

## Original Research Article

# Osmidrosis lotion affect ApoD and ABCC11 mRNA levels in axillary osmidrosis patients

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### Abstract

**Purpose:** To investigate the potential role of osmidrosis lotion in alleviating axillary osmidrosis (AO).

**Methods:** Forty patients were randomly divided into four groups (n = 10). Patients were treated via topical application of *Lithargyrum*, *Sophora flavescens* Alt., or *Cortex dictamni*, or osmidrosis lotion, for 40 min over a three-month period. Total skin RNA was extracted from samples using TRIzol while total platelet RNA was treated with DNase I, followed by quantification using NanoDrop and Agilent 2100 Bioanalyzer.

**Results:** *Lithargyrum*, *Sophora flavescens* Alt. and *Cortex dictamni* significantly inhibited the mRNA expressions of ApoD and ABCC11 in AO patients (p < 0.05). Furthermore, osmidrosis lotion produced the best down-regulating effect on mRNA expressions of ApoD and ABCC11 in AO patients.

**Conclusion:** The suppressive effect of these natural remedies may be beneficial in the development of non-surgical therapy for AO and therefore would be worth further investigation.

**Keywords:** Axillary osmidrosis, Treatment, Health promotion, *Lithargyrum*, Osmidrosis lotion

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## INTRODUCTION

Apocrine osmidrosis (AO) refers to a chronic and embarrassing skin problem which results in production of offensive body odor in the axillary area. This condition negatively impacts the social lives, relationships, and careers of the affected patients. It has been suggested that AO may originate from a complex interplay of factors such as ABCC11 gene mutation, bacterial action, pheromonal effects, and 5 $\alpha$ -reductase [1]. In AO, some compounds in sweat are metabolized by skin bacteria *Corynebacteria* to generate specific metabolites with very foul and strongly repulsive

odors [2-4]. Moreover, histology-based research has demonstrated that AO might be associated with the size and population of apocrine glands [5].

In this study, *lithargyrum* and two Chinese medicinal plants *Sophora flavescens* Alt. and *Cortex dictamni*, were selected and used for preparing an osmidrosis lotion. Then, the mitigating effect of the lotion on osmidrosis symptoms was determined, as well as its effect on mRNA expression levels of ApoD and ABCC11 in osmidrosis patients.

## METHODS

### Drug preparation

Lithargyrum, *Sophora flavescens* Alt. and Cortex Dictamni were purchased from Shanghai local herbs shops. Each drug was extracted in boiling water to obtain 1 % extract. Then, osmidrosis lotion was prepared by mixing the extracts of Lithargyrum, *Sophora flavescens* Alt. and Cortex Dictamni at a volume ratio of 1:1:1.

### Patients and grouping

Forty osmidrosis patients from ShangHai Nineth Peoples' Hospital, Affiliated to ShangHai JiaoTong University, China were enrolled in this study. Subjects who had autoimmune or infectious ailments were not included in the study. Healthy individuals served as control. The study received approval from the ethical authority of ShangHai Nineth Peoples' Hospital, Affiliated with ShangHai JiaoTong University (approval no. LL-KY 2019514), and followed international guidelines for human studies. The patients were randomly divided into four groups, with 10 patients per group. Every day, the four groups were treated via topical application of Lithargyrum, *Sophora flavescens* Alt., or *Cortex dictamni*, or osmidrosis lotion, for 40 min.

Another twenty osmidrosis patients (10 males and 10 females) from the Shanghai People's Hospital were enrolled in this study. They were divided into two groups, based on sex. Every day, the two groups were topically treated with osmidrosis lotion for 40 min. The treatment lasted for three months.

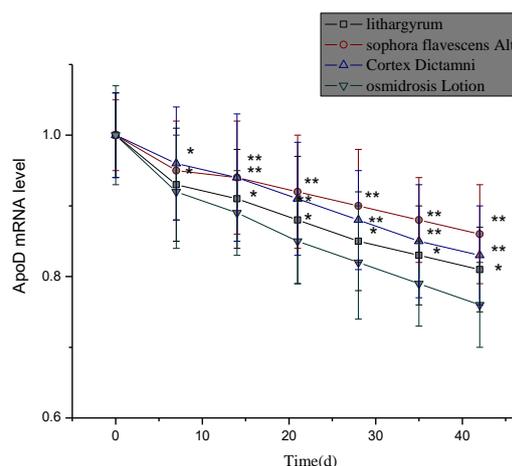
### Skin sample preparation and total RNA extraction

