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Full Length Research Paper

Development of a sebum control cream from a local desert plant *Capparis decidua*

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The aim of this study was to develop a stable cream from a local desert plant capable of producing Antisebum effects. Two creams (emulsions) were prepared, both of which were of w/o type. One was the formulation in which 5% extract obtained from the plant *Capparis decidua* was added during the preparation of the cream and the other was the base or control in which the extract was not added while other ingredients were the same as that of the formulation. Thirteen healthy male volunteers were selected and their initial sebum readings of both the cheeks were noted with the help of Sebumeter. The volunteers were given both the creams and asked to apply the creams on the face daily two times, the base on the right side and the formulation on the left side. The readings were taken every fifteen days for a period of three months. At the end of the study period, it was found that the formulation significantly decreased the sebum values on the left side. On the other hand, an increase in the sebum values was observed on the right side where the base was applied, although the increase was not significant statistically. The results showed that the cream prepared from the local desert plant *C. decidua* had the ability to produce Antisebum effects in the human volunteers.

Key words: Antisebum, extract, *Capparis decidua,* Sebumeter, Sebum.

INTRODUCTION

Capparis decidua which is also known as *Capparis aphylla* is a desert plant (Mishra et al., 2007; Sarathchandiran et al., 2007) (Figure 1). It is very commonly found in the dry regions of Pakistan, India, Tropical Africa and Egypt (Neelkamal, 2009a). In Pakistan, this plant is abundantly present in the Cholistan desert (Mohammad et al., 2008). *C. decidua* plant belongs to the family *Capparidaceae* (Govind et al., 2009) and is a densely branching shrub having scanty, small caducous leaves (Ravi et al., 2010). A large number of biological compounds, alkaloids, phenols, sterols or glycosides (Mishra et al., 2007; Rajni and Rajbala, 2010), terpenoids as well as some fatty acids have been reported in the plant *C. decidua* (Neelkamal, 2009a; Baby and Jini, 2011). The presence of these constituents has resulted in the use of this plant in asthma, gout, rheumatism, ulcer, ear infection, as hypoglycemic and antidiabetic agent, in lowering oxidative stress in diabetes, as anthelmentic, as constipative, as purgative and diuretic as well as in some skin disorders (Mishra et al., 2007; Ravi et al., 2010; Dangi and Mishra, 2010; Yamini and Ranjana, 2001).

The extract of this plant has also been reported to cause reductrion in plasma triglycerides, total lipids and phospholipids, because of which it is also used as a hypocholesterolemic (Dheeraj and Ranjay, 2011; Yamini and Ranjana, 2001; Rajni and Rajbala, 2010). High contents of isothiocyanate glucoside, glucocapparin, stachydrine, n-triacontane, β-carotene and β-sitosterol have been revealed in the Phytochemical screening of the plant, while other constituents found include n-triacontanol, n-pentacosane and phthalic acid (Pradeep et al., 2011).

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Figure 1. The plant *Capparis decidua*.

Sebum is produced by the sebaceous glands and it is the main component of skin surface lipids. It has several functions, among which one of the most important is the controlling of the moisture balance in the stratum corneum. The production of sebum by sebaceous glands is controlled by the androgens (Robert and Shirley, 2008).

Excessively, oily facial skin is due to overactive sebaceous glands. In such case the skin becomes greasy and shiny. It develops large pores, feels unpleasant, and may also become a serious cosmetic problem. Moreover, such type of skin has much more chances to develop acne and seborrheic dermatitis (Hristo, 2007). Increased sebum secretion is one of the most important cause of Acne which is the most common skin disease of the people of age between 11 and 30 years (Naveed et al., 2010). Therefore, it is very important to control the excessive oiliness of the skin (Hristo, 2007).

The aim of this study was to develop a cream from the extract of a natural plant that could control the excessive sebum production. The common products available to control the problems associated with excessive sebum production generally contain benzoyl peroxide which usually causes irritation, swelling or redness and moreover people also get allergic to it (Carol and Jeffrey, 2007). Other treatments like antibiotics and steriods carry the risk of severe side effects. The cream prepared from the extract of a plant can therefore be of great benefit and may solve all these problems.

MATERIALS AND METHODS

C. decidua plant was collected from the Cholistan desert near Bahawalpur, Abil®EM90 was purchased from Franken Chemicals Germany, Paraffin oil from Merck Germany; Methanol from BDH England, Distilled water was prepared in the Pharmaceutical Labs of Department of Pharmacy, The Islamia University of Bahawalpur, Pakistan. The Lemon oil was purchased from the local market.

