

Cream Derived from the Black Soldier Fly Meal (BSFM) for the Functional Parameters of Human Skin

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VB Khyade*

Department of Infectious Diseases, Malegaon, Kh. Baramati

***Corresponding Author:** VB Khyade, Department of Infectious Diseases, Malegaon, Kh. Baramati.

Abstract

The present attempt is dealing with assessment of cream obtained through the use of black soldier fly meal for the potential of antiaging. Through the use of method of dansyl-chloride-fluorescence, the activity of black soldier fly meal cream (BSFMC) for renewal of the skin was assessed through applications to the layer of stratum-corneum in skin cadaver of human being. The fluorescence of the patches stained with "Dansyl-chloride" in control group took sixty days to disappear. While, the fluorescence of the patches stained with "Dansyl-chloride" in the group treated with the BSFM cream. The t-test shows that increase in skin renewal by investigational cream is significant (at the $P < 0.05$ level of significance). The t-test shows that increase in skin renewal by investigational cream is significant (at the $P < 0.05$ level of significance). Black Soldier Fly Meal (BSFM) derived cream deserves significant antiaging efficiency. Black Soldier Fly Meal (BSFM) derived cream is going to prove to be excellent preparation for antiaging properties. This cream can be used for preventing the symptoms of the aging. Further studies should be made for additional data before practically using the investigational cream.

Keywords: black soldier fly meal skin cream (BSFMSC); melanin-pigment; Dansyl-chloride

Introduction

The protective, supportive, soft, flexible outer most layer of the vertebrate is the skin. The significant functions allotted for the skin include: protection, regulations and sensations (Alibardi, Lorenzo, 2003). In healthy condition, the layers of the skin work hard for the protection. Unhealthy condition use to compromise the abilities of skin to work as an efficient barrier. It is therefore, the maintenance of healthy skin is prime concern. Now a days some animal derived ingredients are commonly a part of contents of creams used for augmenting the beauty, the attractiveness and wellness of human skin health. The squalene for example is with antiaging properties. Therefore, it is often used in the products of skincare. The liver of the shark (Family: Squalidae) serves as the source of squalene. This squalene is utilized in the preparation of balms used for lip health, oils of tanning, skin-creams and skin-moisturisers (Huang, et al., 2009). There are plants from which, the squalene (with "a", not "e") is extracted. Olives, wheat germs and sugar cane are some of the examples of plant-sources of squalene (Mcphee, et al., 2014). The carmine is a red pigment derived from the female scale insect, Dactylopius

coccus (L). This insect derived carmine is commonly used as ingredient of blush, nail polish and lipsticks (Dutton, 2021). The scales of fishes are used for obtaining guanine, crystalline, shiny and shimmery compound. The guanine is used in the preparation of nail polishes, lipstick, eyeshadow, highlighter and bonzer (Hans-Joachim Wagner, et al., 2009). The honey is with anti-microbial property and wound healing potential. Honey is prepared by the bees. It is used in preparation of balm, scrub, lotion and cream (McLoone, et al., 2016). Wool of sheep give lanolin, which is used in the preparation of beauty products and skin care products. The lanolin is most found in the lip-balm, glosses and face-creams or moisturiser. Plant derived lanolin is also popular in the preparations of skin care products. The olive-oil, coconut-oil or shea butter are some of the examples of sources of plant derived lanolin (Shanazi, et al., 2015). Amber coloured resin recognized as, "Shellac" is product produced by lac insect, *Kerria lacca* (L). This shellac is thermoplastic in nature and glossy in appearance. It is used in the preparation of nail polish and lacquers (Adarkar, 1945; Baboo and Goswammi, 2010). One of the animal-derived ingredients used as skin moisturizing agent is glycerene, obtained from animal fats (Artelt and Schneider, 2002). Due to antiaging properties, the collagen is highly prized. The collagen is used in preparations of products of beauty through the improvement in the elasticity of the skin. The collagen serves to reduce the appearance of the wrinkle lines on the skin. The collagen used at industrial is obtained from beef and fishes (Avila Rodríguez, et al., 2018).

