Preparation of Strong Antidandruff Shampoo Using Medicinal Plant Extracts: A Clinical Trial and Chronic Dandruff Treatment

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Abstract

Background: Nowadays more than half of the populations in the world are suffering from dandruff. Malassezia fungus is an important factor in causing dandruff as it may stimulate cytokine production by keratinocytes (epidermal cells that synthesize keratin) and inflammatory pathways. As dandruff is a hurting issue for people, a lot of efforts are being done for treatment. Many reports based on medicinal plants, seem to be more effective in curing mentioned concern.

Objectives: The aim of this research was to investigate a clinical trial for dandruff therapy by Zinc L-pyrrolidone carboxylic acid (Zinc-PCA) and pirocton olamine in combination with six medicinal plant extracts.

Patients and Methods: In this study, the combination of Punica granatum L, Rosmarinus officinalis L, Matricaria chamomilla L, Urtica dioica L, Mentha piperita L, and Salvia officinatis L methanolic extracts with Pirocton Olamine and Zinc-PCA in the shampoo form were tested on 30 patients with dandruff on hair within a period of two months. Chronic dandruff of 15 patients were highly removed in the second week, 12 other patients suffering from dandruff were seen with dandruff removal after 28 days, while remaining sufferers expressed satisfaction at the end of the fifth week.

Results: Based on the results, medicinal plant extracts have marvelous effects on dandruff removal with fewer side effects, though it takes long time to treat the mentioned concern.

Conclusions: The results show that applying the combination of medicinal plant extracts and natural ingredients with chemical compounds in pharmaceutical industry can optimize treatment.

Keywords: Dandruff, Plant Extracts, Medicinal Plant, Pirocton Olamine, Malassezia

1. Background

Dandruff is characterized as a hyperproliferation of the scalp epidermis accompanied with scalp itching and redness (1). Dandruff mechanism is thought to be the result of the activitiy of enzyme called lipase (2). The Malassezia fungus (cause dandruff) uses this enzyme to break down sebum to oleic acid (pro-inflammatory free fatty acids) (2). Also, this fatty acid penetrates into the top layer of scalp and causes inflammation and increased skin cell flaking, in susceptible people (2, 3). Nowadays many chemical treatments are available for reducing and removing highly resistant dandruff against therapeutc cure, on the other hand, there are many antidandruff productions with poor clinical efficacy in markets (4). Due to these concerns, now days, a great tendency to use medicinal plant extracts is revealed to treat dandruff. Some studies showed that extracts of Punica granatum L, 5, 6), Rosmarinus officinalis L, 7, 8), Matricaria chamomilla L, 9), Urtica dioica L, 10), Mentha piperita L, 11, 12), and Salvia officinatis L remove scalp dandruff, or at least decrease it to high extent. The aim of this study was to investigate the clinical trial for dandruff therapy by Zinc L-pyrrolidone carboxylic acid (Zinc-PCA) and pirocton olamine in combination with the above-mentioned six medicinal plant extracts.

Punica granatum L belongs to the family Punicaceae (13). This plant has been used for thousands of years to cure a wide range of diseases, especially dandruff and scalp inflammation. It is one of the most important endemic plants in Iran (14). Punica granatum L chemical constituents are ellagic acid, ellagitanins (including punicalagins), luteolin, β-sitosterol, icosanoic, linolenic, citric acid, malic acid,
protocatechuic acid, chlorogenic acid, caffeic acid, ferulic acid, coumaric acid, anthocyanins, polyphenols, flavonoids and tannins (15-17). In various studies reported that these chemical compounds have various pharmacological properties, including anti-itching, antidiarrheal, anti-inflammatory (by inhibiting pro-inflammatory cytokines) and antioxidant (18-22). Also they have inhibitory effects on enzymes cyclooxygenase (COX), lipoxygenase (LOX) and Phospholipase A2 (PLA2) (23, 24). As COX and LOX are key enzymes in converting arachidonic acid to prostaglandins and leukotrienes which cause inflammation (25, 26). Also tannin, ellagic acid and phenolic acid in the plant possess antidiarrheal, antifungal and antimicrobial properties (5, 6).

