## *Original Research Article*

# The Effectiveness of Combined Prebiotic and Postbiotic Moisturiser as an Adjuvant Therapy in Improving Maskne

Mohd Nurrul Azam Mohd Azhari[1], Sabrina Ab Wahab[1], Mohd Shahril Ahmad Saman[2], Liyana Dhamirah Aminuddin[1], Tarita Taib[1*]

[1]Dermatology Unit, Department of Medicine, Hospital Al-Sultan Abdullah, Universiti Teknologi MARA, Bandar Puncak Alam, 42300, Selangor, Malaysia
[2]Department of Public Health Medicine, Hospital Al-Sultan Abdullah, Universiti Teknologi MARA, Bandar Puncak Alam, 42300, Selangor, Malaysia

## ABSTRACT

Personal protective equipment (PPE) has become the new social norm as part of COVID-19 protection since the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, but it has had an impact on the skin barrier, particularly the face. Maskne refers to acne eruptions around the facemask area. The combination of friction, repeated pressure, sweat, or stress on the skin from wearing the mask results in acne or exacerbates pre-existing acne. This study aimed to analyse the effectiveness of a combined prebiotic and postbiotic moisturiser (CPPM) as an adjuvant therapy for improving maskne. This was a double-blind randomised control trial with systematic random sampling of 1:1 to receive either CPPM or placebo moisturisers. From December 2022 to May 2023, patients diagnosed with maskne at the Dermatology Clinic, Hospital Al-Sultan Abdullah, Universiti Teknologi MARA (UiTM), Bandar Puncak Alam, Selangor, Malaysia were studied. Subjects were assessed at baseline, week 2 and 4 after the application of moisturisers, using modified global acne grading system (mGAGS) and Cardiff Acne Disability Index (CADI) score. A total of 150 patients completed the study. Using the mGAGS score, compared to baseline, the mean score reduction was statistically significant at week 4 [5.33 (±4.06) vs 1.13 (±4.33); p< 0.001] in the CPPM arm compared to the placebo arm. In terms of CADI score, compared to baseline, there was also a significant reduction in mean score at week 4 [2.23 (±2.53) vs 0.55 (±2.59); p< 0.001] in the CPPM arm compared to the placebo arm. This study found that using CPPM as an adjuvant moisturiser improved maskne significantly.

**Keywords:** Maskne, Combined Prebiotic and Postbiotic moisturiser, Global Acne Grading System, Cardiff Acne Disability Index

***Corresponding author:***
*Assoc. Prof. Dr. Tarita Taib*
*Dermatology Unit, Faculty of Medicine,*
*Hospital Al-Sultan Abdullah, Universiti Teknologi MARA (UiTM),*
*42300 Bandar Puncak Alam,*
*Selangor, Malaysia*
*Email: tarita@uitm.edu.my*

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## 1.0 Introduction

Coronavirus disease 2019 (COVID-19) is a disease caused by the novel coronavirus SARS-CoV-2, which initially spread in Wuhan, China. COVID-19 was declared a global pandemic by the World Health Organization (WHO) in 2020 and ended in May 2023. SARS-CoV-2 infectiousness has become a public health concern, with over 7 million deaths recorded globally (1). When compliance is high, public mask-wearing is most effective at reducing virus spread (2,3).

Face mask is a protective headgear that covers part of the face, mainly the nose, mouth and cheek, also known as the 'O' area. It can be made of medical masks (2ply, 3ply, N95), cotton, silk or any other materials (4). Wearing a mask may cause pathophysiological changes such as elevated skin temperatures and sebum production on the chin, cheeks, and peri-oral region. A previous study found a significant difference in skin-to-skin temperature, redness, and hydration after wearing a mask compared to the non-mask-wearing area, which was more noticeable at the peri-oral site (5). In another study, the duration of face mask wearing of more than 4 hours/day and the reuse of face masks increased the risk of adverse skin reactions compared to changing the mask daily (6). This confirms that wearing a face mask produces both mechanical and chemical harm to the skin.

Maskne is a term created to describe mask-induced acne. It is both a form of acne mechanica and a subtype of acne vulgaris. Many patients complain of the occurrence of new acne or worsening acne after using a face mask (7,8). Understanding the underlying pathophysiology directly relates to the novel skin microenvironment and textile-skin friction created by mask-wearing, distinct from nontextile-related acne mechanica previously linked to the wearing of headgear. Masks cause humidity inside the skin, which is an excellent breeding ground for bacteria, increasing problems with infection, hence inflammation on the skin and causing acne. The mask also caused friction on acne and triggered fraction-induced acne.

