Effects of *Linum usitatissimum* L. ingestion and oil topical application on hair growth in rabbit

BEROUAL K.¹, MAAMERI Z.¹, HALMI S.¹*, BENLEKSIRA B.¹, AGABOU A.³, HAMDI PACHA Y.¹,²

¹Laboratory of Toxicology and Pharmacology, Veterinary Science Institute, University of Constantine 1, Algeria
²National Superior School of Veterinary, Algeria
³PDESCA Laboratory, Veterinary Science Institute, University of Constantine 1, Algeria

Article History: Received 27th October 2013, Revised 17th December 2013, Accepted 18th December 2013.

Abstract: Flax (*Linum usitatissimum*) is an annual plant of the linaceae family with several biological properties such as an indirect effect on hair regrowth through the intermediary of γ-glutamyl transpeptidase. The aim of this study was to investigate its effect on hair growth process in rabbits. Two trials were carried out using two plant forms and administration routes: oil topical application and seed ingestion. For each trial animals were assigned into two groups, a control and a tested one. A 10cm/10cm area on the back of each rabbit was limited and every four weeks, 10 hairs were plucked to measure their lengths and widths, then the hair of the whole limited area was shaved and weighed. After 4 weeks of use, linseed oil topical application has a significant positive effect on hair width (39.00 µm against 27.2 µm for the control group). Like linseed oil application, the linseed supplementation showed a significant (P<0.10) beneficial effect on hair width, this effect appeared at the 12th week of ingestion, and did not stopped 04 weeks after (P<0.5) supplementation withdraw. Both seed and oil had no significant positive effect on hair length and weight. These results suggest that flaxseed oil has some hair growth promoting potential. The mechanism of action, and the plant component(s) responsible of this activity, should be investigated.

Keywords: Linseed, ingestion; linseed oil; topical application; hair growth; rabbits.

Introduction

Phytotherapy is based on the use of herbal remedies to treat and prevent diseases in humans and animals. Nowadays, the importance of phytotherapy is increasing. Many patients prefer herbal medicines and especially value their good tolerability and low side effects profile. Furthermore, herbal medicines are now approached far more scientifically (Eichele 2010).

Alopecia, or hair loss, is a common and often distressing problem. Actually, no treatment can completely cure alopecia except the hair-transplants technique indicated in rebellious and advanced alopecia cases (Clere 2010).

Various works have been undertaken to document a variety of medicinal plants used to improve hair growth in several animal species: *Hibiscus rosa-sinensis* (Adhirajam ,et al., 2003), *Asiasari radix*; (Rho ,et al., 2005), Amla (fruits of *Embelica officinalis*), Brahmi (leaves of *Bacopa monnieri*), Methi (seeds of *Trigonella foenumgraecum*), Meetha Neem (*Murraya koenigii*), *Hibiscus rosa sinensis* flowers, (Purwal ,et al., 2008), Banerjee ,et al., 2009), raspberry (*Rubus idaeus*) (Harda ,et al., 2008), *Eclipta alba* (Roy ,et al., 2008), *Russelia equisetiformis* (Awe and Makinde, 2009) and *Abrus precatorius* (Upadhyay ,et al., 2012)

Flax (*Linum usitatissimum*) is an annual plant of the family Linaceae. It is an oilseed produced in more than 50 countries mainly in the northern hemisphere. It contains about 40% Lipids (most of them Omega-3 fatty acids), 30% dietary fibers and 20 % protein (Rubilar et al., 2010). After oil extraction from seeds, the linseed meal is used as a supplement in animal
feeds (Cattles, rabbits) (Benatmane et al., 2010; Bouchard 2010).

Flax showed several biological effects like anti-inflammatory and antimicrobial properties used successfully in mastitis and skin lesions treatment (O’Neill et al., 2002). Its fixed oil has interesting analgesic and antipyretic activities (Kaithwas et al., 2011).

The aim of this study is to investigate the effect of linseed ingestion and oil topical application on hair growth.

**Materials and methods**

Experiments procedures used in this study were approved by the scientific council of the Institute of Veterinary Sciences (University of Constantine1. Algeria) and conform to the guidelines of animal care and use in research and teaching.

**Vegetal material**

Linseed and linseed oil were purchased from a local herbalist. Specimens of the two products are deposited at the laboratory of pharmacology-toxicology-Institute of veterinary sciences, University of Constantine (Algeria).

**Animals**

The experiments have been carried out on male New Zealand rabbits, weighing approximately 2.5 Kg and aged 06 months.

