

Protection Convergence

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Corresponding author*
E-mail: wellskin7@gmail.com

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Usefulness of Smilax China Leaves Fermented Product as a Cosmetic Material for Scalp Hair Protection

Miyoung Choi¹

Incheon Jaeneung University, Incheon, Republic of Korea

Eunjoo Choi^{2*}

Westminster Graduate School of Theology University, Yongin, Republic of Korea

Abstract

Purpose: Today, the population with hair loss is decreasing in age given various factors, and due to such, the market for scalp and hair cosmetics is exploding. Due to the growing interest in side effects such as allergies and environmental pollution, recently, many studies have been conducted to find cosmetic raw materials from natural substances or to apply fermentation techniques to the cosmetic manufacturing process. Hence, after enzymatic fermentation with *Smilax china*, which has been used for various pharmacological functions in the private sector for a long time and has secured clinical safety, the active ingredients and effectiveness (in vitro) were examined.

Method: After preparing a sample by the enzymatic fermentation of *Smilax china*, which is known to have various pharmacological actions, with malt, the active ingredients and effectiveness (in vitro, HaCaT cell protective effect against oxidative stress, antibacterial activity, anti-inflammatory activity, dermal papilla cell proliferation rate) was confirmed.

Results: As a result of the experiment conducted, the fermented *Smilax china* enzyme had excellent antibacterial activity, HaCaT cell protective effect against oxidative stress, anti-inflammatory activity, and dermal papilla cell proliferation rate, respectively.

Conclusion: It was confirmed that the fermented product obtained by fermenting *Smilax china* malt with malt offers the excellent HaCaT cell protection effect against the oxidative stress, antibacterial activity, anti-inflammatory activity, and the dermal papilla cell proliferation rate, and hence, it can be applied as a raw material for various cosmetics. In particular, the usefulness as a cosmetic material for scalp and hair that is effective for the health of the scalp and hair was confirmed. Future research is expected to articulate the pharmacological mechanisms of the *Smilax china* fermented products through the physiological studies related to the fermentation process and the growth rate of dermal papilla cells.

Keywords: *Smilax China, Malt Enzyme Fermentation, Antimicrobial Activity, Hair Loss, Anti-Inflammatory Activity*

1. Introduction

1.1. Need and purpose of the study

Given the recently exceptional industrialization and economic growth, the quality of life has significantly improved and the life expectancy has increased. As a result, the interest in the healthy body and beauty is rising over ever before, and the industries such as healthy food, exercise for health, and pharmaceuticals are showing high growth [1]. This trend is also prevailing in the cosmetics industry, and the preference for organic, well-being, eco-friendly, and natural cosmetics is becoming clear [2]. Such a market change has been transformed into an up-

graded stage called the era of bio-cosmetics thanks to the development of life science and technology as a matter of evolving trend[3]. The modern people are suffering from the natural hair loss due to genetic factors or aging, as well as external factors such as increasing pollutants and stress, UV rays, environmental hormones, western eating habits, scalp hair cosmetics that stimulate the scalp, and frequent cosmetic procedures. The scalp has physiologically different characteristics from the normal skin as hair roots are located.

The scalp discharges wastes out of the body through pores, sweat glands, and sebaceous glands, and also plays an important role in balancing the oil-water balance of the skin, and hence, the excessive secretion of sweat and sebum clogs pores and causes bacterial growth. Since such a phenomenon causes scalp diseases such as Tinea capitis and hair loss, scalp management is very important not only in terms of beauty but also in terms of medical care[4]. Accordingly, scalp physiology is very important not only in cosmetic aspects but also in the study of scalp diseases, and while many studies are being conducted in connection with hair loss and hair growth-related hair physiology, there is still no way to completely solve this problem. Furthermore, many studies have been made on scalp and hair care products that can maintain and restore the health of the scalp and hair, but many products irritate the scalp or damage the scalp or cause hair loss, such as causing allergies due to toxic residues, and accordingly, they damage the scalp if not cause side effects[5].

Furthermore, since KINESIOLOGY places importance on muscles and massage areas, various studies are conducted to search for substances useful for scalp care using relatively safe natural products[6][7][8], and not only hair, but also scalp care and massage, etc., are attracting attention in the overall beauty and health fields. Hence, in this study, the main ingredient of *Smilax china*, which has been used for various pharmacological functions in the private sector for a long time, and has secured clinical safety, can reduce environmental pollution by enzymatic fermentation with malt used in traditional beverage manufacturing, and it was attempted to find the clinically safe cosmetic raw materials.

1.2. Theoretical background

1.2.1. Scalp and hair loss

Skin, which is a membrane covering the outside of the body, is an important part which protects the body from various environmental factors and occupies the position of the primary immune defense system, and the part that covers the head is called the scalp. While the scalp is thin, there is the root of the hair, which is the first line of defense that protects the skull, and has the function of generating, growing, and maintaining hair. Furthermore, since it is a very important part in terms of skin beauty, such as being connected to the skin of the face and neck, and having a great influence on the formation of skin wrinkles[9], and hence, beauty devices that are effective for hair by managing the scalp have also been released[10].

Hair, which operates as a barrier to protect the skull, functions as an excretory organ that discharges wastes through the hair root, and is involved in maintaining body temperature by protecting the head from external stimuli such as physical friction and direct sunlight. Furthermore, as an external organ of the skin, it protects the head from external shocks, ultraviolet rays, cold, friction, etc., and has the function of absorbing and discharging unnecessary heavy metals from the body[11]. It is not always attached to the scalp, but goes through the process of growth and fallout, and this period is very constant[12], which is called the 'hair cycle'. If over 200 hairs fall out per day, it is a condition that requires management due to the abnormal hair loss. Abnormal hair loss occurs when the hair growth cycle is shortened, the number of resting follicles increases, and hair loss occurs excessively, and it is known that it appears for various reasons such as stress, nutritional status, imbalanced action of male hormones, and genetic factors[13]. In particular, it is classified into female pattern hair loss, male pattern hair loss, alopecia areata, and infectious hair loss according to the cause and type[14]. The most cited

causes of hair loss are aging, genetic factors, and blood circulation disorders. Among the substances which perform the function of signal transduction in the body, the chemical that commands the hair follicle to start the growth or resting phase is Superoxide Radical, and the signal that commands the start of the growth phase is Nitric Oxide, and hence, it can be applied to the hair loss area. In researching the development of therapeutic agents that can be used, many studies are being conducted in the FDA on how to lower the level of Superoxide radical using SOD(Super Oxide Dismutase)[15].

1.2.2. Natural fermented cosmetics

Phenolic compounds, Flavonoids, Carotenoids and Cellulose which are contained in the natural plant extracts are used to improve beauty and health as the nature-friendly physiologically active materials with antioxidant, anticancer and antibacterial properties, and are also used as a material for promotion and for medicine, food and cosmetics[16][17][18]. As the physiologically active ingredients of plants that have been used as medicines in the private sector for a long time, they have been scientifically proven, and are the active ingredients concentrated or separated from the plants and are used as materials for hair cosmetics as reported according to the previous studies[19][20][21].

Fermentation means that humans obtain beneficial effects by using secondary metabolites produced when microorganisms grow[22]. When they undergo the fermentation process, the physiological activities of natural substances are further maximized, the nutrients contained in it are activated, and their absorption is improved, which offer beneficial effects on humans, such as sterilizing or inhibiting the growth of harmful bacteria or neutralizing toxicity. Furthermore, there is a report that anti-inflammatory efficacy and nitrite scavenging ability are increased through fermentation[23], and while Hwangchil extract is fermented, the inhibitory efficacy of pathogenic microorganisms is increased as reported[24]. According to the studies conducted, when secondary metabolites or fermented extracts generated during fermentation were applied to the skin, antioxidant, moisturizing, and cellular activity were improved, while their side effects were relatively few, thereby indicating excellent safety as a cosmetic raw material, and it has been reported that the natural fermented broth exhibited high antioxidant power, increased the efficacy of cosmetic ingredients, and increased transdermal absorption[25]. Fermentation is used in a variety of industries, including food, cosmetics, pharmaceuticals, and feed, due to the results of such preceding studies and the growing interest in natural fermented cosmetics.

1.2.3. Smilax china

Smilax china is a deciduous broad-leaved vine shrub affiliated with the *Liliaceae* family, whose leaves are ovate, and the leaves are heart-shaped, while their tips are round shaped and convex, and has 5-7 veins coming out of the base, and they form a network again. They are grown mainly in the sun at the foot of the mountain, and geographically, it is widely distributed in South East Asia such as Korea, Japan, China, Taiwan, and Manchuria. Depending on the region, it is called variously, such as Myeonggam tree in Gyeongsang-do, bell thorn vine in Jeolla-do, barberry thorn in Hwanghae-do, and berry vine in Gangwon-do, and in the horticultural field, it is known as a sea squirrel or mange tree, and in oriental medicine, it is also called Tobokryeong or Sanguiirae[26].

In the ancient times, it has been known that in China or Korea, food was scarce and used as a substitute for old-fashioned food in times of famine. In the private sector, young leaves are eaten as herbs, or large leaves are used as a natural food preservative to preserve rice cakes in summer, and the roots are called Tobokryeong and are used as herbal medicines.

The young shoots and fruits of *Smilax china* are edible, and the roots and wood are known to be effective in antipyretic, detoxification, alleviation of diuresis, physical strength, cystitis, dermatitis, nephritis, arthritis, antibacterial action, and breast cancer[27]. Furthermore, it has been reported that the leaves of Myeonggam tree have an antibacterial effect on the skin flora[28],

and there is also a study uncovering the fact that the ethanol extract of the leaves of *Smilax china* maintains high antibacterial activity against *B. cereus*, *V. parahaemolyticus*, *S. typhimurium*, and *S. aureus* even after high-temperature treatment at 65-125 °C [29]. As such, various pharmacological actions such as antioxidant and antibacterial action of the leaves of *Smilax china* are known, and is also used for packaging food such as rice cake, and it has been proven to have the effect of not only inhibiting the growth of microorganisms, but also providing a good flavor. Furthermore, it has been reported that bioactive ingredients are effective in preventing aging-related diseases caused by reactive oxygen species [30].

1.2.4. Malt

Malt is a material used to make 'Shikhye', a traditional drink. After sprouting the outer barley, it is dried and ground to a fine powder, which is called malt. It contains a lot of enzymes and minerals such as saccharification enzymes α -Amylase, Glucoamylase, and β -Amylase, and is rich in calcium [31]. In particular, α -Amylase, an enzyme that hydrolyzes α -1,4 bonds in starch, is not present in barley at rest, but is produced during the germination process. At which time, GA3(Gibberellic Acid), a substance similar to Gibberellin, is produced and helps the enzyme activity. Malt is a good source of GABA and is known for its antioxidant properties. Moreover, there is a study which claims that saccharification power differs depending on the length and variety of the first leaf of barley. In addition, there is a research report that the product obtained by saccharification of lactic acid bacteria fermented Chunma using malt demonstrated the best acceptance [32].

2. Research Method

2.1. Fermentation experimental method

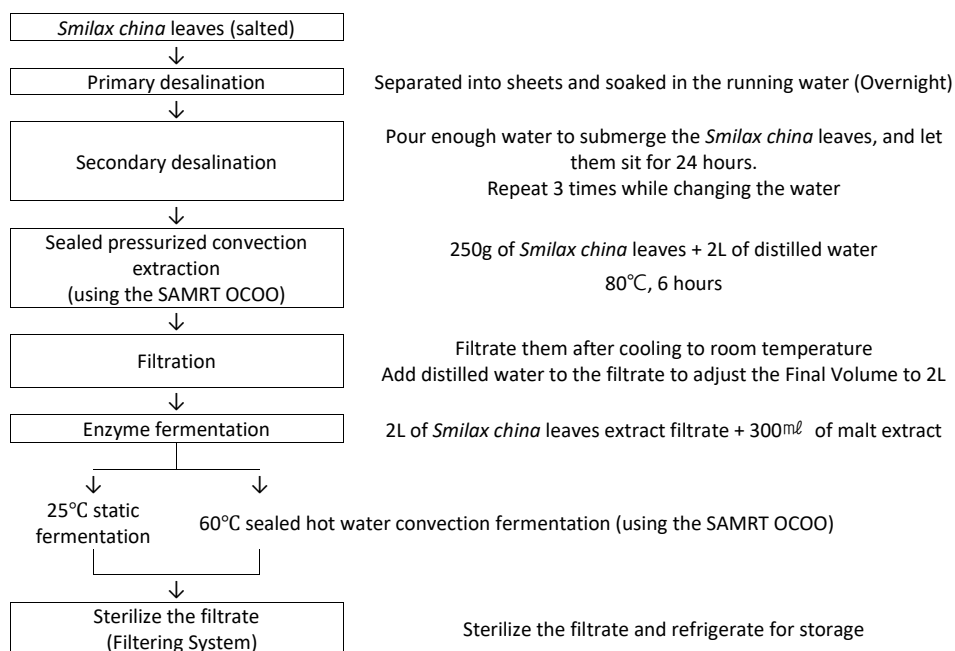
The *Smilax china* leaves used in this study were collected from Uiryeong-gun, Gyeongsangnam-do and processed by the Uiryeong-gun Herb Farming Association, purchased from the Nonghyup Oil Farming Cooperative. The leaves delivered in salted state were used after desalting. The first desalting process was carried out in which the salted *Smilax china* leaves were separated into pieces and soaked in running water overnight to remove the base. After the primary desalination process, the leaves of *Smilax china* leaves were placed in a bucket and watered enough to submerge, followed by a secondary desalination process for 24 hours. The second desalting process was repeated 3 times while changing the water. After the desalting process, the leaves of *Smilax china* leaves were dried and extracted. The 250 g of desalted *Smilax china* leaves and 2 L of distilled water were placed in SMART OCOO(Oku, Korea), sealed and extracted by convection for 6 hours. After extraction, it was cooled to room temperature and used for enzyme fermentation.

The 2L of distilled water was added to 200 g of malt, stirred well, and then left at room temperature for 1 hour. After that, knead it well by hand to make a malt liquid, then set it aside to take only the top water. This process was repeated twice and the combined malt juice was used for the enzyme fermentation.

After mixing 300 ml of malt extract with 2 L of *Smilax china* leaves extract, enzymatic fermentation was carried out under 2 conditions. First, it was made to leave stationary fermentation at 25°C for 2 weeks. As another condition, enzyme fermentation was performed in a sealed bath convection method at 60°C for 6 hours in SMART OCOO(Oku, Korea). After the enzyme fermentation was completed, it was filtered through sterile gauze and stored in a refrigerator for use in the experiment.

The experimental method for the enzyme fermentation of *Smilax china* is as follows <Figure 1>.

Figure 1. Enzyme fermentation testing method.



2.2. Active ingredient analytical method

The Polyphenol content was measured by applying the Folin-Denis method. Polyphenols are representative antioxidants found in plants, and when Pauline reagent reacts with Polyphenols, it turns blue. The concentration of Polyphenols is judged by the intensity of blue, and the darker the color, the higher the concentration. By measuring the absorbance(750nm), a calibration curve was prepared and quantified.

The total sugar content was measured by applying the DNS method. Maltose was used as a standard, and a calibration curve was prepared and quantified by measuring absorbance(470nm).

2.3. Efficacy(in vitro) analytical method

2.3.1. HaCat cytoprotective effect test for the oxidative stress

The HaCat cytoprotective effect on the oxidative stress caused by H₂O₂ at the cellular level was measured by modifying the CCK-8 method. After culturing the HaCaT cells for 24 hours, a culture solution containing H₂O₂ was administered to react for 24 hours, and the change in absorbance was measured after reacting by adding a CCK-8 solution, and the cell viability relative to the control was marked and expressed as a percentage.

2.3.2. Antibacterial activation

2.3.2.1. Antibacterial testing method – paper disc method

The strain used in the antibacterial experiment was purchased from the Korean Collection for Type Cultures(KCTC). The antibacterial testing method was the Paper Disc method(Davidson & Parish, 1989). A single colony of each purely isolated strain was inoculated into 10 ml of a bacterial growth liquid medium, and cultured three times for 18 to 24 hours at the appropriate temperature for each strain, and then used as an antibacterial activity test strain. For the preparation of the plate medium for antibacterial test, sterilize the growth medium of each strain with 15% agar added, dispense 15 ml each to Petri-Dish to solidify the medium for the base

layer, and set the concentration of each test bacteria at 650 nm with Optical Density(O.D.) to the value of 0.4(10^6 CFU/ml), which was aseptically added to the medium for layering with 0.7% agar, mixed well, and then was evenly distributed on the medium for the base layer, followed by coagulation to make a medium for inoculation of bacteria. A sterilized 8mm Paper Disc was placed on a sufficiently hardened solid medium, and the sample was absorbed so as to be 5-1.25 mg/disc, and after culturing under suitable conditions for growth of each strain, a clear zone around the disc was observed.

2.3.2.2. Anti-fungal testing method - liquid mixing testing method

After taking a single colony of each purely separated strain, 5 ml of sterilized distilled water was added to Petri-Dish cultured on a plate, scraped with a loop to make a bacterial suspension, and then transferred to a sterilized test tube and this suspension was used as an antifungal activity test strain. In a sterile test tube, 5 ml each of the fungal activity solution and each sample were mixed well and treated at 28°C for 6 hours. Thereafter, 100 μ l of each strain was dispensed into the appropriate growth plate medium, loaded and inoculated, and growth inhibition was observed while culturing under appropriate growth conditions for each strain.

2.3.3. Cytotoxicity

Prior to the anti-inflammatory activity, a cytotoxicity test was performed to determine the concentration of the sample that does not cause toxicity to cells. Toxicity for the cells was analyzed by CCK-8 method. Changes in absorbance were measured and cell viability relative to the control was marked and expressed as a percentage.

2.3.4. Anti-inflammatory

The proteins in cultured cells were quantified by using the BCA reagent and electrophoresed on 10% SDS Polyacrylamide Gel. It was transferred to a PVDF membrane, the antibody was reacted, and a photograph of each band was taken after color development.

2.3.5. TNF- α , IL-6 and iNOS expression using the HaCaT cells

TNF- α , IL-6 and iNOS are known to cause inflammatory hair loss[33][34]. An experiment was conducted to find out whether the anti-inflammatory properties of the prepared samples had an inhibitory effect on inflammatory hair loss. In order to compare and analyze the efficacy of inhibiting inflammatory hair loss by co-treating green coffee bean ferment extract and LPS(Lipopolysaccharide) to HaCaT cells cultured for 24 hours, the expression levels of genes causing hair follicle destruction and cell death were compared by relative quantification. The proteins were quantified using the BCA(Bicinchoninic Acid) reagent and electrophoresed in 10% SDS Polyacrylamide Gel. The exposed band was transferred to PVDF membrane, reacted with the antibody, and after color development, the photos of each band were taken using the ChemiDoc.

2.3.6. Dermal papilla cell's proliferation rate

5×10^4 cells/ml of the HHDPCs cells were dispensed in a 96-well plate, and the samples were diluted 2-4 times and treated for 72 hours in 24 hour units. After adding CCK-8 solution and reacting for 1 hour at 37°C, 5% CO₂ incubator, the change in absorbance was measured and the cell viability relative to the control was expressed as a percentage. For ERK and Akt phosphorylation, HHDPCs cells were cultured for 24 hours and then treated with ferment extract and minoxidil, then absorbance was measured and confirmed with the Western-blot.

3. Results

3.1. Abbreviation

- * ME : *Smilax china* extract
- * MEE25 : *Smilax china* fermentation by enzyme at 25 °C
- * MEE60 : *Smilax china* fermentation by enzyme at 60 °C

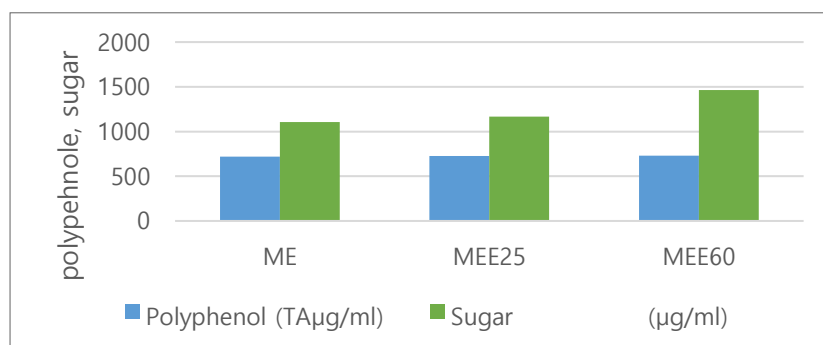
3.2. Fermentation experimental results

During the enzymatic fermentation with the malt of *Smilax china* leaves extract, the pattern according to the temperature turned out to be very different. When the enzyme was fermented at 25 °C, the color was light and slightly viscous, and after 7 days, gas was generated, and the stopper had to be opened to release the gas. The recovery rate was 94%. Meanwhile, when the enzyme was fermented at 60 °C, the color was darker, and it became very sticky and thick. The recovery rate was 78%.

3.3. Active ingredient analytical results

The total Polyphenol content of the *Smilax china* leaves extract was 719 µgTA/ml, and did not change even during enzymatic fermentation, and the difference due to the enzymatic fermentation temperature was not significant. In the enzyme fermented product of *Smilax china* leaves extract, there was no significant change in sugar content, and while there was a difference according to the enzyme fermentation temperature, the difference was not significant <Figure 2>.

Figure 2. Results of the active ingredient analysis.

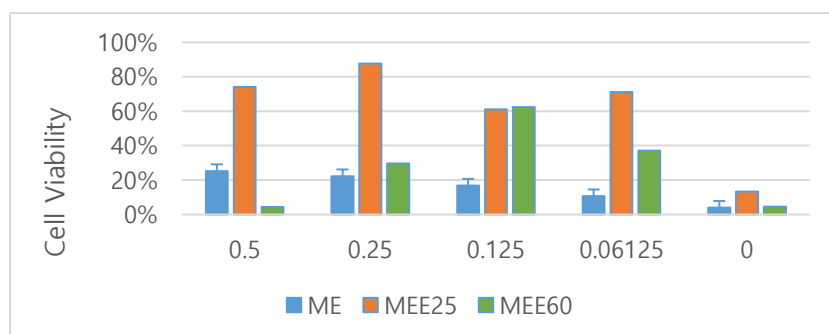


3.4. Efficacy(in vitro) testing results

3.4.1. HaCaT cell protective effect for the oxidative stress

As a result of confirming the HaCaT cell protective effect of the sample under the oxidative stress induced by H₂O₂, it was demonstrated that there was a cell protective effect. The enzyme fermented product of *Smilax china* leaves at 25 °C demonstrated significantly superior cell proliferation effect than control Minoxidil <Figure 3>.





Figure 3. Cytoprotective effect of *Smilax china* ferment according to oxidative stress.



3.4.2. Antibacterial activation

The enzyme fermented products of *Smilax china* leaves extract at 25 °C and 60 °C demonstrated inhibitory rings(13mm, 13mm) for the *Bacillus subtilis*. Furthermore, the effect of inhibiting the growth of *Microsporum canis* and *Trichophyton mentagrophytes* was excellent. The growth inhibitory effect on *Microsporum canis* was excellent in the order of *Smilax china* leaves extract < *Smilax china* leaves extract at 60 °C enzyme ferment << *Smilax china* leaves extract at 25 °C enzyme fermented product. In particular, it was excellent in its ability to inhibit the growth of *T. mentagrophytes*, and the enzyme fermented product of *Smilax china* leaves extract 25 °C inhibited the growth of *T. mentagrophytes* by over 90% <Figure 4>.

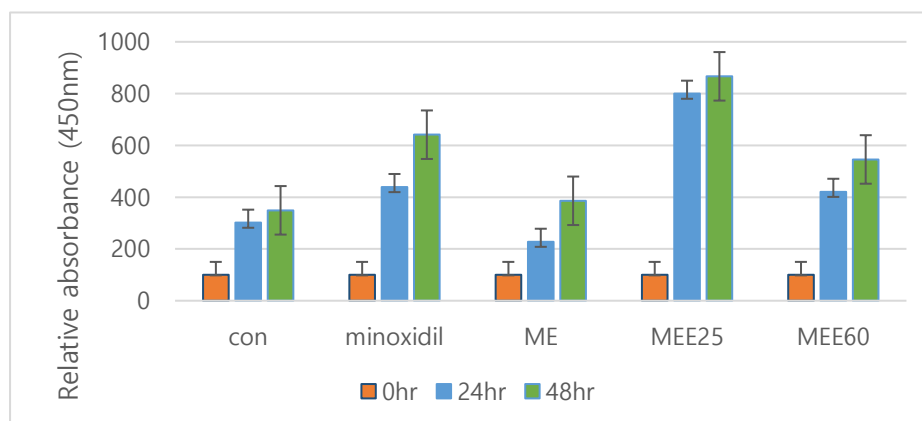
Figure 4. Antibacterial effect of fermented *Smilax china* enzyme.

| | Microsporum canis KCTC 6349 | | Trichophyton mentagrophytes KCTC 6316 | | | |
|---------------|--|--|---|--|---------|-------|
| | 25°C enzyme fermentation | 60°C enzyme fermentation | 25°C enzyme fermentation | 60°C enzyme fermentation | | |
| | ++++ | + | +++++ | +++ | | |
| |  |  |  |  | | |
| Antibacterial | 0% | 0%~25% | 25%~50% | 50%~75% | 75%~90% | 90%~ |
| Expression | ND | + | ++ | +++ | ++++ | +++++ |

3.4.3. Effects on HaCaT cell proliferation

To determine the effect on the proliferation of HaCaT cells. Minoxidil(10 μ m) was treated together as a control, and the enzyme fermented product of *Smilax china* at 25 °C demonstrated significantly superior cell proliferation effect than the control Minoxidil <Figure 5>.

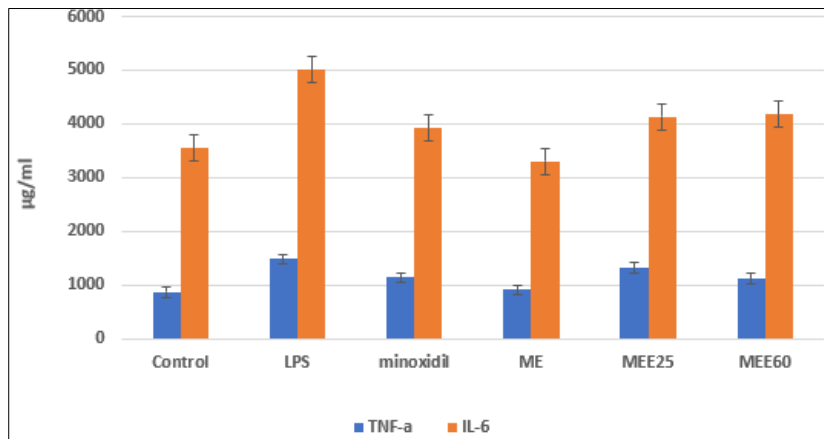
Figure 5. HaCaT cell's proliferation effect of *Smilax china* fermented enzyme.



3.4.4. Anti-inflammatory

In the group treated with each sample, it was revealed that TNF- α and IL-6 were inhibited, and it was found that there was an anti-inflammatory effect <Figure 6>.

Figure 6. Inhibitive effect on inflammatory cytokines by treatment with *Smilax china* fermented enzyme.

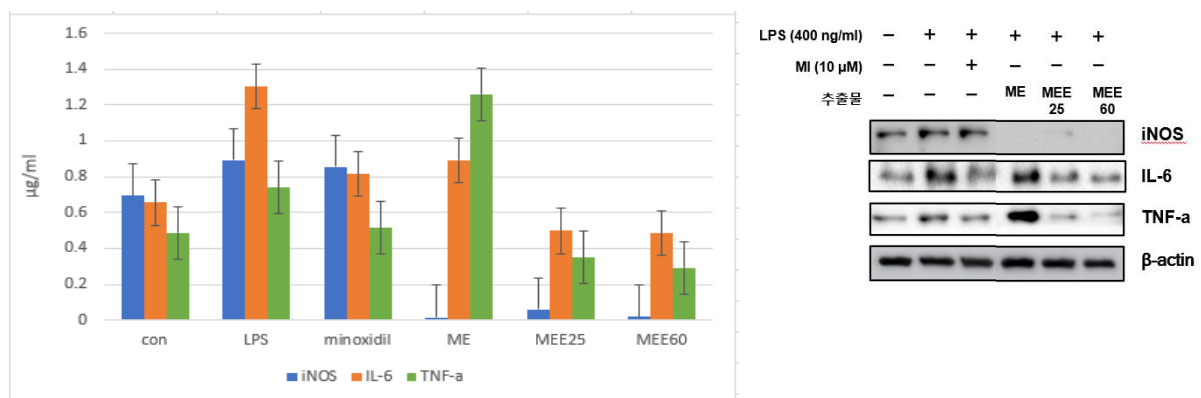


3.4.5. TNF- α , IL-6 and iNOS expression using the HaCaT cells

To compare and analyze the anti-inflammatory efficacy of the HaCaT cells incubated with the sample and LPS, the expression of TNF(Tumor Necrosis Factor)- α and IL-6, which are expressed during inflammation, was confirmed. It was also confirmed that the inflammatory cytokines TNF- α and IL-6 were increased when treated with LPS(400ng/ml), and in the group treated with the sample, TNF- α and IL-6 were inhibited compared to the control treated with LPS confirmed accordingly. In particular, it was confirmed that the TNF- α inhibitory effect was significantly superior to that of Minoxidil, regardless of the presence or absence of fermentation, and hence, the anti-inflammatory effect was significantly superior.