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit. Its pathophysiology includes hyperseborrhea, abnormal follicular keratinisation and *Cutibacterium acnes* (*C. acnes*) proliferation in the pilosebaceous unit. Dysbiosis leads to a disturbed skin barrier and dysequilibrium of the cutaneous microbiome, resulting in the proliferation of *C. acnes* strains. It is divided into two categories: non-inflammatory (closed and opened comedones) and inflammatory (papules, pustules, cystic, nodules). Many studies have shown that acne can seriously impair a person's quality of life (QoL), particularly among younger people (9).

Specifically, the occlusive micro-environment leads to microbiome dysbiosis, which is linked to various dermatological conditions. Additional textile-skin interactions include factors such as breathability, stickiness sensations, moisture saturation, and hygiene maintenance. Increased skin temperature can trigger sweat/heat-related dermatosis, and ear loops can potentially trigger pressure-induced dermatosis. The skin microbiota is influenced by genetic and external factors such as the environment, pH, and temperature, all of which are modified with mask-wearing and retention of biofluid (10).

There was an increase in maskne incidence during the COVID-19 pandemic due to the compulsory and prolonged use of masks among the public. The global prevalence of acne vulgaris (for all ages) is 9.38%, making it the 8th most prevalent disease worldwide (11). The global prevalence for maskne is unknown. Still, acne related to prolonged mask-wearing

was diagnosed in 384 healthcare workers in Italian hospitals within 11 months (12) and 337 healthcare workers in three Irish hospitals within a 2-month period (13). A cross-sectional survey among medical students, resident physicians, and nursing students at Johns Hopkins Medical Centre found that 68.7% of participants reported the development of maskne (14).

Recent research has shown that using a moisturiser can effectively reduce acne (15,16). Moisturiser aids in the restoration of the natural skin barrier and the rebalancing of the skin's natural micro-biome, thereby limiting the proliferation of *C. acnes* (10). Moisturisers function in four ways: they repair the skin barrier, increase skin water content, reduce trans-epidermal water loss (TEWL), and restore the lipid barrier's ability to attract, hold, and redistribute water.[15]

La Roche Posay (LRP) Effaclar Duo is a combined prebiotic and postbiotic moisturiser (CPPM) with an all-in-one formula that treats acne while also moisturising the skin. CPPM contains prebiotic and postbiotic elements such as LRP thermal spring water, mannose and *Aqua Posae Filiformis* (APF), which assist to regulate the skin microbiome in order to reduce acne from recurring. Other main ingredients are lipo-hydroxy-acid (LHA), which acts as keratolytic and anti-inflammatory agents together with niacinamide, procerad as anti-post inflammatory hyperpigmentation, piroctone olamine as anti-bacterial, zinc PCA as sebum regulator and linoleic acid as sebum normaliser. LHA exfoliates and tolerates twice more than beta-hydroxy-acid (BHA) or alpha-hydroxy-acid (AHA) products (17). Hence, CPPM is recommended as a therapy on its own or as an adjuvant, to prevent flare of mild to moderate acne.

This study aims to explore the effectiveness of CPPM in improving maskne and QoL that indirectly influence the subject while coping with pandemic outbreaks that may be useful for future pandemic prevention advice.

## 2.0 Materials and Methods

The study's objective was to assess the improvement of maskne after applying CPPM, which was LRP Effaclar Duo Moisturiser. We used a modified global acne grading system (mGAGS) for clinical measurement and Cardiff Acne Disability Index (CADI) score for QoL impairment assessment. Both are reliable tools that correlate with acne severity.

mGAGS is determined at four different sites on the face, with a factor for each (right cheek=2, left cheek=2, nose=1, chin=1). It is assessed independently on a 0-4 scale based on the most severe lesion in that region (0= no lesion, 1= comedones, 2= papules, 3= pustules, and 4= nodules). The score for each location is the product of the most severe lesion and the area factor. These separate scores are then combined to yield the total score. The subject is characterised as mild if the overall score is 1–9, and moderate if the total score is 10–16. If the overall score is from 17 to 21, the grade is severe; if the total score is 22 or more, the grade is very severe.