Samples of axillary skin were surgically obtained from osmidrosis patients at the same time. During the operation, fresh skin tissue 5 - 6 cm in length and 2 - 3 cm in width, were taken from both armpits of the patients, with depth reaching the fat layer. Total skin RNA was extracted from the skin samples using TRIzol (Invitrogen,

Carlsbad, CA, USA) according to the suppliers' instructions. The total platelet RNA was treated with DNase I, followed by quantification using NanoDrop and Agilent 2100 Bioanalyzer. The primer sequences of ApoD and ABCC11 are shown in Table 1.

## RESULTS

Figure 1 shows that the relative expressions of ApoD mRNA from osmidrosis patients differed amongst the four groups. The ApoD mRNA expression levels in all four groups were continuously decreased with time. However, it is worth noting that patients treated with osmidrosis lotion exhibited much lower relative expression levels of ApoD mRNA than patients from other three groups.

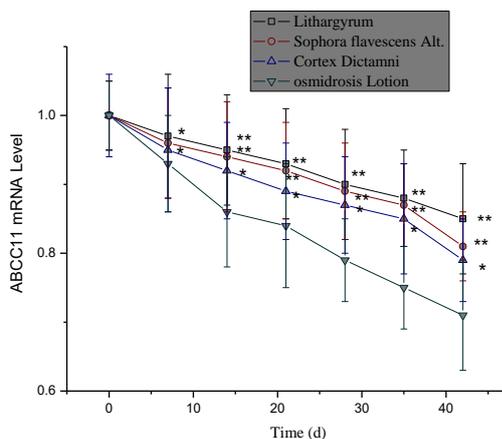


**Figure 1:** ApoD mRNA expression levels in the four groups. \* $P < 0.05$ , \*\* $p < 0.01$ , compared with osmidrosis lotion-treated group

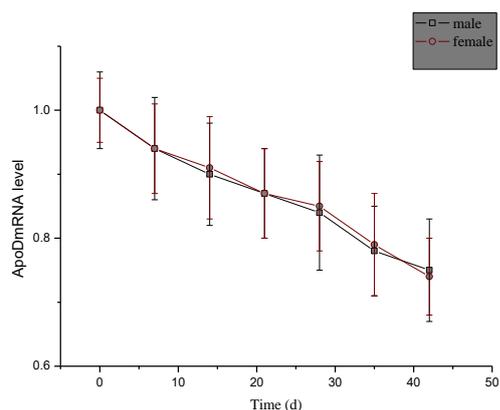
Figure 2 shows that the relative expression of ABCC11 mRNA from osmidrosis patients differed amongst the four groups. The ABCC11 mRNA expression levels in the four groups were continuously decreased with time. However, it is worth noting that patients treated with osmidrosis lotion exhibited much lower relative expression levels of ABCC11 mRNA than patients in the other three groups ( $p < 0.05$ ).

**Table 1:** Primer sequences of ApoD and ABCC11

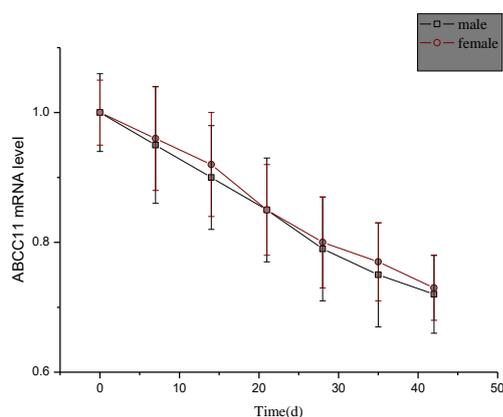
Primer	Sequence	
ApoD	Forward	5'-TAAACATCAGAGACCTGAAG-3'
	Reverse	5'-AGAATCAGCCGATTTGAGAT-3'
ABCC11	Forward	5'-CTCCACATCCTCAATTCTCTGC-3'
	Reverse	5'-GCCATCCATCGTGTGGAAGAT-3'
GAPDH	Forward	5'-AGGCTGTGGGCAAGGTCATC-3'
	Reverse	5'-ACCACTGACACGTTGGCAGT-3'



**Figure 2:** ABCC11 mRNA expression levels in the four groups. \* $P < 0.05$ , \*\* $p < 0.01$ , compared with osmidrosis lotion-treated group



**Figure 3:** ApoD mRNA expression levels in two groups treated with osmidrosis lotion only



**Figure 4:** ABCC11 mRNA expression levels in two groups treated with osmidrosis lotion

Figure 3 shows the relative expressions of ApoD mRNAs from male and female osmidrosis patients. The ABCC11 mRNA expression levels in the two groups were continuously decreased with time. However, the relative expression level of ApoD mRNA in male patients from osmidrosis

lotion-treated group was comparable with that of ApoD from the female group.

