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*Contemporary epidemiological problems
of the human head louse infestation*

During the last decades considerable epidemiological changes concerning a variety of the infectious diseases have been observed. Great increase in the number of infestations caused by the external parasites of humans, including the head louse, can be noted worldwide. Nowadays, the human head louse (*Pediculus humanus capitis*) is regarded as the cosmopolitan parasite, crossing various borders, both geographical and social, and what is more, it is not limited to the traditionally established risk groups. However, common belief, spread even among the physicians, attributes the head louse infestation only to people living in the poor social conditions. This opinion is no longer true, because unlike the body pediculosis, the nutritional state or cleanliness of host are not important risk factors (4). It has been established that this infestation can be found in all social classes (4). Actually, all large social gatherings of the great cities, including the school children first of all, can be regarded as the environments predisposed to the head louse infestation (1, 2, 7, 13). Although, hundreds of millions of louse infestation cases are reported annually worldwide over the past few decades, the complete reliable estimates concerning the prevalence of the disease are still lacking (6, 11). In the USA and European countries pediculosis capitis has been recognised as the most prevalent parasitic infection of humans (8, 11). Data of the numerous epidemiological studies indicate that in the USA *pediculosis capitis* affects from 6 to 12 millions people per year (7). *Pediculus capitis* has been found in 9.6% of adolescent schoolboys in Saudi Arabia (12) and in Mali the prevalence of head lice in children has been estimated as 4.9% (12). Many factors contribute to the phenomenon of increased *pediculosis* prevalence, including the changes in the natural environment affecting the biological features of external parasites, extensive migration of people, patterns of the social behaviour preferred in some social, ethnic groups or age groups (2). One of the most important factors seems to be the inadequate, no longer effective methods of treatment. Another, perhaps the psychological attitude shared by both the health authorities and many physicians as well. Paradoxically, the fact that head lice (unlike the body lice) are not vectors of any human diseases caused the decreased interest in treatment and epidemiology of this infestation regarded as efficiently controlled or limited to the poorest areas and quite unlike to occur in the developed countries.

Pediculosis capitis is highly contagious disease whose transmission can be direct, from person to person, or indirect through numerous fomites (3, 4). In all social groups the children of 3–12 years of age are the most frequently affected (6, 8, 9, 10), probably due to the close head-to-head contact and frequent sharing of various headgear including hats, scarves, helmets and combs (4, 6, 7, 10). So it seems, that the head lice infestation being one of the most communicable diseases can easily spread among the school children due to the pattern of social behaviour characteristic of their age. (4, 6, 10). However, some children seem to be more prone to repeated infestations, whereas other are unaffected due to unknown reason, possibly the genetic factors, including the Rh factor may play a role (9).

Being very host specific parasites, the human head lice cannot be transmitted to or from pets or other animals (9). This limitation to only one host is an epidemiologically important feature which diminishes the chances to survive for both the *Pediculus capitis* individual and the species. So, to overcome this great disadvantage, head lice have developed many mechanisms of adapting to their biological environment. Head lice are capable to adapt their body colour to their surroundings, therefore lice found in dark-haired, dark-skinned individuals are darker than those found on people with lighter skin or blond hair (9). It has been also found that the colour of lice darkens with increased temperature and light (9). What is more, the newly hatched young louse is immediately active and mobile searching a hair to grasp on (9).

There are different data concerning the influence of the host's sex or the hair length on the *pediculosis* prevalence. Some authors believe that the head louse infestation can be found equally in both sexes and the hair length is not relevant (9, 14). Studies carried out in the USA have found however, that more girls than boys have been infested (9). This phenomenon is probably the result of the commonly observed difference in the accepted social behaviour of both sexes. Close physical contact and sharing of combs, brushes, hair ties and various head gears, that increase the possibility of the indirect transmission, is characteristic of young girls rather than boys (6, 7, 9). On the other hand, children with long hair were found to be more often infested than were children with short hair, probably because nits remain longer on the long hair than on the short hair which are frequently being cut (9). What is more, in most ethnic groups or nationalities girls used to have longer hair than boys, so this may additionally account for the sex differences in the epidemiological data (9).