Identification of Plant

The identification of the plant (*C. decidua*) was performed at the Cholistan Institute of Desert Studies (CIDS), The Islamia University of Bahawalpur, Pakistan. The specimen was deposited in the Herbarium of the Islamia University Bahawalpur.

Instruments

The instruments used in the experimental work were; centrifuge machine (Hettich EBA 20, Germany), incubator (Sanyo MIR-153, Japan), Incubator (Sanyo MIR-162, Japan), conductivity-meter (WTW COND-197i, Germany), sebumeter MPA 5 (Courage + Khazaka,Germany), digital humidity meter (TES Electronic Corp, Taiwan), electrical balance (Precisa BJ-210, Switzerland),

homogenizer (Euro-Star, IKAD 230, Germany), pH-meter (WTW pH-197i, Germany), refrigerator (Dawlance, Pakistan) and rotary evaporator (Eyela, Co. Ltd., Japan).

Preparation of the formulation

C. decidua plant was cut into small pieces, 200 g of the plant material was weighed on an electrical balance and macerated with one litre of analytical grade methanol in a container. The container was carefully sealed and kept at room temperature for 72 h. The container was shaken for 10 to 15 min after every 12 h. The macerated plant material was then filtered through multiple layers of muslin cloth. The filtered extract was then filtered through Whatman No.1 filter paper to obtain a particle free extract. The filtered extract was then evaporated by using the rotary evaporator under reduced pressure at 40°C temperature. The evaporation was continued until the extract was reduced to one third of its original volume. The extract was collected in a container and stored in a refrigerator at 4ºC.

The formulations selected for this study were W/O emulsions (creams) which were prepared by adding the aqueous phase into the oily phase with continuous agitation (Barkat et al., 2010). The oily phase contained 16% of paraffin oil and 3.5% of ABIL - EM 90, which was used as the emulsifier. The aqueous phase was comprised of distilled water quantity sufficient to make the volume 100%. Both the oily and the aqueous phases were heated up to 75 ± 5°C, and 5% extract of *C. decidua* was added in the aqueous phase. The aqueous phase was then added drop by drop to the oily phase. The Stirring was continuously done at 2000 rpm by the homogenizer for about 15 min until all of the aqueous phase had been added to the oily phase.

A few drops of lemon oil were added during stirring in order to give good fragrance to the formulation. When whole of the aqueous phase had been added, the speed of the homogenizer was reduced and it was operated at a speed of 1000 rpm for 5 min, afterwards the speed of the homogenizer was further reduced and it was operated at 500 rpm for 5 min so that complete homogenization may occur and emulsion cools down to the room temerature. The Base or control was prepared by the same method, the only difference was that the 5% *C. decidua* extract was not added to it and its volume was replaced by the distilled water.

Study design

Thirteen healthy volunteers were selected for this study. The age of the volunteers was between 20 to 35 years. All the selected volunteers were male. The volunteers were examined by a skin specialist for any serious skin disease or damage especially on cheeks and forearms. A volunteer protocol was provided to each of the volunteer before the study. The protocol stated the terms and conditions of the study. All the volunteers had to sign the consent form to agree with the terms and conditions of the testing individually. The contents of the formulations were kept secret from the volunteers. The readings were taken at 25±1ºC temperature and 40±2% relative humidity conditions. Before the start of the study the patch test was performed on the forearms of the volunteers for 48 h. Such test is done to check if any volunteer feels the irritation, itch or redness on the skin from the application of the formulation.

The volunteers who report such problems are removed from the studies. In this study, none of the volunteers reported such problem after the 48 h patch test. Therefore, the zero hour Sebum readings of the volunteers were taken from the cheeks of the volunteers and noted. Each volunteer was then given two creams, a formulation having the extract of the plant and a base or control, without the extract. The volunteers were instructed about the proper use of the creams. Each volunteer was told to come to the laboratory every second week for the measurements of skin sebum production upto the end of the study period, which was three months.

Ethical standards

The approval of this study was taken from the Board of the Advanced Study and Research (BASR), the Islamia University, Bahawalpur and the Institutional Ethical Committee, Faculty of Pharmacy and Alternative medicine, The Islamia University, Bahawalpur.

