Based on this background, this study aims to design and formulate variations of HPMC gelling agent concentrations F1: 0.1%, F2: 0.2%, F3: 0.3%, F4: 0.4%, and F5: 0.5% in a gel-based setting spray containing ethanol extract of goji berry (*Lycium barbarum* L.), followed by physicochemical quality evaluation of the cosmetic formulation.

METHOD

Study participants

Twenty adult volunteers with dry skin from Universitas Sari Mutiara Indonesia participated in this study. They were recruited using purposive sampling and provided informed consent to take part in the skin tests. Moisturizing efficacy was assessed by applying the gel on a 2×2 cm area of the forearm once daily for four weeks. Skin hydration levels were measured using a skin moisture analyzer, and participants were instructed to avoid other topical products during the study period.

Study organization

The study was conducted at the Formulation Technology Laboratory, Faculty of Pharmacy, Universitas Sari Mutiara Indonesia, from June to August 2025. Dried goji berries (*Lycium barbarum* L.) were obtained from a local herbal store, processed into powder, and characterized by physicochemical analyses, including moisture content, total ash, and water- and ethanol-soluble extractive values. Phytochemical screening was performed to detect alkaloids, flavonoids, saponins, tannins, and steroids/terpenoids. The ethanol extract was formulated into a setting spray gel using HPMC as a gelling agent, propylene glycol as a humectant, and DMDM Hydantoin as a preservative. The gel underwent evaluations for organoleptic properties, homogeneity, viscosity, spreading ability, pH, and moisturizer effectiveness test.

Statistical analysis

All experimental measurements were conducted in triplicate and reported as mean $\pm$ standard deviation (SD). Differences between formulations were analyzed using one-way ANOVA. Linear regression was employed to examine the relationship between HPMC concentration, physicochemical properties, and changes in skin hydration, providing a quantitative assessment of the gel's moisturizing effectiveness.

FINDING AND DISCUSSION

Characterization results of Goji Berry

The characterization test results of Goji Berry (*Lycium barbarum* L.) powder can be seen in table 1.

Table 1. Characterization result of Goji Berry (*Lycium barbarum* L.) powder

Characterization	Test Results (%)	FHI (2017) (%)
Moisture content	4.44	≤ 21
Water-soluble extract	42.9	≥ 32.2
Ethanol-soluble extract	22.4	≥ 20.5
Total ash	8.35	≤ 13.3
Acid-insoluble ash	1.0	≤ 1.1

Note:

$\geq$: Greater than or equal to

$\leq$: Less than or equal to

The characterization results of Goji Berry (*Lycium barbarum* L.) powder are presented in table 1. The moisture content was 4.44%, water-soluble extract 42.9%, ethanol-soluble extract 22.4%, total ash 8.35%, and acid-insoluble ash 1.0%. All parameters met the limits set by the 2nd edition of the Indonesian Herbal Pharmacopoeia (FHI), used as a reference since Goji Berry is not yet listed in the FHI (Dirjen POM, 1995). The low moisture content ($<21\%$) minimizes the risk of microbial growth and enzymatic reactions, while the water- and ethanol-soluble extract values within the standard indicate good extractability of bioactive compounds (Dirjen POM, 1995). The total ash and acid-insoluble ash values are within FHI limits, reflecting adequate mineral content and potential silica presence in the herbal material. Therefore, this Goji Berry powder meets the physicochemical quality requirements for use as a raw material in the formulation of a setting spray gel (Dirjen POM, 1995).

Phytochemical Screening Results of Goji Berry Extract

The herbal material contains various secondary metabolites, which can be verified through phytochemical screening. The results of the secondary metabolites present in goji berry fruit are presented in table 2.

Table 2. Phytochemical Screening Result Of Goji Berry Extract

Compound Class	Reagent	Result	Color
Alkaloid	Mayer	-	White or yellow precipitate
	Wagner	+	Brown precipitate
	Dragendorff	+	Orange precipitate
Flavonoid	Mg(s) + HCl (p)	+	Red or orange
Saponin	Distilled water + 96% ethanol	+	Frothing
Tannin	FeCl ₃ 1%	+	Dark green
Steroid/Terpenoid	Concentrated H ₂ SO ₄	+	Red-orange or purple and bluish-green

Note:

(+) Positive: contains the tested class of compounds

(-) Negative: does not contain the tested class of compounds

Based on table 2, the ethanol extract of goji berry (*Lycium barbarum* L.) tested positive for several secondary metabolites. Alkaloids were confirmed by the formation of a brown precipitate with Wagner reagent and an orange precipitate with Dragendorff reagent, while no yellow or white precipitate was observed with Mayer's reagent. The presence of alkaloids is attributed to solanine, a secondary metabolite commonly found in Solanaceae plants, which exhibits fungicidal and pesticidal activities and serves as a defense mechanism against herbivores (Kulczynski & Gramza, 2016). Flavonoids were detected, indicated by the orange coloration of the extract after treatment with Mg, concentrated HCl, and amyl alcohol. This reaction reduces the benzopyran nucleus in flavonoid structures, producing a red or orange color. Positive flavonoid presence is associated with glabridin, an isoflavane with antioxidant activity capable of scavenging free radicals and deactivating polyvalent cations (Kulczynski & Gramza, 2016).

Saponins were also confirmed, as evidenced by stable foam formation upon shaking, which remained after adding 2N HCl. This reflects the amphiphilic nature of saponins, whose hydrolysis into aglycones and sugars creates stable foaming due to surface activity; the addition of acid enhances polarity, stabilizing the foam. Tannins were positively identified by the dark green color developed with 1% FeCl₃, indicating complex formation between Fe³⁺ ions and gallotannins. Tannins are high-molecular-weight phenolic compounds with hydroxyl and carboxyl groups capable of forming strong complexes with proteins and macromolecules (Kulczynski & Gramza, 2016).

Steroids and triterpenoids were detected in both the extract and the plant material. Reaction with concentrated H₂SO₄ produced red-orange to purple rings for triterpenoids and bluish-green coloration for steroids, indicating the presence of liquiritin. Overall, the ethanol extract of goji berry exhibits a rich profile of bioactive secondary metabolites, supporting its potential pharmacological and nutraceutical applications.

Organoleptic Evaluation Result

The organoleptic evaluation of the goji berry (*Lycium barbarum* L.) extract setting spray gel, including color, odor/aroma, and texture, is presented in table 3.

Table 3. Organoleptic Evaluation Result

Test	F1	F2	F3	F4	F5
Form	Liquid	Liquid	Liquid	Slightly viscous	Slightly viscous
Color	Dark brown	Dark brown	Dark brown	Dark brown	Dark brown
Odor	Characteristic perfume	Characteristic perfume	Characteristic perfume	Characteristic perfume	Characteristic perfume

Notes:

F1: Setting spray gel preparation at 0.1% concentration

F2: Setting spray gel preparation at 0.2% concentration

F3: Setting spray gel preparation at 0.3% concentration

F4: Setting spray gel preparation at 0.4% concentration

F5: Setting spray gel preparation at 0.5% concentration

Based on Table 3, the goji berry (*Lycium barbarum* L.) ethanol extract setting spray gel formulation F1, containing 0.1% gelling agent, exhibited a more liquid consistency, whereas F5 with 0.5% gelling agent appeared slightly viscous. This is due to the increased concentration of HPMC gelling agent, which enhances the gel's viscosity. No differences in color were observed among the formulations; all samples, including F1 and F5, displayed a dark brown hue, reflecting the constant addition of 2.5% goji berry ethanol extract in each formula. The extract's natural odor is not particularly appealing, so perfume was incorporated to mask it and provide a refreshing scent, as commonly applied in cosmetic products (Nasution, 2020). Overall, increasing the gelling agent concentration significantly influences the organoleptic properties of the setting spray gel.

Homogeneity Test Results

The homogeneity test results of the goji berry (*Lycium barbarum* L.) extract setting spray gel formulation, including its uniformity, are presented in table 4.

Table 4. Homogeneity Test Result

F1	F2	F3	F4	F5
Homogen	Homogen	Homogen	Homogen	Homogen

Notes:

F1: Setting spray gel preparation at 0.1% concentration

F2: Setting spray gel preparation at 0.2% concentration

F3: Setting spray gel preparation at 0.3% concentration

F4: Setting spray gel preparation at 0.4% concentration

F5: Setting spray gel preparation at 0.5% concentration

Based on table 4, visual observation of the setting spray gel preparation revealed a uniform color with no visible particles. The homogeneity of the preparation reflects the even distribution of both the active compounds and excipients throughout the gel matrix. Such a homogeneous dispersion ensures that the active ingredient is delivered in consistent amounts across multiple sprays (Cendana et al., 2021). Furthermore, a well-prepared topical formulation must be homogeneous to minimize the risk of skin irritation (Angelia, 2022). Therefore, the homogeneity test confirms that the Goji Berry setting spray gel preparation can be considered homogeneous.