Animals were kept in individual standard cages in the same room and under the same environmental conditions (temperature, relative humidity and hygiene practices). Each morning they received 180g of standard rabbits chow during an acclimatization period of 07 days.

**Experimental design**

At the beginning, a limited skin zone (of 10cm/10cm) was shaved on the back of each rabbit.

Two separate trials were conducted:

The first trial was undertaken (during 04 weeks) to evaluate the effect of linseed oil topical application (LSOA) on hair growth. Animals were divided into two groups. The first group (04 rabbits) served as control group (CRLo) without any applications while those of the second group (04 rabbits) served as tested group (LSOA group) with 01 ml of linseed oil applied daily on their shaved areas (described above).

The second trial is designed to evaluate the effect of linseed Ingestion on hair growth during a 16 weeks period. Animals were divided into 02 groups. The first group (08 rabbits) did not receive any feed supplement and served as control (CRL4 group), the other one (09 rabbits) served as tested group and daily received the same feed as the previous group but supplemented with 3g of crashed linseed (LSI group) during 12 weeks. At the end of this period meal supplementation has been stopped and the kinetic of linseed effects was studied till the 16th week.

**Hair samples**

For all groups, hair was sampled every 04 weeks. 10 hairs were plucked with a pair of tweezers to measure their lengths and widths using respectively a ruler and a scaled micrometer, and then hair was shaved from the delimited area and weighed with a high precision balance (0.001g sensitivity. Kern PLS 510-3N. Germany).

**Statistical analysis**

Results are expressed as Mean. Statistical significance was determined using student t-test. Otherwise, the Wilcoxon T-test was used when data are not normally distributed with unequal variance. The software Matlab v7.7.0.2162 (Release 2008b) was used.

**Results**

**Effect of linseed oil topical application on hair growth**

The effects of Linium usitatissium on hair growth in rabbit

http://www.openaccessscience.com

ijmap@openaccessscience.com
During 48 hours following linseed oil application, animals were observed to detect any skin irritation. Linseed oil application did not cause any erythema or edema (as indicated by UNO H, 1991); this attests that linseed oil is non irritant to rabbit skin.

After 04 weeks of topical application, linseed improved hair width but not hair length and weight. A decrease in hair length was observed in LSOA group, while its width has significantly increased compared to the CTL group (α<9%) (Table 1).

**Table 1: Hair characteristics after 04 weeks topical application.**

<table>
<thead>
<tr>
<th>Hair</th>
<th>Length (cm)</th>
<th>Width (µm)</th>
<th>Weight (gr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL&lt;sub&gt;i&lt;/sub&gt;</td>
<td>2.72</td>
<td>27.17</td>
<td>0.77</td>
</tr>
<tr>
<td>LSOA</td>
<td>2.38</td>
<td>39.00</td>
<td>1.17</td>
</tr>
<tr>
<td>P value</td>
<td>0.74</td>
<td>0.086</td>
<td>0.39</td>
</tr>
</tbody>
</table>

**Effect of linseed ingestion on hair growth**

**Hair length**

Compared to the control group, linseed ingestion had no beneficial effect on hair length during the 12 weeks of ingestion and 04 weeks after supplementation withdraw. A significant transient positive effect was recorded in LSI group at the 8<sup>th</sup> week compared the 4<sup>th</sup> one (Table 2).

**Table 2: Mean hair length (cm).**

<table>
<thead>
<tr>
<th></th>
<th>4 weeks</th>
<th>08 weeks</th>
<th>12 weeks</th>
<th>16 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL&lt;sub&gt;i&lt;/sub&gt;</td>
<td>1.73</td>
<td>2.74</td>
<td>2.32</td>
<td>2.72</td>
</tr>
<tr>
<td>LSI</td>
<td>1.66*</td>
<td>2.08*</td>
<td>2.04</td>
<td>2.15</td>
</tr>
<tr>
<td>P value</td>
<td>0.64</td>
<td>0.99</td>
<td>0.80</td>
<td>0.81</td>
</tr>
</tbody>
</table>

*P=0.006, α< 1%

**Hair width (diameter)**

During the first 08 weeks, hair mean width has linearly decreased in the two groups. The slight beneficial effect of supplementation was significant (α<10%) after 12 weeks of intake. However, this effect didn’t last; since it stopped 04 weeks after supplementation withdraw (corresponding to the 5<sup>th</sup> hair harvest) (α<5%) (Table 3).