The modern decade using to demand the ingredients of natural origin and ingredients of renewable source. This condition is driving all the types of industries (animal-feed, human-food, pharmaceutical-products and the cosmetics) for the purpose to offer the consumer innovative product with natural origin and belong to renewable source. There should be improvement in the exploitation of natural resources and renewable forms of sources. The closed system concept for the production of the ingredients of natural origin and ingredients of renewable source is going to help to minimize the residue-generations, energetic cost, transportations and generations of greenhouse gases (Teixeira, et al., 2018). The mass cultures of the insects have become available and popular in modern decade. The mass cultures of the insects are working as efficient source for bio-compounds (proteins, carbohydrates and lipids). Therefore, the mass cultures of the insects are currently occupying the place of promising and eco-friendly alternative. The insects are efficient for bio-conversion of the waste organic material. Therefore, the mass cultures of the insects are the sound rationale (Van Huis, 2012).

Due to decline of resources of oil from fossils and due to the fear about impact of human activities (production of immense quantity of waste material and overexploitation of natural resources) on the planet made modern industries for searching the novel material and product (with little or no impact on the environment). Plant material appears to be alternative for the fossil-oil. This is leading to over use of plant origin material for the applications of oleochemical (Shortall, et al., 2015). At very first sight, use of plant origin material for the applications of oleochemical may sometimes appears to be eco-friendly. Practically, the influence of use of plant origin material for the applications of oleochemical on the environment is significantly considerable (itzherbert, et al., 2008). The use of plant origin material for the applications of oleochemical exert influence on environment through deforestation, changes in natural habitat, fragmentation, and loss of biodiversity (Fa yle, et al., 2010; Senior, et al., 2013). Therefore, research on chemical compounds through safe sources is essential. Release of organic waste materials through the production of natural food and functional food is the largest impact of activities through human being on earth planet. There is a need to increase food production keeping the pace with available (or projected) demands through the growth of population, changes in diet of human being (use of meat for example) and increasing demand of bioenergy (Fo ley, et al., 2011; Piment el, et al., 2009). Decline in the burden on ecosystem is possible if and only if the organic waste material processed for profitable biomass. Use of insects for biodegradation appears to be excellent avenue in the process of establishment circular economy. Consumption of insects as a functional food is not in the common practice in most of the countries. The practice of consumption of insects as a functional food however, may have significant impact on problems of food and animal feed. It is therefore, need to work further for demonstration of the potentials of the edible insect groups (van Huis, 2013). Apart from the functional food, "use of insect groups to obtain biomaterial (fat, protein and chitin) is going to serve another strategy. The bio-material (fat, protein and chitin) fraction may have diverse utilization in the chemical industries. The process of insect breeding should be coupled with the stream of reduction of waste material for the purpose to establish sustainable alternatives in the production of proteins and lipids (fat and oil) biomaterials (Diener, et al., 2011). The insect black soldier fly, *Hermetia illucens* (L) is best example on this line to establish feasible method on, "The process of insect breeding coupled with the stream of reduction of waste material". The process of breeding of the insect black soldier fly, *Hermetia illucens* (L) appears to be easy and feasible relatively in larger quantity

with smaller space and economic investment. The larval stages of the insect black soldier fly, *Hermetia illucens* (L) are experts in the degradation of the streams of organic waste materials (Cickova, et al., 2015). The larval stages of the insect black soldier fly, *Hermetia illucens* (L) convert the streams of organic waste materials into immense quantities of the biomaterial (fat, protein and chitin) (Zhen, et al., 2011; Zheng, et al., 2012) in the form of biomass. The resulting biomaterial (fat, protein and chitin) may find applications in several fields (industries of food and nutrition; biotechnological industries; material-science; and pharmaceutical field) (Prashanth and Tharanathan, 2007).