It was sought to confirm the gene expression levels of the inflammatory enzymes iNOS and the inflammatory cytokines TNF- α and IL-6. As shown in the ELISA results, iNOS, TNF- α and IL-6 were increased in the LPS-treated group compared to the control, and decreased when Minoxidil was treated. The expression of TNF- α and IL-6 genes was significantly reduced compared to the LPS-treated group, and in particular, almost no iNOS gene was found <Figure 7>.

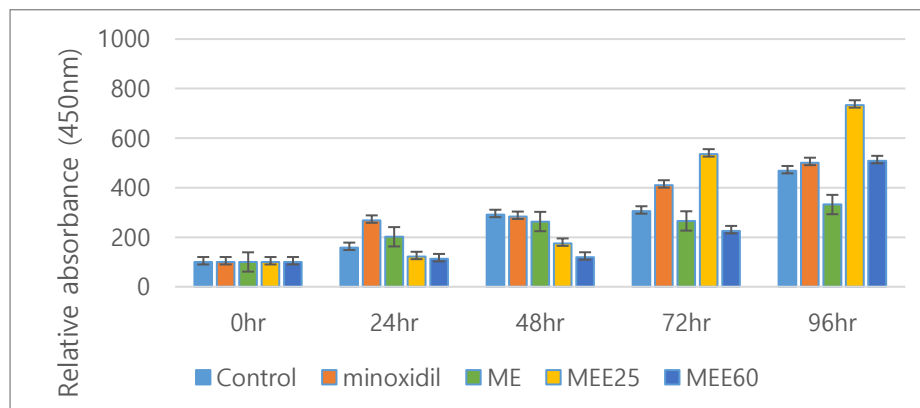
Figure 7. Inhibitive effect of the inflammatory cytokine gene expression by treatment with *Smilax china* fermented enzyme.



3.4.6. Dermal papilla cell's proliferation rate

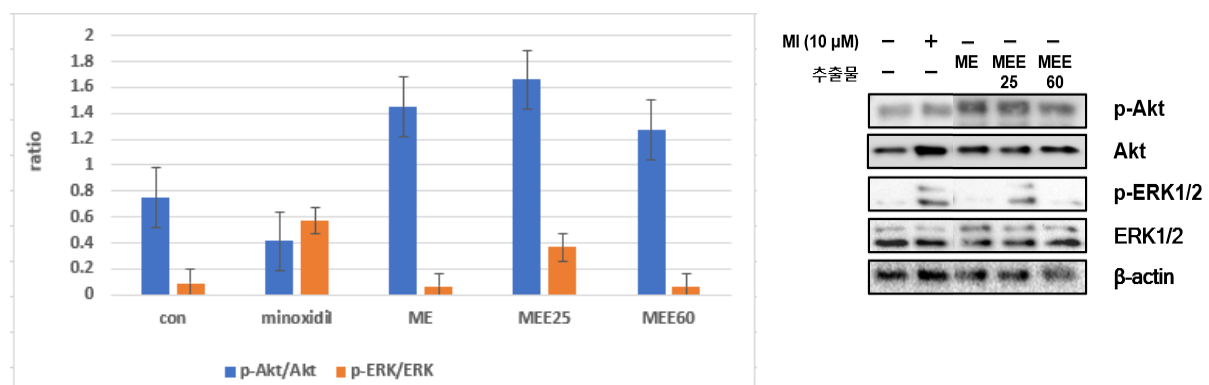
It was sought to confirm the cell proliferation effect on the human dermal papilla cells(HHDPCs). Minoxidil was treated together as a control, and the effect of HDP cell proliferation over time was confirmed. As a result, the cell proliferation effect was increased with time in the cells treated with Minoxidil compared to the control, and the *Smilax china* fermented at 25°C demonstrated a significantly superior cell proliferation effect than the control Minoxidil <Figure 8>.

Figure 8. Proliferative effect of human dermal papilla cells(HHDPC) by treatment with *Smilax china* fermented enzyme.



To investigate the signaling pathways related to the proliferation of dermal papilla cells, the effect on Akt and ERK phosphorylation was confirmed and the Western Blot was performed. As a result of the experiment, the expression level of Akt phosphorylation gene was significantly increased compared to the positive control Minoxidil treatment. In particular, the enzyme fermented product of *Smilax china* at 25°C significantly increased the expression level of ERK phosphorylation gene than Minoxidil <Figure 9>.

Figure 9. Effect of Akt and ERK phosphorylation by *Smilax china* fermented enzyme fermented broth treatment.



4. Conclusion

For this study, the active ingredients and effectiveness(*in vitro*) were analyzed after the enzymatic fermentation of malt used in the manufacture of traditional beverages using *Smilax china*. As a result of the study, the following conclusions were reached.

First, as a result of confirming the protective effect of the HaCaT cells in the oxidative stress induced by H₂O₂, the enzyme fermented product of *Smilax china* at 25 °C demonstrated an excellent cell protective effect.

Second, the enzyme fermented extract of *Smilax china* leaves extract was excellent in inhibiting the growth of *Microsporum canis* and *Trichophyton mentagrophytes*, which are the causes of Tinea capitis.

Third, the enzyme fermented product at 25 °C of *Smilax china* papillae demonstrated an excellent growth rate of dermal papilla cells.

Fourth, the fermented *Smilax china* demonstrated excellent anti-inflammatory properties.

Fifth, the expression levels of Akt and ERK phosphorylation genes significantly increased in the enzyme fermented product of *Smilax china* at 25 °C.

As a result of the study conducted, the enzyme fermented product of *Smilax china* has excellent HaCat cell protective effect against oxidative stress, antibacterial activity, anti-inflammatory activity, and dermal papilla cell proliferation rate, and hence, it can improve scalp condition, prevent hair loss and promote hair growth, and it can be applied as an effective material for cosmetics, as it was confirmed.

The difference of this study is that the main raw material is *Smilax china*, a clinically safe natural material that has been used in the private sector for various pharmacological effects for a long period of time, and that it was fermented by enzyme using malt used in traditional beverage manufacturing. Also, By using only pure water as a solvent for extraction and fermentation, a method that is safe for the human body and reduces environmental pollution was presented. A limitation of this study is that dried leaves were not used. Since dried leaves are used for medicinal purposes, further research using dried leaves should be conducted.

It is expected that the studies on the fermented cosmetic materials using natural products will continue in the trend that the population with hair loss is getting younger due to environmental pollution and sensitive scalp, and moving forward, it is also expected that the development of scalp and hair care cosmetics or quasi-drugs using the fermented natural products as materials and applying massage will help the scalp activity and blood circulation of the head muscles.

5. References

5.1. Journal articles

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6. Appendix

6.1. Author's contribution

| | Initial name | Contribution |
|-----------------------|--------------|---|
| Lead Author | MC | -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/> |
| Corresponding Author* | EC | -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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Corresponding author*
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The Effect of Socio-Cultural Attitude towards Appearance on the Medical Skin Care Customer Behaviors' Intention: With a Focus on the Sequential Mediating Effect of the Medical Skin Care Involvement and the Appearance Related Quality of Life

Haedeun Kim¹

Seokyeong University, Seoul, Republic of Korea

Eunsook Kim^{2*}

Seokyeong University, Seoul, Republic of Korea

Abstract

Purpose: The purpose of this study is such that, the socio-cultural attitude towards appearance and the effect of medical skin care customer behaviors' intention were analyzed, and the effect of medical skin care involvement and the appearance related quality of life sequentially was studied, while the basic data was presented for strategic counseling and promotional marketing expansion of medical skin care according to socio-cultural attitude towards appearance and customer behaviors' intention.

Method: In this study, a statistical analysis was performed by using the SPSS 25.0 and PROCESS macro for SPSS programs as an empirical analytical method for 507 copies through an online questionnaire in the Seoul metropolitan area targeting men and women in their 20s and 60s, and the independent sample t-test was used to confirm the difference among the major variables according to gender, and the model 6 analysis was performed by using the SPSS Process Macro to verify the research model.

Results: In terms of the results of this study, first, as a result of confirming the differences among the major variables according to gender, significant differences were found in the socio-cultural attitude towards appearance, appearance related quality of life, and the customer behaviors' intention. The socio-cultural attitude towards appearance did not directly affect the customer behaviors' intention, but a high extent of medical skin care involvement increased appearance related quality of life and affected the customer behaviors' intention where the sequential mediating effect was found, and in terms of the difference between male and female pathways, it was found that the higher the quality of life related to appearance, the higher the customer behaviors' intention.

Conclusion: According to the results of this study, women with high skin care behavior according to the socio-cultural attitude and aesthetic desire and men with a weakened relationship between quality of life and customer behaviors' intention were appropriate for the intention to purchase according to their appearance, depending on gender, and from a positive point of view, it is necessary to approach the counseling services and marketing that can increase the intention to purchase through the external beauty. The increase in the appearance related quality of life according to the extent of medical skin care involvement affects the customer behaviors' intention, which provides the service information that can promote a stable life and provides self-care through the various beauty lifestyles through the skin care, and hence, it is considered that it would be necessary to provide the information that not only self-satisfaction but also the overall quality of life is affected.

Keywords: Medical Skin Care, Socio-Cultural Attitude Towards Appearance, Customer Behaviors' Intention, Medical Skin Care Involvement, Appearance Related Quality of Life

1. Introduction

The ideal condition of beauty required by the modern society has long been the aesthetic

standard for the desire to have a beautiful appearance and a beautiful body. Furthermore, appearance management, which is among the very necessary elements in forming gender relationships in society[1], becomes competitive for interpersonal relationships and ability related evaluations[2]. Currently, as a result of the development of information and communication technologies, the scope of social and cultural attitude towards appearance is expanding given the changes in the environment and perception[3]. Popularly speaking, the concept of beauty has been recognized as a smooth and healthy skin, and the knowledge and technology for aesthetics have been developed to inevitably create and maintain[4] the healthy skin[5].

Together with which, along with the interest in appearance, the demand for skin care and cosmetics has increased[6]. Furthermore, as the skin care performed at hospitals[7], problematic skin diseases that cannot be addressed at general skin care centers[8] due to the increase in the post-procedure treatment related to cosmetic surgery, etc., medical skincare has become a representative trend in the field of cosmetic medicine[7]. Furthermore, it was recognized by the customers for the use of medical devices, the professionalism of doctors and the reliability of hospitals[9]. As the skin beauty industry develops into an important area of the service industry[10], the importance of behavioral intention to evaluate whether customers will maintain a relationship with a dermatologist or hospital is emphasized. As a result, the behavioral intention is the most positive result for maintaining a lasting relationship with the customers[11], which can change depending on the specific factors such as physical environment and service related costs, which can affect the customer behavior such as repurchase and reuse[12].

Furthermore, there are individual differences in the extent of personal importance or interest that affects the purchasing behavior of medical skin care[13], and the extent of involvement that indicates the extent of relevance of the consumer him or herself[14]. People search for more information as their level of involvement with their needs rises, and they have a high relationship with the interest and involvement according to their level of medical skin care[15].

Examining the previous studies of this study, the effects of socio-cultural attitude towards appearance of middle-aged women on the body image and appearance management related behavior[16], development of cosmetic involvement related scale and group categorization of the Korean men in their 20s and 30s[17], and others as such were studied, while the studies have been conducted on the effect of cultural attitude towards the personal appearance related satisfaction and quality of life through the appearance management related behaviors[18]. However, the study on the relationship between medical skin care customer behaviors' intention is very scarce, and furthermore, the study on the effect of medical skin care involvement and the appearance related quality of life on the quality of life is even more scarce.

Hence, in this study, first, differences between the major variables according to gender were identified, and second, a study on the sequential mediating effects of medical skin care involvement and the appearance related quality of life in terms of the relationship between socio-cultural attitude towards appearance and customer behaviors' intention, and third, according to gender, the basic data are presented for the scalability of medical skin care physical service environment regulations by analyzing how the path difference affects the relationship between the major variables as a matter of purpose.

2. Theoretical Background

2.1. Medical skin care

Medical skin care is a combination of medical treatment and skin care, and the skin care is performed concurrently with medical treatment by a professional doctor. That is, it is called the

therapeutic skin care[19]. On top of the treatment of skin diseases, the focus is placed on increasing the customer satisfaction and therapeutic effects across the areas of skin care and prevention of skin diseases[20].

2.2. Socio-cultural attitude towards the appearance

In the modern society, the appearance management has become an essential element as image has become a criterion for determining a person regardless of the person's actual personality according to the body image[21]. The socio-cultural attitude towards appearance was developed in 1995 and is consisted of the 2 factors of cognitive and internalization. The cognitive factor refers to recognizing the socially objective importance of the ideal appearance, and the internalization factor refers to accepting the social importance of the appearance and using it as a criterion for evaluating one's body[22].

2.3. Customer behaviors' intention

The customer behaviors' intention refers to a customer's thoughts or plans to perform a specific action in the future. This is a social behavioral intention that induces the positive word-of-mouth behavior according to the intention and satisfaction of the economic actions that which the profit structure of a company, such as revisitation and repurchase, and can also be used for predicting the future behaviors[23]. This behavioral intention has been proven to increase the intention to purchase for skin care when the consumption desire arises, which is understood to occur when the customized cosmetics are considered to satisfy the consumers' needs of [24].

2.4. Medical skin care involvement

Involvement is a variable which affects the consumer behavior, and refers to the extent of perception of an individual's importance to a specific object in a given situation [17]. It is a multi-dimensional concept that is divided into dimensions such as personal importance, pleasure, symbolic value, and risk, and among them, personal importance or interest is recognized as the most central concept[25].

2.5. Appearance related quality of life

Quality of life is a subjective and comprehensive concept which includes not only the visible material things, but also the external and internal parts of social life, such as the psychological, social, and emotional aspects of immaterial things[26]. In a recent study, a measurement tool was developed based on the intimate relationship between the body image and the quality of life in the Korean society, which emphasizes appearance. For the women who are highly concerned about their appearance, body image has become a major factor in determining their overall quality of life[27].

3. Research Method

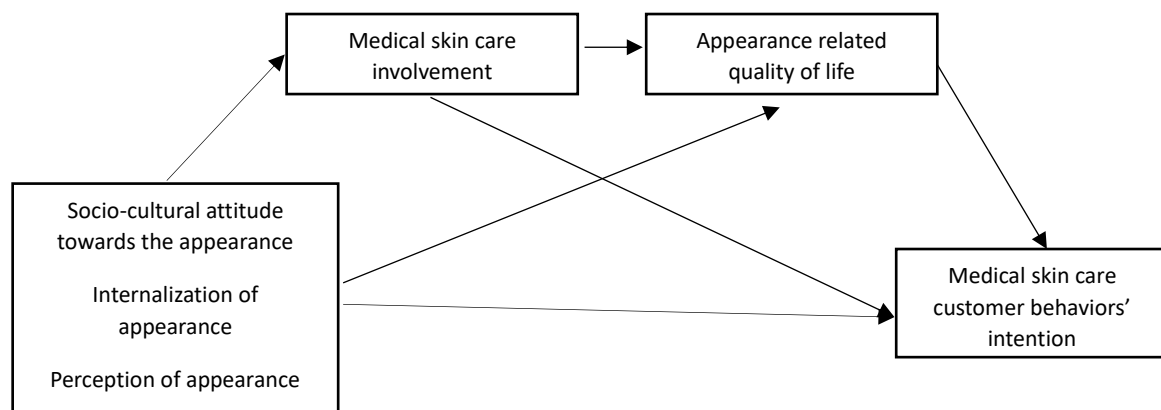
3.1. Research subject

In this study, in order to examine whether the socio-cultural attitude towards appearance has a sequential mediating effect on the medical skin care involvement and the appearance related quality of life in terms of the effect of medical skin care customer behaviors' intention, from February 10, 2022 through February 17, 2022, a total of 530 copies of online questionnaires and consent forms were distributed targeting men and women(251 men, 256 women) in their 20s through 60s in the Seoul region, which were collected, following which 507 copies excluding 23 copies were selected and analyzed.

3.2. Research method

In this study, the online questionnaire method was used as a research tool to empirically analyze the research question, and the questionnaire was consisted of 6 questions using nominal scales for general characteristics, and 6 questions for the socio-cultural attitude towards appearance[20], 5 questions for the medical skin care involvement[28], 3 questions for the appearance related quality of life[20], and 3 questions for the customer behaviors' intention[29] for a total of 23 questions using a Likert 5-point scale, which were corrected and supplemented by the researcher in line with this study.

Figure 1. Research model.



3.3. Research questions

H1. There will be differences between the major variables according to gender.

H2. There will be a sequential mediating effect of the medical skin care involvement and the appearance related quality of life in terms of the relationship between the socio-cultural attitude towards appearance and the customer behaviors' intention

H3. The differences in pathways by gender will affect the relationship between the major variables.

3.4. Statistical analytical method

The following statistical analysis was performed for the data of this study by using the SPSS 25.0 program.

First, to check the reliability and validity of the scales used in the study, the internal agreement(Cronbach's α) was calculated for each scale, and an exploratory factor analysis applied with principal component and the Varimax rotation was performed.

Second, the descriptive statistical analysis was performed to understand the level of the research variable.

Fourth, an independent sample t-test was conducted to confirm the difference in major variables according to gender.

Fourth, the Pearson's correlation was performed to examine and understand the correlation between the research variables.

Fifth, the model 6 was analyzed by using the SPSS Process Macro to verify the research model. In the statistical analysis above, the statistical significance was determined based on the significance level of 5%.

4. Research Results

4.1. Exploratory factor analysis

The exploratory factor analysis was performed to verify the validity of the variables used for this study. The principal component analysis and the Varimax rotation were performed as the methods. For the factor classification, if the factor loading exceeded .40, it was classified as a relevant factor.

4.1.1. Socio-cultural attitude towards the appearance

The socio-cultural attitude towards appearance was analyzed by a factor of 6 questions, as illustrated in <Table 1>. As a result of the factor analysis performed, the KMO measure turned out to be .796, and the result of Bartlett's sphericity test was significant($\chi^2=897.217$, $p<.001$), confirming that it was a suitable form to proceed with the factor analysis. The socio-cultural attitude towards appearance was classified into two factors, and the two factors demonstrated 66.139% of the factor explanatory power. The first factor was named 'internalization' with 3 questions, and the second factor was named 'perception' with 3 questions.

Table 1. Factor analysis of socio-cultural attitude towards the appearance.

| | Questions | 1 | 2 |
|---|---|--------|--------|
| Internalization | I tend to compare my body to the celebrities of television and movies. | 0.803 | 0.172 |
| | When I see pictures of those with nice bodies, I want to be like them. | 0.842 | 0.247 |
| | I want my body and appearance look like the people's in television or movies. | 0.795 | 0.248 |
| Perception | Appearance is very important for success in today's society. | 0.255 | 0.599 |
| | Most people believe that the thinner you are, the better you look. | 0.231 | 0.807 |
| | Most people think that 'the thinner you are, the more stylish you are'. | 0.135 | 0.827 |
| Eigen value | | 2.123 | 1.846 |
| % of variance | | 35.380 | 30.759 |
| Cumulative % | | 35.380 | 66.139 |
| KMO=.796, Bartlett $\chi^2=897.217(p<.001)$ | | | |

4.1.2. Medical skin care involvement

The factor analysis was performed with 5 questions for the medical skin care involvement. As a result of the factor analysis performed, the KMO measure turned out to be .814, and the result of Bartlett's sphericity verification was also significant($\chi^2=809.159$, $p<.001$), and the factor analysis model was determined to be suitable. The level of medical skin care involvement was classified into 1 factor, and the 1 factor demonstrated a factor explaining power of 57.771%, as illustrated in <Table 2>.

Table 2. Factor analysis of the medical skin care involvement.

| Questions | 1 |
|---|-------|
| Medical skin care is important to me. | 0.733 |
| Medical skin care makes my life interesting. | 0.788 |
| I'm usually very interested in the medical skin care. | 0.763 |

| | |
|--|--------|
| I have a lot of knowledge about the medical skin care. | 0.774 |
| I tend to actively recommend to those around me about the medical skin care. | 0.740 |
| Eigen value | 2.889 |
| % of variance | 57.771 |
| Cumulative % | 57.771 |
| KMO=.814, Bartlett $\chi^2=809.159(p<.001)$ | |

4.1.3. Appearance related quality of life

For the appearance related quality of life, the factor analysis was performed with 3 questions. As a result of the factor analysis performed, the KMO measure turned out to be .688, and Bartlett's sphericity verification result was also significant($\chi^2=409.019$, $p<.001$), and the factor analysis model was determined to be suitable. The appearance related quality of life was classified as 1 factor, and the 1 factor demonstrated 68.749% of the factor explanatory power, as illustrated in <Table 3>.

Table 3. Factor analysis of the appearance related quality of life.

| Questions | 1 |
|--|--------|
| I consider myself a valuable person via the appearance management. | 0.808 |
| I'm living a valuable life by managing my appearance. | 0.861 |
| I have a bright and positive future via the appearance management. | 0.818 |
| Eeigen value | 2.062 |
| % of variance | 68.749 |
| Cumulative % | 68.749 |
| KMO=.688, Bartlett $\chi^2=409.019(p<.001)$ | |

4.1.4. Medical skin care customer behaviors' intention

The medical skin care purchasing behavior was analyzed by 3 factors. As a result of the factor analysis performed, the KMO measure turned out to be .730, and the result of Bartlett's sphericity verification was also significant($\chi^2=637.029$, $p<.001$), and the factor analysis model was determined to be suitable. The medical skin care customer behaviors' intention was also classified as 1 factor, and the 1 factor demonstrated 76.589% of the factor explanatory power, as illustrated in <Table 4>.

Table 4. Factory analysis of the medical skin care customer behaviors' intention.

| Questions | 1 |
|--|-------|
| I will spread positive words of mouth about this hospital. | 0.808 |
| I intend to visit this hospital again soon. | 0.861 |
| I'm willing to recommend this hospital to those around me. | 0.818 |
| Eeigen value | 2.298 |

| | |
|---|--------|
| % of Variance | 76.589 |
| Cumulative % | 76.589 |
| KMO=.730, Bartlett $\chi^2=637.029(p<.001)$ | |

4.2. Reliability analysis

The reliability analysis was performed by using the Cronbach's alpha value to check whether the respondents provided their answers consistently in the scale of this study, which is as illustrated in <Table 5> below. The reliability condition was based on Cronbach's alpha value of 0.6(Hair et al., 1998)[30], and the alpha value of all variables turned out to be 0.6 or higher, confirming their good reliability.

Table 5. Reliability analysis.

| Variable | Number of questions | Cronbach's α |
|--|---------------------|---------------------|
| Internalization of appearance | 3 | 0.797 |
| Perception of appearance | 3 | 0.673 |
| Socio-cultural attitude towards the appearance | 6 | 0.796 |
| Medical skin care involvement | 5 | 0.816 |
| Appearance related quality of life | 3 | 0.77 |
| Medical skincare customer behaviors' intention | 3 | 0.845 |

4.3. Descriptive statistical analysis

The descriptive statistical analysis was performed to verify the characteristics of the main variables, and the results are as illustrated in <Table 6>. It turned out that the mean of socio-cultural attitude towards appearance was 3.8166, mean of involvement was 3.2757, mean of appearance related quality of life was 3.4149, and the mean of customer behaviors' intention was 3.3248. Furthermore, the skewness and kurtosis were checked to verify the normality of each variable, and the absolute values of all skewness and kurtosis were less than 3 and 10, confirming the normal distribution(Kline, 2005)[31].

Table 6. Descriptive statistics.

| Name of variable | Minimum value | Maximum value | Mean | Standard deviation | Skewness | Kurtosis |
|--|---------------|---------------|--------|--------------------|----------|----------|
| Socio-cultural attitude towards the appearance | 1.33 | 5.00 | 3.8166 | 0.65175 | -0.746 | 0.685 |
| Medical skin care involvement | 1.40 | 5.00 | 3.2757 | 0.71380 | -0.077 | -0.270 |
| Appearance related quality of life | 1.00 | 5.00 | 3.4149 | 0.72590 | -0.292 | 0.509 |
| Customer behaviors' intention | 1.00 | 5.00 | 3.3248 | 0.84070 | -0.497 | 0.264 |

4.4. Differences in key variables according to gender

The independent sample t-test was conducted to verify the difference in terms of the mean between the 2 groups in order to confirm the difference in the major variables according to gender, as illustrated in <Table 7> below. As a result of the analysis performed, it turned out that it was significant in the socio-cultural attitude towards appearance ($t=-2.900$, $p=0.004$), appearance related quality of life ($t=2.195$, $p=0.029$), and the customer behaviors' intention ($t=2.745$, $p=0.006$). It turned out that the mean of women was higher in socio-cultural attitude towards appearance, and the mean of men in appearance related quality of life and customer behaviors' intention was higher than that of men.

Table 7. Differences according to gender.

| Variable | Classification | Mean | Standard deviation | t | p |
|--|----------------|--------|--------------------|----------|-------|
| Socio-cultural attitude towards the appearance | Men | 3.7324 | 0.64273 | -2.900** | 0.004 |
| | Women | 3.8991 | 0.65122 | | |
| Medical skin care involvement | Men | 3.3124 | 0.71753 | 1.144 | 0.253 |
| | Women | 3.2398 | 0.70969 | | |
| Appearance related quality of life | Men | 3.4861 | 0.64989 | 2.195* | 0.029 |
| | Women | 3.3451 | 0.78845 | | |
| Customer behaviors' intention | Men | 3.4276 | 0.78851 | 2.745** | 0.006 |
| | Women | 3.2240 | 0.87881 | | |

Note: * $p<0.05$ ** $p<0.01$ *** $p<0.001$.

4.5. Correlation analysis

The Pearson's correlation analysis was performed to examine and understand the correlation between the variables in this study, as illustrated in <Table 8> below. As a result of the analysis performed, the socio-cultural attitude towards appearance had a positive(+) relationship with involvement, appearance related quality of life, and the customer behaviors' intention, while the involvement was positive(+) with the appearance related quality of life and the customer behaviors' intention, and it turned out that the appearance related quality of life had a positive(+) relationship with the customer behaviors' intention.

Table 8. Correlation analysis.

| | 1 | 2 | 3 | 4 |
|---|---------|---------|---------|---|
| 1. Socio-cultural attitude towards the appearance | 1 | | | |
| 2. Medical skin care involvement | .364*** | 1 | | |
| 3. Appearance related quality of life | .359*** | .491*** | 1 | |
| 4. Customer behaviors' intention | .206*** | .586*** | .395*** | 1 |

Note: * $p<0.05$ ** $p<0.01$ *** $p<0.001$.

4.6. Verification of research hypothesis

The analysis using the Process Macro No. 6 model proposed by Hayes(2012) to verify the sequential double mediating effect of the medical skin care involvement and the appearance related quality of life in terms of the relationship between socio-cultural attitude towards appearance and customer behaviors' intention was carried out, which is as illustrated in <Table 9> below[32].

A total of 4 phases of the model process were analyzed, and the F values of all models were statistically significant, thereby satisfying the model fit($p < .001$). First, in Model 1, the socio-cultural attitude towards appearance had a significant positive effect on the medical skin care involvement($\beta = .36$, $p < .001$). That is, it was confirmed that the higher the socio-cultural attitude towards appearance, the higher the medical skin care involvement's score. Next, in Model 2, when the effect of socio-cultural attitude towards appearance and medical skin care involvement on the appearance related quality of life was analyzed, the socio-cultural attitude towards appearance($\beta = .21$, $p < .001$) and the medical care involvement($\beta = .42$, $p < .001$) had a significant positive effect on the appearance related quality of life. This means that the higher the socio-cultural attitude towards appearance and the higher the level of medical skin care involvement, the higher the quality of life related to appearance.

In Model 3, the extent of involvement in the medical skin care for appearance($\beta = .53$, $p < .001$) and the appearance related quality of life($\beta = .15$, $p < .001$) were positively significant in the customer behaviors' intention, whereas the socio-cultural attitude towards appearance did not significantly affect the customer behaviors' intention. Lastly, in Model 4, the direct relationship between the socio-cultural attitude towards appearance and the customer behaviors' intention was confirmed, and the relationship between them was positively significant($\beta = .21$, $p < .001$). That is, while the socio-cultural attitude to appearance independently had a significant effect, it was not significant in Model 3, which was added with parameters, thereby confirming that it was a fully mediated effect. Furthermore, to verify the significance of the mediating effect, the bootstrapping-test was conducted, as illustrated in <Table 10> below. As a result of the analysis performed, it was confirmed that the mediating effect of medical skin care involvement, the mediating effect of appearance related quality of life, and the sequential mediating effect of the involvement and quality of life were all significant since 0 was not included between the lower value(LLCI) and the upper value(ULCI).