The CADI score is a short five-item questionnaire that uses a quantitative, validated scoring method to quantify QoL impairment. It is self-explanatory and can be simply provided to the patient, who is then instructed to complete it without more explanation. A higher score indicates a more substantial QoL impairment (18).

### *2.1 Design of the study*

This was an investigator-initiated, prospective, randomised, double-blind study of those who were diagnosed with maskne and fulfilled the inclusion criteria:

minimum contact with the mask of 10 minutes per day, three times per week, and two months prior to enrolment with new or worsening maskne. Those with present skin infections or severe acne, pregnancy or breast-feeding, endocrinopathy or exogenous steroid use, and those using isotretinoin were all excluded from the study.

From December 2022 to May 2023, patients diagnosed with maskne at Hospital Al-Sultan Abdullah (HASA) UiTM Dermatology Clinic, from diverse industries and professions were examined. Each subject's study duration was four weeks in total, with two weeks of interval reviews (week 0 as baseline, at the end of week 2, and at the end of week 4). Using the permuted block randomisation technique, subjects were systematically assigned to a 1:1 ratio of the studied sample and placebo. Subjects were required to apply the provided moisturiser twice daily, during the day and at night, with each application estimated to be half a fingertip unit (weighing between 0.25 and 0.35 grams).

*2.2 Sampling and sample size*

We derived the numbers of subjects based on the previous study by Bissonnette *et al* which found a reduced number of inflammatory lesions from baseline to week 12 by 44% with LHA formulation moisturiser and 47% with placebo treatment (13). Sample size calculation was performed using a two-proportion sample size formula. The initial calculation was 142, with 71 subjects in each arm, and adding a standard attrition rate of 10%, the total calculated sample size 'n' was 158, with 79 subjects in each arm.

After a thorough explanation of the study was given to each possible subject, all patients provided written informed consent. Subjects had their mGAGS and CADI clinical scores assessed. The sociodemographic data and its underlying comorbid were obtained during a clinical interview in an objective format. Also included was information on a more detailed history of acne risk factors, a dermatological history and an allergy history.

The history of allergic reactions to food and drugs information helped to reduce any possibility of allergic reaction towards moisturiser sample. A possible adverse event was briefly explained to subjects before the study along with their next course of action. Before the trial period, a 48-hour washout period for other types of moisturisers was permitted.

*2.3 Ethical considerations*

Ethics approval was obtained from the Health Research Ethics Committee of Universiti Teknologi MARA (UiTM), Malaysia REC/04/2021 (FB/18).

*2.4 Data collection and statistical analysis*

Baseline mGAGS and CADI scores and other questionnaire responses were gathered in week 0 of the trial. They were again evaluated in the clinic at the end of week 2 and 4 for progress and clinical relevance. The mGAGS score specifically involved only maskne or O-zone area. mGAGS did not include the forehead, chest and upper back calculations as per the original GAGS score. The data was analysed with the IBM Statistical Package for Social Sciences (SPSS) version 27. Continuous data were reported as ‘mean’ and ‘mean reduction difference’ calculated using an independent samples t-test, with a p-value of less than 0.05, considered statistically significant. Meanwhile, the categorical variables were presented as frequency (n) and percentage (%) using descriptive statistics.