Mathematical and statistical analysis

The sebum values of the right and left cheek of the volunteers were calculated at zero hour, 2nd week, 4th week, 6th week, 8th week, 10th week and 12th week. The data obtained was then analyzed by the SPSS 17.0 on the computer by using the two-way ANOVA for variation between different time intervals and the paired sample t-test for the variation between the two formulations. The level of significance was 0.5 %.

RESULTS

In vitro evaluation of creams

The stability of both the creams, base and the formulation was evaluated by keeping them at four different storage conditions which were 4, 25, 40 and 40°C + 75% RH for eight weeks (2 months). Both the centrifugation test and storage at accelerated conditions of temperature are very important parameters for detecting the stability of creams. No phase separation was observed during the study period of two months. The liquefaction was not observed at 4 and 25°C through out the study period of 2 months, while slight liquefaction was observed at 40 and 40°C + 75% RH at the 6th and 8th week in case of the base and only 8th week in case of the formulation.

In vivo evaluation of the creams on skin sebum

In this study an increase in the sebum values occurred on the right cheeks where the base was applied. There were variations seen but generally an increase in sebum occurred by the base as shown in the Table 1. The ANOVA test showed that the increase was not significant ($p = 0.171$) with respect to time. The increase was less than 2.5% upto the 6th week but it was more than 5% on 8th, 10 th and 12th week (Figure 2). In case of formulation, a continuous decrease in the values of the sebum was observed throughout the study period of three months on the left cheeks as shown in the Table 1. The application of ANOVA test showed that the decrease in the values of sebum was highly significant ($p = 0.000$) with respect to time. The decrease in sebum values was less than 5% upto the 4th week but it became more than 12% after 6th week and onwards. The heighest decrease was seen at the end of the study period which was 18% (Figure 2).

Table 1. Mean of the Sebum values of the volunteers after the application of base and formulation.

	Skin Sebum (Mean ± SEM)						
Time	**0 Hour**	**2nd week**	**4th week**	**6th week**	**8th week**	**10th week**	**12th week**
Base	132.23±8.84	131.77±9.11	134.69±9.49	134.00±8.16	137.85±8.20	138.46±8.73	138.15±8.61
Formulation	136.00±9.78	133.92±10.48	130.15±9.98	120.08±9.68	114.85±8.31	112.31±8.55	111.62±8.29

