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# Pharmacological aspect of *Linum usitatissimum*: Flax ingestion on hair growth in rabbits

Beroual K.<sup>1</sup>, Halmi S.<sup>2</sup>, Maameri Z.<sup>1</sup>, Benlaksira B. S.<sup>1</sup>, Agabou A.<sup>3</sup>, Chibat M.<sup>3</sup> and Hamdi Pacha Y.<sup>1</sup>

<sup>1</sup>Laboratory Pharmacology & Toxicology, Institute of Veterinary, University of Constantine1, Algeria

<sup>2</sup>Biotechnology Research Center, Constantine, Algeria

<sup>3</sup>PADESCA Laboratory, Veterinary Science Institute. University of Constantine 1, Algeria

## ABSTRACT

Flax is not a new food. It is actually one of the older and, perhaps, one of the origin foods," treasured because of its healing properties throughout the Roman Empire. The following study aims to assess the quantitative effects of linseed (flaxseed) (*Linum usitatissimum*) on hair growth in rabbits and also to study its safety. A trial has been conducted on adult New-Zealand rabbits according to the ingestion of ground flaxseed, animals were divided into control and test groups. Weekly, rabbits were weighed and each month hair was taken from a same delimited area on their backs, blood samples were also analyzed. Results showed a slight increase in mean live weight (+3%) and a significant decrease in glycemia (-9%) and cholesterolemia (-22%) in the group fed daily with ground linseed compared to control one. These findings are similar to those reported in the literature. However, our results related to the trichogen effects are original. An increase in hair length (+26%) was observed in the third month (2.04±1.23cm) with a slight positive effect (+7%) on hair diameter (40.25±22.1µm). Mechanisms of the beneficial effects of flaxseed on hair growth are yet to be determined, knowing that a study on rats showed that flaxseed chutney diet doesn't affect  $\gamma$ -glutamyl transpeptidase load. This microsomal enzyme is an indicator of hair growth (associated to alkaline phosphatase). Along with investigating mechanisms of action more are needed to determine the right doses and frequency of use while taking into account the seasonal variations in hair growth.

**Keywords:** Linseed ingestion, safety, hair growth, rabbit.

## INTRODUCTION

*Linum usitatissimum* (Linn.), commonly known as flaxseed or linseed belongs to the family Linaceae. The flax plant is not a new crop and is native to West Asia and the Mediterranean. As the source of linen fiber, flax has been cultivated since at least 5000 BC [1]. It contains about 40% Lipids (most of them Omega-3 fatty acids), 30% dietary fibres and 20 % protein.

After oil extraction from seeds, the linseed meal is used as a supplement in animal feeds [2]; Cattle, sheep [3], horses [4], [5], rabbits [6], poultry, turkey [7]; and pig [8].

On the other hand, the biological and mainly the pharmacological values of this plant have not been well studied especially in our country.

The principal objectives of this research are to contribute to a better understanding of the effects of linseeds ingestion on hair growth in rabbits and its safety.

## MATERIALS AND METHODS

### Animals and husbandry

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 1 (Algeria).

### Animals

The experiments have been carried out on 16 New Zealand rabbits, weighing approximately ( $2.5 \pm 0,05$  Kg) and aged between 24-32 weeks.

They 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 the same feed during an acclimatization period of 07 days.

The experimentation was conducted for 12 weeks.

### Experimental design

- The Effect of linseed ingestion on hair growth (during 12 weeks): animals were divided into 02 groups. The first group did not receive any feed supplement and served as control (CRL<sub>i</sub> group), the other one served as test group and received the same feed as the previous group but supplemented with 2.5% of crashed linseed (LSI). For two groups, monthly, hair was shaved on a limited zone (of 10cmx10cm) on each rabbit's back. Prior to shaving a lock was sampled with a clamp to measure the length and the width of 10 hairs using respectively a ruler and a scaled micrometer (with 10 objective magnifications). Hair from the shaved zone was weighed with a high precision balance then conditioned in labeled plastic bags.

- The safety of repeated and prolonged linseed ingestion: Weekly, rabbits were weighed at the same day and the same hour before feed distribution. Blood samples were also taken each month, on heparinized tubes from the marginal ear vein of rabbits (using vacutainer system). Plasma was obtained by blood centrifugation at 3000 rpm for 5 min and then kept at -20° C until used for analysis to dose the following blood parameters:

Glycemia (GLU), Cretinemia (CREA), Uremia (URE), Albuminemia (ALB), Bilirubinaemia (BIL), Total protein (TP), glutamic pyruvic transaminase (GPT), glutamic oxaloacetic transaminase (GOT), cholesterolemia (CHOL) and triglycerides (TRI).

To compare the results of the different groups the Student *t* test was computed after testing their normal distribution (*K2* test) and equality of variances (Fisher's test): (data not shown)

## RESULTS AND DISCUSSION

### - Effect of linseed ingestion on hair growth

\* **Lock length:** The results reveal an effect of linseed ingestion only at the 2<sup>nd</sup> month with length instability in the two groups (Table 1). An increase of 34% against 26% has been recorded respectively at the end of the experiment compared to J<sub>30</sub> and 3.5% against 7.3%, compared to the original dimensions (J<sub>0</sub>)

Table 1: Mean hair length (cm)

	J0	J30	J60	J90
CTLi	2.240±0.940	1.737±0.689	2.692±0.606	2.325±1.026
LSI	1.900±0.8815	1.655±0.735	2.080±0.618	2.043±1.233

\* **Lock width (diameter):** the lock mean width has linearly decreased in the CTLi group and a little less in the LSI group with a diet effect from the second month attesting a positive effect of the linseed ingestion on hair width at the end of the experimentation (07% increase).