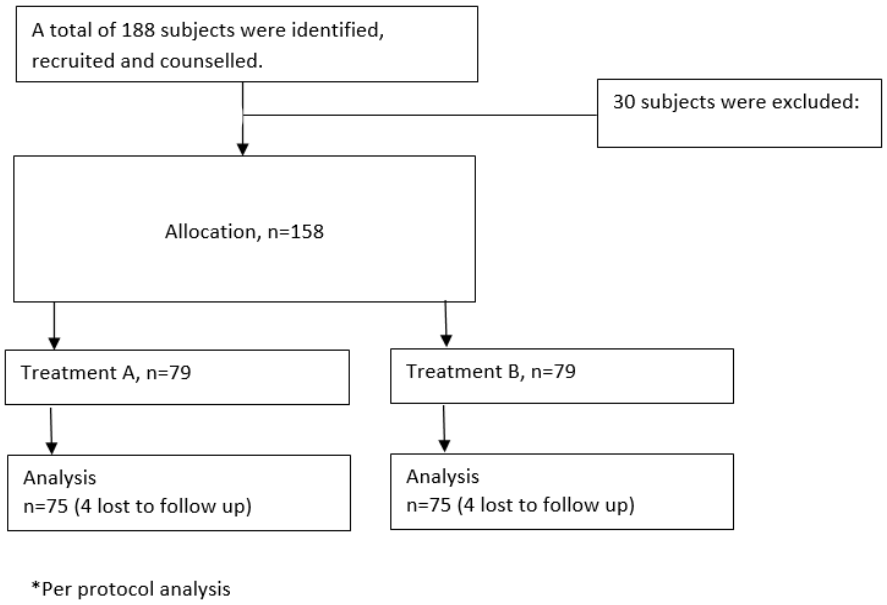


**Figure 1:** Study flow diagram

## 3.0 Results

One hundred and fifty-eight out of 188 potential subjects were enrolled (Figure 1). Only 150 subjects completed the study, as there were four dropouts after the first evaluation visit from each treatment arm.

Females comprised 71.5% of the study cohort (Table 1). The mean age was 22.8 (± 3.5) years. The baseline mean mGAGS and CADI scores of the total population were 10.9 (±3.8) and 6.3 (±3.1), respectively. There was no significant difference between the mGAGS (p-value 0.278) and CADI (p-value 0.837) scores between cohorts in both treatment arms at baseline.

Among those with underlying comorbidities, 12.0% were obese. Except for acne, both groups only had small numbers (<20%) of people with underlying skin conditions. There were 35.5% of the total cohort with a family history of acne. Each of our subjects wore masks for more than 4 hours daily, and nearly all (99.4%) used surgical masks. As most of the study cohort was female, an expectedly high percentage (70.3%) used cosmetics daily. In study inclusion, 17.1% of the subjects were exposed to systemic antibiotics, with 10.1% within three months.

**Table 1:** Baseline clinico-sociodemographic data

| Variables | Treatment A CPPM n=79 (%) | Treatment B Placebo n=79 (%) | Total n=158 (%) |
|---|---|---|---|
| Gender | | | |
| Male | 18 (22.8) | 27 (34.2) | 45 (28.5) |
| Female | 61 (77.2) | 52 (65.8) | 113 (71.5) |
| Race | | | |
| Malay | 76 (96.2) | 75 (94.9) | 151 (95.6) |

| Variables | Treatment A CPPM n=79 (%) | Treatment B Placebo n=79 (%) | Total n=158 (%) |
|---|---|---|---|
| Chinese | 0 (0.0) | 1 (1.3) | 1 (0.6) |
| Others | 3 (3.8) | 3 (3.8) | 6 (3.8) |
| Income bracket | | | |
| B40 | 37 (51.9) | 51 (59.5) | 88 (55.7) |
| M40 | 26 (32.9) | 18 (22.8) | 44 (27.8) |
| T20 | 12 (15.2) | 14 (17.7) | 26 (16.5) |
| Underlying Illness | | | |
| Obese | 12 (15.2) | 7 (8.9) | 19 (12.0) |
| DM | 1 (1.3) | 0 (0.0) | 1 (0.6) |
| NKMI | 66 (83.5) | 72 (91.1) | 138 (87.3) |
| Underlying skin disease | | | |
| Eczema | 9 (11.4) | 5 (6.3) | 14 (8.9) |
| Seborrhoeic Dermatitis | 1 (1.3) | 5 (6.3) | 6 (3.8) |
| Psoriasis | 2 (2.5) | 2 (2.5) | 4 (2.5) |
| Eczema + Psoriasis | 0 (0.0) | 1 (1.3) | 1 (0.6) |
| Eczema + Seborrheic Dermatitis | 1 (1.3) | 1 (1.3) | 2 (1.3) |
| Nil | 66 (83.5) | 65 (82.3) | 131 (82.9) |
| Family History of Acne | | | |
| Yes | 36 (45.5) | 20 (25.3) | 56 (35.5) |
| No | 43 (54.5) | 59 (74.7) | 102 (64.5) |
| Alcohol consumption history | | | |
| Yes | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| No | 79 (100.0) | 79 (100.0) | 158 (100.0) |
| Stress level | | | |
| Mild | 51 (64.6) | 53 (67.1) | 104 (65.8) |
| Moderate | 25 (31.6) | 26 (32.9) | 51 (32.3) |
| Severe | 3 (3.8) | 0 (0.0) | 3 (1.9) |
| Nil | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| Mask types | | | |
| Surgical | 78 (98.7) | 79 (100.0) | 157 (99.4) |
| Cloth | 1 (1.3) | 0 (0.0) | 1 (0.6) |
| Duration of wearing a face mask | | | |
| < 1hour per day | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| 1-4 hours per day | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| > 4 hours per day | 79 (100.0) | 79 (100.0) | 158 (100.0) |
| Cosmetic use | | | |
| Daily | 56 (70.9) | 55 (69.6) | 111 (70.3) |
| Sometimes | 17 (21.5) | 11 (13.9) | 28 (17.7) |
| Rarely | 6 (7.6) | 7 (8.9) | 13 (8.2) |
| Never | 0 (0.0) | 6 (7.6) | 6 (3.8) |
| Facial treatment | | | |
| Chemical Peel | 4 (5.0) | 1 (1.3) | 5 (3.2) |
| Laser therapy | 2 (2.5) | 8 (10.1) | 10 (6.3) |
| Microdermabrasion | 1 (1.3) | 0 (0.0) | 1 (0.6) |
| Others | 1 (1.3) | 0 (0.0) | 1 (0.6) |
| Never | 71 (89.9) | 70 (88.6) | 141 (89.2) |
| Antibiotic history | | | |
| < 3 months | 12 (15.2) | 4 (5.0) | 16 (10.1) |
| > 3 months | 2 (2.5) | 1 (1.3) | 3 (1.9) |
| > 6 moths | 4 (5.0) | 4 (5.0) | 8 (5.1) |
| No | 61 (77.3) | 70 (88.6) | 131 (82.9) |
| Hormonal Therapy | | | |
| Yes | 0 (0.0) | 0 (0.0) | 0 (0.0) |