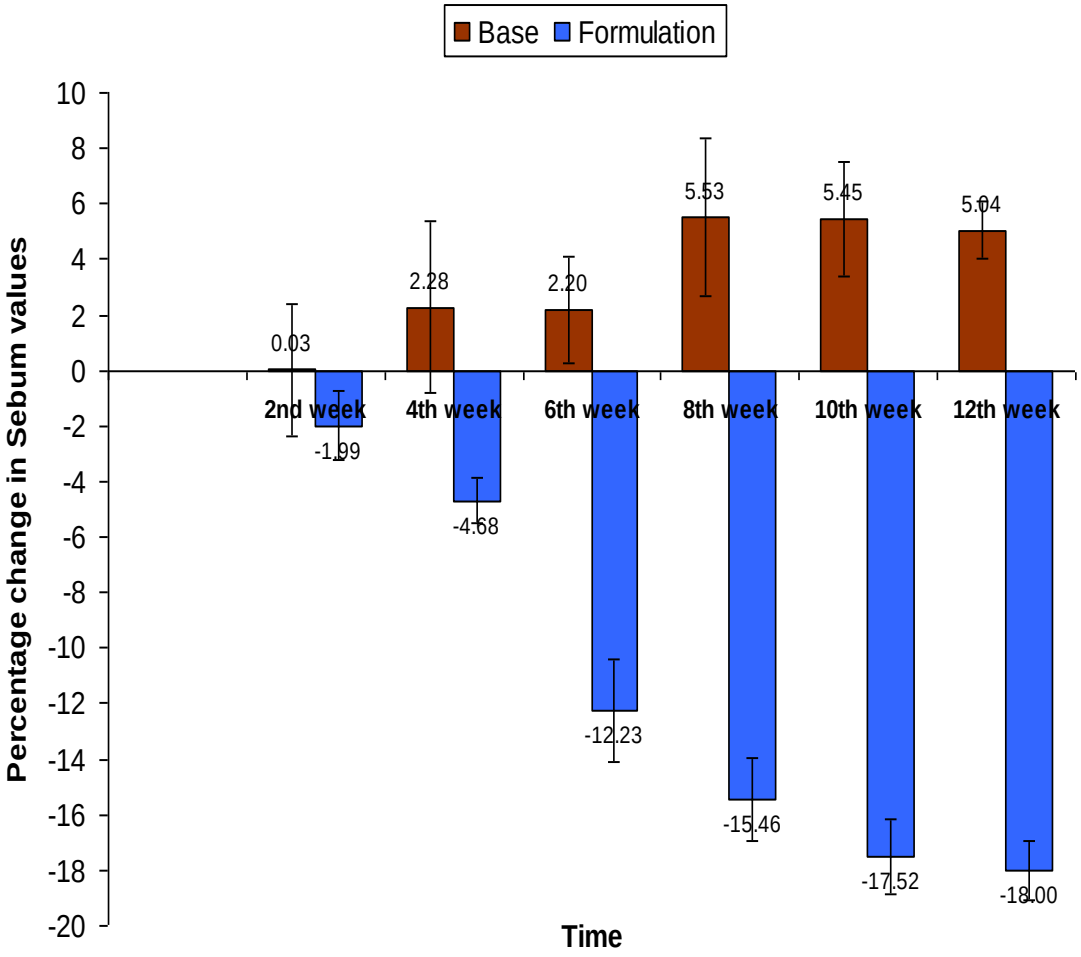

Figure 2. Percentage of change in the Sebum values of volunteers after the application of Base and Formulation.

DISCUSSION

The stability characteristrics are of prime importance for any kind of formulation and if a formulation does not meet the stability standards it becomes unfit for use. In case of creams, the elevated temperature can cause change in viscosity because of which phase separation or liquefaction may occur. As Abil®EM90 was used in this formulation which is a lipophilic surfactant and is more stable at elevated temperature (Raymond et al., 2009), therefore the creams showed good stability characteristics. The liquefaction was not observed at 4 and 25°C through out the study period of 2 months, while slight liquefaction was observed at 40 and 40°C + 75% RH at the 6th and 8th week in case of the base and only 8th week in case of the formulation.

Sebum is an oily substance which is produced by the sebaceous glands in the skin. These are tiny glands mostly located on the scalp, face and around the anus. The production of sebum is partly controlled by male sex hormones. Sebum which is composed of fat and wax lubricates the skin and protects it from becoming soggy when wet, as well as from becoming cracked when exposed to hot, dry temperatures. Sebum also helps

protect the skin from bacteria and fungi, but oversecretion of sebum causes Seborrhea (oily skin and scalp) and may lead to seborrheic dermatitis or acne. Although, the exact cause of this excess production is not fully understood but it is observed that male sex hormones (androgen hormones) do play a role in its excess production. This is the reason that the problem of Seborrhea is very common in adolescent boys and men (Carol and Jeffrey, 2007).

This study showed an increase in the sebum values on the right cheeks where the base was applied, although it was not significant (Figure 2). The increase in sebum values may be due to the oily nature of the cream as Paraffin oil was used in the formulation (Naveed et al., 2011). In case of formulation a regular decrease was observed in the sebum values throughout the study period of three months (Table 1) and the ANOVA test showed that the decrease was highly significant. It has been reported that the androgens stimulate the sebum production. The enzyme 5α-reductase is the enzyme that metabolizes the testosterone into its more potent form the dihydrotestosterone in the skin, which causes the enlargement of sebaceous glands and increased secretion of sebum. It is supposed that the application of inhibitors of 5α-reductase type 1 or dual inhibitor may be effecctive in lowering the sebum level. Many botanical compounds are thought to inhibit 5α-reductase, like Saw palmetto extract, essential fatty acids (γ-linolenic acid,α-linolenic acid, linoleic, and oleic acids), and phytosterols (β-sitosterol) (Hristo, 2007).

It has been reported that *C. decidua* contains β-sitosterol (Mishra et al., 2007; Neelkamal, 2009b; Satyanarayana et al., 2008), fatty acids as well as thioglucosides which release the isothiocyanates or Mustard oils (Dheeraj and Ranjay, 2011). These constituents have the ability to inhibit the enyme 5α-reductase, which may inhibit the excesive sebum secretion (Hristro, 2007). As these constituents are present in *C*. *Decidua*, so they may be responsible for the decrease of sebum values in case of formulation.

Conclusions

This study shows that a cream from the extract of a local desert plant can be formulated; which has the ability to control the excessive sebum secretion and therefore can be used by people having oily and those who have developed acne or seborrhea due to excessive sebum secretion. The main advantage of this cream lies in the fact that it is prepared from the extract of plant and so it is free of the adverse effects of strong antibiotics, steroids or products containing strong chemicals.

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