Spreadability Test Results

The results of the spreadability test of the Goji Berry (*Lycium barbarum* L.) setting spray gel preparation, including its spreadability, can be seen in table 5.

Table 5. Spreadabilty Test Result

Formulation	Spreadability Test Result			Average
	I	II	III	
F1	6.82	6.85	6.89	6.8533
F2	6.62	6.64	6.67	6.6433
F3	6.51	6.53	6.54	6.5267
F4	5.70	5.71	5.73	5.7133
F5	5.62	5.64	5.66	5.6400

Notes:

F1: Setting spray gel preparation at 0.1% concentration

F2: Setting spray gel preparation at 0.2% concentration

F3: Setting spray gel preparation at 0.3% concentration

F4: Setting spray gel preparation at 0.4% concentration

F5: Setting spray gel preparation at 0.5% concentration

Based on table 5, the spreadability test showed that formulation F1, containing 0.1% HPMC as a gelling agent, had the highest spreadability, reaching a diameter of 6.89 cm under applied load. This is because lower gelling agent concentrations result in a gel that flows and spreads more easily, increasing the contact area of the active ingredient with the skin. In contrast, F5, containing 0.5% HPMC, exhibited the lowest spreadability at 5.62 cm, as higher gelling agent concentrations increase resistance to flow and reduce spreading. All formulations showed spread diameters within the SNI No. 06-2588 standard (5–7 cm), which is considered optimal for topical preparations (Sugihartini, 2015). Statistical analysis using one-way ANOVA demonstrated a significant effect of HPMC concentration on spreadability ($p < 0.05$), confirming that varying gelling agent levels significantly influences the flow properties of the setting spray gel. Similarly, HPMC concentration significantly affected the viscosity of the gel, with higher concentrations increasing gel thickness, as also confirmed by one-way ANOVA ($p < 0.05$). These results indicate that careful adjustment of HPMC levels allows precise control of both spreadability and viscosity in setting spray gel formulations.

Viscosity Test Results

The results of the viscosity test of the goji berry (*Lycium barbarum* L.) extract setting spray gel, including pH, can be seen in table 6.

Table 6. Viscosity Test Result

Formulation	Spreadability Test Result			Average
	I	II	III	
F1	35	35	35	35.0000
F2	50	50	50	50.0000
F3	65	65	65	65.0000
F4	80	80	80	80.0000
F5	95	95	95	95.0000

Notes:

F1: Setting spray gel preparation at 0.1% concentration

F2: Setting spray gel preparation at 0.2% concentration

F3: Setting spray gel preparation at 0.3% concentration

F4: Setting spray gel preparation at 0.4% concentration
 F5: Setting spray gel preparation at 0.5% concentration

Based on table 6, the viscosity test conducted using a Brookfield viscometer NDJ-8S with spindle No. 1 at 60 RPM showed that Formula 1, containing 0.1% of the gelling agent (HPMC), had the lowest viscosity value of 35 cps. This occurs because a lower concentration of HPMC produces a more fluid preparation, resulting in a lower viscosity. Meanwhile, Formula 5 with a gelling agent concentration of 0.5% exhibited the highest viscosity value of 95 cps, as a higher concentration of HPMC increases the viscosity of the gel. The viscosity values of all five formulas ranged from 35–95 cps, and all formulas met the viscosity requirement for spray gels, which should be low, within the range of 25–250 cps (Fitriansyah et al., 2016). The use of varying concentrations of HPMC in formulas FI, FII, FIII, FIV, and FV significantly affected the viscosity of the preparation. Statistical analysis using a one-way ANOVA test with a significance level of $0.000 < 0.05$ indicated a meaningful difference among all formulas. This confirms that variations in HPMC concentration lead to differences in the viscosity of the setting spray gel.

pH Test Results

The pH test results of the goji-berry (*Lycium barbarum* L.) extract setting spray gel formulation can be seen in table 7.