The head louse is an ectoparasite confined to the scalp hair of humans and can be found in all climates and countries (4, 6). The scalp provides controlled environment where the surface temperature and relative humidity only slightly vary and neither the louse or its eggs are able to survive outside (4). For this reason, lice are usually found close to the scalp, but they can wander through the hair (4). The eggs (ova, nits) require optimum condition of 30° C and 70% humidity to hatch within the average period of 7–8 days, however incubation time is longer at lower temperatures (6.12). It has been established that ova do not hatch at temperatures lower than 22° C but can remain alive for as long as 1 month away from the body on various fomites (6). The head louse lives on the human skin from 15 to 30 days (6.13). Early death is not rarely observed, and results from the gut rupture during feeding or cementing of the female to the hair shaft during ovipositioning (6). Louse eggs are laid within 2–3 mm of the scalp and are cemented firmly to a hair shaft (5, 7, 14). One female head louse can lay approximately 1,000 ova over an average lifetime (7). Young lice hatch within 1 week and pass through 3 nymphal stages, growing larger and developing to sexually mature insects over a period of 7 to 10 days (5, 7). First and second nymphal forms are not easily transmitted (7). Transmission from one host to another is related to third nymphal form and adults (7). Nymphs and adult head lice take several blood meals daily and on most climates they can survive only 15 to 24 hours off the host scalp (5, 7). Head lice move by grasping hairs remaining possibly close to the scalp but can wander along the hair shafts as well (7). Although head lice can be noticed on any part of the scalp, they are most commonly found in the postauricular and occipital areas (14). In need this parasite can crawl rapidly, travelling up to 23 cm/min which explains their ease of transmission (7).

The mechanisms of transmission from one host to another and the activity of head lice differ between cool and warm climates (9). Because maximal eggs production is only possible at optimum temperatures of 29° C to 30° C with the ample supply of food, most eggs are laid close to the scalp (9). Taking into consideration that hair grows approximately 10 mm per month the distance of nits from the host skin may be used to estimate the duration of lice infestation (9, 14). The head lice infestation is the highest during the warmer summer months (6). In very hot geographical areas where children spend long periods of time playing outdoors, the top of the head is too warm for the eggs and the lice to survive (9). Lice have to wander around and along the hair until they find the optimum temperature for their eggs, which may be some distance from the scalp (9). The nape of the neck and behind the ears areas are their favourite places because they are more pro-

tected from extreme temperatures (9). It is well established that lice need the stable body warmth and will leave a febrile human host looking for another person to find a more suitable environment for laying and incubating eggs (9). Death of the host induces lice to quick leaving the cooling body in the search of a new human (9). Moreover, head lice prefer clean healthy scalp surface and will leave the head of person who has become malnourished moving to a new host (9). This pattern of the head lice behaviour generates an additional risk of the ectoparasite migration from the sick to the healthy humans (9).

Head lice can infest most ethnic groups worldwide (9, 14). These parasites can be found equally on the heads of white people, Asians, Hispanics, North-Central and South American Indians (9). The one known exception is the African American population of North America. In the USA, black persons are less commonly affected by head louse infestation than individuals from any other racial group (6, 14). It has been found that only 0.02–0.3% of African American children compared with 7–10.4% of non-African American children are infested by the head lice (9). This phenomenon was previously mostly attributed to the common habit among the black Americans to apply hair pomades which much worsen the environmental conditions for the parasites. Further observations revealed however, that head *pediculosis* is frequent among the people of various races living in India among whom the using of the hair pomades is a popular custom (9). Curled hair common among the African Americans has been also believed as much less suitable for the head lice to live on than the straight hair. The actual cause of very low incidence of the head *pediculosis* in the black American population seems to be more complex because in Africa head lice may be abundant on black children with tightly curled hair (9). The shape of the hair shaft different in the white persons and Asian or African American persons has proved to be the most important factor (6, 7). Non-black human races have round cross-section of hair that attracts the European, Middle Eastern, or North and South American head lice (9). It has been observed that African head lice (unlike the North-American lice) have claws and legs that are adapted for grasping the oval cross-section of curly hair of the native African inhabitants (9). Very low prevalence of the head *pediculosis* among the African Americans is well known phenomenon which may affect the results of the epidemiological studies. Due to this fact, it is recommended that the African Americans should be excluded from the studies when prevalence in the general population is estimated (9).