Figure 4 shows the relative mRNA expression levels of ABCC11 in male and female osmidrosis patients treated with the lotion. The ABCC11 mRNA expression levels in the two groups were continuously decreased with time. However, it is worth noting that the relative expression levels of ABCC11 mRNA in male patients from osmidrosis lotion-treated group was similar to that of ABCC11 mRNA in the female patients.

## DISCUSSION

Lead (II) oxide (lithargyrum) is a solid lead oxide-containing drier that is dried by adding oil. Lead oxide mineral is red, tetragonal, heavy and soft, with an oily sheen. It occurs in oxidation zones of lead deposits. At the concentration of 2 %, the extract inhibited *Trichophyton concentricum*, *Trichophyton pedis*, *Trichophyton rubrum* and *Microsporum in vitro*, while at 4 %, it inhibited the growth of *Trichophyton*, *Epidermophyton floccosum*, *Trichophyton gypseum* and *Trichophyton pedis* [6,7].

The roots of *Sophora flavescens* contain matrine and sparteine which are used for clearing heat and removing dampness, resisting bacteria and inflammation, strengthening stomach and repelling insects. The roots are often used for treating skin itch, neurasthenia, dyspepsia and constipation [8,9].

*Cortex dictamni* is mainly used for clearing heat and dampness, dispelling wind and detoxification. Thus, it is used in traditional Chinese medicine for the treatment of dampness-heat, sore toxin, yellow water exudation, eczema, rubella, scabies, rheumatism-heat, arthralgia, jaundice, red urine, and other symptoms [10,11].

The level of ApoD mRNAs is consistently high in osmidrosis patients [12,13], thereby confirming that it is used as the reference gene for quantification of drug effect. Osmidrosis lotion treatment decreases relative expression levels of ApoD mRNA in patients. This indicates that the combination of *lithargyrum*, *Sophora flavescens* Alt. and *Cortex Dictamni* resulted in synergistic and cumulative treatment effect on osmidrosis.

The ABCC11 mRNA is consistently highly expressed in osmidrosis patients [14]. This further confirms its use as the reference gene for quantification of the effect of drugs on osmidrosis. Similar results were obtained on the

expression of ABCC11 mRNA in this study. Relative expression levels of ABCC11 mRNA in patients treated with osmidrosis lotion are much lower than in patients in the other three groups. This is an indication that a combination of lithargyrum, *Sophora flavescens* Alt. and *Cortex Dictamni* resulted in synergistic and cumulative treatment effects on osmidrosis.

The relative expression levels of ABCC11 mRNA and ApoD mRNAs in male patients from osmidrosis lotion-treated group were similar to that of ABCC11 mRNA in the female patients. This indicates that there were no discriminatory sex differences in the effect produced by osmidrosis lotion.

### Limitations of this study

The current number of trial cases is still very small, and in the future, there will be need to expand the scope of the trial.

### CONCLUSION

Osmidrosis lotion is effective in the mitigation of osmidrosis symptoms. The results of this study present beneficial information that can be further explored for the treatment of bromhidrosis with Chinese herbal medicine.

### DECLARATIONS

#### Acknowledgements

None provided.

#### Funding

None provided.

#### Ethical approval

This study was approved by the Ethics Committee of ShangHai Nineth Peoples' Hospital, Affiliated with ShangHai JiaoTong University, China (approval no. LL-KY 2019514).

#### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

#### Conflict of Interest

No conflict of interest associated with this work.

### Contribution of Authors

We declare that this work was done by the authors named in this article and all liabilities pertaining to claims relating to the content of this article will be borne by the authors. Bin Chen designed the study and carried it out. JiFeng Xie, KeKe Ding, and ChunRong Gong supervised the data collection, as well as analyzed and interpreted the data; Bin Chen prepared the manuscript for publication and reviewed the draft of the manuscript. All authors read and approved the manuscript.

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