The cosmetics and the creams of skin health are prepared through the use of biomaterials like fats and oils. The property of emollients for softening the skin belongs to the triglycerides (Le Poole, 1994). The triglycerides are also expert in skin moisturising. Through the process of reduction in the "Trans-epidermal Water Loss (TEWL)", the triglycerides use to moisturize the skin (Stamatas, et al., 2008). The chemical properties of the fats depend on their profile of fatty-acids. Therefore, intensity of their working as skin moisturizing or healing can vary. The skin protective functions of cream are possible for enhancement through the use of linoleic acid for the dry skin. The viscosity of skin creams is also possible to increase (or decrease) through the use of specific fats in specific quantities. The specific fats in specific quantities decide the levels of their emulsification (Alander, 2007). With reference to the health of skin, oil obtained from the mink is with favourable profile of fatty acids. Traditionally, therefore, mink oil has been used in many creams prepared for the health of skin (Cahan, Eli, 2020). On this much background, the present attempt on the "Evaluation of various functional skin parameters using a topical cream prepared through the use of Black Soldier Fly Meal (BSFM)" had been planned.

Material and Methods

The attempt on evaluation of various functional skin parameters using a topical cream prepared through the use of Black Soldier Fly Meal was completed through the steps like: Rearing of the larval-stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae); Preparation of Black Soldier Fly Meal (BSFM); Preparation of skin cream through the use of Black Soldier Fly Meal (BSFM); Assessment of physical parameters of the Skin Cream; Assessment of ability of diffusion of the of the skin cream; Determination of water number for skin cream; Enumeration of Microbial-count; Assessment of Renewal of the Skin and Statistical analysis.

Rearing of the larval-stages of black soldier fly (LBSF), Hermetia illucens (Linnaeus) (Order: Diptera, Family: Stratiomyidae)

Being insect, the life cycle of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) is with life stages like: egg, larval-instars, pupal stage and the adult stage (Da Silva, 2019). The larval stage is the longest phase of life cycle of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae). Pupal stage is next to the larval stage with reference to the sequence and life duration of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae). The egg stage and the adult stage are relatively short with reference to life duration of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae). There is a death of adult male soon after mating. The adult female lays the eggs, which are near about five hundred to nine hundred in number. Incubation period of fertilized eggs is about four to five days. This period may vary according to the conditions of seasons, regions, and the temperature. There are actually five larval instars. The prepupal stage is exactly similar to the fifth larval stage (except colour and size). Therefore, many a times six larval instars are considered for the life cycle of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) (Agus Dana Perma, et al., 2020). The range of size of larval stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) is about 1.8-20 mm to 20 mm. There is initiation of feeding by the larvae soon after hatching. The larval stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) feed on various types of organic material, including animal derived manure, decaying-fruit, decaying-vegetables, and food-waste. The larval stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) are voracious. The rate of consumption is increasing significantly in the third instar stage (Cuncheng Liu, et al., 2019). In prepupal stage (or in the sixth stage), there is change in body colour through the process of melanization. At this stage, there is cease in feeding. There is migration of prepupae from rearing bed. The process of metamorphosis of prepupa into pupa requires about seven to ten days duration. The pupa in its life span remains motionless and non-feeding. The adult flies are also non-feeding (except water). The adult stage of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order:

Diptera, Family: Stratiomyidae) is without harmful activity to the field crops. The adult stage of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) is not concerned with pollution of environment and spread of the disease. The adult stage of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) live remotely from human dwellings. The adult stage of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) are proceed for maturation and mating in shaded areas (Cuncheng Liu, et al., 2019).