**Table 3: Mean hair width (µm).**

<table>
<thead>
<tr>
<th></th>
<th>4 weeks</th>
<th>08 weeks</th>
<th>12 weeks</th>
<th>16 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL&lt;sub&gt;i&lt;/sub&gt;</td>
<td>49.90</td>
<td>45.32</td>
<td>32.60</td>
<td>27.20</td>
</tr>
<tr>
<td>LSI</td>
<td>50.09</td>
<td>37.06</td>
<td>40.30</td>
<td>38.00</td>
</tr>
<tr>
<td>P value</td>
<td>0.44</td>
<td>0.93</td>
<td>0.096</td>
<td>0.048</td>
</tr>
</tbody>
</table>

**Hair weight**

As for hair width, after 12 weeks ingestion, hair weight, showed a non significant beneficial effect of linseed which continued 04 weeks after supplementation withdraw. At that time, hair weight showed an acute decrease. A very significant positive effect (α<2%) was recorded at the 2<sup>nd</sup> hair harvest compared to the 1<sup>st</sup> one. This effect vanished soon after (Table 4).

Results of the two administrations routes (ie 4 weeks of linseed oil topical application and 12 weeks of linseed ingestion) were compared. Oil application is significantly (α<4%) more effective in promoting hair length than the ingestion of the seeds (Table 5).

**Table 4: Mean weight (g) of shaved hair.**

<table>
<thead>
<tr>
<th></th>
<th>4 weeks</th>
<th>08 weeks</th>
<th>12 weeks</th>
<th>16 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTL&lt;sub&gt;i&lt;/sub&gt;</td>
<td>1.25</td>
<td>2.05</td>
<td>0.47</td>
<td>0.77</td>
</tr>
<tr>
<td>LSI</td>
<td>0.54*</td>
<td>1.47*</td>
<td>0.68</td>
<td>0.24</td>
</tr>
<tr>
<td>P value</td>
<td>0.95</td>
<td>0.77</td>
<td>0.30</td>
<td>0.75</td>
</tr>
</tbody>
</table>

* P=0.01

**Table 5: Hair characteristics with tow use application.**

<table>
<thead>
<tr>
<th></th>
<th>Length (cm)</th>
<th>Width (µm)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSOA*</td>
<td>2.38</td>
<td>39.00</td>
<td>1.17</td>
</tr>
<tr>
<td>LSI</td>
<td>2.04</td>
<td>40.30</td>
<td>0.68</td>
</tr>
<tr>
<td>P value</td>
<td>0.035</td>
<td>0.55</td>
<td>0.40</td>
</tr>
</tbody>
</table>

**Discussion**

Several authors reported that fur quality depends on some factors such as gender, environmental conditions, season, photoperiodism and sampling method (shaving or depilation) (Charlet-Lery et al., 1985; Rochambeau and Vrillon, 1985). This is why animals used in this study were of the same sex and breed, and kept at the same environmental conditions and during the same season.
The important results of our study are mainly obtained with linseed oil topical application and at a lesser degree with linseed ingestion, which showed effect. Linseed ingestion improves hair weight and insures a continuous effect once supplementation is withdrawn.

The exact mechanism of action or the component(s) of flaxseed and flaxseed oil that promote the hair growth could not be established in this study. However, it was shown that flaxseed chutney diet doesn’t affect γ-glutamyl transpeptidase load (Faseehuddin and Basavaraj, 2007). This microsomal enzyme is an indicator of hair growth (associated to alkaline phosphatase) (Kang Bong, et al., 2011)

Furthermore, hair growth is inhibited by the administration of paracrine growth factors such as EGF (epithelial Growth factor) (Tsuboi, 1997). This latter is inhibited by flaxseed use (Tan, et al., 2004).

In addition, the ALA (alpha linoleic acid) in flaxseed oil can help in inhibiting the 5 alpha reductase type 2 enzyme, responsible of converting testosterone into dihydrotestosterone (DHT). This male hormone shrinks hair follicles and changes cyclic phase of hair growth cycle (Galcer 2002; Brenner 2003); all these studies may explain the beneficial effect observed in our experiments.

Conclusion

Linseed ingestion has a slight beneficial effect on hair width, this result was more interesting with linseed oil topical application, however, the right dosage should be determined. The use of this plant may be a promising treatment for alopecia and baldness but more studies are necessary to assess its effects on skin histology, hair structure and chemical composition. Furthermore, the exact mechanism of action, and the plant’s component(s) responsible of this activity, should be investigated.

Acknowledgements: Authors are thankful to Dr. Beghoul S. and Beroual L. for their assistance during the implementation of the experiments and also to Dr. Abdeldjelil M.C. for his help in reviewing this article.

References


Effects of Linium usitatissium on hair growth in rabbit

Beroual et al.

Int. J. Med. Arom. Plants

Effects of Linium usitatissium on hair growth in rabbit