Head *pediculosis* can be diagnosed by finding lice or viable eggs on examination (5). The presence of a single live louse is sufficient for the adequate diagnosis (5). Finding of nits alone does not necessarily indicate active infestation (5, 7). If only nits can be observed, they should be examined microscopically for viable embryos (5). The definitive diagnosis of the head *pediculosis* is made when crawling lice are seen in the scalp hair or are combed from the scalp (7). As head lice avoid light and can crawl quickly, visual inspection without combing can be difficult (7). The use of dense comb increases the chances of finding live lice and is a useful tool for examination (7). Louse egg can be recognised because it is laid near the scalp, glues firmly to a hair shaft and is very difficult to remove (5). When only nits are found, the careful differential diagnosis should be made. Nits can be easily confused with inner root sheath remnants, debris on the hair shaft left by hair spray and accumulated seborrheic flakes (7). Changed hair shaft in the black *pedra* and white *pedra* as well as some trichodystrophies, such as *moniletrix* and *trichorrhhexis nodosa* have also been mistaken for nits at visual examination (7). Microscopic examination of hair shafts helps to exclude the abnormalities of the hair shaft and enable to observe the viable embryos within nits and finally establish the correct diagnosis (7).

Effectiveness of the head *pediculosis* treatment is closely connected with the knowledge of the biological features and the life cycle of this parasite. Efficient eradication of the head *pediculosis* is possible by treating only those individuals with confirmed infestation. Data of many epidemiological studies indicate that pediculicides should not be used prophylactically because the excessive and improper use of these agents increases chances of developing the louse resistance to pesticides. Patterns of pediculicide resistance often follow patterns of the insecticide use in different parts of the world (7). Current prevalence of the head lice infestations should be monitored

continuously because it is influenced by many changing biological and environmental factors affecting one another.

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SUMMARY

Pediculus capitis, caused by the human head louse (*Pediculus humanus capitis*) is one of the most frequent parasitic diseases of the humans. It can be easily transmitted, directly and indirectly, crossing the geographical and social boundaries. During the last decades not only the prevalence of the head lice infestation has still been increasing but the failures of the conventional treatment as well. This epidemiological phenomenon is carefully observed worldwide. Many factors contribute to the increased prevalence of the head louse infestation, including the changes in the natural environment affecting the biological activities of the ectoparasite, extensive migration of people, patterns of the social behaviour preferred in some ethnic or age groups and ineffective methods of treatment.

Współczesne problemy epidemiologiczne zakażeń ludzką wszą głowową

Wszawica głowy wywoływana przez wesz głowową (*Pediculus humanus capitis*) jest jedną z najczęstszych chorób pasożytniczych występujących u ludzi. Może się łatwo szerzyć drogą bezpośrednią lub pośrednią, przekraczając granice zarówno geograficzne, jak i społeczne. W czasie ostatnich kilku dekad obserwuje się nie tylko zwiększoną częstość zakażeń wszą głowową, lecz także niepowodzenia stosowanych dotychczas metod leczenia. Zjawisko to jest obserwo-

wane przez epidemiologów na całym świecie. Wiele czynników może wpływać na zwiększoną częstość wszawicy głowy, wśród nich zmiany w środowisku przyrodniczym, wpływające na aktywność biologiczną pasożyta zewnętrznego, ruchy migracyjne ludności, wzory zachowań społecznych charakterystyczne dla pewnych grup wiekowych i etnicznych, a także nieskuteczne metody leczenia.