The present attempt on the rearing of the larval-stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) was carried in the insectary (Green House) of Shardabai Pawar Mahila Mahavidyalaya, Shardanagar (Malegaon Colony) Tal. Baramati, Pune, India. The culture was initiated through the use of commercial granular poultry feed. The content of the commercial granular poultry feed was taken in a wooden box (LBSF Rearing Bin). 2x1.5x1.5 feet was the dimensions of this wooden box (LBSF Rearing Bin). This LBSF rearing bin was with ventilation holes at the top lid. There was a rectangular wooden plank placed at inclined position (with the angle of forty-five degree with the bottom of LBSF rearing bin. Purpose of keeping the wooden plank inclined is to allow the self-harvesting for the mature larva as it turn into the pre-pupa. Little amount of water was used to spray on the feed contents (commercial poultry feed) in a LBSF rearing bin. This water spraying is for the initiation of the process of decomposition of the feed through bacteria intervention¹⁷. The mass of fertilized eggs of the black soldier fly (BSF), *Hermetia-illucens* (Linnaeus) (Diptera: Stratiomyidae) was procured from ICAR-National Institute of Abiotic Stress Management, Malegaon, Baramati-413 115 (District-Pune, State: Maharashtra, India). The mass of fertilized eggs of the black soldier fly (BSF), *Hermetia-illucens* (Linnaeus) (Diptera: Stratiomyidae) was kept suspended over fresh food. The slices of papaya fruits (*Carica papaya* L.). The cool place with humidity and flow of fresh air are required for hatching the larval-stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) uniformly. The duration required for hatching of the larval-stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) from fertilized eggs is about twenty-four of hours of provision of optimum or favourable conditions. On the fifth day after hatching, the unfed slices of papaya fruits (*Carica papaya* L.) were replaced by feed contents (commercial poultry feed) (pre-treated with little amount of water) in a LBSF rearing bin. The larval-stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) were allowed for feeding and their development (Vitthalrao B Khyade, 2021).

Preparation of Black Soldier Fly Meal (BSFM)

The larval stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) are voracious. The rate of consumption is increasing significantly in the third instar stage (Cuncheng Liu, et al., 2019). In prepupal stage (or in the sixth instar stage), there is change in body colour through the process of melanization. At this stage, there is cease in feeding. There is migration of prepupae from rearing bed. Random selection of the pre-pupae of was carried for the preparation of black soldier fly meal (BSFM). Individual weight of the prepupa was noted. The randomly selected prepupae were kept in freezer at minus thirty-five degree Celsius for twenty-four hours. After twenty-four hours, the prepupae were subjected for thawing. The process of thawing is mild homogenization. The process of thawing is used in combination with methods of other homogenizations. The process of thawing consists of quick freezing at minus eighty-five degree Celsius for ten minutes. The content was then processed for keeping at four degrees Celsius (for ten minutes); six degrees Celsius (for ten minutes); eight degrees Celsius (for ten minutes) and ten degrees Celsius (for ten minutes) in water bath. In present attempt, soon after thawing, the prepupal stages of black soldier fly (LBSF), *Hermetia illucens* (Linnaeus) (Order: Diptera, Family: Stratiomyidae) were subjected for drying for forty-eight hours in oven (60 °C). Through the use of blender, the oven dried pre-pupal stages of the Black-Soldier-Fly (BSF), *Hermetia.illucens* L. (Order: Diptera; Family: Stratiomyidae) were subjected for grinding until smooth. The content thus obtained was titled as, "Black-Soldier-Fly-Meal" (BSF Meal).

Preparations of skin cream through the use of Black Soldier Fly Meal (BSFM)

The "Black-Soldier-Fly-Meal" (BSF Meal) was processed for drying for forty-eight hours in oven (40 °C) in oven. Through the use of blender, the oven dried "Black-Soldier-Fly-Meal" (BSF Meal) was subjected for grinding until smooth. The "Black-Soldier-Fly-Meal"

(BSF Meal) in the form of powder was used for further processing. About fifty grams of bee-wax (Yellow Refined) was weighed on electronic balance. The bee-wax (Yellow Refined) (fifty grams) was processed for melting at low temperature. Addition of ten grams of "Black-Soldier-Fly-Meal" (BSF Meal) (in powder form) in melting wax was made. For uniform mixing, the content was stirred continuously (for about fifteen minutes). The content was allowed for cooling. The resulting preparation (in the form of cream) was transferred into a suitable container prior to quality assessment.