Table 7. pH Test Result

Formulation	Spreadability Test Result			Average
	I	II	III	
F1	5.65	5.65	5.65	5,6500
F2	5.77	5.77	5.77	3,2400
F3	5.84	5.84	5.84	4,0033
F4	5.88	5.88	5.88	3,7533
F5	5.92	5.92	5.92	3,7233

Notes:

F1: Setting spray gel preparation at 0.1% concentration
 F2: Setting spray gel preparation at 0.2% concentration
 F3: Setting spray gel preparation at 0.3% concentration
 F4: Setting spray gel preparation at 0.4% concentration
 F5: Setting spray gel preparation at 0.5% concentration

Based on table 7, the pH test results show that Formula 1, containing 0.1% gelling agent, has the lowest pH value of 5.65, while Formula 5 with 0.5% gelling agent has the highest pH value of 5.93. The variation in pH across all five formulas is influenced by the different concentrations of HPMC used in each formulation. Despite these differences, all formulas remain within the acceptable pH range specified by SNI 16-4399-1996 for topical preparations (4.5–8.0) and are compatible with the natural skin pH (4.5–7.5). The use of varying HPMC concentrations in F1–F5 significantly affected the pH of the formulations. Statistical analysis using one-way ANOVA showed a significance value of $0.000 < 0.05$, indicating meaningful differences between formulas. This confirms that HPMC concentration variation directly influences the pH of the setting spray gel.

Moisturizing Effectiveness Test Results

The results of the moisturizing effectiveness test of the preparation can be seen in Table 8.

Table 8. Moisturizing Effectiveness Test

Formulation	Volunteer	Initial Condition	Treatment Time (Weeks)				Moisture Increase (%)
			1	2	3	4	
F1	1	39	37	46	51	55	47,27
	2	25	30	34	47	51	50,98
	3	28	34	39	45	52	46,15
	Average	28	33,3	38,3	46,6	52	48,13
F2	1	28	34	40	48	53	47,16
	2	27	35	40	46	54	50
	3	29	37	46	51	55	47,27
	Average	28	35,3	42	48,3	55	48,14
F3	1	25	29	35	46	51	50,98
	2	28	34	39	45	52	46,15
	3	27	34	40	47	53	49,05
	Average	26,6	32,3	38	43,6	53	48,72
F4	1	27	30	36	44	50	46
	2	25	31	38	46	52	51,92
	3	28	34	39	45	51	45,09
	Average	26,6	30,6	37,6	45	51	47,67
F5	1	28	33	39	44	50	44
	2	29	34	38	46	52	44,23
	3	25	31	40	46	53	52,83
	Average	27,3	32,6	39	45,3	51,6	47,02
Control X	1	27	34	41	49	58	53,44
	2	29	37	46	55	60	51,66
	3	28	35	46	53	59	52,54
	Average	28	35,3	44,3	52,3	59	52,54

Dehydration 0–29, Normal 30–50, Hydration 51–100

Notes:

F1: Setting spray gel formulation, 0.1% concentration

F2: Setting spray gel formulation, 0.2% concentration

F3: Setting spray gel formulation, 0.3% concentration

F4: Setting spray gel formulation, 0.4% concentration

F5: Setting spray gel formulation, 0.5% concentration

X: Control

Based on Table 8, the moisture effectiveness test results show that all formulations were able to increase skin hydration. This is due to the addition of 2.5% ethanol extract in each formulation 2.5% goji berry ethanol extract is effective for alleviating dry skin, with an increase in skin moisture of 33.21%. Skin hydration is also influenced by other ingredients in the formulation, such as propylene glycol as a humectant. The mechanism of humectants, according to Rawlings

(2003), is to retain water in the stratum corneum and to attract water from the environment into the skin. The highest increase in skin moisture was observed in F3, with 48.72%, while the lowest was in F5, with 47.02%. This is because F5 had the highest viscosity, resulting in a slightly thicker formulation that could not spread evenly when sprayed, reducing its therapeutic effectiveness. Table 8 also shows the results of the skin moisture effectiveness test of goji berry ethanol extract setting spray gel over 4 weeks on volunteers. From these results, it can be concluded that goji berry ethanol extract (*Lycium barbarum* L.) effectively improves skin hydration. The moisture effectiveness values are illustrated in Figure 1, and the average percentage increase in hydration over four weeks is shown in Figure 2.