| Variables | Treatment A CPPM n=79 (%) | Treatment B Placebo n=79 (%) | Total n=158 (%) |
|---|---|---|---|
| No | 79 (100.0) | 79 (100.0) | 158 (100.0) |
| Food Allergy | | | |
| Known allergen | 4 (5.0) | 10 (12.7) | 14 (8.9) |
| Unknown allergen | 0 (0.0) | 2 (2.5) | 2 (1.3) |
| No allergy | 75 (95.0) | 67 (84.8) | 142 (89.8) |
| Drug Allergy | | | |
| Known allergen | 2 (2.5) | 2 (2.5) | 4 (2.5) |
| Unknown allergen | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| No allergy | 77 (97.5) | 77 (97.5) | 154 (97.5) |
| | | | **n=158 (±SD)** |
| Mean Age | | | 22.8 (3.5) |
| Mean mGAGS | | | 10.9 (3.8) |
| Mean CADI | | | 6.3 (3.1) |
| | **n= 79 (±SD)** | **n= 79 (±SD)** | **p-value** |
| Baseline mean mGAGS | 11.2 (3.5) | 10.5 (4.1) | 0.278 |
| Baseline mean CADI | 6.3 (3.0) | 6.4 (3.2) | 0.837 |

The efficacy analysis involved 150 subjects who completed the study protocol. There was already a significant difference in mGAGS score as early as week 2 between treatment A (CPPM) and treatment B (Placebo), 8.71 (± 3.71) versus 9.95 (± 3.91), p=0.048. A further significant difference was seen in week 4, 5.95 (± 3.85) versus 9.45 (± 4.71), p< 0.001 (Table 2).

**Table 2:** Comparison of mGAGS mean score at analysis interval week

| Time | CPPM n = 75 Mean (SD) | Placebo n = 75 Mean (SD) | Mean difference (95% CI) | p value |
|---|---|---|---|---|
| **WEEK 0** | 11.31 (3.514) | 10.63 (4.080) | 0.680 (-0.549, 1.909) | 0.276 |
| **WEEK 2** | 8.71 (3.712) | 9.95 (3.907) | -1.240 (-2.470, -0.010) | 0.048 |
| **WEEK 4** | 5.95 (3.848) | 9.45 (4.711) | -3.507 (-4.895, -2.119) | <0.001 |

Table 2

*Independent Sample T-Test

mGAGS mean reduction scores calculated at week 2 and week 4 compared to week 0 and week 2 were significant between both treatment arms (Table 3). Compared to baseline, the mean score reduction was statistically significant at week 4 [5.33 (±4.06) vs 1.13 (±4.33); *p*< 0.001] in the CPPM arm compared to the Placebo arm.