Assessment of Physical Parameters of Skin Cream

The parameters like cream colour, physical state, and smell were assessed through randomly selected panel of hundred female volunteers studying in F. Y. B. Sc. class (Sharadabai Pawar Mahila Arts, Commerce and Science College, Sharadanagar Tal. Baramati Dist. Pune - 413115 India). The skin cream was used to apply on dorsal, lateral and ventral surfaces of the left forearm (starting from wrist region to the bony prominence at distal end of the ulna in fore arm of randomly selected volunteers to ascertain whether it's greasy or non-greasy (Muazu J, et al., 2015). The members of panel of volunteers were asked to note down their views on the parameters like consistency of the cream, texture of the cream, spreading ability of the cream, tendency of the cream to occlude (consonant resulted through stopping the air flow at certain point and its sudden release) and washability of the cream. The findings / observations (in the form of verbal feedback) were recorded.

Assessment of ability of diffusion of the of the cream Black Soldier Fly Meal (BSFM)

The penetration tendency (ability of penetration) of a cream (or fluid) into a contiguous-fluid through the wandering movements molecules in its contents. The ability of diffusion is measurement of quantity of the cream diffused with the skin (body surface). The method explained by Sabale, et al. (2011) was adopted for the purpose to measure the ability of diffusion of the of the cream Black Soldier Fly Meal (BSFM). The cream of salicylic acid was prepared (salicylic acid = 2 g and cream base = 98 g). It was followed by preparation of medium of "Nutrient-Agar". The material used for the preparation of medium of "Nutrient-Agar" include: Beef Extract (10 g), peptone (10 g), sodium chloride (5 g), agar (1.2 g) and distilled water (1000 ml). The "Nutrient-Agar" medium thus prepared was used to pour into a Petri-dish. At the centre of "Nutrient-Agar" medium in a Petri dish, the hole was made. The cream was then applied to the hole at the centre of "Nutrient-Agar" medium in a Petri dish. The diffusion of the cream was evidenced through the rings of pink colour around the point of application of cream. Time required appearance of all possible number (maximum number) of the pink coloured rings around the point of application of cream was recorded.

Determination of water number for skin cream

Maximum volume of the water used for addition to hundred grams of the base at a given temperature decides the water number for given cream. The cream was kept in stirring the base. The distilled water was used for addition. The water that no more was absorbed into the base was evidenced by water droplets remaining in the container. The time for occurrence of water droplets started for remaining in the container was considered as end point.

Enumeration of Microbial-count

The method of pour plate was used for the enumeration of microbial-count. One in thousand serial dilutions of one gram weight of the cream prepared through the use of the Black Soldier Fly Meal (BSFM). Inoculation by pour plate method was then carried. Diluted sample (one millilitre) was used for aspiration into the nutrient agar media. Then, the nutrient agar media was transferred aseptically into the sterile-petri dish at temperature of forty degrees Celsius. The content was then swirled. The preparation was allowed for solidification for incubation at the temperature of thirty-seven degrees Celsius. The time duration of incubation was twenty-four hours. At the end of incubation, the counting of typical colonies of growth of the microbials on plates was carried out. The unit for presenting the result was "colony forming unit" per gram (cfu/g) (Muazu J, et al., 2015).

Assessment of Renewal of the Skin

The method of "Fluorescence-Staining" (Dansyl-Chloride-Fluorescence Method) explained by Jansen, et al. (1974) was used for assessment of influence of the cream prepared through the use of the Black Soldier Fly Meal (BSFM) on renewal of the skin for (turnover of the human skin-stratum-corneum). The chemical compound, "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) is a fluorescent dye. The amino groups (primary) of aliphatic and aromatic amines are reacting with "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) is a fluorescent dye. This reaction leads into production of blue (or blue-green) fluorescent-sulfonamide-adducts. The "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) can also react with secondary amines. The "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) is used for the modification of amino acids, protein-sequencing and for the analysis of amino acids (Walker, 1994). It is also useful for "Protein-Fluorescence-Tagging". The duration of time required for the purpose of disappearance from the stained horny layer of skin gives estimate time for its replacement.

In present attempt, five percent (w/w) of A 5% w/w dispersion of the "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) was prepared with the white petrolatum in dark with subdued red light (as the dye is light-sensitive). For the preparation of "Human-Cadaver-Skin", fresh piece of skin from forearm was obtained from the Government Medical College and General Hospital, Baramati.