Figure 1. Lip Moisture Over Four Weeks Of Treatment

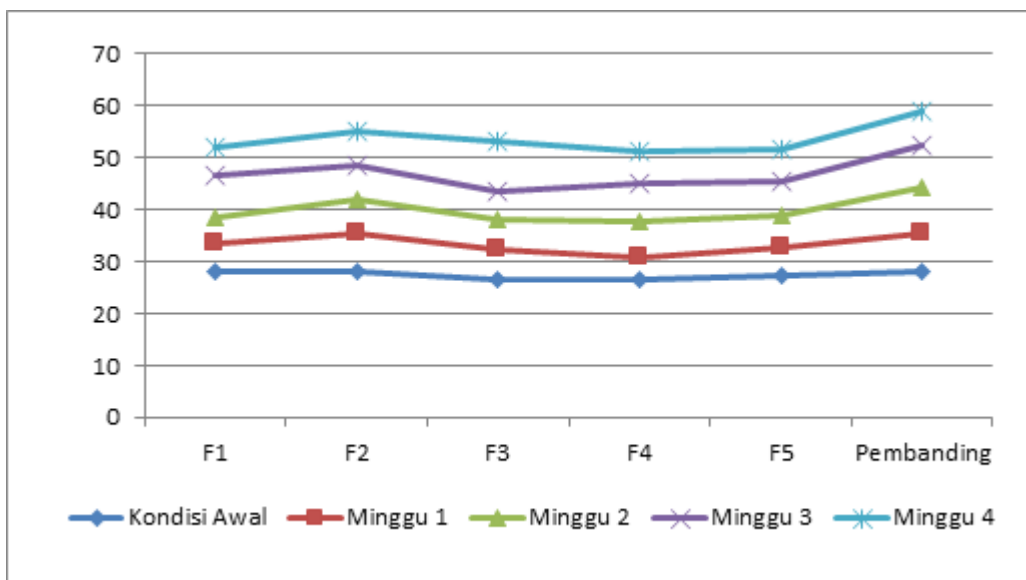
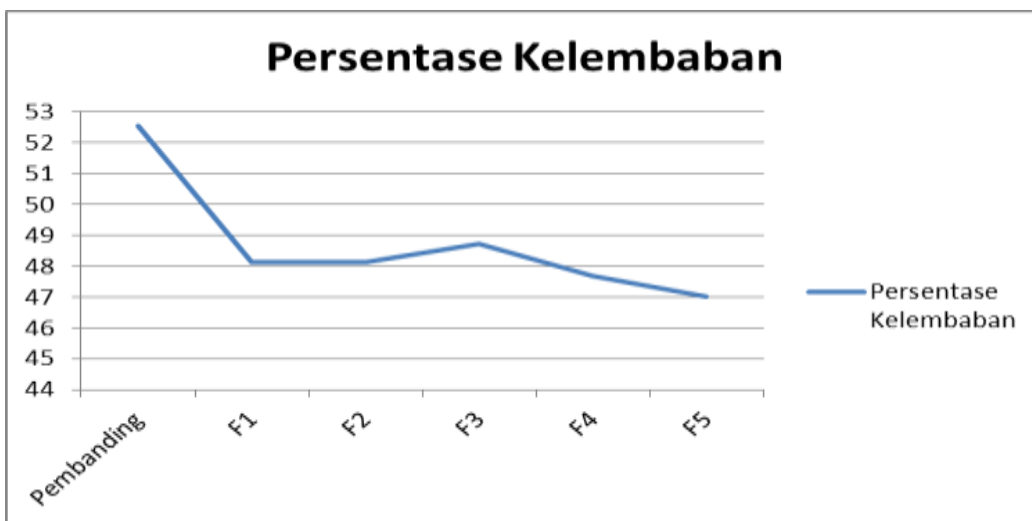


Figure 2. Lip Moisture Percentage



CONCLUSIONS

Based on the results of the study, the setting spray gel formulation containing ethanol extract of goji berry (*Lycium barbarum* L.) revealed several key findings. First, the ethanol extract of goji berry can be formulated into a setting spray gel that meets physicochemical quality standards, including organoleptic evaluation, homogeneity, spreadability, and viscosity. Second, variations in the concentration of the HPMC gelling agent significantly affect the properties of the formulation;

formulation F3 with 0.3% HPMC concentration was found to be the most optimal, producing a well-formed and easily spreadable gel. Third, the addition of 2.5% ethanol extract of goji berry in each formulation is effective as a moisturizer, capable of increasing skin hydration by up to 48.72%.

Acknowledgement

I would like to express my gratitude to the presence of Almighty God for His blessings and guidance, which have enabled this research to be completed successfully. I sincerely thank the authors of the referenced articles for their ideas, data, and work that have greatly contributed to this study, as well as Sari Mutiara Indonesia University and Tjut Nyak Dhien University for the facilities, support, and opportunities provided throughout the research process. I also extend my appreciation to my family and friends for their prayers, encouragement, and support, which have allowed this research to be completed smoothly and meaningfully.