**Table 3:** Comparison of mGAGS mean reduction score

| Time | CPPM n = 75 Mean (SD) | Placebo n = 75 Mean (SD) | Mean difference (95% CI) | p value |
|---|---|---|---|---|
| **W2-W0** | 2.60 (3.276) | 0.83 (3.077) | 1.773 (0.748, 2.799) | <0.001 |
| **W4-W2** | 2.76 (2.789) | 0.63 (2.958) | 2.133 (1.206, 3.061) | <0.001 |
| **W4-W0** | 5.33 (4.055) | 1.13 (4.326) | 4.200 (2.847, 5.553) | <0.001 |

Table 3

*Independent Sample T-Test

CADI mean score was only significant at week 4 (Table 4). A statistically significant difference in CADI mean

reduction score analysis was seen when results were compared between week 4 to week 2 and week 4 to baseline (Table 5). Compared to baseline, there was a significant reduction in mean score at week 4 [2.23 (±2.53) vs 0.55 (±2.59); $p<$ 0.001] in the CPPM arm compared to the Placebo arm.

**Table 4:** Comparison of CADI mean score at analysis interval week

| Time | CPPM n = 75 | Placebo n = 75 | Mean difference (95% CI) | p value |
|---|---|---|---|---|
| | Mean (SD) | Mean (SD) | | |
| WEEK 0 | 6.24 (3.044) | 6.49 (3.227) | -0.253 (-1.266,0.759) | 0.622 |
| WEEK 2 | 5.43 (2.791) | 6.07 (3.033) | -0.640 (-1.580,0.300) | 0.181 |
| WEEK 4 | 4.01 (2.571) | 5.95 (3.601) | -1.933 (-2.943,-0.924) | <0.001 |

Table 4

*Independent Sample T-Test

**Table 5:** Comparison of CADI mean reduction score

| Time | CPPM n = 75 | Placebo n = 75 | Mean difference (95% CI) | p value |
|---|---|---|---|---|
| | Mean (SD) | Mean (SD) | | |
| W2-W0 | 0.81 (1.887) | 0.43 (1.802) | 0.387 (-0.209, 0.982) | 0.201 |
| W4-W2 | 1.41 (2.034) | 0.12 (1.973) | 1.293 (0.647, 1.940) | <0.001 |
| W4-W0 | 2.23 (2.529) | 0.55 (2.585) | 1.680 (0.855, 2.505) | <0.001 |

Table 5

*Independent Sample T-Test

## 4.0 Discussion

The mean age in our study was 22.8 (SD± 3.5) years, reflecting the incidence of global acne in the younger age population as reported by Abo El-Fetoh *et al*, which is also the preferred age for maskne (19). Seventy-two percent of our study cohort were female, consistent with the prevalence findings by Collier *et al*, that it was higher in women than in men in all age groups above 20 years (20).

There were 35.5% of subjects with family history of acne, and 12.0% had a history of obesity, both of which were reported risks of maskne (21-22). A significant number (60.0%) of maskne were reported among the HCW cohort in Jeddah, with mask contact hours of less than 4 hours per day (23). Dani *et al* reported an increased frequency of maskne occurrence with longer hours of mask contact, 97% of subjects with contact of more than 8 hours per day compared to 67% with contact of 2 to 4 hours and 0% with contact less than 2 hours (14). All our subjects had contact hours with masks for more than 4 hours daily. Our study didn't have a variety of mask types to analyse, as almost all (99.4%) used surgical masks.

The history of previous acne treatments is vital as various acne medications may cause skin irritancy, magnifying the moisturiser's role. Acne therapies such as benzoyl peroxide and retinoids can affect epidermal barrier function and may cause skin irritation, specifically during the initial application. Numerous strategies have been adopted to improve maskne during the pandemic, including reducing contact time with masks and using moisturiser. Moisturising skin is a part of a holistic approach for acne apart from cleansing and photoprotection (24). The ideal moisturiser should be alcohol-free, non-greasy and water-based to avoid irritation on sensitive skin, which is compatible with the study product and placebo.

