

Permethrin Resistance in Head Lice (*Pediculus humanus capitis*) in Istanbul, Turkey: A Pilot Study



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Summary

Background: Permethrin has been used effectively in the treatment of head lice infestation caused by *Pediculus humanus capitis*;

✓ However, late reports show an emerging resistance to permethrin, which is mainly due to M815I mutations on voltage-sensitive sodium channels of α -subunit gene located on the IIS1-2 extracellular loop.

✓ There is no report about permethrin resistance in native isolates of *P. capitis* in Turkey.

✓ Here, we present the results of our preliminary study on permethrin resistance in 92 *P. capitis* isolates obtained from 32 children in two primary schools in Istanbul.

Material/Methods: The head lice were collected from infested children in school visits, during combing with special combs.

✓ Following DNA isolation, the fragment of voltage-sensitive sodium channel α -subunit gene, containing M815I mutation site, was amplified in each head lice sample by PCR.

✓ Obtained PCR products were sequenced and aligned, followed by calculation of frequencies for alleles, genotypes and haplotypes.

Results: A novel mutation was identified on the first nucleotide of 815th amino acid, defined as M815F (ATG>TTT) mutation.

✓ Analyses indicated that both M815I (ATG>ATT) and M815F amino acids in our samples were highly buried (on the extracellular loop between the IIS1 and IIS2 transmembrane segments of the voltage-sensitive sodium channel α -subunit (Figure 1).

✓ Analyses of our data revealed a resistance frequency of 0.972 (M815I=0.481 and M815F=0.492) among the isolates in the study.

Conclusions: This is the first report of permethrin resistance in head lice in Istanbul, Turkey.

✓ Our findings indicate high resistance rates among local head lice isolates, which may define the increasing number of cases irresponsive to permethrin treatment.

✓ Large-scale studies from different provinces are necessary to unveil the scale of permethrin resistance in Turkey.

Introduction

✓ *Pediculus capitis* is one of the oldest human parasites and is a worldwide public health problem that affects mostly the school-aged children.

✓ It means a “social stigma” for both parents and children and may cause psychological problems (no will to go to school).

✓ Despite lack of concrete data about its vectorship for serious bacterial or viral infections, *P. capitis* may irritate school children through intense itching, loss of motivation, irritability and act as a social stigma for families.

✓ Previous studies indicated that it as a prevalent infection among school children in Turkey, with infestation rates ranging between 1.3-27.4.

✓ Permethrin has been used in its treatment for decades; however, emerging resistance to permethrin is reported in many regions of the world, but not yet in Turkey.

✓ **Mutations on at least one “Voltage-sensitive sodium channel (VGSC) α -subunit gene” on *Pediculus capitis* isolates => resistance!**

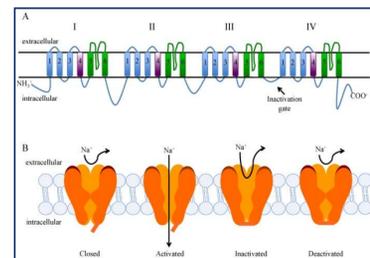


Figure 1. The α -subunit of the voltage-gated sodium channel (VGSC) located on the IIS1-2 extracellular loop

“Knockdown” resistance (*kdr*) modifies the sensitivity to permethrin on the genes encoding the α -subunit of VGSC on head lice.

Three point mutations => T917I, L920F, M815I

The aim of the present study is to investigate permethrin resistance in head lice collected during school visits in Istanbul, and identify the features of resistance sites on the head lice.



Materials & Methods

✓ A total of 92 *Pediculus capitis* samples were initially grounded in liquid nitrogen in different vials

✓ DNA isolation was done with a commercial kit (Qiagen® Tissue Kit).

✓ The fragment of voltage-sensitive sodium channel α -subunit gene, containing **M815I mutation site, was amplified in each sample by PCR.**

✓ PCR products were then sequenced with “Big Dye cycle Sequencing Kit® (Applied Biosystems, Foster City, California)”, using an ABI 3130 XL genetic analyzer (Applied Biosystems).

✓ The sequence of voltage-sensitive sodium channel **α -subunit gene was aligned** by using MEGA7® software.

✓ The frequencies for alleles, genotypes and haplotypes, and the resistance level was evaluated on a scale within 0 to 1.00, where 1.00 indicated highest resistance by using SHEsis Online Software.

Results

✓ A new mutation on the first nucleotide of 815th amino acid was defined as **M815F (ATG>TTT) mutation.**

✓ Both M815I (ATG>ATT) and M815F amino acids in our samples were highly buried on the extracellular loop between the IIS1 and IIS2 transmembrane segments of the voltage-sensitive sodium channel α -subunit (Figure 2).

✓ A resistance frequency of **0.972 (M815I=0.481 and M815F=0.492)** was found among the isolates in the study.

Results

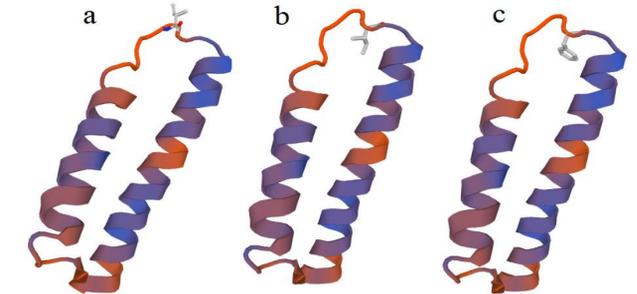


Figure 2. Conformational change according to the mutations on the 815th amino acid of the voltage-sensitive sodium channel α -subunit. a) M815, b) M815I, c) M815F.

Discussion

✓ Treatment failures due to emerging permethrin resistance among head lice have already been reported from France, Israel, Czech Republic, United Kingdom, Argentine, USA, Australia, and Denmark.

✓ This is the first report of permethrin resistance in head lice in Istanbul, Turkey.

✓ Our findings indicate high resistance rates among local head lice isolates, which may define increasing number of non-responsive cases to commonly used permethrin treatment.

✓ **Further Research:** Large-scale studies from different provinces of Turkey are necessary to unveil the scale of permethrin resistance in Turkey.



References

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