REFERENCES

- Albrian, D., Wijaya, S., Setiawan, H.K. 2013. *Fraksinasi dan Identifikasi Senyawa Antioksidan Pada Ekstrak Etanol Buah Goji Berry (Lycium barbarum linn) Secara Kromatografi Kolom*. Journal of Pharmaceutical Science And Pharmacy Practice, 31-5.
- Angelia, G. R. Putri, A. Shabrina, and N. Ekawati, "Formulasi Sediaan Spray Gel Ekstrak Kulit Jeruk Manis (*Citrus sinensis* L.) sebagai Antiaging," *Generics : Journal of Research in Pharmacy*, vol. 2, no. 1, pp. 44–53, 2022.
- Ansel, H.C. 1989. *Pengantar Bentuk Sediaan Farmasi*, Edisi Keempat. Jakarta:Universitas Indonesia Press.
- Dirjen POM. (1995). *Farmakope Indonesia Edisi Keempat*. Jakarta:Departemen Kesehatan Republik Indonesia.
- Farnsworth, N.R. 1966. *Biological and Phytochemical Screening of Plants*. Journal of Pharmaceutical Science. 55(3): 225-26.
- Fidrianny, I., Darmawati, A., Sukrasno. 2014. *Antioxidant Capacities from Different Polarities Extracts of Cucurbitaceae leaves Using FRAP, DPPH Assay and Correlation with Phenolic, Flavonoid, Carotenoid Content*.
- Fitriansyah, SN., Wirya, S., Cici, H. 2016. *Formulasi dan Evaluasi Spray Gel Fraksi Etil Asetat Pucuk Daun Teh Hijau (Camelia Sinensis (L.) Kuntze) Sebagai Antijerawat*. Pharmacy.
- Harwood, R.J. 2006. *Hydroxypropyl Methylcellulose*, In: Rowe, R. C., Shesky, P. J. and Owen, S.C. (eds.), *Handbook Of Pharmaceutical Excipients*, Fifth Edition, 346, Pharmaceutical Press, UK.
- Hidayat, T. 1995. *Kulit kering. Dalam: Berkala LP kulit & kelamin* Airlangga Periodical Of Dermato-Venerology vol 7 no 1 Suplemen Semiloka kosmetik medik 2, Lab I.P kulit kelamin. Surabaya .FK Unair /RSUD Dr. Sutomo, 27–31.
- Kulczynski, B., and Gramza-Michalowska, A. 2016. *Goji berry (Lycium barbarum): Composition And Health Effects—a review*. Polish Journal of Food and Nutrition Sciences. 66(2):67–76. doi: 10.1515/pjfn-2015-0040.
- Nasution, R.A.P. 2020. *Formulasi Sediaan Hand and Body Lotion Ekstrak Etanol Buah Goji Berry (Lycium barbarum L.)*. (Doctoral dissertation, Universitas Sumatera Utara).
- Potterat, O. 2010. *Goji (Lycium Barbarum And L. Chinense): Phytochemistry, Pharmacology and Safety In The Perspective Of Traditional Uses and Recent Popularity*. *Planta Medica*, 76(01):7–19.
- Puspita, W., Puspasari, H., Restanti, N.A. 2020. *Formulasi Dan Pengujian Sifat Fisik Sediaan Spray Gel Ekstrak Etanol Daun Buas-Buas (Premna Serratifolia L.)*. *Jurnal Ilmiah Farmako Bahari*, 11(2): 145.
- Rawlins, E.A. 2003. *Bentleys of Pharmaceutics*. Edisi Kedelapanbelas. Baillierre Tindal.London. Hal 22-35.

- Suardi, M., Armenia, A., Maryawati, A. 2008. *Formulasi dan Uji Klinik Gel Anti Jerawat Benzoyl Peroksida-HPMC*, Jurnal Penelitian, Fakultas Farmasi FMIPA UNAND.
- Sugihartini, N dan Lena, M. 2015. *Formula Gel Ekstrak Etanol Kulit Buah Manggis (Garcinia Mangostana L.) Dengan Variasi Gelling Agent Sebagai Sediaan Luka Bakar*. Pharmacia. 5(1): 43-52.
- Van S.E.J., and Dieullangard, D.1986. Xerosis (Dry Skin, Xeroderma) in: Practical Management Of Dermatologic Patient, Athur Rook, Philadelphia, J.B Lippincott co, 224.
- Wasitaatmadja. 1997. *Penuntun Ilmu Kosmetik Medik*. UI Press. Jakar