Rosmarinus officinalis L. is native of Mediterranean and related to the family Lamiaceae. This plant grows widely in large areas of southern Europe, northern Africa, England, Mexico and USA. Rosmarinus officinalis chemical compounds include l-cineole (15 - 55%), β and α-pinene (9 - 26%), camphor (5 - 31%), resin, tannic acid, flavonoids, volatile oils consists of borneol (1.5 - 5%), lomonene (1.5 - 5%), comphene (2.5 - 12%) and cineole (27, 28). This plant has traditionally used as an antibacterial and antifungal effective ingredient due to reduce fatty acid peroxidation and inhibit fungi growth in pH = 5 - 6 by membrane damage, related to the loss of ions and membrane potential reduction, collapsing proton pump and ATP depletion (7, 29). Moreover, the antioxidant properties of the R. officinalis methanolic extract is attributed to its phenolic compounds, flavonoids, rosmarinic acid, natural pigments such as capsacin and curcumin, and terpenes such as carnosic acid and carnosol (8, 30).

Matricaria chamomilla L. is an annual plant related to the family Asteraceae and it mainly grows in Europe, Asia and Africa (31). The main constituents of this plant include terpenoids α-bisabolol (56%), luteolin, chamazulene and azulenes that they have properties anti-inflammations by blocking cyclooxygenase enzyme in the synthesis of prostaglandins and inhibit leukotriene formation. Matricaria chamomilla L. components also relieve skin and inhibit fungal growth (32, 33). The other compounds of M. chamomilla are caffeic acid, flavones: apigenin, glycoside, flavonoids: quercetin, rutin, uronic acid and a bitter substance named anthemique acid acts as a great anti-allergic substance. Moreover, studies have shown that the mentioned herb inhibits prostaglandin formation, cyclooxygenase: (COX-1), (COX-2) and central enzymes in pro-inflammatory pathways. As well as it blocks histamine release, based on this fact, its anti-inflammatory effect is revealed (9, 34).

Urtica dioica L. is a perennial plant and belongs to the family Urticaceae. It grows in temperate regions such as Asia, Europe and America. This plant essential oils and extract contains formic acid and acetic acid, histamine, tannins, muclage, vitamins (A, B1, B2 and C), lutein and lycopene have medicinal effects. Interestingly, U. dioica inhibits the 5-alpha-reductas enzyme and promotes blood flow to nourish follicles due to β-sitosterol and ursolic acid (10).

Mentha piperita L. is a perennial and important therapeutic plant that belongs to the family Labiate. The plant is endemic of Europe, although now it is being cultivated all around the world. M. piperita leaves contains 0.5 - 4% volatile oil (50 - 78% free menthol, menthone, monoterpenes and menthofurane) (11, 12, 35). This oil has a notable role in alleviating pain and improving blood flow in the scalp (36, 37). Azulenes, carotenes, coline, essential oil (containing β and α-pinene), cineole, limonene (1 - 5%), flavonoids: menthols (14 - 32%), rosmanic acid and tannins are inhibitory to bacteria, fungi and yeasts (38, 39).

Salvia officinalis L. is a medicinal and aromatic plant belongs to the family Lamiaceae, which is native to Mediterranean countries (39). An important chemical compounds of this plant include linoleic acid, gallic acid, ursolic acid, luteolin and apigenin for removing dandruff and fungus (39, 40). Additionally, rosmarinic acid, caffeic acid, gallic acid, flavonoids, phenol acid, caumarins, tannins (41-44), and 8-cineole, camphor and borneol, possess strong anti-inflammatory, antifungal and antibacterial activities (40, 44) by inhibiting liposomes lipid peroxidation (45). These biological effects act through modulation of signal transduction pathways, inhibiting cyclooxygenases and lipoxygenases (46, 47). In this study, antidiarrheal and anti-inflammatory properties of the mentioned six medicinal plants in combination with two chemical compounds pirocton olamin (PO) and Zinc PCA are being examined on hair with dandruff, in order to evaluate the efficacy of extracts on dandruff removal and reducing chemical side effects.

2. Objectives

The aim of this study was to investigate the clinical trial for dandruff therapy by zinc L-pyrrolidone carboxylic acid (Zinc-PCA) and pirocton olamine in combination with six medicinal plant extracts.