Plot no. P-107, MIDC Area, Tal - Baramati, District - Pune - 413133, Maharashtra, India. To avoid deterioration, this fresh pieces of the skin from forearm were kept immediately into ice and carried to laboratory. In laboratory, through process of removal of the fats (subcutaneous) attached, the skin was cleaned with the help of forceps and scissors. The method of heat (or warm) trypsinization explained by Kligman (1963) was used for separation of epidermis. Then, the skin was used to dip in hot water. Through the use of forceps, slowly peeling of layer of epidermis was carried out. The peeled layer of epidermis was placed in five percent aqueous solution of trypsin for about five minutes. The treating the epidermis with the solution of trypsin result into stratum corneum separation. The preparation was processed for spreading on wire-mesh of stainless-steel and then kept overnight in a desiccator for drying. The stratum-corneum layer was processed for cutting into three pieces with particular dimension (1 cm x 1 cm). Three pieces of stratum-corneum were used to store in a desiccator. Finally, the three pieces of stratum-corneum were placed in a refrigerator.

Through the use of index finger, in dark, the "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) was smeared uniformly on the skin pieces. Each piece of skin with patches of smeared "Dansyl chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) was processed for sandwiching between two glass slides. Then, the was processed for the preservation in a refrigerator below zero degree Celsius for twenty-four hours. Soon after the completion of storage period, the stained pieces of the skin were processed for measurement of "staining intensity" through the use of spectrofluorometer at 340 nm at General Hospital, Baramati.

Plot no. P-107, MIDC Area, Tal - Baramati, Dist - Pune - 413133, Maharashtra, India. For the purpose to ascertain declining the fluorescence, the intensity of fluorescence of the preparation was confirmed through checking daily for about sixty days.

For the purpose of analysis of the influence of the cream prepared through the use of the Black Soldier Fly Meal (BSFM) for the activity of renewal on the skin patches developed, the two pieces of skin were treated with investigational cream. The first skin patch was considered as untreated control group. The second skin patch was used for treatment with the cream prepared through the use of the Black Soldier Fly Meal (BSFM). The third skin patch was used for treating with known antiaging cream, the retinol (retinol cream is the standard anti-ageing skin cream preparation). The derivative of vitamin A is retinol. Soon after the absorption in skin, the retinol is converted into retinoic acid. This retinoic acid enhances the rate of production of collagen, which further increase the turnover of cells. All the effects use to combine and help to plum-out the wrinkles. It also helps to decrease of the hyperpigmentation (Kang, et al., 1995; Flur, et al., 1999). The cream was applied daily at 7.0 a.m. The intensity of fluorescence was noted on the next day at 7.0 a.m. The measurement of renewal time for stratum corneum was noted in the units of days required for complete disappearance of the patches.

Statistical Analysis

Each and every attempt in the experimentation was repeated for three times. This is for the purpose to obtain the consistency in the

results. The data on the attempt was collected and subjected for statistical analysis. The student "t" - test was used for significance of the data (Norman, T.J.& Baily, 1955; Vitthalrao B. Khyade and Manfred Eigen, 2018).

Results and Discussion

The results on the on the attempt of Influence of Cream Derived from the Black Soldier Fly Meal (BSFM) on the Functional Parameters of Human Skin are summarized in table-1; table-2 and fig.1. The skin-cream in present attempt appeared smooth in nature. The observations on physical appearance, odour and after-feel response of the skin cream prepared through the use of black soldier fly meal (BSFM) for topical application were light brown, pleasant and greasy respectively. The physical appearance, odour and after-feel are the tactile sense, which allow human being to get the feeling of skin-cream. The tactile sense is significant aspect of human body. The tendency of penetration (ability of penetration) of a cream (or fluid) into a contiguous-fluid through the wandering movements of the molecules in its contents is the ability of diffusion in the skin cream. The ability of diffusion is measurement of quantity of the cream diffused with the skin (body surface). The length (cm) the skin cream diffused from the point of application at the time interval of 5, 10, 15, 20, 25, 30 minutes after the application of the cream was found recorded 00.721 (± 0.056); 00.892 (± 0.063); 01.367 (± 0.058); 01.953 (± 0.786); 02.897 (± 0.842); 03.843 (± 0.963) respectively. With reference to the ability of diffusion through the nutrient agar, skin cream obtained from black soldier fly meal (BSFM) had statistically significant rate.