Table 9. Relationship between major variables.

| Model | DV | IV | B | SE | β | t | p | F(R ²) |
|-------|------------------------------------|--|-------|------|---------|-------|-------|---------------------|
| 1 | Medical skin care involvement | Socio-cultural attitude towards appearance | 0.40 | 0.05 | 0.36 | 8.79 | 0.000 | 77.249*** (.133) |
| 2 | Appearance related quality of life | Socio-cultural attitude towards appearance | 0.23 | 0.05 | 0.21 | 5.11 | 0.000 | 97.256*** (.279) |
| | | Medical skin care involvement | 0.42 | 0.04 | 0.42 | 10.22 | 0.000 | |
| 3 | Customer behaviors' intention | Socio-cultural attitude towards appearance | -0.05 | 0.05 | -0.04 | -1.01 | 0.314 | 94.349*** (.360) |
| | | Involvement | 0.62 | 0.05 | 0.53 | 12.51 | 0.000 | |

| | | | | | | | | |
|---|-------------------------------|--|------|------|------|------|-------|---------------------|
| | | Appearance related quality of life | 0.17 | 0.05 | 0.15 | 3.59 | 0.000 | |
| 4 | Customer behaviors' intention | Socio-cultural attitude towards appearance | 0.27 | 0.06 | 0.21 | 4.74 | 0.000 | 22.455*** (.043) |

Note: *** p<.001.

Table 10. Verification of mediating effects via bootstrap.

| Path | B | S.E. | 95% CI | |
|---|--------|-------|--------|-------|
| | | | LLCI | ULCI |
| Total effect | 0.266 | 0.056 | 0.156 | 0.377 |
| Direct effect | -0.051 | 0.051 | -0.151 | 0.049 |
| Mediating effect of involvement | 0.247 | 0.037 | 0.178 | 0.324 |
| Mediating effect of the appearance related quality of life | 0.040 | 0.020 | 0.010 | 0.087 |
| Sequential mediating effect of the involvement and the appearance related quality of life | 0.029 | 0.011 | 0.008 | 0.053 |

4.7. Comparison of research model pathways according to gender

In order to compare and analyze the differences between the male's and the female's pathways, the research model was analyzed for each male and female, and it is as illustrated in <Table 11> below. With a total of 4 phases of the model process, the F values of all models were statistically significant, satisfying the model fit($p < .001$). As a result of the analysis performed, in Model 1, Model 2, and Model 4, it turned out that the static relationship between the independent variable and the dependent variable was all at a similar level, but in Model 3, the relationship between the appearance related quality of life and the customer behaviors' intention was weakened for men. As a result of verifying the significance of the difference between the 2 coefficients using the beta value and the standard error's score, it turned out to be $-2.106 (Z > 1.96)$, indicating that the appearance related quality of life had a stronger influence for women than for men. Furthermore, as a result of the bootstrapping-test, only the mediating effect of involvement in the medical skin care was significant for men, and no other significant results were found, and as for the results of the mediating effect for women, it was confirmed that all mediating effects were statistically significant, as with the results for all subjects in <Table 12>.

Table 11. Relationships between the main variables.

| Model | DV | IV | Men | | Women | |
|-------|-------------------------------|--|---------|-------|---------|-------|
| | | | β | p | β | p |
| 1 | Medical skin care involvement | Socio-cultural attitude towards appearance | 0.42 | 0.000 | 0.33 | 0.000 |
| 2 | Appearance related | Socio-cultural | 0.17 | 0.004 | 0.27 | 0.000 |

| | | | | | | |
|---|-------------------------------|--|-------|-------|-------|-------|
| | quality of life | attitude towards appearance | | | | |
| | | Medical skin care involvement | 0.44 | 0.000 | 0.39 | 0.000 |
| 3 | Customer behaviors' intention | Socio-cultural attitude towards appearance | -0.01 | 0.924 | -0.05 | 0.436 |
| | | Medical skin care involvement | 0.61 | 0.000 | 0.45 | 0.000 |
| | | Appearance related quality of life | 0.11 | 0.048 | 0.17 | 0.008 |
| 4 | Customer behaviors' intention | Socio-cultural attitude towards appearance | 0.29 | 0.000 | 0.17 | 0.006 |

Note: ***p<.001.

Table 12. Verification of mediating effects via bootstrap.

| Path | | B | S.E. | 95% CI | |
|-------|--|-------|-------|--------|-------|
| | | | | LLCI | ULCI |
| Men | Mediating effect of the medical skin care involvement | 0.311 | 0.052 | 0.212 | 0.417 |
| | Mediating effect of the appearance related quality of life | 0.023 | 0.017 | -0.005 | 0.062 |
| | Sequential mediating effect | 0.025 | 0.015 | -0.005 | 0.056 |
| Women | Mediating effect of level of medical skin care involvement | 0.204 | 0.052 | 0.118 | 0.322 |
| | Mediating effect of the appearance related quality of life | 0.061 | 0.039 | 0.002 | 0.150 |
| | Sequential mediating effect | 0.030 | 0.016 | 0.001 | 0.064 |

5. Conclusion

The purpose of this study was to verify the sequential mediating effects of the medical skin care involvement and the appearance related quality of life in terms of the relationship between the socio-cultural attitude towards appearance and the customer behaviors' intention. To achieve the purpose of the study, 507 men and women in their 20s to 60s in the Seoul region were surveyed online, and the results of the analysis are as follows.

First, as a result of Hypothesis 1 which confirms the difference between the major variables according to gender, excluding the medical skin care involvement, the socio-cultural attitude

towards appearance($t=-2.900$, $p=0.004$), appearance related quality of life($t=2.195$, $p=0.029$), and the customer behaviors' intention($t=2.745$, $p=0.006$) had a significant difference, the socio-cultural attitude towards appearance was higher for women in terms of mean, and the appearance related quality of life and the customer behaviors' intention were higher for men for mean. Examining the previous papers, their results are similar to those of Seonhee Kim [33], Soogyong Oh and Soogyong Kang [34], and it is apparent that the effect on the medical skin care is different according to men and women by gender. Furthermore, it is apparent that the appearance oriented views have a lot of influence on women according to the Korean social culture.

Second, in terms of the relationship between the socio-cultural attitude towards appearance and the customer behaviors' intention, it was analyzed as a process of a total of 4 phases of the model.

In Model 1, the socio-cultural attitude towards appearance had a significant positive effect on the medical skin care involvement($\beta=.36$, $p<.001$). That is, it was confirmed that the higher the socio-cultural attitude towards appearance, the higher the medical skin care involvement's score.

In Model 2, the socio-cultural attitude towards appearance($\beta=.21$, $p<.001$) and the involvement in medical skin care($\beta=.42$, $p<.001$) had a significant positive effect on the appearance related quality of life. This means that the higher the socio-cultural attitude towards appearance and the higher the level of medical skin care involvement, the higher the quality of life related to appearance.

In Model 3, the extent of involvement in the medical skin care for appearance($\beta=.53$, $p<.001$) and the appearance related quality of life($\beta=.15$, $p<.001$) were positively significant for the customer behaviors' intention, whereas the socio-cultural attitude towards appearance did not significantly affect the customer behaviors' intention.

In Model 4, the direct relationship between the socio-cultural attitude towards appearance and the customer behaviors' intention was confirmed, and the relationship between them was positively significant($\beta=.21$, $p<.001$). That is, while the socio-cultural attitude to appearance independently had a significant effect, it was not significant in Model 3, which was added with parameters, thereby confirming that it was a fully mediated effect. Examining these models, Seongnam Kim and Kyeongsook Lee [35], Hyeonok Lee and Yangsook Koo [36], and Jihyeon Jeon [37] demonstrate similar trends, and the higher the medical skin care involvement, the higher the appearance related quality of life. Accordingly, the customer behaviors' intention is also increasing, and a diversity of medical skin care programs is required to maintain the attractiveness in accordance with the objective body standards and perceptions required by the society. Furthermore, since it is directly related to the quality of life, a strategy corresponding to the inner psychology via the appearance management is required. It is considered that it will be necessary to regularly provide the service information which can promote a stable life and provide the information which not only provides self-satisfaction but also the overall quality of life through the various beauty lifestyles through the skin care.

Third, as for the process of Hypothesis 3 which examines and understands the relationship between the major variables in the path difference according to gender, the research model of Hypothesis 2 was analyzed for men and women, each respectively.

As a result of analyzing the 4 phased model process as with Hypothesis 2, it turned out that the static relationships between variables in Model 1, Model 2, and Model 4 were all at similar levels, but in Model 3, in the case of men, it was confirmed that the relationship between the appearance related quality of life and the customer behaviors' intention weakened. As a result of confirming the significance of the difference between the 2 coefficients using the beta value and the standard error's score, it turned out to be $-2.106(Z > 1.96)$, thereby indicating that the

appearance related quality of life has a stronger influence for women than for men. This demonstrates a similar result to the study of Nami Kim[38] which claims that women pursue the appearance related rewards or benefits higher than for men. Furthermore, it turned out that Chae-hyeon Han and Jeongmi Lim[4] considered the physical and social standards more importantly than men ideally. Meanwhile, in the case of men, unlike women, it turned out that the standard of living in connection with the appearance had an effect on the customer behaviors' intention.

Based on such results, it is apparent that there was a difference between the major variables according to gender, and that women have a higher socio-cultural attitude towards appearance than men, and hence, it is apparent that they are largely affected by the external social culture of the time. In the case of men, a high customer behaviors' intention demonstrates the tendency to appropriately indicate the intention to purchase according to appearance. Accordingly, this implies that it is necessary to try targeted marketing by dividing and classifying the customer groups according to gender. The universalized social and cultural attitude towards appearance is considered to have a significant effect on the customer behaviors' intention as the interest in the healthy skin care has expanded and the interest in the medical skin care has grown.

It is considered that, the increasing quality of life following the medical skin care involvement consequently requires the efforts to increase the customer behaviors' intention by applying counseling and services for the customers' social status and self-efficacy or confidence from the hospital's point of view, and the understanding of the social and cultural attitude according to the medical skin care, consisted of various programs, and marketing approach and consulting skills. When examining the path comparison according to gender, the skin care behavior according to the aesthetic needs turned out to be significant for women, yet the relationship between the appearance related quality of life and the customer behaviors' intention weakened in the case of men. It is believed that such results do not offer much significance for the external changes through the skin care than for women. It would be necessary to approach the medical skin care in a positive way to ensure that it will be possible to understand the results which may be secured through the external beauty. Furthermore, it will be necessary to prepare a management plan which will help improve life while offering confidence at the same time.

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7. Appendix

7.1. Authors Contribution

| | Initial name | Contribution |
|-----------------------|--------------|---|
| Lead Author | HK | -Set of concepts <input checked="" type="checkbox"/> |
| | | -Design <input checked="" type="checkbox"/> |
| | | -Getting results <input checked="" type="checkbox"/> |
| | | -Analysis <input checked="" type="checkbox"/> |
| | | -Make a significant contribution to collection <input checked="" type="checkbox"/> |
| | | -Final approval of the paper <input checked="" type="checkbox"/> |
| Corresponding Author* | EK | -Corresponding <input checked="" type="checkbox"/> |
| | | -Play a decisive role in modification <input checked="" type="checkbox"/> |
| | | -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> |
| | | -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> |
| | | -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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Corresponding author*
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A Study on the Automatic Facial Recognition System for Cosmetic Surgery Based on Physiognomy -With a Focus on the Shape of Eye

Jeongshin Park

Joongbu University, Geumsan, Republic of Korea

Abstract

Purpose: The purpose of this study is to develop a system for the cosmetic surgery procedures to help improve the work efficiency for those who specialize in the cosmetic surgery, and increase their satisfaction with procedures and surgical results for their customers. For instance, when a customer's eyes are illuminated on a mobile screen, the physiognomy characteristics can be automatically recognized, which can help determine a procedure for the eye surgery or operation. And since the distance between the eyes can be automatically recognized, it is possible to predict the scope and method of cosmetic surgery focused on the eyes, thereby increasing the satisfaction of the customers who desire a good physiognomy and appearance.

Method: First, each part(front of the eye, tail of the eye, upper line, and underline) forming the shape of the eye, the top and bottom of the face, the left and right sides of the pupil, and the points characterizing the end-points of the cheekbones are designated as the points on the coordinate plane as the feature point.

Second, after defining the physiognomy related elements and the cosmetic surgery elements with a mathematical formula, the coordinate values for the feature points are automatically obtained by the facial recognition technology, and the cosmetic surgery image according to the physiognomy is calculated according to the calculation result entered in the formula, thereby setting the standards for determination.

Third, since the shape of the eye can be distinguished when the condition given by the equation is satisfied with respect to the feature points input as coordinates, the method for outputting physiognomy and cosmetic surgery determinations can be presented.

Results: As it was determined that the eye shape and the distance between the eyes have a large effect on physiognomy, the method for determining the procedure and standard for cosmetic surgery as an automatic facial recognition system was proposed.

Conclusion: The experts of the service industry for the cosmetic surgery identify the eye shape of the customers who desire to change the shape of the eye, and are thinking about whether the shape according to the needs can harmonize with the image on the entire face, and solve it accordingly, and as a method, make reference to the physiognomy. At which time, the backed-up physiognomy knowledge of the app program based on this system is automatically searched, and efficient results can be expected. Hence, this paper will be used as a basis for establishing a system that suggests the procedures or surgical directions such as makeup, plastic surgery, and tattoos.

Keywords: Physiognomy, Cosmetic Surgery, Eye, App, Procedure

1. Introduction

In the modern society, appearance is recognized among the factors which may acquire social competitiveness beyond an individual's physical characteristics. Accordingly, many modern people have increased their interest in their impressions and images to a large extent and consult

their physiognomy related needs online, as well as grooming their appearance and showing off their various personalities[1], and as such, the concept of appearance management is changed to an even larger meaning, replaced by the concept of beauty[2]. Furthermore, the industrial effect related to beauty is expanding, and given this influence, numerous companies exist both offline and online for the physiognomy information services and related sites[3]. However, most sites provide services as a database of numerous people, but there is no facial analysis system utilizing the features of facial features.

However, until now, an automatic face avatar generation system that may automatically generate the face most similar to a customer has been established[4]. This system detects and recognizes a face image using a mobile screen, classifies features, and creates an avatar with the same image as the user's face[5][6]. The accurate detection of feature points according to the facial features such as eyes, nose, and mouth is very important for the face recognition, physiognomy, beauty, and the facial expression analysis[7]. The methods for face recognition include the statistical-based methods[8], neural network-based methods[9], connection structure methods[10] and hidden Markov models[11], and the methods using geometric information[12], etc., while the method of making it corresponds to the method using geometric information.

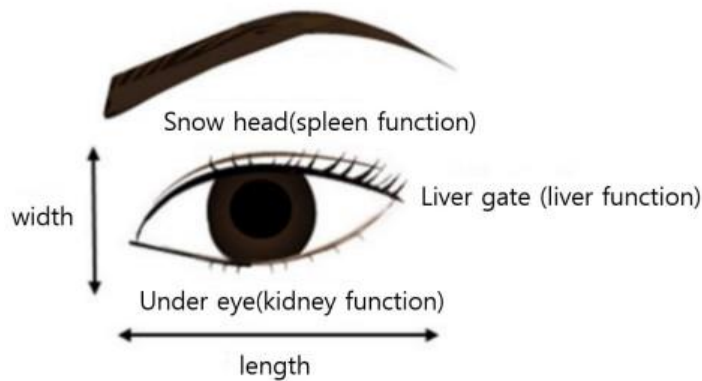
In this study, the facial feature points were set and displayed as coordinates by the method using such geometric information, and the physiognomy related information according to the shape of the user's eyes can be provided as a mathematical formula, and information on coordinates around the eyes protection is possible.

Given that physiognomy is a synchronic phenomenon that appears universally in all civilizations[13], nobody would say that physiognomy is unscientific. Physiognomy not only refers to the study of predicting personality and fate through partial characteristics or overall harmony of the face[14], but reading the information on the face with physiognomy is also a means of enhancing communication with others and understanding the other person. Hence, it may be said that physiognomy analysis for a good impression is an essential process when performing makeup, plastic surgery, and eyebrow tattoo procedures[15]. However, notwithstanding the fact that the procedure operators try to analyze the shape of each part of the face to satisfy the needs of the customer, they have difficulties in responding to the customer due to the misunderstanding and shallow knowledge of physiognomy. Hence, it is considered that a system providing assistance is necessary.

In the system presented in this study, when the customer's face is projected on the mobile screen, the position of the feature point that constructs the eyes can be automatically recorded by coordinates. (At which time, the setting of the characteristic point was consulted by 5 relevant experts.) The length or area between the coordinates is calculated according to the formula presented by this researcher, and is also automatically analyzed according to the conditions of the formula, and the customer's personality, appearance, and the past as well as the future can be predicted, and hence, it will be helpful in the procedure to create a better image.

From a physiognomy related point of view, an individual's image has the persuasive power that it can be formed in the environment surrounding him rather than himself[16]. Hence, the relationship between the beauty industry and physiognomy seems to be progressing actively, and it is considered that they are inevitably interconnected as an integral part of the standards and principles of plastic surgery. In particular, the eyes carry importance in terms of being able to examine all the functions and health of the organs and organs through the length and width of the eyes.

Figure 1. Analytical method for the eye.



Furthermore, since it is the part where the functions of the brain are most exposed to the outside, it is called the window of the mind to see the soul, spirit, and wisdom [17]. Since 90% of the human mind is expressed through the eyes, the surgery and procedures related to the shape of the eye occupy the largest proportion among cosmetic surgery, and many people undergo their eye surgery due to the recent development of new surgical methods [18]. Hence, it is intended to automatically analyze the overall face shape by defining facial feature points in order to measure the length and height according to the shape of the eye and the size of the pupil among many parts of the face.

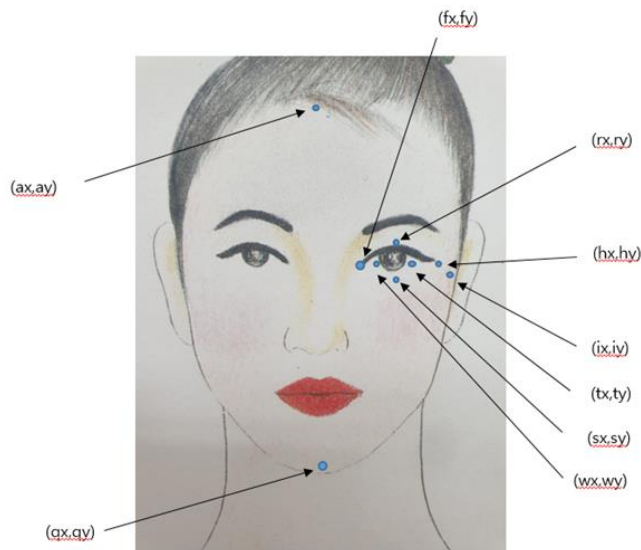
The service quality of the cosmetic surgery industry is playing a public role in enhancing customer preference and emotional bonding, providing satisfaction, and realizing changes in various consumer markets [19]. Accordingly in order to provide high-quality services, it is necessary to expand and specialize efforts from the viewpoint of emphasizing the differentiation of the service industry for cosmetic surgery [20]. Hence, the facial analysis system presented in this paper will play an important role in improving the service quality of the cosmetic surgery industry related to the physiognomy and plastic surgery according to the shape of the eye.

2. Name and Coordinates of the Shape

2.1. Name and location of each point

When there is a photo of rectangular face, the tip of the forehead located on the hairline of the face is called the top point, the coordinate value is $(ax, ay) = (0, 100)$, and the point located at the tip of the chin is called the bottom point, while the coordinate values on the coordinate plane is $(qx, qy) = (0, 0)$. Since the human physiognomy is not an absolute measurement of the size of each part forming the face, but is rather related to the size ratio between the parts, the total length of the human face is set to 100 and the length ratio of each part is calculated. Hence, the upper and lower points are fixed with a length of 100, the names of the feature points for each part are determined, and their positions are measured for each person. That is, as illustrated in <Figure 2>, a name is assigned for each point that designates a specific position of the eye shape, a coordinate name is set, Coordinate is obtained with the length ratio between the bottom point and the top end point which it measures by using ruler. Such coordinate values can be automatically obtained by facial recognition technology.

Figure 2. Locations and names of facial feature points.



2.2. Coordinate values of each point

When the shape of the eye is input on the screen, such devices as a scanner are operated to obtain the coordinates of each point. Naturally, there are research results showing that there is a difference between the left and right eye width in terms of exact numerical value[21]. However, considering that the face is symmetrical with the nose as the center, the flow will not be largely affected even if the other side is not recorded. Hence, in this study, the name of each point was assigned only for the shape of the eye located on the right side of the face. When the coordinates of each point are input and a numerical value is obtained according to the formula, the physiognomy characteristics are automatically output depending on whether the numerical value meets the standard.

The names and coordinate values of each coordinate in <Figure 1> are as in <Table 1>.

Table 1. Coordinate name and coordinate value.

| Name of point | Location | x-coordinate | y-coordinate |
|---------------|----------------------|--------------|--------------|
| A | Top point | 0 | 100 |
| F | Hair in front of eye | 10.5 | 53.4 |
| R | Above eye line | 20.2 | 61.2 |
| S | Eye underline | 20.2 | 56.4 |
| H | Eyebrows | 29.8 | 57.2 |
| T | Right eyeball | 22.7 | 60.9 |
| W | Left eyeball | 17.7 | 60.9 |
| I | Cheekbone endpoint | 31.2 | 54.3 |
| Q | Bottom point | 0 | 0 |

When the conditions are satisfied by substituting the data of the points illustrated in the table into the pre-entered formula, the result of physiognomy is output.

3. Physiognomy by the Eye Shape

3.1. Eye's shape

In certain cases, the concept of an excellent face in terms of physiognomy and the concept of an excellent face in terms of plasticity are different. For example, the eye in terms of physiognomy is good for the upper and lower eyelids to meet naturally at the corner of the eye[22], and if the eyes are long and low rather than wide, leadership and respect are easy to arise, and it is good to see them as an advantage by doing great things, yet on the other hand, in terms of plastic surgery, people with large, round eyes are viewed as images of a beautiful woman.

The shape of the eye is basically divided into shape and size, specifically, the width of the brow, the presence or absence of double eyelids, the angle of the corners of the eyes, and the protrusion of the eyelids[23]. In this chapter, it is intended to examine the characteristics of the eyes according to physiognomy except for the protrusion of the eyelids, which is difficult to present with the frontal photographic data.

3.1.1. Phoenix eye

The phoenix eye is the most evaluated eye in terms of the physiognomy of the eye. It is contrary to the aesthetic elements of modern society, but in terms of physiognomy, the thinner, longer and more detailed, the better, and the best is the phoenix eye. In particular, they are both very dark and precious eyes to the extent that the pupil is indistinguishable[24].

The phoenix eye refers to an eye with a long rim and tail, and when determining whether it is a match using facial recognition technology, the ratio of the length and height of the eyes to the total length of the face should be considered.

Now, in order for an eye to become the phoenix eye, the following two conditions must be satisfied. The numerical standards were set with normal photos, yet better objective standards will require adjustment by experts, and eventually the figures will be converged.

Figure 3. Phoenix eye.



Note: <https://www.google.com/search>.

Conditions of the phoenix eye

- A) It must be a small eye with $(rx-sx)/(hx-fx) < 18\%$ (objective criterion)
- B) It must be a long eye with $(hx-fx)/ix > 70\%$ (objective criterion)

Among the above conditional expression, A) means that the height of the eyes should not be high, and B) means that the length of the eyes should be long. When specific points around the eyes are input by the facial recognition technology, the authenticity of the phoenix eyes will be immediately revealed by this equation.

Among the celebrities, Jiseob Soh and Seungho Yoo are the representative figures with the phoenix eye.

Figure 4. Jiseob Soh.

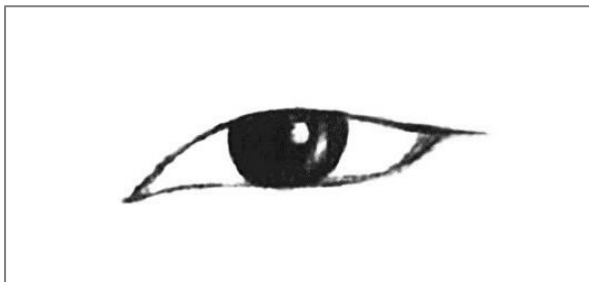


Note: <https://www.google.com/search>.

3.1.2. Dragon eye

The dragon eyes are long torn and large, and they are not as good as the phoenix eyes, but they are good enough to become the king of a country. The dragon eyes are larger than phoenix eyes, yet are smaller and longer than the cow eyes, with clear black and white eyes.

Figure 5. Dragon eye.



Note: <https://www.google.com/search>.

The condition to become the dragon eyes is that the eyes are relatively small and the eyes are long.

A) $18\% < (rx-sx)/(hx-fx) < 25\%$ should be larger than phoenix eyes but relatively small(objective criteria)

B) $(hx-fx)/ix > 70\%$ must be a long torn eye(objective criterion)

Yuna Kim is a representative figure of the dragon eyes.

Figure 6. Yuna Kim.

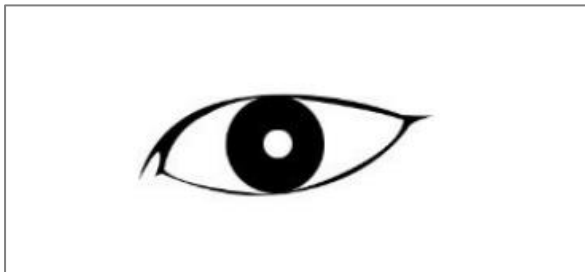


Note: <https://www.google.com/search>.

3.1.3. Tiger eye

While the eyes are large, the pupils are rather small, and hence, the whites of the eyes can be seen a lot, and they are also called auspicious. Overall, it refers to the eyes with bulging eyes at both ends, and there are many types who are respected by the people around them because of their upright personality and overflowing sense of justice. This may lead to wealth and fame, but in the later years of life, there may be no blessing for the children.

Figure 7. Tiger eye.



Note: <https://www.google.com/search>.

To become the tiger eyes, the pupils must be small and the eyes are large, and hence, the following two conditions must be satisfied at the same time.

- A) $(tx-wx)/(hx-fx) < 40\%$, the pupil should be small(objective standard)
- B) Must have large eyes with $(rx-sx)/(hx-fx) > 30\%$ (objective criterion)

Dongwon Kang is a representative figure of the tiger eyes.

Figure 8. Dongwon Kang.



Note: <https://www.google.com/search>.

3.1.4. Lion eye

The lion eye refers to the shape of large eyes, double eyelids, and raised eye tails. The eyes with raised eyebrows belong to a sheep's temperament, and have a strong personality [25], have excellent conviction, execution ability, intelligence, and senses, and have a fast brain [26]. In the physiognomy studies, the lion eyes are the eyes of a leader with a wise and ferocious personality, and it is considered that they have good potential to succeed in bureaucracy and rise above the ranks early. Be careful of the extreme temperament and the excessive greed.

Figure 9. Lion eye.



Note: <https://www.google.com/search>.

A) It must have large eyes with $(rx-sx)/(hx-fx) > 30\%$. (objective criteria)

B) $H_y > (r_y-s_y)/2$, the corner of the eye should rise. (objective criteria)

Actors Soo Koh and Donggeon Jang are representative figures of the lion eye.

Figure 10. Donggeon Jang.



Note: <https://www.google.com/search>.

3.1.5. Cow eye

Cow eye refer to the eyes with large, round eyes and many eyelashes. The right eye is a large, round eye with many eyelashes. It has been said that he is a physiognomy who is diligent, earnest like the image of a cow, and has a lot of patience, and hence, he or she would become wealthy as much as he or she works hard.

Figure 11. Cow eye.



Note: <https://www.google.com/search>.

Cow eyes are large and round eyes. The following two conditions must be satisfied simultaneously.

- A) It must have large eyes with $(rx-sx)/(hx-fx) > 30\%$ (objective criterion)
- B) $(hx-fx)/ix < 60\%$ must be round eyes(objective criterion)

Actor Boyoung Park's eyes correspond to these eyes.

Figure 12. Boyoung Park.



Note: <https://www.google.com/search>.

4. Conclusion

Since there has not been a numerical concept yet in the criteria for judging physiognomy or images and determining the status of cosmetic surgery, most of the experts and ordinary people have tended to judge by guessing eyes[27]. The consumers verbally express the purpose of cosmetic surgery they desire, and the surgeon listens to them and, if necessary, subjectively determines the patient's condition through examination and performs the procedure [28][29]. However, while such subjective determination as this is important, if the objective data are presented together, the reliability will be much higher. Hence, standardization of data is considered to be a necessary process to improve service quality for each medical customer.