Muttaqin *et al* 2022, found no significant correlation between using face moisturisers to prevent acne vulgaris due to masks in a single Indonesian population (25). However, this could be due to the study's limitation: a cross-sectional study that didn't analyse prospective data on

moisturiser application duration and was done within a limited number of participants. Our study found that a significant mGAGS mean reduction score was seen when compared from week 4 to week 0, 5.33 (4.05) vs. 1.13 (4.33) with a p value of < 0.001. A study conducted by Prof. Li Li in China showed a reduction of acne lesions by 58% after 56 days of CPPM usage in 15 patients (26). Another study, a multi-centred, double-blind study using CPPM in 66 patients spread over 12 weeks, showed a reduction of 68.4% of inflammatory lesions and 65.2 of non-inflammatory lesions (27).

There was no other prospective study to compare with regards to the use of moisturiser to improve maskne. Our study showed improvement of clinical acne (reduced mGAGS score) as early as two weeks and improved QoL (reduced CADI score) after four weeks with both moisturiser arms but a more significant reduction in the treatment CPPM arm. According to Dreno *et al*., acne-related absenteeism was observed in 5.7% of instances and was significantly correlated with poor quality of life (28). A double-blind study using the OSSIQ scoring system reported a 24% improvement in quality of life among 35 patients using CPPM after 56 days (29). *C. acnes* is the major occupant of the pilosebaceous unit, accounting for up to 90% of the microbiota in sebum-rich sites such as the scalp, face, chest, and back (30). *C. acnes* has always been thought of as the main bacterium in the pathogenesis of acne. Staphylococcus is the predominant genus of the superficial skin (upper epidermis) microbiota. Disbalanced cutaneous microbiota that leads to overabundance or overexpression of staphylococcus may trigger inflammatory skin conditions like atopic eczema and acne. The *APF* found in the treatment cream is derived from prebiotic thermal spring water, which is incorporated with the enhanced probiotic component *Vitroscilla filiformis*. *APF* on the skin would balance the cutaneous microbiota, strengthening the skin's natural defence by improving the innate cutaneous defence system, improving the skin barrier and regulating skin inflammation (31). Thermal spring water in *APF* also contains selenium, which can fight free radicals and minimise skin damage and inflammation (32).

The study moisturiser CPPM had additional benefits from LHA, niacinamide and procerad. LHA is a bigger molecule derivative of salicylic acid with the long fatty acid chain that is lipophilic, allowing a slower penetration rate to exfoliate dead skin cells from the outer layer of the skin, almost like mimicking our physiologic desquamation. In one study, topical BPO 5.5% with LHA in combination with topical tretinoin 0.025% cream was found to be as effective as BPO 5%-clindamycin 1% gel and tretinoin 0.025% cream for the treatment of mild to moderate acne (33).

Environmental factors such as using soaps, cosmetics, antibiotics, occupation, temperature, humidity, and UV exposure (34) also influence microbial colonization (35). In mild to moderate acne, a regimen of cleanser and an active formulation moisturiser reduced the mean total lesion count (6.9% vs 1.4%), pustular lesions ($p < 0.05$), and sebum levels ($p < 0.01$) and reduced colonisation of *C.acnes* (49.4% vs 3.2%) compared to vehicle (36). CPPM provides both benefits in skin hydration and a barrier with the correction of cutaneous microbiota imbalances, hence reducing the severity of skin inflammation in acne, which has proven to be of significant use to the maskne population.

## 5.0 Conclusion

This study indicated that using CPPM as an adjuvant moisturiser greatly improved the maskne.

## Authorship contribution statement

**MNAMA:** data curation (equal), formal analysis (lead), investigation (lead), project administration (lead), software (lead), visualisation (lead), writing-original draft preparation (lead), writing-review and editing (equal); **SAW:** conceptualization (supporting), data curation (equal), methodology (supporting), supervision (equal), validation (supporting), writing-review and editing (supporting); **MSAS:** formal analysis (supporting), validation (lead), **LDA:** conceptualization (supporting), funding acquisition (supporting), resources (supporting); **TT:** conceptualization (lead), funding acquisition (lead), methodology (lead), resources (lead), supervision (lead), writing-review and editing (lead).

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## Conflict of Interest

The main author declared that he has no conflict of interest to disclose.

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