The present attempt dealt with reporting the percentage decline in the intensity of fluorescence of the BSFM skin-cream at the interval of the five days. On the fifth day, percentage decline in fluorescence intensity was found to be 97.786 (± 3.317) percentages for the control group; 83.342 (± 6.746) percentages for the group of BSFM skin-cream and 75.427 (± 6.568) percentages for the group of retinol skin cream. On the tenth day, decline in fluorescence intensity was found to be 95.934 (± 5.543) percentages for the control group; 67.087 (± 6.789) percentages for the group of BSFM skin-cream and 42.721 (± 8.673) percentages for the group of retinol skin cream. On the fifteenth day, decline in fluorescence intensity was found to be 86.276 (± 5.392) percentages for the control group; 38.187 (± 4.536) percentages for the group of BSFM skin-cream and 17.395 (± 4.712) percentages for the group of retinol skin cream. On the twentieth day, decline in fluorescence intensity was found to be 63.784 (± 3.436) percentages for the control group; 14.741 (± 2.543) percentages for the group of BSFM skin-cream and 11.056 (± 3.531) percentages for the group of retinol skin cream. On the twenty-fifth day, decline in fluorescence intensity was found to be 41.559 (± 4.967) percentages for the control group; 02.784 (± 0.436) percentages for the group of BSFM skin-cream and 00.697 (± 0.089) percentages for the group of retinol skin cream. On the thirtieth day, decline in fluorescence intensity was found to be 38.632 (± 5.246) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. On the thirty-fifth day, decline in fluorescence intensity was found to be 32.285 (± 3.967) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. On the fortieth day, decline in fluorescence intensity was found to be 29.816 (± 3.967) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. On the forty-fifth day, decline in fluorescence intensity was found to be 25.752 (± 3.663) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. On the fiftieth day, decline in fluorescence intensity was found to be 19.248 (± 2.846) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. On the fifty-fifth day, decline in fluorescence intensity was found to be 12.329 (± 2.443) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. On the sixtieth day, decline in fluorescence intensity was found to be 11.817 (± 2.874) percentages for the control group; zero percentages for the group of BSFM skin-cream and zero percentages for the group of retinol skin cream. The fluorescence of the patches stained with "Dansyl-chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) in control group took sixty days to disappear. While, the fluorescence of the patches stained with "Dansyl-chloride" (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) in the group treated with the BSFM cream and in the group treated with the retinol skin cream took twenty-five days to disappear exhibiting significant activity of skin renewal. The t-test shows that increase in skin renewal by investigational cream is significant (at the $P < 0.05$ level of significance).



Figure 1: Diffusion of the “Black Soldier Fly Meal (BSFM) Cream” through nutrient agar medium.

Day	Percentage of Intensity to Decline in fluorescence of the “Dansyl-chloride” (Group: Untreated Control)	Percentage of Intensity to Decline in fluorescence of the “Dansyl-chloride” (Group: Treated-With Skin Cream derived from black soldier fly meal (BSFM))	Percentage of Intensity to Decline in fluorescence of the “Dansyl-chloride” (Group: Treated-With Standard Skin Cream: Retinol cream)
05	97.786 (±3.317)	83.342 (±6.746)	75.427 (±6.568)
10	95.934 (±5.543)	67.087 (±6.789)	42.721 (±8.673)
15	86.276 (±5.392)	38.187 (±4.536)	17.395 (±4.712)
20	63.784 (±3.436)	14.741 (±2.543)	11.056 (±3.531)
25	41.559 (±4.967)	02.784 (±0.436)	00.697 (±0.089)
30	38.632 (±5.246)	-	-
35	32.285 (±3.967)	-	-
40	29.816 (±3.967)	-	-
45	25.752 (±3.663)	-	-
50	19.248 (±2.846)	-	-
55	12.329 (±2.443)	-	-
60	11.817 (±2.874)	-	-

Each figure is the mean of the three replications.