3. Patients and Methods

3.1. Plant Preparation

For this study, flowers of Punica granatum L. (Markazi Province, gardens in Saveh City), Rosmarinus officinalis L. leaves (Mountains near Karaj), Matricaria chamomilla L. flowers (Damavand Province), Urtica dioica L. roots (Shemiranat Province), Mentha piperita L. leaves (forest in northern of Alborz province) and Salvia officinalis L. leaves (heights of Mashhad) were collected between June 2011 and July 2011 and recognized by Herbarium expert of the Pars Azmaye Teb (Cerita) company, based on Flora Iranica. Table 1 shows address of the area of collected plants for the extraction of plant.
3.2. The Plant Extraction Method

Plants were carefully and attentively collected from mentioned places and dried in sheets within a week in clean, dry and dark room. Flowers of *P. granatum*, *M. chamomilla* and *S. officinalis*, leaves of *M. piperita* and *R. officinalis* and *U. dioica* roots were fully separated and milled. In this study, Soxhlet apparatus was used for extraction and according to Tekli et al. method also Rotary evaporation apparatus was used to evaporate methanol (48). Then 15 g of each powder was dissolved in 300 mL methanol 96% (Merck, Germany) and shaken for 24 hours by shaker (KS 130 Control Mixing Orbital Shaker, IKA Company, Germany) after necessary time shaking, these solvents were filtered by Whatman No. 1 and Rotary evaporation (RV 10 Digital Rotary Evaporator IKA Company, Germany) in 90 rpm, 50°C and 15 minutes was used to evaporate methanol, up to 10 mL for preservation in vials in 4°C. For producing pure extracts, methanolic solvents in vials remain under hood for 24 hours till full evaporating and based on musilagic form of extract, DMSO was used to dissolve it and combine it with chemicals.

3.3. Physicochemical Tests

In the present study, the effects of the 6 medicinal plants on dandruff treatment were investigated. Then the physico-chemical parameters such as moisture content, pH (1% aqueous), total ash, acid insoluble ash, alcohol and water soluble extractives, and preliminary phytochemical screening for the presence of alkaloid, flavonoid, glycoside, phenol, saponin and tannin were studied using the standard procedures as follows (49):

- **Moisture content**: 5 g of powdered material weighed accurately in a dry and flat petri dish and the sample was dried in an oven at 110°C (drying was carried out for two days and the loss of weight was calculated in terms of percentage).
- **pH (1% aqueous)**: 1 g of powdered sample was dissolved in 100 mL of distilled water; then was stood for 18 hours and sample was filtered and the pH was checked using a pH meter.
- **Dried weight**: 15 g of each powder was dissolved in 300 mL methanol 96% (Merck, Germany) and shaken for 24 hours by shaker until it to be white. It was cooled in a desiccator, and weighed and finally the content of total ash was calculated in terms of percentage.
- **Acid insoluble ash**: Twenty-five mL of Hydrogen chloride HCl (~ 70 gr/mL) was added to the crucible containing total ash, and was covered with watch glass then boiled gently for 5 minutes. The watch glass was rinsed with 5 mL of hot water and this liquid was added to the crucible. The insoluble matter was collected on an ashless filter paper and washed with hot water. The filter paper containing insoluble matter was ignited in the crucible to constant weight then was cooled in a desiccator. It was weighed and the content of acid insoluble ash calculated in terms of percentage.
- **Alcohol soluble extractives**: Approximately 4 g of air-dried material was weighed accurately in a glass stoppered conical flask and macerated with 100 mL of absolute alcohol for 6 hours (with shaking frequently) then stood for 18 hours. Solution matter was filtered rapidly taking care not to lose any solvent and 25 mL were transferred to a tared flat bottomed petri dish and evaporated to dryness on a water bath and at 105°C for 6 hours. Finally, it was cooled in a desiccator for 30 minutes and weighed and the content of alcohol-soluble matter was calculated in terms of percentage.
- **Alkaloid (Wagner’s test)**: Acidify 1 mL of alcoholic extract of the plants with 1.5% of HCl and add a few drops of Wagner’s reagent (a brown precipitate indicates positive test for alkaloids).
- **Flavonoid**: In a test tube containing 0.5 mL of the alcoholic extract of plants, add 5 - 10 drops of dilute HCl, followed by a small piece of magnesium. Boil the solution for a few minutes (in the presence of flavonoids a pink, reddish pink or brown color is produced).
- **Glycoside**: Dissolve a small amount of alcoholic extract of plants in 1 mL of water and add 1 Normal (N) Sodium Hydroxide (NaOH) and the reddish pink or brown color is produced).
hydroxide (NaOH) solution (a yellow color indicates the presence of glycosides).