The number of foreigners visiting Korea, known to be a powerhouse for the cosmetic surgery related medical technology, is expected to continue to rise in the future, and the Korean Wave is also expected to have a significant impact on the cosmetic surgery market in Korea[30]. It is believed that standardization of numerical values is essential in order to utilize the value of an IT powerhouse and demonstrate cutting-edge technology in the cosmetic surgery field[31]. Towards this end, cooperation with the animation development field will be required[32][33].

In this paper, when the eyes are exposed to the screen using the modern devices, the positions of the dots are automatically input, and the results of cosmetic surgery of the eye area based on physiognomy are presented. Since it will be possible to quantify not only the shape of the eyes but also other parts of the face, it is considered that the future task will be to create formulas and figures for cosmetic surgery standards along with the physiognomy related analysis of the feature points that form all faces.

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6. Appendix

6.1. Author's contribution

| | Initial name | Contribution |
|--------|--------------|--|
| Author | JP | <ul style="list-style-type: none"> -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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The Mediating Effect of Socio-Cultural Attitude towards Appearance on the Appearance Interest in the Relationship between Acne Perception and Appearance Satisfaction

Heeyoung Lee¹

Seokyeong University, Seoul, Republic of Korea

Eunsook Kim^{2*}

Seokyeong University, Seoul, Republic of Korea

Abstract

Purpose: The purpose of this study was to examine and understand the mediating effect of socio-cultural attitude towards appearance on the appearance interest in the relationship between acne perception and appearance satisfaction, and provide a practical assistance for the programs for the acne skin in the beauty industry and market.

Method: In this study, the statistical analysis was conducted using the SPSS 25.0 and AMOS 22.0 programs of 282 online questionnaires for the subjects with acne skin.

Results: As for the results of this study, the socio-cultural attitude towards appearance has had a positively significant impact on the appearance interest ($\beta=.453, p<.001$), acne perception ($\beta=.149, p<.05$), and appearance satisfaction ($\beta=.535, p<.001$), and the direct effect of socio-cultural attitude towards appearance on the appearance satisfaction was negatively significant ($\beta=-.362, p<.001$), while having a positively significant effect on the acne perception ($\beta=.149, p<.05$). Furthermore, in the relationship between the socio-cultural attitude towards appearance and appearance satisfaction, the interest in appearance demonstrated a positive mediating effect. This is a result demonstrating that if a person's socio-cultural attitude towards appearance is large, he or she can directly cause dissatisfaction with one's appearance, yet if one's interest in the appearance is raised before then, the appearance satisfaction might also be increased as a result.

Conclusion: Based on the results of this study, it was confirmed that the larger the socio-cultural attitude towards the appearance, the larger the appearance interest and acne perception scores, and the larger the appearance interest, the larger the appearance satisfaction. Meanwhile, the socio-cultural attitude towards appearance negatively and significantly impacts the appearance satisfaction. Hence, it is apparent that the overall appearance is important as it impacts the appearance interest, not the skin type, and when consulting with the customers with acne skin, it is necessary to present the direction of interest in the appearance and suggest that it is also important to accurately perceive one's own skin condition. Through which, it is intended that the direction of social and cultural attitude towards appearance and interest in the appearance are presented to provide the services desired by consumers to increase their satisfaction with their appearance, and furthermore, provide assistance for the practical on-site management programs and counseling skills for acne skin in the medical skin care beauty industry and market.

Keywords: Socio-Cultural Attitude Towards Appearance, Acne Perception, Appearance Satisfaction, Appearance Interest, Medical Skin Care

1. Introduction

The fast development of the modern society has brought about many changes to the society, and as social and cultural exposure to science and technology and various media has increased, the social trend of paying attention to one's internal and external appearance has also increased,

which is called 'appearance orientedness' while the interest in appearance has increased significantly[1][2]. Accordingly, the modern people give and internalize the value of beauty in the body reflected on television, accept it as an evaluative standard, and compare it with their own body to form an attitude towards appearance, and the standards of beauty are constantly changing[3][4]. An appropriate appearance management makes interpersonal relationships even more amicable, and furthermore, as an important factor to express one's image and individuality in a fiercely competitive society, effective beauty care is continuously practiced to create an individual image of individuality[5][6]. Today, appearance has become more competitive, and the dependence on the skin care and plastic surgery is consistently increasing[7]. Accordingly, as the desire for appearance satisfaction has increased, the demand related to scientific treatment of skin, plastic surgery, and beauty increased, and it has begun to spread in the form of medical skin care[8].

Everyone is interested in beauty and appearance and pursues beauty, and the desire for skin care to maintain their healthy and beautiful skin has existed since the beginning, which is often expressed through their appearance[9][10]. Recently, skin diseases have occurred even in the early adulthood due to such factors as environmental changes and stress, and among which, acne is one of the most common diseases, and it is a skin disease which can be directly seen or touched[11]. As the demand for acne treatment has increased, various treatment methods have been developed and used, and the surgical treatment methods such as extrusion, dermabrasion, and laser treatment have been facilitated[12]. Hence, it is effective and important to know exactly about one's own skin and find a management method most appropriate for one's skin.

Examining the recent studies conducted, a study on the effect of socio-cultural attitude towards physical image and appearance on the psychological influence: with a focus on the mediating effect of beauty health care behavior[13], a study of the impact of beauty health care behavior and aesthetic image on the relationship between socio-cultural attitude and psychological influence[14], a multidisciplinary study on the characteristics of appearance improvement behavior and interpersonal relationships on the socio-cultural attitude of female university students[15], a study on the self-esteem and interpersonal relationship according to the condition of acne skin[16], an analysis of acne perception and acne management methods of Chinese in their 20s and 30s[17], and a study on the use of color cosmetics according to the women's interest in appearance[18] have been conducted, yet the studies focused on the mediating effect of people with acne skin on the perception level of acne and appearance interest according to their appearance satisfaction are inadequate. Furthermore, by examining and understanding such, it is considered that it will have a positive marketing effect when applied for the customers with acne when setting up programs and consulting in the medical skin care field among the beauty service industry. Hence, it is intended that in this study, by examining and understanding the mediating effect of socio-cultural attitude towards appearance on the appearance interest in the relationship between acne perception and appearance satisfaction, the socio-cultural attitude through the appearance interest was examined to identify and understand the relationship between acne perception and appearance satisfaction, and so that the help can be offered for the basic data for the medical skin care's field marketing.

2. Research Method

2.1. Research subject

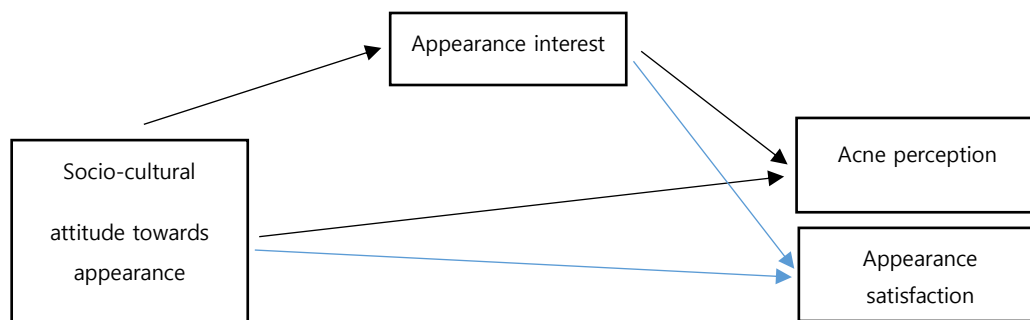
To analyze the mediating effect of social and cultural attitudes according to appearance on the appearance interest for the acne perception and appearance satisfaction, this study was conducted by using an online questionnaire and 300 copies of the consent form were distributed and collected, of which, 282 copies were selected and analyzed, excluding 18 insincere copies.

2.2. Survey method

The study used an online questionnaire as a research tool to analyze the research problem, and the questionnaire consisted of 8 questions for general characteristics[19], 12 questions for socio-cultural attitude towards appearance[20], 25 questions for acne perception[21], 1 question for appearance satisfaction[19], and 11 questions for appearance interest[22], for a total of 57 questions using the 5-point Likert scale and self-entry method.

2.3. Research model

Figure 1. Research model.



2.4. Hypotheses

H1, the socio-cultural attitude towards appearance will have a significantly positive(+) effect on the interest in appearance.

H2, the appearance interest will have a significantly positive(+) effect on the acne perception.

H3, the socio-cultural attitude towards appearance will have a significantly positive(+) effect on the acne perception.

H4, the socio-cultural attitude towards appearance will have a significantly positive(+) effect on the appearance satisfaction.

H5, the appearance interest will have a significantly positive(+) effect on the appearance satisfaction.

H6, there will be a mediating effect of interest in appearance in the relationship between socio-cultural attitude towards appearance and acne perception score.

H7, there will be a mediating effect of interest in appearance in the relationship between socio-cultural attitude towards appearance and appearance satisfaction.

2.5. Data processing method

The data of this study were statistically analyzed by undergoing the following procedures using the SPSS 25.0 and AMOS 22.0 programs.

First, the reliability of the scale was confirmed by using the Cronbach's alpha value of the measurement tool.

Second, the frequency analysis and descriptive statistical analysis were performed to examine and understand the characteristics of the study subjects and major variables.

Third, the one-way ANOVA was performed to confirm the differences in major variables according to age.

Fourth, the Pearson correlation analysis was performed to examine and understand the correlation between major variables.

Fifth, the path analysis was performed to confirm the causal relationship of each major fraction, and the mediating effect was confirmed through the Bootstrapping-test.

The significance of all statistical analyses was determined based on 0.05.

3. Research Results

3.1. Verification of reliability and validity

The reliability analysis was performed by using the Cronbach's alpha value to confirm as to whether respondents responded consistently in the scale of this study. The reliability condition was based on Cronbach's alpha value of 0.6[23], and the alpha value of both the socio-cultural attitudes and appearance interest, which were surveyed by the Likert scale, was 0.6 or greater, thereby confirming a good reliability.

3.2. General characteristics of the research subjects

<Table 1> illustrates the results of the frequency analysis to confirm the general characteristics in this study. By the age group, teens were 81 people(28.7%), 20s were 108(38.3%), 30s were 93(33.0%), and as for the occupation, there were 120 students(42.6%), 25 service workers(8.9%), 27 others(9.6%), and the monthly skin care cost was less than 100,000 won for 214 people(75.9%), for 41 people(14.5%) for less than 100,000 won to 300,000 won, 12 people for less than 300,000 won to 500,000 won(4.3%), and 2 people for more than 500,000 won(0.7%), 13 for others(4.6%), as for the acne area, face was 278 people(98.6%), chest was 67 people(23.8%), back for 113(40.1%), neck for 28(9.9%), and buttocks for 14(5.0%), respectively.

Table 1. General characteristics of research subjects.

| Variables | Classification | Frequency | Ratio |
|------------------------|----------------------------------|-----------|-------|
| Age group | Teens | 81 | 28.7 |
| | 20s | 108 | 38.3 |
| | 30s | 93 | 33.0 |
| Occupation | Student | 120 | 42.6 |
| | Service worker | 25 | 8.9 |
| | Professional | 31 | 11.0 |
| | Clerical | 65 | 23.0 |
| | Housewife | 5 | 1.8 |
| | Self employed | 9 | 3.2 |
| | Others | 27 | 9.6 |
| Monthly skin care cost | Less than 100,000 won | 214 | 75.9 |
| | 100,000 to less than 300,000 won | 41 | 14.5 |
| | 300,000 to less than 500,000 won | 12 | 4.3 |
| | 500,000 won or more | 2 | 0.7 |
| | Others | 13 | 4.6 |
| Acne face | N | 4 | 1.4 |
| | Y | 278 | 98.6 |
| Acne chest | N | 215 | 76.2 |
| | Y | 67 | 23.8 |
| Acne back | N | 169 | 59.9 |
| | Y | 113 | 40.1 |
| Acne neck | N | 254 | 90.1 |
| | Y | 28 | 9.9 |

| | | | |
|--------------|---|-----|-------|
| Acne buttock | N | 268 | 95.0 |
| | Y | 14 | 5.0 |
| Total | | 282 | 100.0 |

3.3. Descriptive statistical analysis

The descriptive statistical analysis was performed to confirm the characteristics of the main variables, and the results are as illustrated in <Table 2> below. It turned out that the average of the socio-cultural attitude was 3.5127, average of appearance interest was 3.3221, average of acne perception was 18.8865, and the average of appearance satisfaction was 2.89. Furthermore, the skewness and kurtosis were confirmed to check the normality of each variable, and the absolute values of all skewness and kurtosis turned out to be less than 3 and 10, thereby confirming the normal distribution[24].

Table 2. Descriptive statistics.

| Name of variable | Minimum value | Maximum value | Mean | Standard deviation | Skewness | Kurtosis |
|--|---------------|---------------|---------|--------------------|----------|----------|
| Socio-cultural attitude towards appearance | 1.08 | 5.00 | 3.5127 | 0.68286 | -0.234 | 0.623 |
| Appearance interest | 1.18 | 5.00 | 3.3221 | 0.58319 | -0.146 | 0.628 |
| Acne perception | 5.00 | 23.00 | 18.8865 | 2.87978 | -1.118 | 1.993 |
| Appearance satisfaction | 1 | 5 | 2.89 | 0.935 | 0.010 | -0.442 |

3.4. Difference by age

The one-way ANOVA, which can confirm the average difference between 3 or more groups, was performed to confirm the difference according to age, as illustrated in <Table 3>. As a result of the analysis, significant differences were found in the appearance interest($F=3.280$, $p<.05$) and acne perception($F=17.040$, $p<.001$), and as a result of conducting an ex post test, it was con-firmed that the average of those in their 20s and 30s relative to the teens was large.

Table 3. Difference by age.

| Variables | Classification | Mean | Standard deviation | F | p (scheffe) |
|--|----------------|-------|--------------------|-----------|-------------|
| Socio-cultural attitude towards appearance | Teensa | 3.37 | 0.78 | 2.930 | 0.055 |
| | 20sb | 3.61 | 0.67 | | |
| | 30sc | 3.52 | 0.58 | | |
| Appearance interest | Teensa | 3.21 | 0.60 | 3.280* | 0.039 (a<b) |
| | 20sb | 3.43 | 0.54 | | |
| | 30sc | 3.29 | 0.60 | | |
| Acne perception | Teensa | 17.41 | 2.93 | 17.040*** | 0.000 |

| | | | | | |
|-------------------------|--------|-------|------|--------|-------|
| | 20sb | 19.63 | 2.25 | (a<bc) | |
| | 30sc | 19.31 | 3.04 | | |
| | Teensa | 2.85 | 0.88 | | |
| Appearance satisfaction | 20sb | 3.01 | 1.00 | 1.539 | 0.216 |
| | 30sc | 2.78 | 0.90 | | |

Note: * p<.05 ** p<.01 *** p<.001.

3.5. Correlation analysis

The Pearson's correlation analysis was performed to examine and understand the correlation between the variables in this study, as illustrated in <Table 4> below. As a result of the analysis performed, the socio-cultural attitude towards appearance had a significant relationship with appearance interest and acne perception positively(+), and negatively(-) with the appearance satisfaction. The appearance interest turned out to have a positively(+) significant relationship with the acne perception and the appearance satisfaction.

Table 4. Correlation analysis.

| | Socio-cultural attitude towards appearance | Appearance interest | Acne perception | Appearance satisfaction |
|--|--|---------------------|-----------------|-------------------------|
| Socio-cultural attitude towards appearance | 1 | | | |
| Appearance interest | .453*** | 1 | | |
| Acne perception | .177** | .129* | 1 | |
| Appearance satisfaction | -.120* | .371*** | 0.010 | 1 |

Note: * p<.05 ** p<.01 *** p<.001.

3.6. Path analysis

The path analysis was performed to confirm the causal relationship between major variables. As a result of verifying the conformity of the model, it turned out to be a saturated model with 0 degrees of freedom, confirming that the model was suitable, and is as illustrated in <Table 5> below. Examining the analytical results, socio-cultural attitude had a significantly positive effect on appearance interest($\beta=.453$, $p<.001$) and acne perception($\beta=.149$, $p<.05$), and the appearance interest also had a positive effect on the appearance satisfaction($\beta=.535$, $p<.001$). That is, it was confirmed that the larger the socio-cultural attitude towards the appearance, the larger the appearance interest and acne perception scores, and the larger the appearance interest, the larger the appearance satisfaction. Meanwhile, the socio-cultural attitude towards appearance had a negatively significant effect on appearance satisfaction($\beta=-.496$, $p<.001$). This result demonstrates the fact that the larger the socio-cultural attitude, the less the appearance satisfaction.

Table 5. Path analysis.

| Independent variable | Dependent variable | Estimate | SE | β | CR |
|--|-------------------------|----------|-------|---------|-----------|
| Socio-cultural attitude towards appearance | Appearance interest | 0.387 | 0.045 | 0.453 | 8.529*** |
| Appearance interest | Acne perception | 0.302 | 0.325 | 0.061 | 0.929 |
| Socio-cultural attitude towards appearance | Acne perception | 0.629 | 0.277 | 0.149 | 2.268* |
| Socio-cultural attitude towards appearance | Appearance satisfaction | -0.496 | 0.08 | -0.362 | -6.213*** |
| Appearance interest | Appearance satisfaction | 0.858 | 0.093 | 0.535 | 9.178*** |

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

3.7. Mediating effect analysis

The bootstrapping-test was conducted to confirm the mediating effect, which is as illustrated in <Table 6> below. As a result of the analysis, the direct effect of socio-cultural attitude towards appearance on the appearance satisfaction was negatively significant ($\beta = -.362$, $p < .001$), and had a significantly positive effect on acne perception ($\beta = .149$, $p < .05$). Furthermore, in the relationship between socio-cultural attitude towards the appearance and appearance satisfaction, the appearance interest demonstrated a positively mediating effect. This is a result demonstrating that if a person's socio-cultural attitude towards appearance is large, he or she can directly cause dissatisfaction with one's appearance, yet if one's interest in appearance is raised before then, appearance satisfaction can also be increased as a result.

Table 6. Mediating effect.

| Path | β | p |
|--|----------|------|
| Socio-cultural attitude towards appearance \rightarrow appearance satisfaction | -.362*** | .000 |
| Socio-cultural attitude towards appearance \rightarrow acne perception | .149* | .028 |
| Socio-cultural attitude towards appearance \rightarrow appearance interest \rightarrow appearance satisfaction | .243*** | .000 |
| Socio-cultural attitude towards appearance \rightarrow appearance interest \rightarrow acne perception | .028 | .322 |

Note: * $p < .05$, *** $p < .001$.

4. Conclusion

This study was conducted for the purposes of verifying the effect of socio-cultural attitude towards appearance on the mediating effect of appearance interest in the relationship between the acne perception and the appearance satisfaction, and the results of the analysis are as follows.

First, hypotheses 1, 2, and 3 which provide that the socio-cultural attitude towards appearance will impact the appearance interest, acne perception, and the appearance satisfaction were found to have a significantly positive(+) effect. Such results demonstrated a similar trend as with the research results of Jeongsoo Lee[25], Gyeongja Song[26], and Minji Lee[27], and it was also found that the socio-cultural attitude towards appearance impacts the appearance interest, acne perception, and the appearance satisfaction, and hence, it is considered that it can be used for marketing by understanding what kind of socio-cultural attitude they have.

Second, hypotheses 4 and 5 which provide that the appearance interest will impact acne perception and appearance satisfaction were found to have a significantly positive(+) effect only with hypothesis 5. Such results demonstrated a different trend from that of Gwanghee Park[28]. It seems that people can be interested in their appearance regardless of their perception of acne, and it will be helpful to understand the needs of consumers if they distinguish between the appearance interest and the acne perception.

Third, of hypothesis 6 which provides that there will be a mediating effect of appearance interest in the relationship between socio-cultural attitude towards appearance and acne perception score, and hypothesis 7 which provides that there will be a mediating effect of appearance interest in the relationship between socio-cultural attitude towards appearance and appearance satisfaction, only hypothesis 7 was found to have a significantly positive(+) effect. Such results demonstrated a somewhat similar tendency with a certain portion of Hyunok Lee[29] and Kyungin Kim[30], but only the mediating effect of appearance interest in the relationship between the socio-cultural attitude towards appearance and appearance satisfaction had a significantly positive(+) effect, and not on the skin type, but on the appearance, in view of which, it is apparent that the overall appearance is important as it impacts the external appearance. It will be helpful to understand which factors exist to provide the services that the consumers want.

Hence, it can be used for marketing by applying to the extent of interest in the appearance of the consumers by knowing that socio-cultural attitudes on appearance impact many parts and accurately understanding it. However, when the consumers receive skin care, they may face difficulties in selecting a program, and hence, it is implied that consultation is needed to accurately understand such and help them select their program. However, the acne perception, which is a disease, is still low, and it is difficult to obtain accurate information, and the relevant studies are inadequate. It is necessary to conduct a detailed study by skin type or gender, rather than the overall appearance.

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6. Appendix

6.1. Author's contribution

| | Initial name | Contribution |
|-----------------------|--------------|---|
| Lead Author | HL | <ul style="list-style-type: none"> -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/> |
| Corresponding Author* | EK | <ul style="list-style-type: none"> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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Corresponding author*
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A Study on the Regulations Concerning the Purchase Related Decision Making Factors of Interest in Beauty according to the Cosmeceutical Perception of the Tendency for Practical Consumption

Woonsil Ko¹

Seokyeong University, Seoul, Republic of Korea

Munseong Han^{2*}

Seokyeong University, Seoul, Republic of Korea

Eunju Jang³

Sunmoon University, Cheonan, Republic of Korea

Abstract

Purpose: The purpose of this study is to examine and understand what factors influence the consumers with their practical consumption related tendency to purchase the cosmeceutical products.

Method: In this study, the practical consumption related tendency, cosmeceutical perception, and the purchase decision making factors were measured as the dependent variables.

Results: As a result of the significant study conducted on the purchase related decision making factors, first, it was confirmed that the consumers' tendency for the practical consumption only during the discounted sales period or they make purchases by comparing the type, price, and the quality of the brands they are interested in. Second, as for the interest in beauty, the UV rays are more related to the skin aging(83%) than the need to consume the beauty related food(69.2%), and the appearance-oriented consumers responded that they are willing to undergo cosmetic surgeries if they need cosmetic surgeries(8.8%). Third, the perception of cosmeceuticals demonstrated the preference for natural cosmetics(68.1%) and the scientific evidence(65.9%). Lastly, the decision to purchase cosmeceuticals demonstrated the importance in the order of all ingredients(88.7%), effectiveness(87.6%), eco-friendliness(87.2%), stability(86.8%), and mental effects on the fragrance(84%), respectively.

The direct, indirect, and the total effects of cosmeceutical perception were significant as the purchase related decision making factors according to the interest in beauty, and the correlation analytical result and the confirmatory analysis of the research model were significant as a positive(+) relationship.

Conclusion: As a result of such study conducted, cosmeceutical is a word which divides the quality of functional cosmetics, and the producers need to form a market which could commercialize and provide the customer needs, and according to the consumer preferences, capacity, fragrance, ingredients and efficacy, and correlation with skin, the originality and value of the study may be recognized since it has derived the implications for the development of cosmeceutical products which may be positioned through the studies.

Keywords: Consumption Related Tendency, Purchase Related Decision Making Factors, Beauty Related Interest, Cosmeceutical, Practical Consumption

1. Background of and Need for the Study

Given the self-centered investments made by the consumers over the recent years, cosmeceuticals are equipped with a wide range of purchasing requirements which allows for the purchases to be made via the consumption related tendency in line with the era of emotions. The luxury of products is a symbolic means of expressing one's individuality, and it manifests across various forms in the consumption related tendency and the purchase related decision making. Accordingly, the materialism within the consumers is also appearing in the domestic functional cosmetics market that wants practical consumption. Given the increasing consumer's need for beauty, the cosmetics industry is transitioning towards a concept that pursues beauty

both internally and externally, not just a simple appearance. That is, it is possible to purchase the medically proven cosmeceutical products without a physician's prescription, thereby breaking away from the existing simple oil and moisture moisturizing cosmetics such as the cosmetics to eat and fruits to apply, and this is affecting the consumption related tendency and purchase related decision making factors[1].

The interest in cosmetics using the natural ingredients in the cosmeceutical market, and the perception that they are safe and scientific products for skin, not only the consumers who want high functionality for specific skin, but also the companies feel the need for a product with a small-volume production system. The consumption characteristics of cosmetics have expanded to the beauty field, which helps to improve hair function and treat skin diseases. As for the quasi-drugs, which are faced with more regulations than the other cosmetics, have shifted towards the functional cosmetics, and the interest is significant than ever. The high growth of functional cosmetics purchased at hospitals and pharmacies, as the cosmeceutical's inner beauty craze has led to the beauty related food, is focused on the disease-centered marketing and satisfaction that emphasizes medicinal functions above all others[2], and the various studies on the cosmeceuticals[3][4] have been conducted on brands, images, package design, perception, and materials, yet the studies on the factors determining the purchase of cosmeceuticals are inadequate.

Hence, in this study, it is intended to provided the basic data based on the needs for the A study which added the psychological variables of consumers who want to obtain functional value of products through consumption, and the study on whether the psychological effect of fragrance, the objective satisfaction with the product, and the empathy of individual and subjective consumer satisfaction through the importance of the feeling of the fragrance suitable for the consumer's taste are the purchasing requirements that can satisfy the emotions.

2. Purpose of the Study

The purpose of this study is to examine and understand what factors influence the consumers with the practical consumption related tendency to purchase the cosmeceutical products. First, this study analyzes the direct effects of usability, effectiveness, safety, and stability, as well as eco-friendliness, active ingredient labelling, empathy, and psychological effects on the purchase related decision making factors according to the consumers' practical consumption related tendency. Second, based on the level of interest in beauty and cosmeceutical awareness, the improvement plans are derived that enable the consumers to make the effective purchase related decision making, and marketing is re-examined or reinterpreted to provide the basic data needed for establishing the marketing strategies suitable for the consumers, development plans, and product development.

3. Distinction of the Study

The diversification of the purchase decision making related requirements according to the consumption related tendency is that the detailed characteristics of a specific product, brand reliability, and overall quality are considered very important in the purchasing stage. However, it is difficult to examine and understand the subjective feelings of each individual given the lack of accurate objective information about product performance or quality. Hence, the distinction of this study based on the results of previous studies is as follows.

First, in terms of the structure of variables in the previous studies, 8 requirements were set as dependent variables based on the basic requirements that K-cosmeceuticals must have, as

suggested in[5] my previous work of the “Basic Study on Korean Cosmeceutical Market Development Plan,” which was the first study to determine the purchase related decision making factors of cosmetics, and in particular, there has been no study case in which the characteristics of cosmetics and psychological variables were used as purchase related decision making factors according to the independent variable practical consumption related tendency. The previous studies on the purchase related decision making factors of cosmetics are the factors for products. However, this is because it may be an answer for the question of how to make a product aware of the characteristics of the product itself, the type of product, and the salesperson's knowledge of the product when selling it, and how to manufacture it.

Second, in terms of the product selection, while moving towards the purpose or functionality, they tried to share consumer psychology, quality and function about environmental hormones and cosmeceuticals. Hence, in this study, the objective satisfaction with products and empathy and psychological effects reflective of the individual and subjective consumer satisfaction were examined and understood. The implications of this study are significant since the number of practical consumers who demand a new paradigm of cosmeceuticals through the one-on-one customized counseling with a counselor is further growing for the feeling of scent that suits the user's taste and the psychological effect on the scent.

As the expected effect and application plan of this study, one will be able to receive suggestions for the suitable products and solutions based on the information on the consumer purchase related decision making factors. To establish a marketing strategy for the higher-quality cosmeceutical products, the relevant companies will pay attention to the rise of various types of consumer soybeans, functional enhancement products, and entry into an aging society in the cosmetic market. Hence, it will be more beneficial for integrating the IT and the BT to grow into future cosmetics in the industrial field to lead consumer empathy. Furthermore, the advancement of functions can lead to changes in new industries, and hence, it will be possible to achieve the fusion of neuroscience or the subdivision of cosmeceutical concepts combined with the brain science.

4. Definition of Cosmetics and the Classification of Items

"Cosmetics" refers to the products which are used in a similar manner, such as rubbing and spraying, etc., on the human body in order to clean and beautify the human body to add attractiveness, brighten the appearance, or maintain or promote the skin and hair health, thereby offering minor operations. The types and forms of cosmetics largely depend on the purpose of use, parts of use, components and forms, technical characteristics, and sources of components, and are classified as follows according to the Ministry of Food and Drug Safety Notification; Chapter 1 Article 2 Paragraph 2 of the Cosmetics Act.

① Natural cosmetics(Chapter 1 Article 2 Paragraph 2 of the Cosmetics Act) refers to the cosmetics that contain animals and plants and their derived raw materials and meet the standards set by the Minister of Food and Drug Safety. That is, it is a cosmetic manufactured by a general processing method using chemical solvents, etc., from the raw materials grown by the general farming methods using chemical fertilizers and pesticides.