Figure with ± sign in the bracket is standard deviation.

Figure below the standard deviation is the increase for calculated parameter and percent increase for the others over the control. *: P < 0.05; **: P < 0.005; ***: P < 0.01.

Table 1: Percentage of Intensity to Decline in fluorescence of the “Dansyl-chloride” (5-Dimethyl-Amino-Naphthalene-1-Sulfonyl-chloride) stained patches with the application of the cream prepared through the use of the Black Soldier Fly Meal (BSFM) for the Activity of the Skin Renewal.

<i>Serial No.</i>	<i>Time Duration (minutes)</i>	<i>Length Skin-Cream Diffused</i>	<i>Volume of Water Used for Addition (ml)</i>
1	05	00.721 (± 0.056)	01
2	10	00.892 (± 0.063)	02
3	15	01.367 (± 0.058)	03
4	20	01.953 (± 0.786)	04
5	25	02.897 (± 0.842)	05
6	30	03.843 (± 0.963)	06

Each figure is the mean of the three replications.

Figure with \pm sign in the bracket is standard deviation.

Figure below the standard deviation is the increase for calculated parameter and percent increase for the others over the control. *: $P < 0.05$; **: $P < 0.005$; ***: $P < 0.01$.

Table 2: The ability of diffusion of the cream prepared through the use of the Black Soldier Fly Meal (BSFM) and Its Water Number.

The cream (derived from black soldier fly meal: BSFM) treatment reflected in renewal time reduction in comparison with the untreated control site. The expected increase in time duration for renewal through the treatment with the chemical agent like hypomitic compounds and reduction with the hypermitotic agent is reported through daily treatment. Further, this commencement reported two weeks prior staining (with dansyl-chloride) and continued after staining (with dansyl-chloride). It is not possible when treatment started after staining (Ridge, et al., 1988). In order to demonstrate changes in activity of mitosis for the cell renewal it is prime concern for pre-treatment to the skin with the investigational cream for the establishment of full equilibrium at the affected (or changed) state of mitosis before labelling with the dansyl chloride. Consequential claim for the influences on the cell renewal through the application with the ingredients of the specific skin cream should only be possible through comparison with the site of treatment (Ridge, et al., 1988). The skin layer of stratum corneum of the young-adults, the transit time duration is approximately twenty days. The skin layer of stratum corneum of the older-adults, the transit time duration is lengthened by more than ten days. The number of horny layers of the skin are not changing with age. The increased stratum-corneum transit time, the results of present attempt appear to be the reflection of diminished proliferation of epidermal cells. The decline renewal of the epidermal-cells may not occur with a constant rate throughout the life-span of adult. In younger life-span of younger adult, "decline renewal of the epidermal-cells" is remaining relatively constant. The "decline renewal of the epidermal-cells" begins to drop significantly after the age of fifty (Grove and Kligman, 1983). Fruitful claim for the influence of the investigational skin cream on renewal of the cells should made if and only if the results compared with the sites treated with standard (or known) antiaging skin cream, both having been allowed for the purpose to equilibrate, instead of comparison with the untreated site of the skin. Black Soldier Fly Meal (BSFM) derived cream deserves significant antiaging efficiency. Conclusively enough, the "Black Soldier Fly Meal (BSFM) derived cream" is going to prove to be excellent preparation for antiaging properties. This cream can be used for preventing the symptoms of the aging. Further studies should be made for additional data before practically using the investigational cream.

Conclusion

Black Soldier Fly Meal (BSFM) derived cream deserves significant antiaging efficiency. Black Soldier Fly Meal (BSFM) derived cream is going to prove to be excellent preparation for antiaging properties. This cream can be used for preventing the symptoms of the aging. Further studies should be made for additional data before practically using the investigational cream.

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