Phenols (FeCl₃ test): Dissolve a small quantity of alcoholic extract of plants in 2 mL of distilled water and a few drops of 10% ferric chloride solution (a blue or green color is produced indicates the presence of phenols).

Saponins: Dissolve a small quantity of alcoholic extract of plants in 5 mL of distilled water, shake the mixture vigorously and leave for 3 minutes (honeycomb like froth indicates the presence of saponins).

Resin: Dissolve a small quantity of the methanolic extract of plants in 5 mL of acetic anhydride by means of gentle heat, cool and add a drop of sulphuric acid (a bright purplish red color indicates the presence of resins).

Tannin: To prepare the methanolic extract of plants, add a few drops of 5% aqueous ferric chloride solution (a bluish black color indicates the presence of tannins).

The slight variation in physicochemical and phytochemical results may be due to several factors such as different geographical conditions, edaphic factors, environmental conditions, period of cultivation and harvesting, method of collection, source of irrigation and fertilizers, age of the plant, powdering method, and extraction method. Table 2 and 3 show the results of the physico-chemical study.

### 3.4. Determination of Extraction Yield (% yield)

The yield (% w/w) from all the dried extracts was calculated as:

\[
\text{Yield (\%)} = \left( \frac{W_1 \times 100}{W_2} \right)
\]

Where \(W_1\) is the weight of the extract after lyophilization of the solvent, and \(W_2\) is the weight of the plant powder. Table 4 shows the percentage extract yield of medicinal plants.

<table>
<thead>
<tr>
<th>Table 2. Results of the Physico-Chemical Study(^a)</th>
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<tbody>
<tr>
<td>Name of plant</td>
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<tr>
<td>----------------</td>
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<tr>
<td>Punica granatum L.</td>
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<tr>
<td>Rosmarinus officinalis L.</td>
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<tr>
<td>Matricaria chamomilla L.</td>
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<tr>
<td>Urtica dioica L.</td>
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<tr>
<td>Mentha piperita L.</td>
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<td>Salvia officinalis L.</td>
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</table>

\(^a\)Data are presented as gram.

<table>
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<td>Mentha piperita L.</td>
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<td>Salvia officinalis L.</td>
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\(^a\)Percent by weight-weight (%w/w).

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<th>Table 4. The Extract Compounds of Used Medicinal Plants(^a)</th>
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\(^a\)(+), There active ingredient; (-), Absence of active ingredient.
3.5. Producing Shampoo With Necessary Materials for Assaying in Trial

A basic shampoo containing methanolic extract of *P. granatum*, *R. officinalis*, *M. chamomilla*, *U. dioica*, *M. piperita*, *S. officinalis* (each of them 0.1% V/V) were combined with sodium laureth sulfate 70% (10% V/V) and panthenol (0.3% V/V) and polyquaternium-10 (0.5 V/V) sigma aldrich, (USA) also salicylic acid (1% V/V) and disodium-ethylenediaminetetraacetic acid (EDTA) (0.3% V/V) and triethanolamine (0.2 V/V) and methylchloro isothiazolinon (0.1 V/V) and butylene glycol (0.2 V/V) (Merck, Germany), cocamido propyl betaine 30% (7% V/V) and cocamide diethanolamine (DEA) 85% (12% V/V) (bought from Iranian Chemical Process Company), finally deionized water (100% V/V) (provided in Department of Pilot Nanobio Technology- Pasteur Institute of Iran), which were provided according to standards of shampoo in Iran. In the next step, PO 1% and zinc-PCA (Sigma Aldrich, USA) were added to the basic formulation for preparing new antidandruff shampoo (viscosity of about 8000 cp and pH = 5.5). The type of extracts, concentration and other ingredients in the shampoo is selected according to national and international standards (USP) and Institute of Standards and Industrial Research (FCC or CFR) in Iran.

All clinical trials were assessed based on terminology, and defined in the ICH E8 guidance (50) and safety pharmacology and pharmacodynamic (PD) studies have been defined ICH S7A (51). Also, for ethical approval of studies and human experimental investigations used from principles outlined in the Declaration of Helsinki (World Medical Association) (52, 53). The ethical principles are emphasized to select and participate voluntary patients and the responsibility of research subjects protection by physician or other health care also is mentioned the primary propose of medical research for human subjects such as understanding the causes, development and effects of diseases and improving preventive, diagnostic and therapeutic interventions. Therefore, in this study, even the smallest interventions evaluated continually through research for patients’ safety, effectiveness, efficiency, accessibility and quality of treatment. Also, performance of each research study on patients described clearly in a research protocol (This protocol include personal information, incentives for treatment, assessment of predictable risks; improvement in treatment etc.). Finally, every precaution was taken to protect the privacy of research subjects and the confidentiality of their personal information and minimize the impact of the study on their physical, mental and social integrity.