② Organic cosmetics(Chapter 1 Article 2 Paragraph 3 of the Cosmetics Act) refers to the cosmetics containing organic raw materials, animals and plants, and raw materials derived therefrom, which meet the standards set by the Minister of Food and Drug Safety.

③ Customized cosmetics(Chapter 1 Article 2 Paragraph 3-2 of the Cosmetics Act) is a cosmetic made by adding the contents of other cosmetics or raw materials prescribed by the Minister of Food and Drug Safety to the contents of manufactured or imported cosmetics, and cosmetics in which the contents of manufactured or imported cosmetics are subdivided.

④ There is no statutory definition or scope of oriental cosmetic products currently established, yet the Korean Food and Drug Administration(KFDA) has 11 types of established oriental medicine books stipulated in the Pharmaceutical Affairs Act, and it is a cosmetic containing herbal medicines using raw materials and prescriptions listed in the herbal medicine books including Donguibogam, Hyangyakjipseongbang, Gwangjebigeum, Jejungshinpyeon, Yakseongga, Sasang Medicine, Introduction to Medicine, Gyeongakjeonseo, Susebowon, and Bonchogangmok[6].

⑤ Bio-cosmetics refers to the cosmetics that contain ingredients naturally produced by living things as other cosmetics using bio-technology. Recently, useful microorganisms such as Lactobacillus, Bifidobacterium, and yeast have been used to make fermented cosmetics in which organic substances are decomposed[7].

⑥ Hair in the hair cosmetics refers to the hair of the body. In the “Sanggocheonjinron” of “黃帝內經” of the East Asia, it is said that all the hairs on the body are combined to be hair. The types of hair are divided into two types of hair, several hairs for beards, curvaceous hair on the pubic area, short hair on the eyebrows, sideburns on the face, hair on the armpits, and spontaneous hair on the mustache. Conventionally, the correct name is to call the hair on the head, which is called hair, and as “hair”, which means “to be removed”, it means that it has been pulled up all the way up. Conceptually, the definition of hair cosmetics is an article used to clean or beautify the hair and scalp to add attractiveness, brighten the appearance, or maintain and promote health, which may be defined as hair dyes, hair growth agents, and treatments for scalp use[8][9].

4.1. Product and industrial characteristics of the cosmetics

The product characteristics of cosmetics are the products which could communicate non-verbally as a social human being in terms of aesthetic desire and psychological meaning for humans. Cosmetics make the products based on various technologies such as chemical engineering, microbiology, pharmacy, psychology, skin and hair science, emotional engineering, perfume science, analytical chemistry, and color science[10][11]. As an image industry that satisfies the human meaning and needs related to the body, it is an industry that is comprehensively applied with basic science and applied technology, as well as an environment-friendly field. As a result, income elasticity is high, and as a domestic demand-oriented industry, growth potential is high depending on income level. Hence, it is a necessity of life, and it is an emotionally involved industry in which cultural products and the fashion industry coexist[7][12][13].

The industrial characteristic of cosmetics is an aging-friendly industry closely related to human life, and it is an industry based on the fundamental human desire to pursue beauty. As it is a daily consumer product and has the characteristics of a luxury good, it is a necessities used in daily life and personal preferences have a significant influence on purchasing behavior. This is because it is an industry with a short product lifespan and a multi-variety, small-volume production system. This is because the cosmetics that respond sensitively to the trends in preference and fashion, short period of distribution and extinction, and trends seeking beauty, have characteristics as a technology convergence industry across various fields[14][15].

4.2. Changes in the cosmetic consumption related trends

Research and development, manufacturing, processing, storage, and distribution of cosmet-

ics have a strong emotional tendency. Given the nature of the industry, scientific and psychological research is expected to appear in the neurocosmetics as the convergence of neuroscience and personal customization[16]. Accordingly, the consumption trend of the cosmetic industry is characterized by low irritation with reduced harmful ingredients by segmentation of consumer needs, good products with natural ingredients, recognition of the seriousness of fine dust, and sensitive and quick response to trends in the anti-pollution cosmetics market.

Such characteristics of consumption trend are, first, globalization started Given changes in social and culture, and changes in aesthetic consciousness occurred. Well-looking, which is concerned with health and beauty, lookism, which cares about appearance, eco-friendliness, and social and cultural influences demonstrated various phenomena along with interest in functional cosmetics[1][17][18].

Second, the change in science and technology is a consumption trend in line with the spread of the 'scientific and technological evidence' for the cosmetic materials and raw materials. Consumers have secured competitiveness with new technology convergence and new technology in response to environmental changes that lead to sustainable sensibility as the consumers expand into new technological areas, skin-to-brain, and human body biologics. Various targets of digital and fragrance emotional technology for pre-diagnosis and treatment with smart skin, focused on big data, artificial intelligence(AI), the Internet of Things(IoT), augmented reality(AR), virtual reality(VR), and 3D printing[19][20][21].

4.3. Definition of cosmeceutical

The definition of cosmeceutical is a term used only in Korea and Japan, and functional cosmetics are defined as a category within cosmeceuticals in the United States and the European markets. Compared to general cosmetics that prioritize safety, the focus is on effectiveness. Cosmeceutical, a high-functional cosmetic product, is a compound word of cosmetics and pharmaceuticals. It is an improved product compared to cosmetics. It is a medicinal cosmetic, and refers to a therapeutic cosmetic including cosmetics for consumption. It is a non-pigmented skin supplement containing medicinal crop extracts, and is a high-functional cosmetic for comprehensive understanding and counseling of each individual's side effects and constitution theory[5].

The characteristic of cosmeceutical is that it contains the physiologically active ingredients that help the treatment of skin diseases, and serves as an auxiliary treatment, and the purpose is to increase the effect of the existing treatment and to reduce the side effects. If the existing functional cosmetics are cosmetics made with emphasis on effectiveness, the differences between cosmetics, pharmaceuticals, and cosmeceuticals with the meaning of more active treatment for cosmeceuticals are shown in <Table 1>.

Table 1. Comparison of cosmetics, pharmaceuticals, and cosmeceuticals.

| Classification | Cosmetics | Pharmaceuticals | Cosmeceuticals |
|--------------------|---------------------------------|---|--|
| Purpose of use | Pursuit of beauty | Treatment and prevention of diseases | Auxiliary treatment |
| User | Unspecified many | Specific patients with skin diseases | Specific masses and the general public with skin diseases who visited the hospital |
| How to use | Daily, long term | Mostly temporary | Long term |
| Raw materials used | A wide range of all ingredients | Prioritized effects focused on notified ingredients and sometimes accompanied by minor side effects | Auxiliary efficacy centric ingredients |

Note: Recited from cosin Korea and woonsil ok (2018).

4.4. Tendency for consumption and the purchase related decision making factors

4.4.1. Consumption related tendency

Consumers purchase tangible goods and directly consume their use value, purchase intangible services and enjoy the benefits of those services, and use ideologies and ideas rather than products or services[22]. Consumption refers to the general use of goods or services to satisfy certain desires, and production and consumption are interrelated. Consumption related tendency played an important role in subdividing the cosmetics market according to the cultural consumption preference or preference scale of the society[23]. It is a lifestyle related to shopping that defines the consumers' tendency as the purchase related tendency and shopping related tendency according to the scholars, and reflects a complex phenomenon in which substances owned or consumed by consumers define their identity[24][25][26].

In classifying the consumption related tendency, no absolute standard or method has been specified yet. From such point of view, this study aims to examine the effects on cosmeceutical purchase related decision making through beauty related interest, cosmeceutical awareness, and hair cosmetics usage according to consumption related tendency and synchronous consumption, etc.[27], but in this study, the practical consumption is the opposite of impulsive consumption, which may be said to be rational consumption. That is, it aims to achieve the cognitive purpose, and the function of the product is an essential element of consumption. Practical consumption is among the most widely used concepts in connection with consumption. It is mainly used to solve problems faced by the consumers, and the objective substance of the product is considered important. The consumers who choose products in a practical way are very careful and emphasize the efficiency aspect, and actively collect information and act rationally. From the above point of view, the practical consumption is the concept of purchasing using a discount or sale period after Examining various places, comparing the types and quality of brands, collecting and comparing various types of information to see if the value is worth it[27][28][29].

4.4.2. Purchase related decision making

Purchasing decision refers to purchasing the most preferred brand by consumers after evaluation of each brand in the evaluation stage. That is, after the consumer ranks the preference for alternative products or brands, the purchase intention of the preferred product is formed. The relationship between purchase intention and purchase is a factor which may result in not purchasing according to purchase intention depending on the attitudes of the surrounding people towards alternatives or unexpected situational variables. To satisfy their needs by recognizing the problem for consumers' purchasing behavior, there are internal stimuli that normally occur and external stimuli through advertisements and other factors[30][31].

In the research on the cosmeceutical's preference, the purchase related decision making factor is the marketing strategy of the hospital-distributed cosmetics, the credibility of the brand in which the research team participated in product development, rather than atopic skin concerns, rather than atopic skin concerns. That is, it varies according to price, brand, perceived quality, and seller's image[32]. According to the cosmetic type, it was revealed that quality, reputation and price suitability, design, advertisement, trend, and ingredients were related to satisfaction when selecting functional products. As the purchase related decision making factor regarding the care marketing strategy, those with dry skin purchase mainly cleansing products in consideration of their skin condition, which can take into account their blemishes and blemishes, as the knowledge of expert counseling is in the people around them[33]. In a study on the step-by-step behavior and consumer satisfaction to decide the purchase intention of a road shop cosmetic with a low price characteristic for a single brand in a place with a large floating population, price, quality, and service satisfaction were at an intermediate level. and quality

rather than price, the purchase related decision makings are made based on the importance of labeling information so that consumers can easily and fully understand the contents, such as ingredients, precautions for use, expiration date, etc.[34][35][36].

4.5. Interest in beauty and the perception of cosmeceutical

4.5.1. Interest in beauty

Beauty related interest is a compound word of 'beauty', 'interest', and 'level' , which refers to the level of interest in the application and behavior of beauty to the overall beauty industry[37][38]. The interest in beauty goes beyond the simple interest in the aesthetic expression of an individual's face, and is the interest in meaningful behavior with the purpose of basic human needs, self-esteem, and interpersonal orientation. The reason for managing the appearance of adults and adolescents is psychological satisfaction, and appearance is an important part for women. It is believed that the technological alliance will improve the technological prowess of cosmetic companies to a certain level.

As for the interest in beauty, the more people are satisfied with their appearance, the more satisfied they are with their face, the more they are satisfied with their appearance. According to the level of cosmetic surgery intention and positive attitude [39][40].

In a study of consumer group beauty related interest and medical-beauty care purchasing behavior according to value type, consumers with active achievement type for the treatment of problematic skin diseases used medical-skin care for their desire for their appearance so that good looks could become competitive. receive It was found that beauty management behaviors were interested in professional management, appearance management, and tools in the order, and received beauty management according to practical, extrinsic, and intrinsic factors. That is, the higher the material orientation, the higher the facial satisfaction of male and female high school students had a positive effect on the beauty related interest, and the higher the interest in appearance[41][42].

Hence, as the beauty standards of the times change, there is a social pressure on attractive looks. The interest in beauty is to show the body in an attractive and improved form for one's individuality and psychological satisfaction. At this time, it is obtained through various information that promotes interest in appearance, health pursuit, and appearance orientation by dressing up the face, hair, and appearance. Recognizing and wanting to reveal others is accompanied by social emotions. They value the hairstyle that determines the impression of the people around them, protect their health with accessories, hair care, skin, exercise, self-care, and beauty related food, and are interested in cosmetic surgery, beauty information, and the beauty industry.

4.5.2. Perception of cosmeceutical

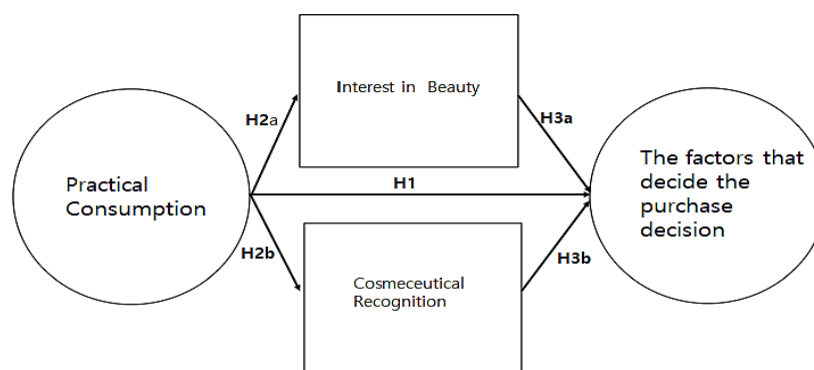
The cosmeceutical hair cosmetics market has grown and subdivided along with technological developments as consumers' desires have arisen as a result of interest in healthy hair. Examining the recent preceding studies on cosmeceuticals, the satisfaction with consumption characteristics preferred by cosmeceuticals is believed to be safe and professional for regenerating skin and resolving dryness through hospital workers and consumers' awareness of hospital distribution cosmeceuticals[42]. The function-oriented consumption value selection considering the age-specific usage status of cosmeceuticals and fermented cosmetics, price satisfaction, complex perception, and product price. There is a need to develop products that are used in the pharmaceutical industry by stabilizing raw materials that have therapeutic functions beyond cosmetic functions, with fewer side effects and proven efficacy and safety, focused on the development of awareness-enhancing packages[43].

As the age of the hair loss population decreases Given environmental influences, consumers are more interested in hair and the reason for the rapid growth of the hair cosmetic market is the rise of cosmeceutical awareness, which is a form of consumption that differentiates and specializes in beauty and differentiates beauty, in addition to professional products. As such, the study on the requirements for cosmeceuticals and the development of new raw materials as various materials has been conducted the most so far. The results of a survey on women's perception and usage of hair cosmetics, the use of functional hair products as an effective way to improve scalp and hair health, and the use of functional hair products to consider their own scalp and hair condition when choosing hair cosmetics, demonstrate the fact that women value efficacy and effect the most, and hence, technological development is required in terms of efficacy in order to increase the consumers' use and satisfaction with cosmeceutical hair cosmetics, and it is considered that segmentation, professional product development, and the marketing strategy development are necessary[9].

5. Design of the Study

5.1. Research model

Figure 1. Research model.



5.2. Research hypotheses

Hypothesis 1. The consumers' practical consumption related tendency will have a positive(+) effect on the purchase related decision making factors of cosmeceuticals.

Hypothesis 2. Appearance related interest, health pursuit, and appearance orientation of the interest in beauty will play a mediating role in the influence of the consumers' tendency to consume on the cosmeceutical purchase decision making factors.

Hypothesis 3. Cosmeceutical perception will play a mediating role in the influence of practical consumption related tendency on the cosmeceutical purchase related decision making factors.

5.3. Operational definition

Practical consumption uses the price comparison, quality comparison, information collection, and the discount period in connection with the consumption behavior. According to a consistent preference system, it refers to the entire process related to individual interests, such as rational consumption that one wants to purchase, and a consumption related tendency such as price emphasis.

To narrow the difference between the social ideal and one's actual appearance, interest in appearance, health pursuit, hair style management according to hair discoloration for appearance orientation, beauty related food, exercise for body management, cosmetic surgery, skin

self-care, etc., it refers to the level of behavior and the interest in managing appearance with the beauty related information.

The deciding making factors for purchasing cosmeceuticals are high-performance cosmetics classified as specialty drugs, with high absorption rates and therapeutic properties. Recognition of effectiveness in terms of effectiveness, superiority of usability, stability of deterioration, discoloration, and separation of formulation, etc., demonstrate the importance of securing safety of skin irritation and allergic toxicity, sympathy of objective satisfaction and subjective satisfaction, eco-friendliness of raw materials and subsidiary materials, which means the importance of the labeling of all ingredients, the user's taste, and the mental effect of the fragrance.

5.4. Research subject

For this study, the residents in their 20s to 60s were selected from the Seoul and Gyeonggi regions, and a total of 1,006 questionnaires were distributed and 283 copies were recovered, with a recovery rate of 35.67%. Among the collected questionnaires, a total of 282 meaningful questionnaires were obtained and used as the statistical analytical data except for 1 copy with insincere responses.

6. Results of the Empirical Analysis

Table 2. Demographic characteristics.

| Classification | Category | Frequency(people) | Percentage(%) |
|----------------|---------------|-------------------|---------------|
| Gender | Male | 127 | 45.0 |
| | Female | 155 | 55.0 |
| Age | 20s | 16 | 5.7 |
| | 30s | 39 | 13.8 |
| | 40s | 90 | 31.9 |
| | 50s | 110 | 39.0 |
| | 60s or older | 27 | 9.6 |
| | Overall total | 282 | 100.0 |

Table 3. Functions of cosmeceuticals currently in use or used.

| Classification | Category | Frequency (people) | Percentage(%) |
|--|--|--------------------|---------------|
| Functions of cosmeceuticals currently in use or used | Not used for therapeutic or cosmetic purposes/refused to respond | 133 | 47.2 |
| | Functional cosmetics which inhibits the formation of spots and freckles, and whitens | 26 | 9.2 |
| | Cosmetics which lightens the melanin pigment deposited on the skin | 7 | 2.5 |
| | Functional cosmetics which reduces or improves wrinkles | 23 | 8.2 |
| | Cosmetics which protects the skin from strong sunlight and brighten the skin | 2 | 0.7 |

| | | | |
|--|---|-----|-------|
| | Cosmetics which protects the skin from UV rays | 4 | 1.4 |
| | Cosmetics which changes the color of hair(desalting or bleaching) | 10 | 3.5 |
| | Cosmetics which helps to prevent or alleviate hair loss | 56 | 19.9 |
| | Cosmetics which helps to relieve acne-prone skin | 11 | 3.9 |
| | Cosmetics which helps to relieve atopic skin | 6 | 2.1 |
| | Cosmetics which lightens the red lines caused by stretch marks | 4 | 1.4 |
| | Overall total | 282 | 100.0 |

Table 4. Consumption related tendency.

| Frequency(percentage) | | | | | | | | |
|--------------------------------|--|----------------|--------------|---------------|---------------|-----------------|--------|--------------------|
| Factor | Contents | Absolutely not | Not at all | Usual | True | Absolutely true | Median | Standard deviation |
| Practical consumption tendency | I buy a product after looking at several stores or products and comparing them | 8 (2.8) | 38 (13.5) | 137 (48.6) | 78 (27.7) | 21 (7.4) | 3.23 | 0.88 |
| | I make the purchase after visiting several places and comparing the types, prices, and quality of brands | 10 (3.5) | 44 (15.6) | 107 (37.9) | 98 (34.8) | 23 (8.2) | 3.28 | 0.95 |
| | I collect and compare various information about the product I want to purchase and make a decision | 7 (2.5) | 41 (14.5) | 125 (44.3) | 89 (31.6) | 20 (7.1) | 3.26 | 0.88 |
| | When choosing a product, I consider whether the product is worth the price | 4 (1.4) | 14 (5.0) | 105 (37.2) | 115 (40.8) | 44 (15.6) | 3.64 | 0.85 |
| | I buy only during discounted sales | 17 (6.0) | 46 (16.3) | 104 (36.9) | 94 (33.3) | 21 (7.4) | 3.20 | 1.00 |

Table 5. Level of interest in beauty.

| Frequency(percentage) | | | | | | | | |
|------------------------|--|----------------|--------------|--------------|---------------|-----------------|--------|--------------------|
| Factor | Contents | Absolutely not | Not at all | Usual | True | Absolutely true | Median | Standard deviation |
| Interest in appearance | I'm interested in preventing aging or discoloration of hair | 1 (0.4) | 10 (3.5) | 39 (13.8) | 116 (41.1) | 116 (41.1) | 4.19 | 0.83 |
| | I usually pay attention to my Appearance | 7 (2.5) | 22 (7.8) | 49 (17.4) | 119 (42.2) | 85 (30.1) | 3.90 | 1.00 |
| | I care about the people around me about my appearance | 6 (2.1) | 29 (10.3) | 71 (25.2) | 117 (41.5) | 59 (20.9) | 3.69 | 0.98 |
| | Hairstyle is important for me in determining a person's impression and style | 1 (0.4) | 5 (1.8) | 36 (12.8) | 135 (47.9) | 105 (37.2) | 4.20 | 0.75 |
| Pursuit of health | I pay attention to what fruits and vegetable I consume | 1 (0.4) | 15 (5.3) | 52 (18.4) | 140 (49.6) | 74 (26.2) | 3.96 | 0.83 |
| | I think that UV rays are related to skin aging | 1 (0.4) | 5 (1.8) | 42 (14.9) | 131 (46.5) | 103 (36.5) | 4.17 | 0.77 |

| | | | | | | | | |
|---------------------|--|--------------|--------------|---------------|---------------|--------------|------|------|
| | I try to keep my beauty through regular exercise | 6 (2.1) | 22 (7.8) | 73 (25.9) | 122 (43.3) | 59 (20.9) | 3.73 | 0.95 |
| | If I think it is necessary to consume beauty food(eating cosmetics), I will eat it | 9 (3.2) | 16 (5.7) | 6 2(22.0) | 113 (40.1) | 82 (29.1) | 3.86 | 1.00 |
| Appearance oriented | I'm willing to undergo cosmetic surgeries if needed in the future | 36 (12.8) | 60 (21.3) | 77 (27.3) | 64 (22.7) | 45 (16.0) | 3.08 | 1.26 |
| | I frequently access magazines and online media to obtain cosmetic beauty information | 26 (9.2) | 78 (27.7) | 116 (41.1) | 49 (17.4) | 13 (4.6) | 2.80 | 0.98 |
| | I often do face packs at home | 20 (7.1) | 54 (19.1) | 123 (43.6) | 62 (22.0) | 23 (8.2) | 3.05 | 1.01 |
| | I undergo treatment for scalp and hair loss prevention care | 76 (27.0) | 68 (24.1) | 54 (19.1) | 60 (21.3) | 24 (8.5) | 2.60 | 1.31 |

Table 6. Cosmeceutical perception.

| Frequency(percentage) | | | | | | | | |
|--------------------------|--|----------------|--------------|--------------|---------------|-----------------|--------|--------------------|
| Factor | Contents | Absolutely not | Not at all | Usual | True | Absolutely true | Median | Standard deviation |
| Cosmeceutical perception | I have experience using it for therapeutic or cosmetic purposes | 50 (17.7) | 65 (23.0) | 37 (13.1) | 76 (27.0) | 54 (19.1) | 3.07 | 1.41 |
| | I'm interested in the natural cosmetics | 3 (1.1) | 16 (5.7) | 71 (25.2) | 144 (51.1) | 48 (17.0) | 3.77 | 0.83 |
| | It will be a cosmetic that is safe for your skin | 4 (1.4) | 11 (3.9) | 90 (31.9) | 137 (48.6) | 40 (14.2) | 3.70 | 0.81 |
| | If there are indications that the efficacy has been scientifically proven through clinical trials, it will help you choose | 4 (1.4) | 7 (2.5) | 8 6(30.5) | 126 (44.7) | 59 (20.9) | 3.81 | 0.84 |
| | I think it is expensive compared to other cosmetics | 3 (1.1) | 15 (5.3) | 8 2(29.1) | 140 (49.6) | 42 (14.9) | 3.72 | 0.82 |
| | I have heard about cosmeceuticals | 17 (6.0) | 27 (9.6) | 58 (20.6) | 119 (42.2) | 61 (21.6) | 3.64 | 1.10 |
| | I think of it as scientific cosmetics | 2 (0.7) | 12 (4.3) | 99 (35.1) | 137 (48.6) | 32 (11.3) | 3.66 | 0.76 |
| | I have expectations for cosmetics as natural ingredients are used | 2 (0.7) | 8 (2.8) | 82 (29.1) | 152 (53.9) | 38 (13.5) | 3.77 | 0.74 |

Table 7. Cosmeceutical purchase related decision making.

| Frequency(percentage) | | | | | | | | |
|-----------------------|---|----------------|-------------|--------------|---------------|-----------------|--------|--------------------|
| Factor | Contents | Absolutely not | Not at all | Usual | True | Absolutely true | Median | Standard deviation |
| Effectiveness | Effectiveness in terms of effectiveness is crucial | 1 (0.4) | 2 (0.7) | 32 (11.3) | 134 (47.5) | 113 (40.1) | 4.26 | 0.71 |
| Usability | Excellent usability is important | 1 (0.4) | 13 (4.6) | 60 (21.3) | 125 (44.3) | 83 (29.4) | 3.98 | 0.85 |
| Stability | Stability is important to prevent deterioration, discoloration, odor, and separation of formulations during storage | 1 (0.4) | 3 (1.1) | 33 (11.7) | 149 (52.8) | 96 (34.0) | 4.19 | 0.70 |

| | | | | | | | | |
|----------------------------|---|------------|-------------|---------------|---------------|---------------|------|------|
| Safety | It is important to secure safety against toxicity that can cause skin irritation or allergies | 1 (0.4) | 21 (7.4) | 140 (49.6) | 120 (42.6) | 1 (0.4) | 4.34 | 0.65 |
| Empathy | Objective satisfaction with products and empathy for individual and subjective consumer satisfaction are important | 1 (0.4) | 6 (2.1) | 46 (16.3) | 139 (49.3) | 90 (31.9) | 4.10 | 0.77 |
| Eco-friendliness | The eco-friendliness of raw materials and various subsidiary materials is important | 1 (0.4) | 2 (0.7) | 33 (11.7) | 162 (57.4) | 84 (29.8) | 4.16 | 0.67 |
| All ingredients are marked | For active ingredients, all ingredient labeling contents of the ingredients are important | 1 (0.4) | 2 (0.7) | 29 (10.3) | 166 (58.9) | 84 (29.8) | 4.17 | 0.66 |
| Mental effect | It is important to have a sense of smell that suits the user's taste, and the psychological effect on the fragrance | 1 (0.4) | 4 (1.4) | 40 (14.2) | 125 (44.3) | 112 (39.7) | 4.22 | 0.76 |

6.1. Factor analysis of the measured variables

6.1.1. Factor analysis of the consumption tendency

Table 8. Factor analysis of consumption related tendency.

| | | Factor | | | | | |
|---------------------------------|---|----------|-------|-------|-------|-------|--------------|
| Questions | | 1 | 2 | 3 | 4 | 5 | Common-ality |
| Practical consumption | Examine, compare, then buy | .832 | -.042 | .106 | .051 | .081 | .714 |
| | Compare types, prices, and qualities then make the purchase | .873 | .129 | .001 | .059 | -.008 | .783 |
| | Collect product information and comparatively analyze | .816 | -.063 | .166 | .116 | .075 | .717 |
| | Whether it is worth the price | .736 | .055 | .038 | -.120 | -.039 | .562 |
| | Buy only during discounted sales | .532 | .403 | -.007 | .134 | -.307 | .559 |
| Explanation variance | | 3.040 | 2.949 | 2.314 | 2.259 | 1.433 | |
| Total cumulative explanation(%) | | 66.6 | | | | | |
| Kaiser-Meyer-Olkin measurement | | .794 | | | | | |
| Bartlett's test χ^2 | | 2091.230 | | | | | |
| df | | 153 | | | | | |
| p | | .000 | | | | | |

Table 9. Factor analysis of the beauty related interest.

| | | Factor | | | | | | | |
|------------------------|--|--------|------|-------|------|------|------|-------|-------------|
| Questions | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Commonality |
| Interest in appearance | Interested in aging prevention and discoloration | .729 | .101 | -.044 | .178 | .293 | .283 | -.084 | .748 |
| | Usually care about appearance | .847 | .163 | .189 | .046 | .082 | .169 | .118 | .832 |
| | Appearance evaluation by those around | .834 | .049 | .257 | .063 | .049 | .033 | .189 | .807 |

| | | | | | | | | | |
|---------------------------------|--|-------|-------|-------|-------|-------|-------|-------|------|
| | Hair style decides what impression is made | .479 | .002 | .091 | .668 | .067 | -.328 | -.011 | .796 |
| Pursuit of health | Consume fruits and vegetables | .178 | .153 | .812 | .273 | .036 | .167 | -.165 | .846 |
| | UV rays related to skin aging | .010 | -.044 | .131 | .890 | .099 | .148 | .125 | .859 |
| | Preserve beauty through exercise | .190 | -.064 | .782 | -.023 | .284 | -.008 | .303 | .824 |
| | Need to consume beauty food | .237 | .169 | .253 | .140 | .862 | .129 | .052 | .930 |
| Appearance oriented | Willing to undergo cosmetic surgery | .055 | .829 | -.077 | .089 | .214 | -.089 | .304 | .850 |
| | Frequent access to the online media for the beauty related information | .188 | .389 | .077 | .152 | .043 | .199 | .777 | .861 |
| | Wear cosmetic masks t at home | .363 | .161 | .158 | .030 | .157 | .772 | .196 | .843 |
| | Undergo treatment | .173 | .833 | .164 | -.148 | -.011 | .269 | .030 | .846 |
| Explanation variance | | 4.995 | 3.312 | 3.055 | 2.850 | 2.012 | 2.000 | 1.858 | |
| Total cumulative explanation(%) | | 83.7 | | | | | | | |
| Kaiser-Meyer-Olkin measurement | | | | | | | | | |
| Bartlett's test χ^2 | | | | | | | | | |
| df | | | | | | | | | |
| p | | | | | | | | | |