Hair length and width variability in this first trial demonstrate that the ingestion of the linseed doesn't block body hair physiological cycle and stimulate it slightly, since there is a positive effect on hair width and a reinforcement of its length from the second month.

**Table 2: Mean hair width ( $\mu\text{m}$ ) sampled before each shaving**

	J0	J30	J60	J90
CTLi	50.00 $\pm$ 24.36	48.00 $\pm$ 32.61	45.50 $\pm$ 17.60	32.58 $\pm$ 19.67
LSI	54.88 $\pm$ 27.74	50.88 $\pm$ 28.02	37.61 $\pm$ 25.69	40.25 $\pm$ 22.10

\* **Hair weight:** there was an important variance in hair weight between the two groups but the effect of linseed ingestion on hair weight was very marked.

**Table 3: Mean weight (g) of shaved hair**

	J0	J30	J60	J90
CRLi	3.89 $\pm$ 1.43	1.24 $\pm$ 0.87	2.04 $\pm$ 1.89	0.46 $\pm$ 0.47
LSI	3.92 $\pm$ 0.80	0.53 $\pm$ 0.53	1.47 $\pm$ 0.77	0.88 $\pm$ 0.92

According to [9], hair growth increases 6 to 7 weeks after depilation then it becomes specific to each hair kind after 9 to 13 weeks. 2 to 3% of hair lengths will be superior to the others and belong to a different tylotrich population.

Several authors reported that fur quality depends on some factors such as: gender, environmental conditions, season, photoperiodism, kind of harvest (shaving or depilation) [10, 11]. This is why we have chosen the animals of the study (males belonging to the same breed, kept at the same environmental conditions and during the same season for the first trial).

Our results are in concordance with those reported by [12], who confirms that hair follicle is the only stable cutaneous appendage with its asynchronous stochastic cyclicity.

The most important results of our study are mainly obtained with linseed oil skin-application and at a less degree with linseed ingestion. However, it was shown that flaxseed chutney diet doesn't affect  $\gamma$ -glutamyl transpeptidase load [13]. This microsomal enzyme is an indicator of hair growth (associated to alkaline phosphatase) [14], all these studies may explain the beneficial effect observed in our experiments.

#### - The safety of repeated and prolonged linseed ingestion: weight and blood parameters

As it is shown in table 4, a relative weight increase has been recorded in rabbits receiving a diet supplemented with crashed linseed.

**Table 4: Mean rabbits weight (kg) at the beginning and the end of the trails**

	J0	J90	Yield %
CRLi	2.50	3.10	+24
LSI	2.53	3.11	+22

Mean concentration of the blood parameters seem to be less important in the LSI group than the control one (Figure 1).

A decrease of 9% and 22% was recorded in glycemia and chloeterolemia respectively.

Modifications of blood parameters (following linseed ingestion) founding are in concordance with those recorded by [15] and [16].

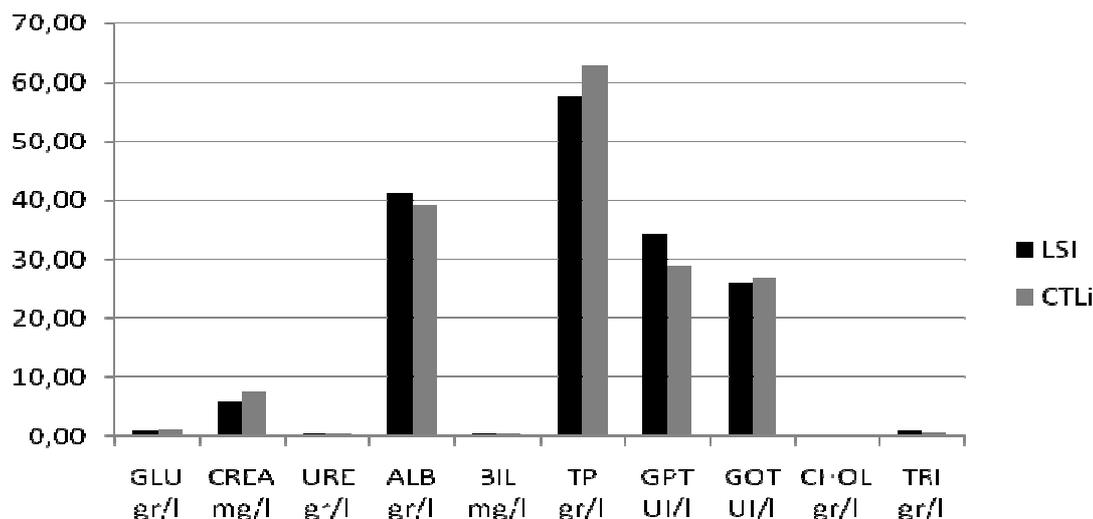


Figure 1: Variations of blood parameters in the LSI group and the control one.

### CONCLUSION

At the end of our study, some observations have been made, both on fundamental and practical aspects:

- Our results show that repeated and prolonged linseed ingestion is safe, however more investigations must be undertaken to study its chronic toxicity on organs (liver, kidney) using histological studies.
- Linseed ingestion has a positive effect on hair density. More studies are necessary to assess its effects on hair structure, morphology and chemical composition.
- More trials must be initiated during several seasons to adjust the right dose of ingested linseed.

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