3.6. Antidandruff Assay

Thirty patients (13 males and 17 females, ages 15 to 60 years) suffering from dandruff were randomly selected and asked to apply this combination in the form of PZ shampoo. Patient’s characteristics are given in Table 5. This experiment lasted 2 months by applying shampoo 3 times a week. Results were closely investigated to evaluate any symptoms of chemical side effects or any dandruff removal or reduction.

3.7. Statistical Analysis

In this study, the SPSS software version 17.0 was used to achieve the results and box plots and mean of dandruff removal plotted. Effectiveness of Shampoo was evaluated during 8 weeks and all 30 patients were carefully checked. The results were statistically significant and a dandruff parameter during 5 weeks was completely removed (box plots shows the issue). In addition, a table of descriptive statistics for better analysis of parameters was plotted, which is showing mean of dandruff decrease and treatment per week (for a series of studies).

4. Results

A total of 13 males and 17 females, enrolled in the study, were closely examined. Results showed remarkable dandruff decrease and itching in the first week. Dandruff was highly removed (approximately it turned to half amount) in 15 people during first week, In fact, about 43% of dandruff were reduced in this week and fully dandruff removal was occurred in the same group during the next 7 days. Other 12 sufferers feel free of dandruff and itching in 1 month (98% of dandruff was treated after about 4 weeks); while 3 remained patients expressed their satisfactory after 5 weeks. Result and investigation about dandruff removal is shown in Figure 1.
In Figure 2, the dandruff removal accelerating rate is being shown in order to assess the efficacy of treatment due to combining plant extracts and chemical compounds during the two-month experiment. The line slope in this figure shows reduction of dandruff. Which in the third week, about 90% were treated and in the fifth week, this amounts increase to 100%. All 30 patients were closely assessed even after full treatment and satisfaction, till 2 months to be highly sure about nonreturning disease condition. Table 6 shows the average in dandruff removal among 30 sufferers during two months.

Based on the above-mentioned table, all 30 sufferers were remained in the experiment during two months. Assessment of dandruff removal mean rates in each week showed the reduction of hair dandruff.

### Table 6. Mean of Removing Dandruff, During 8 weeks

<table>
<thead>
<tr>
<th>Week</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.00</td>
<td>100.00</td>
<td>43.0000 ± 21.03</td>
</tr>
<tr>
<td>2</td>
<td>40.00</td>
<td>100.00</td>
<td>78.33 ± 23.50</td>
</tr>
<tr>
<td>3</td>
<td>60.00</td>
<td>100.00</td>
<td>89.00 ± 12.96</td>
</tr>
<tr>
<td>4</td>
<td>80.00</td>
<td>100.00</td>
<td>98.33 ± 4.61</td>
</tr>
<tr>
<td>5</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00 ± 0.00</td>
</tr>
<tr>
<td>6</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00 ± 0.00</td>
</tr>
<tr>
<td>7</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00 ± 0.00</td>
</tr>
<tr>
<td>8</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00 ± 0.00</td>
</tr>
</tbody>
</table>

\*Dandruff treatment percentage.  
\*Valid N (listwise) = 30.

### 5. Discussion

Chemical ingredients are highly effective for treating dandruff, though they have many side effects. On the other hand, medicinal plant extracts with great impact as antidualuff and anti-itching has been shown during centuries, with no side effects, but long-term treatment time needs sufferer’s patience. Base on this fact, \( PZ^+ \) a highly effective shampoo, combination of 2 scientific sides-chemicals and natural ingredients have been produced to reach the best results. In this product, Zinc-PCA and PO have been combined with 6 plant extracts including \( P. \) *granatum*, \( R. \) *officinalis*, \( M. \) *chamomilla*, \( U. \) *dioica*, \( M. \) *piperita* and \( S. \) *officinalis*.