6.1.2. Factor analysis of the cosmeceutical perception

Table 10. Factor analysis of cosmeceutical perception.

| | Factor | | |
|--|---------|-------|-------------|
| Questions | 1 | 2 | Commonality |
| Extent of experience of using it for therapeutic or cosmetic purposes | .158 | .747 | .583 |
| Extent of interest in natural cosmetics | .653 | .301 | .517 |
| Extent of cosmetics safe for skin | .815 | .158 | .689 |
| Extent to which scientifically proven indications are helpful in selection | .817 | .047 | .669 |
| Extent to which you think it is expensive compared to other cosmetics | .603 | .143 | .384 |
| Extent to which one has heard about cosmeceuticals | .097 | .854 | .739 |
| Extent of thinking that it is scientific cosmetic | .631 | .400 | .558 |
| Extent of expectations for cosmetics using natural ingredients | .777 | .036 | .605 |
| Explanation variance | 3.158 | 1.587 | |
| Total cumulative explanation(%) | 59.3 | | |
| Kaiser-Meyer-Olkin measurement | .829 | | |
| Bartlett's test χ^2 | 707.641 | | |
| df | 28 | | |
| p | .000 | | |

6.1.3. Cosmeceutical purchase related decision making analysis according to the consumption tendency

Table 11. Cosmeceutical purchase related decision making according to consumption tendency.

| | Factor | | |
|---|---------|-------|-------------|
| Questions | 1 | 2 | Commonality |
| Recognition of effectiveness in terms of effectiveness is crucial | .748 | .193 | .597 |
| Excellent usability is important | .805 | .052 | .650 |
| Stability is important when it comes to discoloration, discoloration, odor, and separation of formulations. | .781 | .279 | .687 |
| Secure safety against skin irritation, allergy, and toxicity | .717 | .328 | .621 |
| Empathy for objective satisfaction and subjective customer satisfaction | .296 | .738 | .633 |
| The level at which the eco-friendliness of raw materials and various subsidiary materials is important | .514 | .487 | .501 |
| Marking of all ingredients for active ingredients | .450 | .585 | .545 |
| Perfume's feeling and mental effect tailored to the user's taste | .017 | .879 | .773 |
| Explanation variance | 2.885 | 2.122 | |
| Total cumulative explanation(%) | 62.6 | | |
| Kaiser-Meyer-Olkin measurement | .828 | | |
| Bartlett's test χ^2 | 875.749 | | |
| df | 28 | | |
| p | .000 | | |

6.1.4. Discriminant validity of the purchase related decision making factors for cosmeceuticals according to the consumption tendency

Table 12. Cosmeceutical purchase related decision making factor according to consumption tendency.

| Variable 1 | Variable 2 | R ² | Variable 1 AVE | Variable 2 AVE |
|---|---|----------------|----------------|----------------|
| Consumption tendency | Beauty related interest | .26 | .58 | .59 |
| Cosmeceutical perception | Consumption tendency | .08 | 1.00 | .58 |
| Purchase related decision making factor | Consumption tendency | .02 | 1.00 | .58 |
| Cosmeceutical perception | Beauty related interest | .37 | 1.00 | .59 |
| Purchase related decision making factor | Beauty related interest | .14 | 1.00 | .59 |
| Cosmeceutical perception | Purchase related decision making factor | .27 | 1.00 | 1.00 |

6.2. Correlation analysis

Table 13. Correlation of cosmeceutical purchase related decision making factors according to consumption tendency.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|
| 1. Practical consumption | .14* | .26*** | .18** | | | | | | | | |
| 2. Consumption tendency | .76*** | .80*** | .69*** | .59*** | | | | | | | |
| 3. Interest in appearance | .21*** | .20*** | .28*** | .29*** | .34*** | | | | | | |
| 4. Pursuit of health | .10 | .12* | .23*** | .29*** | .26*** | .54*** | | | | | |
| 5. Appearance oriented | .31*** | .30*** | .35*** | .20*** | .40*** | .41*** | .36*** | | | | |
| 6. Interest in beauty | .28*** | .27*** | .37*** | .32*** | .43*** | .81*** | .76*** | .79*** | | | |
| 7. Cosmeceutical perception | .19** | .21*** | .17** | .20*** | .27*** | .37*** | .30*** | .50*** | .51*** | | |
| 8. Purchase related decision making factor | .10 | .14* | .03 | .13* | .15* | .33*** | .25*** | .14* | .30*** | .50*** | |

6.3. Validation of hypothesis

6.3.1. Effect of the consumption tendency on the purchase related decision making factors

Hypothesis 1. The consumers' consumption tendency will have a positive(+) effect on the cosmeceutical purchase related decision making factor. → Adopted

The consumers with a practical consumption tendency will have a positive(+) influence on the cosmeceutical purchase related decision making factor.

6.3.2. Cosmeceutical purchase related decision making factors of the consumption tendency according to the beauty related interest

Hypothesis 2. The beauty related interest will play a mediating role in the influence of the consumers' consumption tendency on the cosmeceutical purchase related decision making factor. → Partially adopted.

Table 14. The effect of beauty interest.

| Hypotheses | Test results |
|--|-------------------|
| 2-1. The appearance related interest will have a positive(+) effect on the purchase related decision making factor for the cosmeceutical hair cosmetics. | Partially adopted |
| 2-2. The pursuit of health will have a positive(+) effect on the purchase related decision making factor for the cosmeceutical hair cosmetics. | Partially adopted |
| 2-3. The appearance orientation will have a positive(+) effect on the purchase related decision making factor for the cosmeceutical hair cosmetics. | Partially adopted |

6.3.3. Purchase related decision making factors according to the consumption tendency of the cosmeceutical perception

Hypothesis 3. The cosmeceutical perception will play a mediating role in the influence of the consumers' consumption tendency on the cosmeceutical purchase related decision making factor. → Adopted.

Table 15. The effect of cosmeceutical perception.

| Hypotheses | Test results |
|---|--------------|
| 3-1. Those who have used products for therapeutic and cosmetic purposes will have an influence on the mediating role of the purchase related decision making factor according to the consumers' consumption tendency according to the product used. | Adopted |
| 3-2. The consumers' consumption tendency for the natural cosmetics will affect the mediating role of the cosmeceutical purchase related decision making factor. | Adopted |
| 3-3. The skin-safe and scientific cosmetics will have an influence on the mediating role of the cosmeceutical purchase related decision making factor in the consumers' consumption tendency. | Adopted |
| 3-4. Since the cosmetics with proven efficacy are more expensive than other cosmetics, the consumers' consumption tendency will have an effect on the mediating role of the cosmeceutical purchase related decision making factor. | Adopted |
| 3-5. The consumption tendency of the consumers who have never heard of cosmeceuticals will have an effect on the mediating role of the purchase related decision making factor. | Adopted |

7. Conclusion

In this study, the specific results which are considered to provide important directions for the purchase related decision making factors of cosmeceuticals are as follows.

First, they do not rely on information obtained from others in their consumption related tendency to purchase, and it is a determining factor in purchasing cosmeceuticals according to their own standards. In particular, as for the practical consumption related tendency, the consumers' wise judgment about the safety of cosmeceuticals turned out to be making a purchase related decision after collecting and comparing various information about the product to see if the product is worth as much as the price.

Second, the interest in beauty was related to the aging prevention or hair discoloration(82.2%), beauty related food intake in pursuit of health(69.2%), fruit and vegetable intake and regular exercise(64.2%), and UV rays are related(83%) to skin aging.

Third, the consumers' perception of cosmeceuticals was recognized in the order of interest in the natural cosmetics(68.1%), natural ingredients(67.4%), scientific verification(65.9%), skin-safe cosmetics(62.8%), and the scientific cosmetics(60.4%), respectively. This result demonstrated the fact that the practical consumption phenomenon of consumers, and the consumer's prudence toward natural products concerned about side effects could help identify the customer needs for the skin improvement and effects.

Lastly, the purchase related decision making factors for the cosmeceuticals were usability(74.1%), labeling of all ingredients(88.7%), effectiveness(87.6%), eco-friendliness(87.2%), safety(86.8%), and psychological effects(84%), which turned out to be individual and the empathy of subjective consumer satisfaction was important(81.2%), as they were in their order of high preference. The reason as to why the consumers consider cosmeceutical purchase decision making factors important is the phenomenon that the consumers themselves feel about the manufacturing, cosmetic certification, and certification body that recognizes raw materials for various functional cosmetics to protect consumer rights and interests, and the legal basis and regulations of cosmetics.

As a result of the correlation analysis of the purchase related decision making factors of cosmeceuticals according to the consumption related tendency according to the above conclusion, the correlation between all variables was significant. was noted. The purchase related decision

making factors of cosmeceutical awareness had a significant positive relationship with the direct effect and the total effect. The purchase decision making factors were affected according to the products used by the experienced users for therapeutic and cosmetic purposes.

The results of this study are considered to be able to be used as the basic data to develop cosmeceutical products that are sensitive to the economy and are a consumer goods industry and a favorite.

7.1. Limitations of the study and recommendations

The results of this study have the following limitations.

First, since this study analyzed only the parameters of beauty related interest, cosmeceutical perception, and usage status according to consumers' tendency to consume, there is a limit to considering that it fully reflects the cosmeceutical purchase decision. Furthermore, it was difficult for the researcher to arbitrarily classify the items and clearly classify each item.

Second, while the practical consumption related tendency tried to make the items most suitable for the purpose of this study, there was a limit to protruding the items most suitable for practical consumption connected to the purchase decision item.

Third, in the questionnaire survey in this study, since the level of interest was different for men and women, and when each item was created, the number of items was too large and the number of duplicated items was reduced as much as possible to select common items. Given this reason, there is a limitation in that the quality and reliability of the measurement cannot be improved by asking various questions.

Fourth, considering the fact that there are inadequate parts to make a purchase decision because the sub-factors of the independent variables of the study are limited to practical consumption, future research will consider these limitations and select the survey subjects as male and female, age, educational background, occupation, and income. By adding a wider range of items and items on consumers' tendency to consume, beauty related interest, cosmeceutical awareness, and actual use, and by expanding the research area to add psychological variables as well as dependent variables, accurate reproducibility of the research results must be achieved.

According to the results of this research, it is expected that in the future, cosmeceutical manufacturers will increase their sales effect by establishing a sales strategy based on the analysis of the consumers' consumption related tendency, interest in beauty, perception of cosmeceuticals, and the usage status of the consumers moving into the customized era of small-scale production. The results appeared.

The purchase related decision making generally begins with the need recognition stage, which recognizes the need to purchase and recognizes the purchase decision process for a product or service in a given situation. It goes through the information search stage to collect and examine and understand information about the type, quality, price, manufacturer, and seller of the product you want to purchase from various sources of consumer information.

In the future, by thoroughly preparing for the problems and specific improvement plans presented in the above, there must be a detailed methodology which could verify the mediating factors of cosmeceutical purchase decision making factors which are appropriate for consumption related tendency. That is, it is thought that it will be helpful to the cosmeceutical industry as basic data for qualitative improvement and reliable experiments through follow-up research on providing the empirical information for both the companies and the consumers.

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9. Appendix

9.1. Author's contribution

| | Initial name | Contribution |
|-----------------------|--------------|--|
| Lead Author | WK | -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> |
| Corresponding Author* | MH | -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> -Play a decisive role in modification <input checked="" type="checkbox"/> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> |
| Co-Author | EJ | -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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Corresponding author*
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A Study on the Usefulness of the Natural Product Fermentation Mixture as Scalp and Hair Care Cosmetic Material Protection

Miyoung Choi¹

Incheon Jaeneung University, Incheon, Republic of Korea

Eunjoo Choi^{2*}

Westminster Graduate School of Theology University, Yongin, Republic of Korea

Abstract

Purpose: The hair losing population is increasing due to stress, environmental pollution, and various cosmetic procedures, and the market for functional cosmetics for scalp and hair care is further growing due to the lower aging population. Recently, however, many studies have been conducted where many are found to seek cosmetic raw materials from natural substances or apply fermentation techniques to cosmetic manufacturing processes. Hence, after fermenting with *Sasa Borealis*, which is edible and has been used for various pharmacological functions in the private sector for a long time and has secured clinical safety, the effectiveness (in vitro) has been investigated, and the fermented mixture of natural products is used as a sample for damaged hair, and the recovery effect has been examined and understood.

Method: Examined in this study were the antibacterial activity, anti-inflammatory activity, and dermal papilla cell proliferation rate of *Sasa Borealis* leaf fermented product, which were mixed with the green coffee bean and *Smilax china* L. leaf fermented product, and after selecting the fermented mixed sample, the added scalp hair care product was treated with heat perm and dyeing to measure tensile strength and glossiness, where the recovery effect of damaged hair was investigated by imaging with SEM.

Results: *Sasa Borealis* leaf ferment was superior to *M. canis*, anti-inflammatory activity and dermal papilla cell proliferation. The product to which the fermentation mixture sample was added increased both the tensile strength and glossiness of the hair damaged by heat perm and dyeing, and as a result of confirming such via the SEM, it was found that there is an effect of restoring the damaged hair.

Conclusion: *Sasa Borealis* leaf fermented product has excellent *M. canis*, anti-inflammatory ability, and dermal papilla cell proliferation rate, and hence, it was confirmed that it may be applied as a raw material for various cosmetics. The cosmetics containing natural fermentation mixtures increased tensile strength and glossiness of damaged hair. Future research is expected to articulate the pharmacological mechanism of the fermentation mixture through the physiological studies related to the fermentation process and the growth rate of dermal papilla cells.

Keywords: *Sasa Borealis*, Fermentation Mixture, Hair Loss, Tensile Strength, Glossiness

1. Introduction

1.1. Need and purpose of the study

In the 21st century, in the Korean society, the quality of life has significantly improved due to the rapid industrialization and economic growth, and the average life expectancy has increased, thereby raising the interest as to whether it is possible to maintain a healthy body and beauty even in old age, and at the same time, industries such as health supplements, exercise, and pharmaceuticals are showing high growth [1]. Furthermore, as the social life of the elderly has

continued, various beauty devices have been released, and many beauty devices that have a positive effect on hair care by managing scalp are sold [2].

This trend is also prevalent in the cosmetic industry, and the organic, eco-friendly, well-being, and natural cosmetics are preferred [3]. In particular, among the modern people, not only natural hair loss due to genetic factors, aging, etc., yet also external factors such as pollutants, ultraviolet rays, stress, western eating habits, and cosmetic procedures threaten the health of scalp and hair.

Scalp is a skin tissue which protects the head among the skin tissues of the human body, and it is a place where the brain is protected from external shocks, and the function of discharging harmful heavy metals to the outside of the body and generating hair. Furthermore, it is very sensitive and reacts sensitively to internal abnormalities such as perm, dyeing, and chemical procedures such as bleaching, stress, and anxiety [4]. Hair is generated from the hair root of scalp, and is not always attached to scalp, yet goes through the process of growth and exfoliation. When over 200 hairs fall out per day, it is called abnormal hair loss and requires management. Abnormal hair loss occurs is known that it progresses due to various reasons such as stress, nutritional status, imbalance of male hormones, and genetic factors [5].

Accordingly, the interest in the health of scalp and hair has increased, and many studies have been conducted on scalp and hair care products that can maintain and restore the health of scalp and hair. However, many products have caused side effects that damage scalp or cause hair loss, such as irritating scalp or causing allergies due to toxic residues [6]. In order to overcome these shortcomings, in recently, a lot of research has been conducted to search for substances useful for scalp and hair care using natural products [7][8][9].

In this study, an attempt was made to find a cosmetic raw material that can reduce environmental pollution and is clinically safe by fermenting natural products that have been used for various pharmacological functions in the private sector for a long time and have secured clinical safety. In addition, most scalp and hair care products were developed for the purpose of preventing hair damage. In this study, the effectiveness of natural fermented mixture as a functional cosmetic ingredient for scalp hair was investigated by focusing on the recovery of damaged hair.

1.2. Theoretical background

1.2.1. Natural fermented cosmetics

Flavonoids, celluloses, carotenoids, and phenyl compounds contained in natural plants have excellent antioxidant, anti-cancer and antibacterial properties, and are therefore used as materials to improve health and beauty, and are widely used in the fields of food, pharmaceuticals, and cosmetics [10][11][12]. Furthermore, as the physiological activity of plants that have been traditionally used as medicines in the private sector for a long time has been scientifically proven, many studies have been reported [13][14][15].

Fermentation refers to the action of microorganisms using organic matters to produce substances beneficial to humans [16][17], and through the fermentation process, the nutrients contained in it are activated to facilitate absorption, and harmful bacteria and toxins are neutralized, etc., operating beneficially for humans. For this reason, fermentation is widely used throughout industries such as food, cosmetics, feed, and pharmaceuticals [18][19].

1.2.2. Coffee

Coffee tree is affiliated with *Coffea* and with *Rubiaceae* family, there is a study that caffeine in coffee has a function to promote hair growth [20]. Furthermore, Bussoletti et al. reported that caffeine shampoo and lotion were effective for the androgenic hair loss syndrome (AGA) [21]. There is also a study report that the proliferation rate of dermal papilla cells increased when green coffee beans were double fermented using EM and malt [22]. There were also studies

which claimed that caffeine, which is an alkaloid, offers a very strong antioxidant action and is helpful for hair growth by inhibiting the activities of 5 α -Reductase[23].

1.2.3. Smilax china L.

Smilax china L. is a deciduous broad-leaved vine shrub affiliated with the *Liliaceae* family. Various pharmacological actions such as antioxidant and antibacterial action of the leaves of *Smilax china* are known, and is also used for packaging food such as rice cake, and it has been proven to have the effect of not only inhibiting the growth of microorganisms, but also providing a good flavor. The young shoots and fruits of *Smilax china* are edible, and the roots and wood are known to be effective in antipyretic, detoxification, alleviation of diuresis, physical strength, cystitis, dermatitis, nephritis, arthritis, antibacterial action, and breast cancer, furthermore, it has been reported that bioactive ingredients are effective in preventing aging-related diseases caused by reactive oxygen species and hair loss[24].

1.2.4. Sasa Borealis

Sasa Borealis is edible, and hence, both the leaves, stems and roots have been used favorably in private sector since ancient times. The fruit of *Sasa Borealis* contains a lot of starch, and hence, has been used as a crop by the producers, and the dried leaves were used to brew tea or use as a bathing agent. It is widely known that it has antibacterial and anti-inflammatory effects, and hence, it has been widely used in folk remedies, and in particular, it is known to have excellent antipyretic, blood pressure lowering, blood sugar lowering, and anti-inflammatory effects, and is known to help strengthen heart and brain functions by improving blood circulation[25]. As it has been clinically proven for a long time as such, the studies to use it have been actively conducted[26][27].

1.2.5. Malt

Malt is also called 'gilgeum powder', a material used to make 'Shikhye', a traditional drink. It contains a lot of enzymes and minerals such as saccharification enzymes α -Amylase, Glucoamylase, and β -Amylase, and is rich in calcium[28].

2. Research Method

2.1. Preparation of sample

2.1.1. Fermentation of leaf of Sasa Borealis

250g of *Sasa Borealis* leaves and 2L of distilled water were placed in SMART OCOO(Oku, Korea), sealed, and extracted by convection for 6 hours. After the extraction was finished, it was cooled to room temperature and then used for fermentation. 2L of *Sasa Borealis* leaf extract was mixed with 300 ml of malt liquid, and the fermentation was carried out under two conditions. First, it was made to leave stationary fermentation at 25°C for 2 weeks. As another condition, fermentation was carried out in a sealed convection method for 6 hours at 60°C in SMART OCOO(Oku, Korea). After fermentation, it was filtered with sterile gauze and stored in a refrigerator for use in the experiment.

2.1.2. Selection of fermentation mixture

For the human hair experiment, the composition of fermentation mixture for hair treatment and hair essence production was selected. Coffee Green Bean, *Sasa Borealis* leaf and *Smilax china* L. leaf fermented products were tested for antioxidant, antibacterial, anti-inflammatory and dermal papilla cell proliferation rates, then, the fermented product demonstrating were used as a sample by mixing 1:1:1 <Table 1>.

Table 1. Selection of fermentation mixture.

| Test | Sample | CEFE 25 | CEFE 60 | JEE 25 | JEE 60 | MEE 25 | MEE 60 |
|----------------------------|--------------------------|---------|---------|--------|--------|--------|--------|
| | | | | | | | |
| Anti-microbial activity | <i>B. subtilis</i> | - | - | ⊙ | - | ○ | ○ |
| | <i>M. canis</i> | - | - | ⊙ | ○ | ⊙ | ○ |
| | <i>T. mentagrophytes</i> | - | - | - | - | ⊙ | - |
| Anti-oxidant activity | | ○ | ⊙ | ⊙ | ○ | ⊙ | - |
| Anti-inflammatory activity | | ○ | ⊙ | ⊙ | ⊙ | ⊙ | ○ |
| HEDP growth | | ○ | ⊙ | - | - | ○ | - |
| ERK / akt phosphorylation | | ○ | ⊙ | ○ | ⊙ | ⊙ | ○ |
| | | Cancel | Select | Select | Cancel | Select | Cancel |

Note: * CEFE25 : Coffee extract fermentation by EM and enzyme at 25°C.

* CEFE60 : Coffee extract fermentation by EM and enzyme at 60°C.

* JEE 25 : *Sasa borealis* fermentation by enzyme at 25°C.

* JEE 60 : *Sasa borealis* fermentation by enzyme at 60°C.

* MEE25 : *Smilax china* fermentation by enzyme at 25°C.

* MEE60 : *Smilax china* fermentation by enzyme at 60°C.

2.2. Manufacturing of laboratory products

2.2.1. Manufacturing of hair treatment

For this experiment, a base hair treatment to be used as a control group and a test group in which 10% of the fermentation mixture was added to the base hair treatment were prepared. First, the base hair treatment was prepared as a hair treatment that did not contain other extracts or nutrients in order to examine the efficacy of the selected samples. Distilled water was used for the negative control.

2.2.2. Manufacturing of hair essence

For this experiment, a test group in which 10% of the fermentation mixture was added to the base hair essence and the base hair essence to be used as a control group was prepared. First, the base hair essence was prepared as a hair essence that did not contain other extracts or nutrients in order to examine the efficacy of the selected samples. Distilled water was used for the negative control.

2.2.3. Hair sample

The hair used for this study was virgin hair in the fifth grade of elementary school that had not been exposed to chemical treatment for over 3 years. To remove contaminants from the hair sample, it was washed with lukewarm water using a weak acid shampoo, rinsed thoroughly with lukewarm water, and then dried naturally for use in the experiment. Furthermore, it was used with the consent of the subject that the researcher could use it for academic research and experiments.

2.3. Efficacy experiment of *Sasa Borealis*' leaf fermentation

2.3.1. Antibacterial activity

2.3.1.1. Antibacterial test method - paper disc method

2.5. Measurement of the effect of recovery of damaged hair

2.5.1. Tensile strength

To evaluate the extent of damage to the hair, it was measured using a tensile strength meter, Digital Force Gauge, HF-20(Tripod, China). For the reliability of the tensile strength measurements, the average value was obtained after 5 measurements and statistical analysis was performed.

2.5.2. Glossiness

To examine the change in the gloss of the hair, it was measured using a gloss meter(Gloss Meter NH268, Shenzhen Threenh Technology, China). The measurement was taken based on the 7 cm position from the hair root of the sample bundle. To increase the reliability of the measured value, the average value was obtained after 10 measurements and statistical analysis was performed.

2.5.3. Statistical analysis

The two-tailed test was performed with t-tests(Independent Sample t-test) using jamovi 1.2.27 solid, a statistical program, as a post-test after obtaining the mean and standard deviation(SD), and the significance level was verified at the $p < 0.05$ level. The null hypothesis was "There is no difference between before and after the application" and the research hypothesis was "There is a difference between before and after the application".

2.5.4. Hair observation using a scanning electron microscope(SEM)

To observe the extent of damage to the hair, using a scanning microscope(SEM, Scanning Electron Microscope, Electron Gun) was enlarged at a constant ratio($\times 1000$, $\times 3000$) and then observed.

3. Results

3.1. Abbreviation

- PNC : Damaged hair by heat perm
- PBT: Only base treatment on damaged hair with heat perm
- PBTE: Base treatment and base essence treatment for damaged hair with heat perm
- PST: Only treatment with sample addition treatment for damaged hair
- PSTE: Sample addition treatment and sample addition essence treatment for damaged hair
- PPC: Normal hair
- CNC : Dyeing damaged hair
- CBT: Only base treatment on dyed damaged hair
- CBTE: Base treatment and base essence treatment on dyed damaged hair
- CST: Only treatment with sample addition to dyed damaged hair
- CSTE: Sample addition treatment and sample addition essence treatment for dyed damaged hair
- CPC: Normal hair

3.2. Effectiveness of fermented product of leaf of *Sasa Borealis*

3.2.1. Antibacterial activation



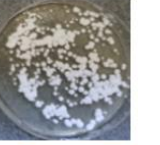



3.2.1.1. Antibacterial test method

The fermentation broth at 25° C. demonstrated an inhibitory ring(18 mm) against *Bacillus subtilis*.

3.2.1.2. Anti-fungal test method

The growth of *Microsporum canis* was inhibited in the order of 60°C fermentation broth and 25°C fermentation broth. In the growth-inhibited *Microsporum canis*, not only the number of colonies yet also the size were small, and it was confirmed that the growth was inhibited because the formation of white filaments was significantly reduced <Table 2>.

Figure 2. Antifungal test results of fermented *Sasa Borealis* leaves.

| temperature | | 25°C | 60°C |
|--|---|---|---|
| controle | <i>Microsporum canis</i> | ++++ | ++ |
| |  |  |  |
| <i>Trichophyton mentagrophytes</i> KCTC 6316 |  |  |  |
| | | ND | ND |

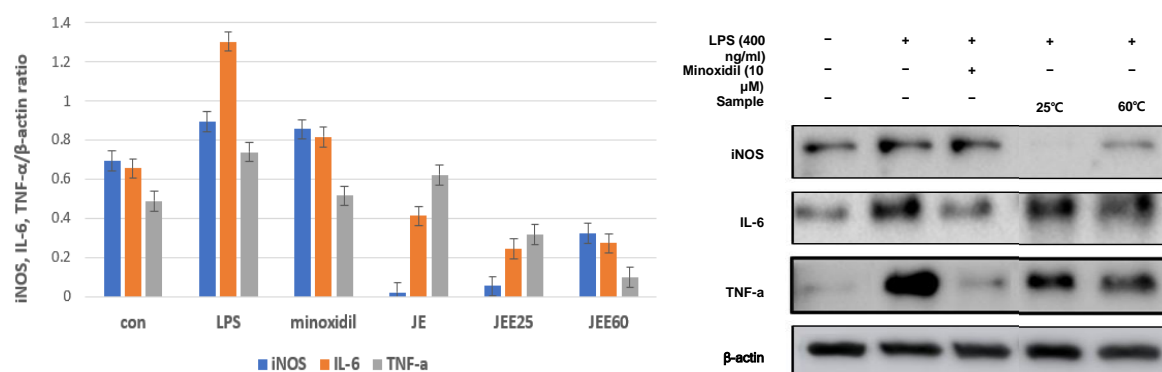
3.2.2. Anti-inflammatory

It was confirmed that the inflammatory cytokines TNF- α and IL-6 were increased when treated with LPS(400ng/ml), as for the sample-treated group, it was confirmed that TNF- α and IL-6 were inhibited compared to the LPS-treated control group.

3.2.3. TNF- α , IL-6 and iNOS expression using the HaCaT Cells

As for the sample-treated cells, it was significantly reduced compared to the LPS-treated group, and in particular, the iNOS gene was hardly found in the fermentation broth at 25°C. The expression level of IL-6 gene was significantly decreased at the 25°C and 60°C fermentation broth. TNF- α gene expression was significantly decreased in the enzyme fermentation broth at 25°C and 60°C <Figure 2>.

Figure 3. Inhibitory effects of extract on iNOS, IL-6, and TNF- α expression.

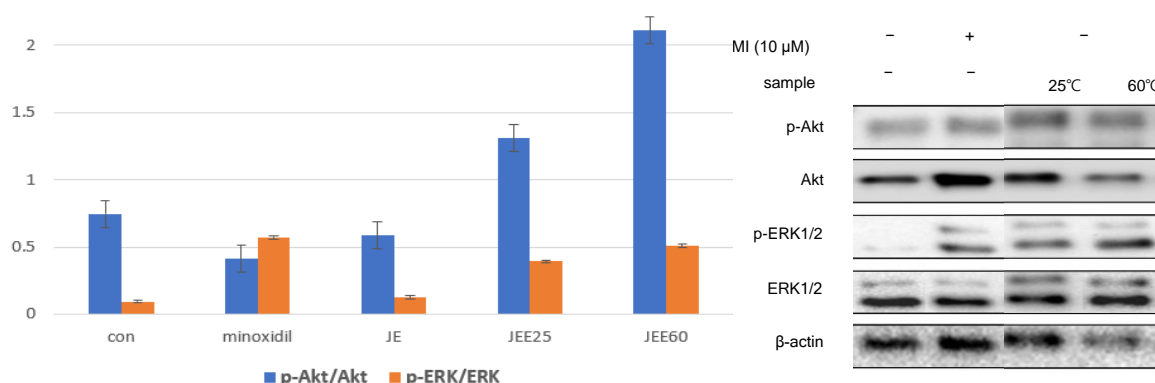


Note: (A) iNOS, IL-6, and TNF- α were evaluated by western blot and (B) Representative protein expression to β -actin. Values are relative to the control. *p < 0.05, **p < 0.01 indicate a significant difference from the LPS-treated control.

