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## RESEARCH ARTICLE

# A PRELIMINARY STUDY OF LIPID IN THE WOOL FIBRE OF DOMESTIC GOAT

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**ABSTRACT**

The aim of the study is to determine the total external lipid present in the wool fibre of goat. Different types of organic solvents such as methanol, chloroform, hexane and petroleum ether were used for extracting the lipids. The amount of lipid present in the chloroform:methanol mixture was about 0.82% to that of wool fibre of goat. The lipid figured from the methanol extract is much lower and is approximately 0.44%, considering the hexane and petroleum ether extract, the quantity of lipid is about 0.72% and 0.68% respectively. It was found that correlated with other solvents, the chloroform: methanol mixture (2:1) were capable of extracting polar, non-polar and neutral lipids attached to the wool fibre of goat.



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## INTRODUCTION

In spite of the discovery of synthetic fibres, natural fibres still have significant demand in the world market. By far, wool, an animal fibre from sheep is an important raw commodity in the textile industry and it has some forensic importance also. The quality of wool is being determined by the following factors such as diameter, crimp, strength and colour. Wool, a multicomponent fibre, is composed of proteins, lipids, carbohydrates, nucleic acids and mineral salts (Zahn, 1977 and Zahn *et al*., 1991). Histological studies revealed that a wool fibre is built up of two types of cells i.e., cortical cells and cuticle cells, which are connected together by means of cell membrane complex (CMC) (Leeder, 1986). The outer layer of wool fibre is made of cuticle cells and it account for about 16% of its total weight (Simpson, 2002). The cortical cells, ie orthocortex and paracotex form the core of the wool fibre. According to Simpson (2002) the cortical cells assembles to form macrofibrils, which in turn made of microfibrils. The outer cuticular layer in turn is composed of four different layers such as epicuticle, exocuticle and endocuticle. The detailed analysis of epicuticle in the wool fibre showed that layer is rich in protein and negligible amount of carbohydrate (Phan and Eurotex, 1991).

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The Proteins in the exocuticle had cystine rich amino acids and showed highest degree of cross-linking also. But the non keratinous endocuticlar layer was found to be permeable to water and other reagents (Simpson, 2002, Rippon 1992). The proteinaceous cuticular layer is covered by a thin layer of lipids (Naebe *et al.,* 2010). Wool grease is synthesized and secreted from the skin of sheep and form a layer around the growing woolfibre. Leeder (1986) investigated the chemical nature of mechanically weak cell membrane complex, which were rich in lipids and proteins. Korner *et al.* (1992) extracted lipids from the intact fibre using choloroform/methanol. It was found that the extracted lipid contain lauric, myristic, palmitic, oleic, stearic, arachidic, behenic, lignoceric and cerotic acid and 18-methyl-eicosanoic acid. Moreover, proteineous materials with hydrophobic amino acid residues have been reported from the lipid extract. A separate analyses on the chemical characteristics of external and internal lipids of wool revealed that the lanolin content of the external lipids of wool is very high, whereas the internal lipids are rich in cholesterol, FFA, cholesteryl sulfate, and ceramides (Coderch *et al*., 1995; Schaefer and Redelmeier, 1996).The lamellar lipid bilayers are mainly due to the specific composition of this lipids and its highly ordered arrangements. The ceramide in the internal lipids acts as physiological barrier impeding the access of external reagents and regulating the loss of water (Elias, 1981). Depra *et al*. (2000) have found that the topical application of

internal wool lipid on disturbed skin, improve its function as barrier. These properties of internal wool lipids have widely been exploited in the formulations of pharmaceutical and cosmetic products. The aim of this work is to extract lipids from the wool of domestic goat using different organic solvents and estimate the amount of lipid present in them.

## MATERIALS AND METHODS

The wool was collected from the domestic goats in the Palakkad district. Cleaned, washed, air dried and weighed (10 g) wool was subjected to lipid extraction using different organic solvents such as, chloroform-methanol mixture (2:1), petroleum ether, methanol and hexane. The extractions were carried out separately using different solvents with the help of soxhlet apparatus. The solvents were heated below its boiling point and 20 cycles were completed within 45 min. The duration of each cycle took about 2 min. After extraction, the solvents were transferred separately into 250 ml beaker. Around 1ml of the solvent was pipetted out into 2.5 ml eppendorf tube and kept on activated silica gel for evaporation. The dried tube was weighed, cleaned using chloroform of known quantity. Lipids washed off from the tube were subjected to quantification analysis. A known volume of sample were transferred into the test tube, 50 µl of concentrated sulphuric acid was addded, kept in water bath (Promega) for about 10 min., cooled at room temperature, then 2 ml of phosphovanillin reagent added and absorbance is measured at 540 nm using glycerol trioleate as standard. The statistical analyses were done by GraphPad software.

## RESULTS

### Quantitative estimation of lipid present in the wool of domestic goat

The content of lipid in the petroleum ether extract was found to be 6.845±0.0562 mg/g of wool. However, a slight increase in the amount of lipid was noticed in the wool extracted with chloroform-methanol (2:1) mixture. The amount of lipid was 8.258±0.081mg/g of wool.

**Table 1. The amount of lipid extracted from the wool of domestic goat using different organic solvents**

| S. No. | Solvents | Amount of lipid (mg/g) |
|---|---|---|
| 1 | Choloroform-Methanol mixture | 8.258±0.0810 |
| 2 | Hexane | 7.215±0.0450 |
| 3 | Petroleum ether | 6.845±0.0562 |
| 4 | Methanol | 4.492±0.1696 |

n=5;Values are expressed as Mean±SEM

The lipid measured in the non-polar organic solvent hexane extracted sample is 7.215±0.0450 mg/g of wool (Table 1). Moreover, the lipids extracted from the wool using polar organic solvent, methanol was 4.492±0.1696 mg/g and was very low compared to other extracted samples.

## DISCUSSION

The percentage of lipid extracted in the chloform-methanol mixture was 0.82% of the total weight of the wool fiber. Anyhow the lipid content present in the above mixture is higher than that of other organic solvents (Table 1). But, the content of lipid in the methanol extract of the wool fibre of goat is approximately 0.44% its total weight. The amount of lipid in the non-polar organic solvents such as petroleum ether and hexane are 0.68% and 0.721% respectively. According Martinetti (1976), the chloroform fraction of merino wool lipid mainly composed of non-polar lipids and the methanol fraction rich in phospholipids. Dowigiallo (1975) found that the organic solvents like diethyl ether, chloroform and petroleum ether were capable of taking neutral lipids away from the animal tissues.

Likely, the high amount of lipids in the chloroform-methanol mixture may account for the successful removal of the non-polar, phospholipids and neutral lipids of wool. Jover *et al* (2006) reported about different types of lipids such as sterols, stanon, steryl sulphate, hydroxyl acids, triacyl glycerol, ceramide etc. in the wool wax of sheep. In this case also, there might be a possibility for the occurrence of such lipids in the chloroform-methanol lipid extract of goat wool. In the present decade people give more importance for protecting their skin and hair, they principally relies on cosmetics for it. The waxes from the wool of sheep contain lanolin and its derivatives, which is used for making cosmetics and medicated drugs. In this circumstance, the lipid from the wool fibre of goat have some value, advanced studies are required in this field. If the lipid in the wool fibre of goat contain sufficient quantities of lanolin or other commercially important sterol, this would definitely be open a door to the pharmaceutical and cosmetic industry.

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