The zinc-PCA is a combination of zinc and PCA (obtained by cyclization of the L-glutamic acid, amino acid by vegetable origin). This compound reduces unwanted sebum and antidualuff also inhibits activator protein-1 production (involved in producing collagenase and collagen degradation). In addition, PO is an effective antidualuff active which its solubility in cosmetic products depends on pH = 5 – 8. This component is antidualuff, antibacterial and antifungal due to its effect on the yeast cell division. Also, PO is an antifungal ingredient as it inhibits the sodium-potassium channel and reduces dandruff.

Chemical compounds have great influence on removing dandruff; however, inflammation as a side effect is hurting patients. For removing this concern and enhancing the effectiveness, using plant extracts is revealed in pharmaceutical industry. These plants extracts, not only remove dandruff, but also prevent itching and inflammation with no side effects but needs long-term treating persistence.

\( P. \) *granatum* (includes ellagic acid and \( \beta \)-sitosterol) (15, 16), \( R. \) *officinalis* (1, \(- 8\)-cineole and \( \alpha \) and \( \beta \)-pinene) (27, 28) and \( S. \) *officinalis* (by having apigenin, ursolic acid, gallic acid and tuteolin) possess antidualuff and antifungal properties (39, 40) In addition, caffeic acid and phenolic acid in 2 latter plants decrease chemical side effects and improve treatment while combined with chemicals.

The outstanding point in this combination is due to an anti-inflammatory factor and reduction in chemical adverse side effects. Menthol in \( M. \) *piperita* makes scalp cool and inhibits redness and inflation (36). Also, \( M. \) *chamomilla* by having \( \alpha \)-bisabolol as anti-inflammation, blocks cyclooxygenase enzymes involved in synthesizing prostaglandins and inhibits leukotrienes formation to prevent redness and it is used as anti-inflammation (32, 33). Interestingly, \( P. \) *granatum* with umaric acid is highly effective to reduce inflammation, which is caused by dandruff and chemical ingredients (23, 24), also, several studies are shown that plants contain \( \beta \)-sitosterol such as \( U. \) *dioica* by blocking enzyme \( 5\alpha \)-reductase and no chance to for testosterone to turn into \( DHT \) and this will control hair loss (10). One more addition is due to combining 2 chemical ingredients PO and Zinc-PCA that can optimize
fast dandruff removal. To sum up, herbal extracts are compounds which enhance antideruff, anti-itching and anti-inflammatory impacts and inhibit probable adverse side effects of chemicals to increase positive medicinal treatments. Hopefully, it will be great if researchers find out other methods and other medicinal herbal extracts for removing dandruff accompanied with chemical substances. Therefore, it should be said in PZ*, herbal extracts such as Punica granatum has effective antideruff properties due to punicalagin, also β-sitosterol and ellagic acid are anti-itching and anti-inflammatory compounds. On the other hand, cineole and α-pinene in Rosmarinus officinalis reduce fatty acid peroxidation, results to fungi growth inhibition in pH 5 - 6. Interestingly, α-bisabolol and luteolin, as anti-inflammations, inhibit cox-1, cox-2 and prostaglandin synthesis, in addition, azulene and coumarin inhibit histamine release. Ursolic acid in Urtica dioica and mentol in Mentha piperita respectively, inhibits 5-α-reductase and promotes blood flow to nourish follicles. To conclude, combination of Zinc-PCA and PO augment resistant dandruff inhibition and herbal extracts reduces chemical side effects; furthermore, it can increase therapeutic effectiveness.

Dandruff is the mild seborrhea usually shows greyish white flakes of skin on the hair and shoulders (these flakes are "oily" or "dry"). Also, this disease may be caused by several different factors such as increased sebum, androgenic, hormonal imbalances, stress and seasonal allergics. The most common symptom of dandruff includes small white flakes. In modern and effective dandruff treatment, herbal extracts with better effectiveness and fewer allergic. The most common symptom of dandruff includes small white flakes. In modern and effective dandruff treatment, herbal extracts with better effectiveness and fewer side effects have been used in cosmetic and pharmaceutical industry. The current study was conducted in the research company of Pars Azmaye Teb (Cerita) which leads to produce and manufacture a highly effective antideruff shampoo PZ* to control and remove these white flakes. In modern and effective dandruff treatment, combination of useful chemical ingredients (PO and Zinc-PCA) and extracts of the medicinal herbs is an outstanding soluble to treat this concern, run by the aforementioned research company.

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References


27. European Pharmacopoeia 25.