3.2.4. Effect on the dermal papilla cell proliferation and Akt phosphorylation

Cell proliferation has increased compared to Minoxidil in the cells treated with *Sasa Borealis* leaf extract and 25°C enzyme fermentation broth of *Smilax china L.* leaf extract. Akt phosphorylation decreased in the positive control group treated with Minoxidil compared to the control group, and significantly increased in the sample-treated group. In particular, the expression level of Akt phosphorylation gene increased about 4 times compared to Control in the 60°C enzyme fermentation broth. Based on such results, it was confirmed that the *Sasa Borealis* leaf fermented product promoted the proliferation of dermal papilla cells by promoting Akt phosphorylation <Figure 3>.

Figure 4. Inhibitory effects of extract on p-Akt, Akt, p-ERK1/2 and ERK1/2 expression.



Note: (A) p-Akt, Akt, p-ERK1/2 and ERK1/2 were evaluated by Western blot and (B) Representative protein expression to β-actin. Values are relative to the Minoxidil. ***p < 0.001 indicate a significant difference from the Minoxidil-treated control.

3.3. Tensile strength

In this experiment, as for the tensile strength, based on the hair damaged by dyeing and heat perm, the tensile strength of the base hair treatment without the addition of the fermentation mixture sample, the base hair essence, the hair treatment with 10% of the fermentation mixture sample, and the hair essence treatment group were compared to the normal hair for analysis.

For the hair damaged by heat perm, the group treated with the hair treatment with the fermentation mixture sample and the hair essence demonstrated an increase rate of about 37% compared to the damaged hair, and it is believed that there will be some preventable effect. It was also found that the tensile strength of damaged hair is lower than that of healthy hair because the extent of damage to hair is increased by chemical treatment. This is supportive of the research result that the cysteine bond cleaved by the perm agent is not completely sealed and the reduced cysteine remains and the tensile strength is lowered <Figure 4>[30].

For the hair damaged by dyeing, the group treated with a hair treatment with a fermented mixture sample and hair essence demonstrated a 30% increase in tensile strength compared to damaged hair, and it is expected to have some preventive effect against the results of steeply falling tensile strength to some extent. This is consistent with the research results that the tensile strength decreases when hair damage occurs due to bleaching or dyeing[31].

Consequently, it is considered that the simultaneous treatment of hair treatment with fermented mixture sample and hair essence will increase the tensile strength of damaged hair, restoring hair breakage and giving it. There is also a study result that the tensile strength is lowered due to damage to the hair due to cosmetic treatment[32], and it is reported that treatment with Googicha extract or Mokdanpi microcapsules to the hair shows higher tensile strength than untreated hair[33][34].

Hence, it is considered that the fermented mixtures in the sample restore the damages to the hair with antioxidant action and hair coating effect, thereby resulting in the increased tensile strength.

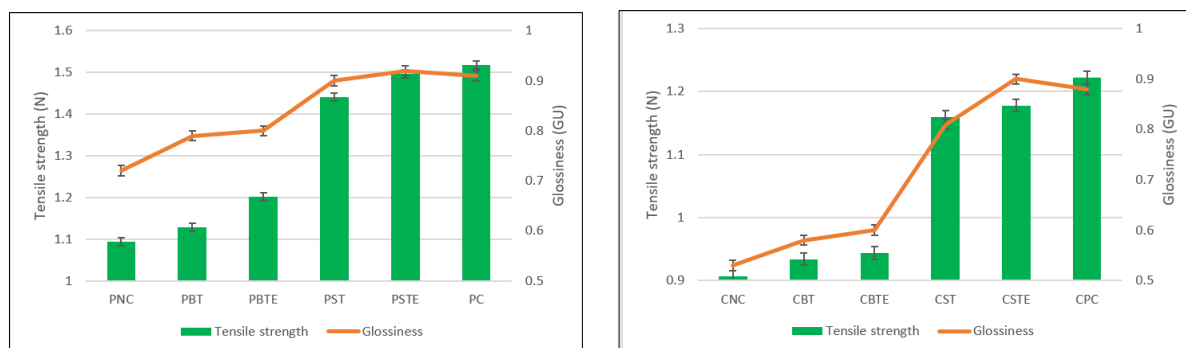
3.4. Glossiness

As for the glossiness of this experiment, the glossiness of the base hair treatment without the addition of the fermentation mixture sample, the base hair essence, the hair treatment with 10% of the fermentation mixture sample, and the hair essence treatment group were compared and analyzed based on hair damaged by dyeing and heat perm. Overall, regardless of the cause of hair damage, the group treated with the fermented mixture sample and the hair essence at the same time demonstrated the highest glossiness and higher glossiness than that of undamaged normal hair <Figure 4>.

As a result of the heat perm test, the glossiness of the group treated with the hair treatment and hair essence containing the fermented mixture sample increased by about 28% compared to the glossiness of the damaged hair, and turned out to be higher than that of the normal hair. As a result of the dyeing experiment, the glossiness of the group treated with the hair treatment and the hair essence containing the fermented mixture sample increased by about 60% compared to the glossiness of the damaged hair, and was higher than that of the normal hair <Figure 4>.

Consequently, it was confirmed that the group treated with both the base hair treatment and the base hair essence without the addition of the fermentation mixture did not increase the glossiness of the hair damaged by heat perm or dyeing, and it is considered that it can make hair shiny by increasing glossiness of damaged hair when the hair treatment with the fermented mixture sample is added and hair essence are concurrently treated.

Figure 5. Restorative effect on hair damaged by heat perm or dyeing– tensile strength and glossiness.



3.5. Analysis of hair surface via SEM(SEM, scanning electron microscope)

The surface of the hair was observed using the SEM with a view to examine the effect of restoring damaged hair of a hair cosmetic prepared by adding 10% of a fermentation mixture to hair damaged by dyeing and heat perming.

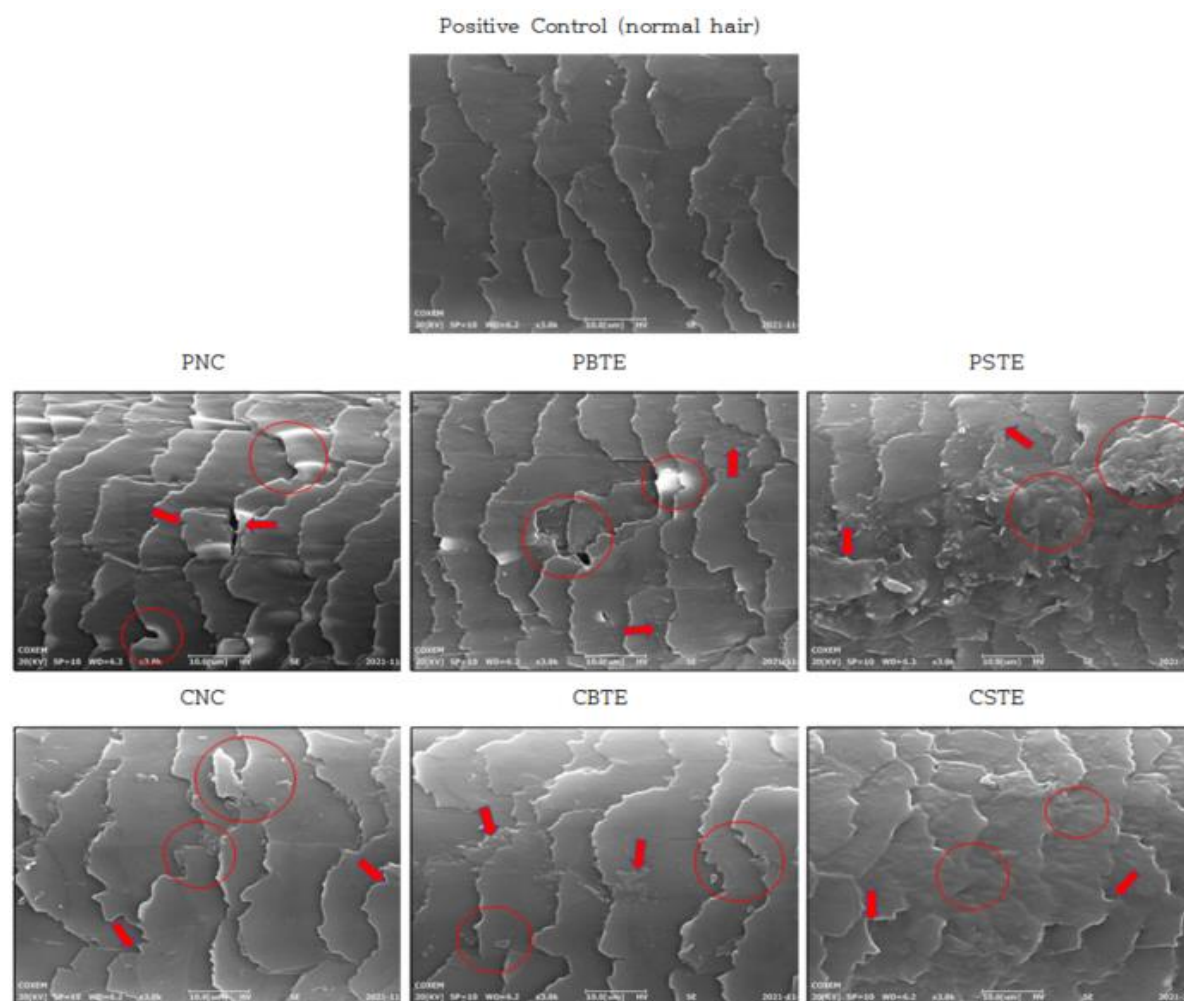
As for the hair damaged by heat perm, it was determined that there would be a recovery effect of damaged hair because cosmetics were adhered to the cuticle damaged area when only hair treatment with fermented mixture was treated alone. Furthermore, when the hair essence added with the fermentation mixture was treated concurrently, the adhesion effect on the cuticle surface was very good, and it was found that the recovery effect of damaged hair was excellent <Figure 5>. In this connection, there is a research report that natural ingredients coat the epidermis to protect hair by reducing porosity during the chemical cosmetic procedures [35].

As for the hair damaged by dyeing, when only the hair treatment with the addition of the fermentation mixture was treated alone, it was determined that there would be an effect of

restoring the damaged hair because the cosmetics were adhered to the cuticle damaged area. Furthermore, when the hair essence containing the fermentation mixture was treated concurrently, the adhesion effect on the cuticle surface was very good, and the shape of the cuticle was not seen because it was covered <Figure 5>. As a result of the experiment, it was apparent that the recovery effect of damaged hair was the best when the hair treatment with the addition of the fermentation mixture and the hair essence were concurrently treated.

As a result of the experiment, regardless of the cause of hair damage, when the hair treatment with fermented mixture and hair essence were treated concurrently, the cosmetics filled the damaged and floating parts of the cuticle, pressed the floating cuticle, and the surface of the cuticle, and it was determined that the recovery effect of damaged hair was excellent by being thickly coated due to its excellent ability to adhere to the hair.

Figure 6. Restorative effect on damaged hair by heat perm or dyeing- SEM.



4. Conclusion

In this study, it was verified as to whether the hair treatment and hair essence added with the natural product fermentation mixture could restore the tensile strength and glossiness of the hair damaged by heat perm and dyeing.

After fermenting the leaves of *Sasa Borealis* using malt, the effectiveness (anti-inflammatory activity, *M. canis*, dermal papilla cell proliferation rate) was examined, and the dermal papilla cell proliferation rate was also excellent, the 25°C fermentation broth was excellent in anti-inflammatory activity and *M. canis* against *M. canis*, and the dermal papilla cell proliferation rate was also excellent. The human hair treatment and hair essence were prepared by adding a fermented mixture of a fermented product of a natural product obtained in the previous experiment (green coffee bean, *Smilax china* L. leaf) and *Sasa Borealis* leaf fermented product, and as a result of such experiment, regardless of the cause of hair damage, the group treated with the fermented mixture and the hair essence at the same time demonstrated the excellent tensile strength and glossiness <Figure 4>.

As a result of the SEM observation, regardless of the cause of hair damage, when hair treatment with fermented mixture sample and hair essence were applied concurrently, the cosmetics filled the damaged and floating parts of the cuticle, and pressed the floating cuticle, and the ability to adhere to the cuticle surface was excellent, and it was determined that the coating had an excellent recovery effect on damaged hair <Figure 5>. As a relevant study, there is one which reported that an extract with antioxidant effect has potential as a raw material for products for the recovery of hair damaged by dyeing [36].

The distinction of this study is that it is fermented using the natural ingredients that are edible and clinically safe, and that it is environmentally safe using only water as a solvent. Furthermore, since the sealed convection bath method is used, there is an advantage in that it is possible to reduce energy consumption and environmental pollution by increasing thermal efficiency. Furthermore, while the existing hair cosmetics studies focused on the pre-treatment and studied the hair protection efficacy, this study is distinct in that it focused on the post-treatment and confirmed the recovery effect of the damaged hair.

Research on fermented cosmetics using natural products is expected to increase in interest due to the increase in environmental pollution and the trend of decreasing the age at which hair loss begins. In addition, since Koreans have been using fermentation technology in their daily life for a long time, it is expected that various studies will be conducted to apply it to medicinal herbs handed down to the private sector, as well as cosmetics, medicine, food, and household products.

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6. Appendix

6.1. Author's contribution

| | Initial name | Contribution |
|-----------------------|--------------|---|
| Lead Author | MC | -Set of concepts <input checked="" type="checkbox"/> |
| | | -Design <input checked="" type="checkbox"/> |
| | | -Getting results <input checked="" type="checkbox"/> |
| | | -Analysis <input checked="" type="checkbox"/> |
| | | -Make a significant contribution to collection <input checked="" type="checkbox"/> |
| | | -Final approval of the paper <input checked="" type="checkbox"/> |
| Corresponding Author* | EC | -Corresponding <input checked="" type="checkbox"/> |
| | | -Play a decisive role in modification <input checked="" type="checkbox"/> |
| | | -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> |
| | | -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> |
| | | -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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Corresponding author*
E-mail: jaebumlee@mju.ac.kr

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Q-Methodological Approach on Type Analysis of Elderly Participating in Health Qigong after COVID-19

Yeonsu Byeon¹

Myongji University, Seoul, Republic of Korea

Jaebum Lee^{2*}

Myongji University, Seoul, Republic of Korea

Sungwoo Sim³

Baekseok Arts University, Seoul, Republic of Korea

Abstract

Purpose: In this study, analysis was conducted using the Q-methodology to find out the types of elderly people participating in Health Qigong after COVID-19. The Q-methodology studies human subjectivity by considering an individual's perception, attitude, emotion, and behavior toward an object at the same time.

Method: In the research procedure, the Q-population was first constructed and the Q sample statement was prepared. In the Q-population, 85 data were obtained through in-depth interviews, 46 data obtained through a literature review were derived, and 131 were finally derived as the primary statement. Comprehensive data were analyzed through in-depth interviews, related literature research, and expert meetings, and a total of 34 Q-sample statements related to the research topic were extracted. Data analysis was performed using the QUNAL-PC program, and the principal component factor analysis method was used for factor analysis.

Results: As a result of the study, the elderly who participated in Health Qigong were found to be the final four types. Type I was classified as an active participation type among the elderly participating in Health Qigong. Type II was classified as a type that recognized that Health Qigong training was connected with healing. Type III was classified as a type recognized that Health Qigong is related to psychological sympathy, that is, emotional state. Type IV was classified as a type that recognizes that it is possible to make new colleagues while socializing with others through Health Qigong.

Conclusion: Currently, Korean society is going through an age of super-aging, and there is a view that sees old age as a time of new creation. Therefore, prepare for successful aging, it is necessary to find a positive way to improve the lives of the elderly. The classification contents of the elderly participating in Health Qigong derived as a result of this study reflect the perception and attitude of the elderly participating in physical activity well.

Keywords: COVID-19, Elderly, Health Qigong, Type Analysis, Q-Methodology

1. Introductions

In Korea, according to the Labor Standards Act and the Elderly Welfare Act, those over 65 are defined as the elderly. For this reason, the number of people living younger is increasing due to the improvement of living standards, the development of medical technology, and the use of various smart devices. Therefore, it has become difficult to call a 65-year-old an elderly person based on their physical age. The age of the so-called silver generation, which is due to the aging population, has arrived[1][2][3].

As for the demographic structure of Korea, the age group born in the baby boom era immediately after the Korean War in 1950 will enter the elderly generation from 2020 onwards, and the elderly population aged 75 years or older is gradually increasing. It is predicted that 20.6% of the Korean population will age in 2026, reaching a super aging society. If this trend continues,

the proportion of the elderly population will exceed 40% by 2050, and Korea is expected to surpass Japan as the world's oldest country[4][5].

The United Nations(UN) defines an aged society as a country in which 14% or more of the population is over 65 years old. According to the future population projection data released by the National Statistical Office of Korea(2019), the total population is the largest at 52.96 million in 2031, and then decreases and will reach 43.02 million in 2065. What is more serious is that the youth population(0-14 years old) in the age composition ratio is expected to decrease from 13.8% to 9.6%, and the working-age population(15-64 years old) is expected to decrease from 73.4% to 47.9%. In addition, the elderly population(over 65) is expected to increase from 12.8% to 42.5%. Currently, according to data from Statistics Korea in 2020, Korea is undergoing a serious demographic change, and is entering an era of super-aging, with the number of the elderly over 65 years old exceeding 8.125million[6][7][8].

In the past, Korea's population pyramid had a thick pot-shaped structure for people in their 30s and 50s, but it is expected to change to an inverted triangle structure with people aged 60 and over getting thicker. However, while increased lifespan is important, what matters is how healthy humans can live for a long time. Life expectancy can be divided into life expectancy and healthy life expectancy. Currently, life expectancy in Korea is 79.4 years for men and 85.7 years for women. Therefore, life expectancy is expected to continue to increase in the future, except for the period when people become ill and receive treatment[9][10].

Recently, in Korea, a digital non-face-to-face lifestyle has become commonplace due to COVID-19, and the direction of health care is also shifting to smart healthcare[11][12][13]. In the past, the concept of applying digital technology to apply health care services existed, but recently, technologies using artificial intelligence(AI) have been widely developed under the philosophy of the 4th industrial revolution. However, there are limits to the ability of the elderly to learn smart devices on their own amid the changes of the times, and there are more cases where they cannot use them because they do not know how to use them[14][15].

In recent previous studies on health promotion for the elderly, participation in physical activity using leisure time as an active alternative for maintaining a healthy life and health intervention is suggested as the most effective method[16][17]. These contents indicate that active participation in physical activity has a positive effect on the maintenance of physical functions in old age, emotional problems and social aspects. Therefore, physical activity in old age is increasingly emphasized and valued[18][19].

Although research and verification on elderly health interventions and physical activity have been quantitatively expanded and presented in various ways, it is very difficult for the elderly to maintain their health while continuing to engage in physical activity. Since there are various internal and external factors that interfere with the physical activity of the elderly, a scientific proposal for voluntary participation is needed[20][21]. Therefore, in this study, type analysis and learning model application of the elderly participating in Health Qigong using Q-methodology were attempted.

In this study, it was judged that the Q-methodology is a research methodology that matches the type analysis and learning model exploration for the elderly participating in Health Qigong, and that it is suitable for use as an analysis method for the development of the elderly health intervention theory. These efforts and research results will serve as an opportunity to scientifically prove that Health Qigong can play a role as a health intervention program for the elderly in an aging society.

2. Research Methods

2.1. Selection of study participants

This study was aimed at the elderly with more than one year of Health Qigong experience, and participants were sampled by convenience sampling and judgmental sampling. The study

participants who participated in the in-depth interview for the Q-population were randomly selected from 2 people in their 40s, 2 people in their 50s, and 2 people in their 60s. In addition, a total of 34 subjects were selected in the P-sample considering gender and age. The period for survey was conducted between May and June 2021, and the data contents of 30 people were used, excluding 4 people who lacked answers.

The Health Qigong experience of the participants in the P sample was distributed as 13 people with 1 to 2 years or less, 15 people with 2 to 4 years or less, and 2 people with 5 years or more. By gender, there were 5 males and 25 females, and the age of participants was 21 in their 60s and 9 in their 70s. The reason that judgment sampling was performed on the age distribution is because it was judged that the age group that could give the most appropriate response to this study was in their 60s to 70s.

2.2. Selection of Q-sample and P-sample

The Q sample statement refers to the final aggregate created through the categorization process by deleting ambiguous meanings or overlapping statements and grouping the same subjects[22]. A total of 32 final Q-sample statements appeared related to the research topic by analyzing comprehensive data through in-depth interviews, related literature research, and expert meetings. The P-sample is the subject to classify the Q-sample statement, and the sample is composed of participants who are highly relevant to the research topic and who are judged to be able to best express the research content[23]. In this study, the data of 30 elderly participants who could express various opinions about participating in Health Qigong were used for analysis.

2.3. Data analysis

To analyze the opinions of participants in Health Qigong, a survey was conducted on 30 people collected as P-sample. Data were classified, scored, and coded on a scale from 1 to 9 according to the location of the distribution map. The input data was analyzed using the QUNAL-PC program, and the principal component factor analysis method was used for factor analysis. The best number of factors was selected in consideration of the total variance and the explanatory variance of the factors, and the standard score(Z) of each statement was used to select the appropriate item according to the type characteristics.

3. Results

3.1. Participant's P-sample factor analysis results

Four types of subjectivity were found in the result of factor analysis of the Q-methodology conducted to investigate the type analysis and learning model development of the elderly participating in Health Qigong. Each type means that respondents' opinions describing differences and characteristics between groups are well represented and are classified into four categories. The explanatory power of the total variance for each of the four types of analysis was 68%. Specifically, looking at the analysis results as shown in <Table 1>, Type I showed 18%, Type II 23%, Type III 15%, and Type IV 12%.

Since Type II shows 23% of explanatory power, it can be seen as the type that explains the participant's subjective structure the most. As for the composition of subjects by type, among the 30 persons in the P sample, type I 5 persons, type II type 8 persons, type III type 4 persons, and type IV type 3 persons were included, so 20 persons out of the total persons were included in the type classification became.

Table 1. Results of P-sample factor analysis.

| Division | ID | Type I | Type II | Type III | Type IV | Background variable | | |
|------------------|------|--------|---------|----------|---------|--------------------------------------|-----|------------|
| | | | | | | Gender | age | Experience |
| 1 | Q-01 | .2487 | .2335 | .1567 | .0463 | Female | 65 | 18 months |
| 2 | Q-02 | .3294 | .3217 | .8061* | .1677 | Male | 78 | 36 months |
| 3 | Q-03 | .8128* | .4332 | .2416 | .3299 | Female | 68 | 24 months |
| 4 | Q-04 | .1018 | .3117 | -.0047 | .4655 | Female | 72 | 24 months |
| 5 | Q-05 | .3371 | .2033 | .0713 | .5978* | Female | 67 | 36 months |
| 6 | Q-06 | .3202 | .3477 | .4013 | .2381 | Female | 66 | 38 months |
| 7 | Q-07 | .1864 | .2353 | .8479* | -.0776 | Female | 68 | 24 months |
| 8 | Q-08 | .0143 | .7841* | .1331 | -.0223 | Female | 65 | 66 months |
| 9 | Q-09 | .0322 | .1931 | .1246 | .0864 | Female | 65 | 18 months |
| 10 | Q-10 | .9211 | -.0541 | .0798 | -.1319 | Female | 76 | 48 months |
| 11 | Q-11 | .2119 | .6610* | .2691 | .224 | Female | 69 | 24 months |
| 12 | Q-12 | .0852 | .3433 | .0468 | .5411 | Male | 74 | 38 months |
| 13 | Q-13 | .0316 | .4714 | .2848 | .6779* | Female | 64 | 24 months |
| 14 | Q-14 | -.1113 | .8321* | .2665 | .0515 | Female | 72 | 42 months |
| 15 | Q-15 | .0658 | .8214* | .0479 | .1468 | Female | 69 | 18 months |
| 16 | Q-16 | .4934 | .3335 | .3582 | .5024 | Female | 74 | 36 months |
| 17 | Q-17 | .1315 | .1215 | .9182* | .1733 | Female | 63 | 24 months |
| 18 | Q-18 | .8316* | -.0327 | -.0664 | .2312 | Male | 75 | 38 months |
| 19 | Q-19 | -.0421 | .1629 | .1692 | .072* | Female | 66 | 24 months |
| 20 | Q-20 | .1113 | .2419 | .0523 | .1382 | Female | 69 | 30 months |
| 21 | Q-21 | .2339 | .7212* | .2164 | -.0533 | Female | 68 | 18 months |
| 22 | Q-22 | .1793 | .8185* | .2330 | .2794 | Male | 76 | 40 months |
| 23 | Q-23 | .4620 | .3205 | .6684* | .4682 | Female | 66 | 18 months |
| 24 | Q-24 | .1416 | .1503 | .0332 | .3331 | Female | 66 | 30 months |
| 25 | Q-25 | .1802 | .2113 | .0969 | .3690 | Female | 65 | 18 months |
| 26 | Q-26 | .0261 | .6289* | .3912 | .1121 | Male | 69 | 40 months |
| 27 | Q-27 | -.004 | .6317* | .3127 | .2468 | Female | 68 | 18 months |
| 28 | Q-28 | .7334* | -.1163 | .3582 | .1921 | Female | 68 | 38 months |
| 29 | Q-29 | .1771 | .0312 | .1364 | .3638 | Female | 69 | 24 months |
| 30 | Q-30 | .7212* | .3111 | -.0331 | .1412 | Female | 71 | 42 months |
| % expl. Var | | 18 | 23 | 15 | 12 | Variance = 4.525, St. Dev.= 2.013 | | |
| cum% expl. Var | | 52 | 21 | 56 | 58 | | | |
| Number of people | | 5 | 8 | 4 | 3 | | | |

Note: * p<0.05.

3.2. Correlation analysis between types

Correlation analysis was performed to confirm the similarity of each classified type of participants, and it can be seen that all of them show a positive(+) correlation. Looking at the contents

of each of the four types conducted in this study, the correlation coefficient between Type I and Type II was .5641, which was relatively high. Type I and Type III were .1469, Type I and Type IV were .2433, Type II and Type III were .2681, and Type IV was .3816. The contents of the correlation analysis by participant type are shown in <Table 2> below.

Table 2. Correlation analysis by participant type.

| Type | I | II | III | IV |
|---|-------|-------|-------|----|
| Type I (active participation type) | 1 | - | - | - |
| Type II (healing participation type) | .5641 | 1 | - | - |
| Type III (psychological sympathy type) | .1469 | .2681 | 1 | - |
| Type IV (accompanied participation type) | .2433 | .4324 | .3816 | 1 |

3.3. Type I characteristics: active participation type

In the characteristics of each type of subjectivity of the elderly participating in Health Qigong, there were 5 type I in all, and they were classified as active participation types. By gender, there were 4 females and 1 male, and most of them participated in the training for more than 3 years, which was relatively long compared to other participants. In addition, in consideration of these characteristics, Type I was named ‘active participation type’. <Table 3> below shows the factor value and recognition level for the Q-statement of Type I.

Table 3. Type I Q-statement content and recognition level.

| Question | Q-statement contents | Z-value | Recognition level |
|----------|--|---------|----------------------------------|
| 17 | Fatigue is relieved by practicing health qigong | 4 | Strong positive ↑ Positive |
| 30 | Learning health qigong is fun | 4 | |
| 5 | Help promote health | 3 | |
| 9 | Effective in disease prevention | 3 | |
| 32 | The days of coming to practice health qigong are fun | 3 | |
| 1 | An oriental exercise method | -3 | Negative ↓ Strong negative |
| 10 | Can get along with other people | -3 | |
| 12 | Leisure time can be used | -3 | |
| 29 | Easy to follow | -4 | |
| 31 | Feeling the risk of falling while practicing | -4 | |

3.4. Type II characteristics: type of healing participation

Type II, which appeared in the characteristics of each type of subjectivity of the elderly participating in Health Qigong, was found to be 8 persons, and it was confirmed that they accounted for the largest number of persons in each type. In consideration of these characteristics, Type II was named ‘healing participation type’. <Table 4> below shows factor values and recognition level of Q-statements according to participation types.

Table 4. Type II Q-statement content and recognition level.

| Question | Q-statement contents | Z-value | Recognition level |
|----------|--|---------|----------------------------------|
| 7 | Natural healing power is improved | 4 | Strong positive ↑ Positive |
| 5 | May help promote health | 3 | |
| 8 | Helps in the treatment of chronic diseases | 3 | |
| 9 | Effective in disease prevention | 3 | |
| 25 | Effective for back pain | 3 | |
| 20 | No financial burden | -3 | Negative ↓ Strong negative |
| 26 | Exercising at any location | -3 | |
| 31 | No financial burden | -3 | |
| 3 | A comfortable and effortless workout | -4 | |
| 29 | Easy to follow | -4 | |

3.5. Type III characteristics: psychological sympathy type

Type III appeared in the characteristics of each type of subjectivity of the elderly participating in Health Qigong was found to be 4 persons. In consideration of these characteristics, Type III was named 'psychological sympathy type'. <Table 5> below shows factor values and recognition level of Q-statements of psychological sympathy type.

Table 5. Type III Q-statement content and recognition level.

| Question | Q-statement contents | Z-value | Recognition level |
|----------|--|---------|----------------------------------|
| 15 | Effective for mental health | 4 | Strong positive ↑ Positive |
| 16 | Mental concentration during training | 4 | |
| 10 | Can get along with other people | 3 | |
| 22 | Learning itself is fun | 3 | |
| 30 | Learning health qigong is fun | 3 | |
| 3 | A comfortable and effortless workout | -3 | Negative ↓ Strong negative |
| 9 | Effective in disease prevention | -3 | |
| 24 | It is said that my appearance has changed actively | -3 | |
| 29 | Easy to follow | -3 | |
| 13 | Being praised for being active | -4 | |

3.6. Type IV characteristics: accompanying participation type

In Type IV, which was shown in the characteristics of each type of subjectivity of the elderly participating in Health Qigong, there were 3 persons. In consideration of these characteristics, Type IV was named 'accompanied participation type'. <Table 6> below shows the factor values and recognition level of the Q-statements of the companion type participation type.

Table 6. Type IV Q-statement content and perception level.

| Question | Q-statement contents | Z-value | Recognition level |
|----------|---|---------|----------------------------------|
| 10 | Can get along with other people | 4 | Strong positive ↑ Positive |
| 21 | Can make new friends | 4 | |
| 3 | A comfortable, effortless workout | 3 | |
| 12 | Leisure time can be used | 3 | |
| 32 | I enjoy coming here to practice health qigong | 3 | |
| 11 | Body became flexible | -3 | Negative ↓ Strong negative |
| 14 | Listening to music while practicing makes it easier | -3 | |
| 19 | Helps manage fitness | -3 | |
| 23 | It's fun to watch and follow the movements | -3 | |
| 18 | Memorizing movements helps with concentration | -4 | |

4. Conclusion and Recommendations

Modern society is called the aging age, or the silver age. This is the result of the increase in life expectancy due to the improvement of living standards and the development of medical technology[24][25]. Therefore, in this study, type analysis was conducted using Q-methodology for type analysis of the elderly participating in Health Qigong. The Q-methodology is a method to study human subjectivity by considering an individual's perception, attitude, emotion, and behavior toward an object at the same time.

Modern society is undergoing many changes in daily life due to the wave of the 4th industrial revolution. In particular, in the information and communication revolution, with the development of equipment, software, and applications, the work that only experts could do is now an era in which ordinary people can do the same work as experts. From this point of view, regarding health intervention methods, not hospital-centered disease management, but individual patients are using diet, exercise, and personal medical devices for health intervention, and each is becoming an active health consumer[26][27].

However, the elderly are afraid of adapting to these changes of the times, and the reality is that they are living behind the actual modern life. In particular, due to changes in social structure and family members, it is becoming very difficult for the elderly to take active actions to enjoy leisure or engage in health interventions[28].

Health Qigong, which was performed as a health intervention therapy for the participants in this study, is based on oriental medicine and is a method of promoting health of body and mind that has been passed down for a long time. Health Qigong is easy to learn because of its slow and simple movements, but it is characterized by excellent effects, so its physical, emotional, social, and educational effects have been verified by prior researchers[29][30].

In this study, the results of Q-methodology factor analysis conducted to find out the type analysis of the elderly participating in Health Qigong after COVID-19 showed that there were four types of subjectivity. Each type shows respondents' opinions describing differences and characteristics between groups, meaning that they are classified into four categories. Therefore, in this study, type I was classified as an active participation type, type II as a healing participation type, type III as a psychological sympathy type, and type IV as a Accompanied participation type in this study.

Currently, Korean society is going through an age of super-aging, and there is a view that sees old age as a time of new creation. Therefore, in order to prepare for successful aging, it is time to find a positive way to improve the quality of life of the elderly. As a result of this study, the classification contents of the elderly participating in Health Qigong well reflect the perception and attitude of the elderly participating in physical activity. Based on the results of this study, it will be necessary to actively utilize it to develop a Health Qigong model in the future.

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6. Appendix

6.1. Authors contribution

| | Initial name | Contribution |
|-----------------------|--------------|---|
| Lead Author | YB | -Set of concepts <input checked="" type="checkbox"/> |
| | | -Design <input checked="" type="checkbox"/> |
| | | -Getting results <input checked="" type="checkbox"/> |
| | | -Analysis <input checked="" type="checkbox"/> |
| Corresponding Author* | JL | -Make a significant contribution to collection <input checked="" type="checkbox"/> |
| | | -Final approval of the paper <input checked="" type="checkbox"/> |
| | | -Corresponding <input checked="" type="checkbox"/> |
| | | -Play a decisive role in modification <input checked="" type="checkbox"/> |
| Co-Author | SS | -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> |
| | | -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> |
| | | -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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Corresponding author*
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A Study on the Waxing Effectiveness of Sugaring

Shinhwa Kang¹

Vision College of Jeonju, Jeonju, Republic of Korea

Jiyoung Lee^{2*}

Vision College of Jeonju, Jeonju, Republic of Korea

Abstract

Purpose: The pursuit of beauty, which started from ancient times, is a basic human need, and many studies on the attractiveness of appearance are on the rise, and such research on human beauty is an important public value. Recently, interest and demand for waxing are rising, but the level of professional education on waxing is low and the understanding of skin changes and follow-up care after waxing is low, so the need for research on waxing is emerging. The purpose of this study is to find out the difference in skin condition and hair growth rate after Brazilian treatment according to the type of waxing and to present it as basic data, and to contribute to the public value in beauty culture.

Method: The subject of this study was a woman in her early 20s who had no experience with waxing, and waxed the bikini area between June and August 2022 using sugar wax and hard wax respectively.

For 4 weeks after Brazilian waxing, the skin condition(including ingrown hair, folliculitis, etc.) and hair growth length were compared and analyzed at weekly intervals. The results were analyzed after the mixed study using clinical trials and interview methods.

Results: As a result of comparative analysis of the skin condition and the length of the growing hair at weekly intervals after waxing, the condition of the skin showed that ingrown hair and inflammation occurred in the area where the sugar wax was applied, and the hair growth rate was slow. In the area treated with hard waxing, ingrown hair did not occur compared to sugar waxing, and the number of inflammations was significantly lower. The growth rate of cross-section hair was faster than that of sugar waxing, and it was confirmed that the thickness of the hair also grew thicker.

Conclusion: Sugar waxing had excellent effects on hair removal and hair thickness reduction, such as lower skin dryness, redness, and irritation of pores compared to hard waxing, but follow-up care is expected to be very important. If follow-up care is not performed properly after Brazilian waxing, it is thought that the risk factors for ingrown hair and folliculitis may be high.

Keywords: Sugaring, Waxing, Brazilian, Ingrown, Public Value

1. Introduction

Humans have a culture and history of adorning their appearance since ancient times[1]. In the past, the expression of beauty was differentiated according to class, but modern society has sufficient value for the beauty of the public[2]. This phenomenon appeared as women's economic activities became more active[3], consumption patterns changed through the Internet and multimedia according to the development of science and technology[4], and thoughts about youth, individuality, and the pursuit of beauty. Human desire for beauty is accelerating with the changing times. Beauty, which is influenced by politics, economy, society, culture, and art, creates public value[5]. Various beauty designs can be a sufficient research subject to have public value[6].

Appearance management is an important factor in human relationships along with self-awareness, and beautiful appearance helps to form favorable human relationships in modern life. Among appearance management, a new beauty field called 'Waxing' called 'Hair removal management', which removes body hair, is attracting attention[7].

Waxing refers to the removal of unnecessary hair roots from the body by melting wax[8]. Waxing not only removes hair, but also removes sebum, old dead skin cells, etc. to add cleanliness to the body. Unlike normal shaving, it removes even the root of the hair, so the growth of the next hair is slowed. After waxing, the waxed area becomes whiter and more pleasant to the touch as dead skin cells and scars are removed after waxing by making the waxed area smooth and making the hair wrinkles invisible[9]. The thickness of the newly grown hair root becomes thinner and the number also decreases.

Types of waxing include plucking, waxing(including sugaring), hair removal, bleaching, shaving, electrolysis, laser, Intensive Pulsed Light(IPL) and eflornithine 13.9% cream (Vaniqa, Barrier Therapeutics, Canada, and other Shire Pharmaceuticals)[10]. Looking at Waxing using the sugaring method, it has a long history as it has been used since ancient Egypt. In the time of Cleopatra in ancient Egypt, 'Oriental Sugaring(waxing technique using sugar, lemon juice, and water)' was popular[11]. Sugar Paste Sugaring refers to a hair removal method using edible natural sugar. It is a hair removal method in which sugar, which is not hot, about 36°C ~ 40°C, similar to the temperature of the human body, is directly taken out by hand and adhered in the opposite direction of hair growth and pulled out in the direction of hair growth. This method is a waxing method with less irritation to the skin[12][13].

Unlike normal wax, sugaring can be applied to all skin types and is characterized by stable operation. It is a waxing method that has recently been spotlighted as a technique that can be performed on troubled skin with low irritation and low pain even during the procedure. Sugaring helps with blood circulation at the same time as hair removal, increasing skin elasticity and clearing skin tone, so it is effective for face reduction and skin improvement management[14].

The waxing industry has developed tremendously[15]. Among them, sugaring is positioned as a popular waxing method, and it can be performed regardless of the skin type of men and women, young and old. It is true that it is rapidly emerging as a new source of income for beauty industry workers.

Soft waxing refers to waxing while melting at a high temperature of 70 to 90 degrees or higher. It refers to waxing in which a thin layer of soft waxing is applied to the area to be waxed using a metal stick or a wooden stick, and then body hair is removed using a muslin cloth or a non-woven cloth[12].

The main component of hard wax is beeswax, which is a good wax for removing coarse hairs. It is a method of peeling off the wax itself by applying a thick layer of wax on the hair removal area[16]. Hard waxing is a fat-soluble hard wax that melts at a temperature of 40 to 60°C. It has a lower viscosity than soft wax and is also called non-strip waxing because it does not use a cloth. Hard wax is mainly applied to areas with thin and sensitive skin such as the face, armpits, and Brazilians[17].

Laser hair removal is safe and effective for most skin types[18]. Laser hair removal is a procedure that removes hair roots by irradiating laser wavelengths that respond to melanin to the skin. When the laser is irradiated to the desired area for hair removal, heat energy is absorbed by the melanin pigment and destroys the root of the hair. In damaged hair follicles, hair regrowth is inhibited, slowing the rate of hair growth. Because it does not respond to skin tissues other than hair, the frequency of side effects such as tissue damage is low, and semi-permanent hair removal effects can be expected if laser hair removal is regularly repeated[19].

Although it is clear that the demand in the domestic hair removal-related market is increasing, the current state of the domestic hair removal market mainly consists of marketing of related products made up of manuals without clinical data or accumulated professional know-how[20]. Although there are many studies on laser hair removal that corresponds to permanent hair removal, studies on the effect and satisfaction of hair removal that can actually help consumers,

such as temporary hair removal, are lacking[21].

Ingrown hair from waxing, folliculitis, pseudo folliculitis, and post-inflammatory pigmentation changes after waxing are common side effects of waxing. Waxing not only removes hair, it also removes dead skin cells. Occasionally, due to lack of skill, the epidermis of the skin is excessively removed along with the wax, which can act as a factor of side effects. The most common symptom is itching. Moisturize sufficiently and follow precautions after waxing [22].

New hair grows inside the skin and punctures the top layer of the dermis, a condition called "ingrown hair". New hair grows inside the skin and punctures the top layer of the dermis, a condition called "ingrown hair" [23][24]. The ingrown hair is shown in <Figure 1>[25].

Figure 1. The shape of ingrown hair.



If ingrown hair is left unattended, it can cause skin problems, because our body recognizes ingrown hair as a foreign substance and triggers an immune response. If ingrown hair is left unattended for a long time, folliculitis and irritant contact dermatitis may occur due to irritation of the hair follicles, and secondary pigmentation and scarring may occur [26], so it is necessary to safely remove and prevent it. Since sugar paste removes very short hair in the growth phase with less stimulation than other hair removal methods, the hair is removed from the dermal papilla of the skin, causing small wounds in the hair follicles and growing thinner and thinner hair.

There are two ways to prevent ingrown hair. The first method is a scrub after waxing. Those who have undergone the procedure should peel off the skin 3 to 4 times a week to maximize the effect of sugaring treatment. The skin moisture and oil content is higher after scrub than before scrub [27]. This is because the weaker hair can break through the skin only by removing the dead and hardened skin cells. The second method is moisturizing. Once the dead skin cells are removed, new skin cells that take their place must be gently held in place. When sufficient moisture is supplied to the skin, it provides sufficient moisture to the sweat glands, skin, and hair of the superficial layer, which greatly helps skin respiration and skin care. The new skin water treatment method enhances the skin's own self-cleaning and self-renewal power to increase skin immunity [28].

The results of previous research on sugaring are as follows. Woo Ji-hyeong(2018) conducted a study on skin reactions according to the methods of soft waxing and sugaring waxing, and found significant results in the difference in the degree of stimulation according to the treatment method, skin satisfaction, the need for follow-up care, and the difference in intention to purchase continuously. The irritation was less and the skin satisfaction was high, which is expected to increase the recognition of Sugaring for bikini waxing and face waxing in the future. In addition, compared to soft waxing, the need for follow-up care and continuous purchase intention for sugaring were higher, and a large area would be used for soft waxing. It was argued that sugaring would be effectively used to increase skin satisfaction by minimizing skin irritation in the treatment of sensitive areas [29].

Shin Eun-ha(2018) conducted a study comparing the difference between satisfaction and re-use intention and recommendation intention after soft waxing and sugaring waxing. It can be seen that sugaring was higher than soft waxing in satisfaction, reuse intention, and recommendation intention. When looking at the contents of this study, it can be seen that among soft waxing and sugaring, the study subjects preferred sugaring more [30].

The purpose of this study is to consider the market and value of waxing in the beauty industry in the future and to use it as a basic data for development by recommending suitable wax to consumers as a hair removal method that minimizes skin irritation according to the type of hair removal and has a superior hair removal effect.

2. Research Method

This study was conducted from June to August 2022, and women living in Jeonju participated in the study. Due to the nature of waxing, the psychological burden of exposed areas during the treatment and the photographing of the research subjects were required to sign the consent form for waxing treatment and research participation. These procedures include, in accordance with bioethics, protection of the subject's privacy, guarantee of anonymity, and voluntary consent. The researcher gave the research subjects a full explanation about Brazilian waxing, and signed the consent form, which included asking for consent and approval, so that the subjects could directly recognize the contents[31].

Interviews(qualitative research method[32][33]) were conducted to study subjects in order to more in-depth research on various psychology about waxing, satisfaction after waxing, and follow-up care. The 5th study was conducted from June to August 2022, which consisted of in-depth interviews and observation of participants to understand the actual conditions and effects of waxing of study participants and ingrown hairs. Each participant observed and interviewed for about 60 minutes.

In order to objectively and simultaneously compare and analyze the differences and effects of sugaring and hard waxing, the study subjects were selected as women without waxing experience who did not experience the advantages and disadvantages of sugaring and hard waxing. This is because, in order to accurately compare the amount of hair that grows after waxing and the thickness of hair, the subject of the study must have no experience in a waxing shop, self-waxing, or hair removal before waxing.

Sugaring(left) and hard waxing(right) sections of the bikini part of the woman's skin were divided in half, and waxing was performed at the same time. In the case of using different waxes at the same time, a clinical test method was selected to find out about each skin condition and hair removal effect according to the characteristics of sugaring and hard wax materials and their usage techniques. The waxing products used in the study were "Play beauty sugar paste(for sugaring)" and "Sensa fine hard wax(for hard wax)".

This study used a mixed study method including a waxing clinical trial of the subject and an interview of the subject. The procedure of this study is shown in <Table 1>.

Table 1. Research procedure.

| Procedure | Period | Research progress on waxing subjects |
|---------------|----------------------------|---|
| Before waxing | 20 June 2022 - 4 July 2022 | Counseling of research subjects according to the selection of waxing subjects, writing and signing a written prior consent form, observing the waxing area, analyzing the skin, and taking pictures of the treated area |
| After waxing | 4 July, 2022 | Consultation, observation of the waxing area, taking pictures of the treatment area, and explanation of side effects after waxing and personal home care tips for ingrown hair |
| 1 week later | 11 July, 2022 | Home care and after-care consultation after waxing Interview Observation of waxing area Taking pictures of the treatment area |
| 2 weeks later | 18 July, 2022 | |
| 3 weeks later | 25 July, 2022 | |
| 4 weeks later | 1 August, 2022 | |

3. Research Method

3.1. Research analysis

The subjects of this study were women, in their early 20s, unmarried, and living in Jeonju. She was a college student, had no experience with waxing at all, and had expectations for the effect of waxing and fear of pain during the procedure. As shown in the following <Table 2>.

Table 2. Research subject information.

| | Gender | Age | Residence | Marital status | Education | Waxing experience |
|--------------|--------|-----|-------------|----------------|-----------------|-------------------|
| Exam subject | Woman | 21 | Jeonju city | Single | College student | No |

3.2. Condition of skin and hair of study subjects before Brazilian waxing

Interview

(Operator): You became involved in waxing as a research subject. For what purpose did you participate?

(Subject): The genital area was wet due to a lot of pubic hair. A lot of my acquaintances recommended Brazilian waxing, so I thought it would be better if I got waxed.

(Operator): There may be pain during the waxing procedure.

(Subject): I have heard the stories of my acquaintances about pain, so I have some expectations. They say that they have ingrown and itchy, but that part worries me.

(Operator): For Ingrown, scrub and moisture management are important. Moisturize every day and scrub 2-3 times a week.

(Operator): Symptoms may appear after waxing. For example, fever, stinging, itching, redness, soreness, etc., before menstruation, overwork, or sensitive skin, symptoms may last for 3 to 5 days.

(Subject): Yes, I understand.

The condition of the skin and hair before Brazilian waxing is as in the picture. As shown in the following <Figure 2>.

Figure 2. Before the Brazilian waxing procedure(july 4, 2022).



3.3. Skin and hair condition of study subjects after Brazilian waxing

Interview

(Operator): Did you have any pain during the waxing procedure?

(Subject) : Although there was pain, it was not as painful as I was worried about.

(Operator): You performed sugar waxing and hard waxing at the same time, which waxing method was more painful?

(Subject): Sugar waxing was painful when applying the product, and hard waxing was painful when removing it. Overall, hard waxing felt more painful.

(Operator): Please read the precautions after waxing.

- Please shower only with water on the day of the shower (Do not use body wash or oil products).
- Avoid drinking and smoking, scratching your hands, irritating underwear, excessive exercise, sexual intercourse, and other activities that irritate the waxing area.
- Do not use saunas, swimming pools, or tanning for 48 hours immediately after the procedure.
- After waxing, the dead skin cells on the skin are exfoliated, so it can be dry, so pay attention to moisturizing.
- Moisturize daily and scrub 2-3 times a week.

When the sugaring (left) and hard waxing (right) parts were compared immediately after the procedure, the sugaring (left) part showed higher skin moisture and smaller pores than the hard waxing (right) part. It was found that the difference in skin tone did not change much before and after the procedure.

After hard waxing, the skin area was accompanied by red erythema, and it was confirmed that the skin was dry and exfoliated. Because the size of the pores is in the opposite direction of hair growth, it was stimulated and the pores were recalled and it was confirmed that the size of the pores was enlarged. In addition, during the waxing procedure, more hairs were found in the sugaring area (left) than in the sugaring area (left) without being removed to the root of the hair <Figure 3>.

Figure 3. Immediately after waxing (July 4, 2022).



3.4. Condition of skin and hair after 1 week of Brazilian waxing

Interview

(Operator): Please tell me how you feel after waxing.

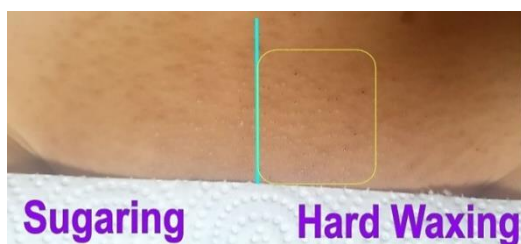
(Subject): It was good because the area to be waxed seemed clean. And since it was summer, it was very humid, but I am satisfied that it is not humid.

(operator): Is there any itching or discomfort?

(Subject): It is not itchy, and there is a feeling that the hard waxed part has rough hair and gets caught in the underwear.

No significant difference in appearance was observed in the skin condition after hard waxing and sugar waxing after 1 week after the procedure [13]. However, after sugaring, very small new hairs were observed to grow thin. After hard waxing, when looking at the skin surface, it was found that some thick broken hair had risen. As shown in the following <Figure 4>.

Figure 4. One week later (July 11, 2022).



3.5. Condition of skin and hair after 2 weeks of Brazilian waxing

Interview

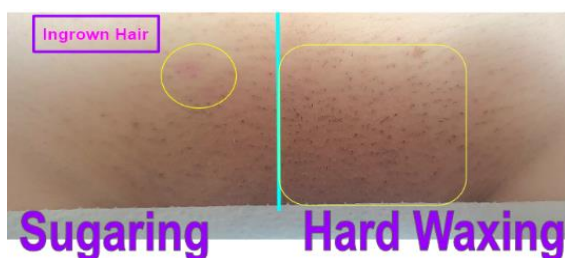
(operator): Is there any itching or discomfort?

(Subject) : It is not itchy, and the feeling of being caught in the underwear has become stronger as there are many new, rough hairs.

The results of comparing the sugaring(left) and hard waxing(right) parts of the skin condition 2 weeks after the procedure are as follows. After sugaring, 1 ingrown hair and 2 folliculitis were found in the skin area. In terms of hair removal effect, it was confirmed that the sugaring area had fewer hairs than the hard waxing area, and the thickness of the hair grew thinner.

When observing the skin area after hard waxing, it was confirmed that there were more cut thick hairs than new thin hairs. As shown in the following < Figure 5>.

Figure 5. Two weeks later(july 18, 2022).



3.6. Condition of skin and hair after 3 weeks of Brazilian waxing

Interview

(Operator): It has been 3 weeks since waxing. Are there any inconveniences?

(Subject) : It was not wet or itchy, but the rough hair was uncomfortable and I scratched it with my hands.

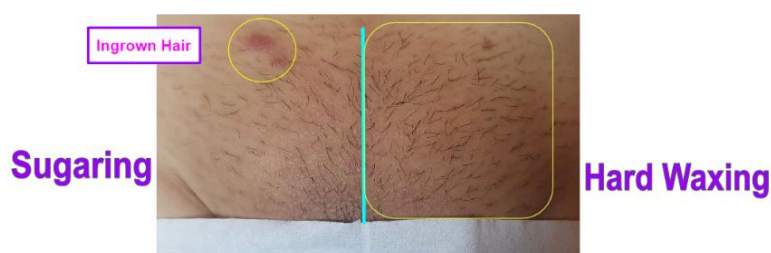
(Operator): Did you manage ingrown hair, that is, scrub and moisturize well?

(Subject): In the first 1 or 2 weeks, my skin is soft and not itchy, so I used a toner that cleans up dead skin cells, and I thought it would irritate the skin, so I softened and softened the scrub, and it seems to have ingrown hair.

(Operator): Waxing is effective not only for hair removal but also for exfoliation, so dead skin cells are regenerated after waxing. If the dead skin cells clog the pores during the process of keratin formation, the newly growing hair cannot break through the dead skin cells, which can lead to ingrown hairs. Scrubs and moisturizes are essential to prevent and prevent.

Three weeks after the procedure, sugaring(left) and hard waxing(right) were observed and compared. As a result, a right-handed study subject had ingrown hairs in areas frequently touched by hand. After the sugaring procedure, it was clearly seen that more hair came up to the edge of the skin surface area after hard waxing than on the skin surface area. As shown in the following <Figure 6>.

Figure 6. After 3 weeks(july 25, 2022).



3.7. Condition of skin and hair after 4 weeks of Brazilian waxing

Interview

(Operator): Did you have any discomfort?

(Subject): There was no inconvenience, but I was concerned about the hair getting caught in the underwear and protruding out of the underwear.

(Operator): Did you do well with ingrown hair care, that is, scrub and moisturizing?

(Subject): After paying more attention to scrub and moisturizing care, ingrown hair did not occur anymore. However, the site where the ingrown occurred was itchy and involuntary scratching caused inflammation, but now it is in a better state.

(Operator): What is the effect of Brazilian waxing?

(Subject): I had vaginitis, but after waxing, the genital area was not humid, the ventilation was good, so the smell was reduced, and it was good because it seemed to help with vaginitis. I want to actively recommend waxing to my acquaintances who have never had Brazilian waxing.

(Operator): If you are getting waxed again, which treatment method will you use, sugar waxing or hard waxing?

(Subject): I remember that hard waxing was painful, so I want to receive regular treatment with sugar waxing. I have experienced ingrown hair, and now that I know how to manage it, I am more confident in preventing it.

Four weeks after the procedure, the results of comparison by observing and comparing the surface area of the skin treated with sugaring(left) and hard waxing(right) are as follows. Four weeks after sugaring, it was confirmed that the hairs on the surface of the skin grew slightly in the center and sparsely at the edges. However, after 4 weeks of hard waxing, it was clearly observed that the hairs on the surface of the skin had long hairs from the center and the edges. Therefore, the density of skin surface hair after hard waxing was much higher than that of hair after sugaring. As shown in the following <Figure 7>.

Figure 7. After 4 weeks(august 1, 2022).



4. Conclusion

Beauty culture is a value-added business regardless of age or gender. Among them, 'waxing' can be said to be a recent trend in the beauty and beauty industry[34]. Conspiracy theories are becoming an increasingly common practice among women of all social and demographic groups[35].

The results of this study are expected to provide useful information to those who are new to grafting and waxing in waxing education. The results of this study are summarized as follows. As a result of experimenting with two types of waxing methods, sugaring and hard waxing, with Brazilian waxing of a woman in her twenties, the waxing area using sugaring had less breakage compared to the hair root area, and the skin condition showed less damage. could confirm that In the area of the skin that was waxed using hard wax, it was confirmed that the shape of the hair was broken, the condition of the skin was very dry, and the keratin was removed.

After the Brazilian waxing procedure, the skin condition and the length of the growing hair were compared and analyzed at 7-day intervals. As a result, the condition of the skin was ingrown hair and

inflammation in the area where sugaring was applied, and the hair growth rate was slow. In the area treated with hard waxing, ingrown hair did not occur compared to sugaring, and the number of inflammations was significantly lower. The growth rate of cross-section hair was faster than that of sugaring, and it was confirmed that the thickness of the hair also grew thicker.

Ingrown hair after sugaring was a factor caused by insufficient follow-up care of the study subjects, and the effect and satisfaction with sugaring were high. In addition, a study subject who had frequent vaginitis had an opinion about vaginitis relief after sugaring, suggesting that Brazilian waxing is effective in reducing cold and odor, such as vaginitis. Women complain of hygienic discomfort because there is a lot of secretion before and after menstruation. Even in this case, waxing helps prevent female diseases[22].

In the future, after sugaring and other waxing methods, a comparative study will be conducted on the side effects that occur when the follow-up care is done well and when the follow-up care is insufficient.

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6. Appendix

6.1. Authors contribution

| | Initial name | Contribution |
|-----------------------|--------------|--|
| Lead Author | SK | <ul style="list-style-type: none"> -Set of concepts <input checked="" type="checkbox"/> -Design <input checked="" type="checkbox"/> -Getting results <input checked="" type="checkbox"/> -Analysis <input checked="" type="checkbox"/> -Make a significant contribution to collection <input checked="" type="checkbox"/> -Final approval of the paper <input checked="" type="checkbox"/> -Corresponding <input checked="" type="checkbox"/> |
| Corresponding Author* | JL | <ul style="list-style-type: none"> -Play a decisive role in modification <input checked="" type="checkbox"/> -Significant contributions to concepts, designs, practices, analysis and interpretation of data <input checked="" type="checkbox"/> -Participants in Drafting and Revising Papers <input checked="" type="checkbox"/> -Someone who can explain all aspects of the paper <input checked="" type="checkbox"/> |

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