



Knowledge and behavioral practice of pediculosis in Hail Region, Saudi Arabia

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Abstract

Aim of the work: The aim of this study is to assess the knowledge, and the behavioral practice regarding head lice among Hail population, Saudi Arabia.

Subject and methods: a total of 1000 Saudi participants were randomly chosen and interviewed. Data from participants were obtained through questionnaires that included socio-demographic information and information about mode of transmission, clinical manifestations, prevention and treatment of pediculosis.

Results: 240 (24%) of the respondents admitted that they or members of their families were infected by pediculosis during once or more their life.

Moreover, there is a clear gap indicating deficiency of knowledge, about head lice, specially among illiterate categories of the participants.

Conclusion: Although Pediculosis is common in Hail area, knowledge on head lice, transmission, manifestations, prevention and treatment is poor and limited.

Recommendation: It is highly recommended that the Health authorities in Hail region should direct the local health departments to work together to ensure the dissemination of correct health information about head lice among families, schools and other public areas specially in the rural places.

Keywords: pediculosis, head lice, knowledge, hail, Saudi Arabia

Introduction

Pediculosis capitis is a widespread medical problem in many developing countries specially in young and school students (Motovali-Emami *et al.*, 2008; Hodjati *et al.*, 2008) [27]. In Saudi Arabia prevalence rate of infestation is as high as 49% in Al Hassa (Bosely *et al.*, 2011 & Amin *et al.*, 2011) [12, 8] 19.8% in Albaha (Gharsan *et al.*, 2016) [21], 13.3% in Jazan (Bosely *et al.*, 2011) [12], 12.2% in Riyadh city (AL-Megrin, 2015 & Bosely *et al.*, 2011) [12] and 5.2% in Eastern Saudi Arabia (Al- Saeed, 2006) [5]. Head lice infestation, caused by *Pediculus humanus capitis* arthropod (De Geer, 1778). The life cycle of the arthropod includes eggs (nits) and larvae (nymphs) (De Geer, 1778). The clinical picture is mainly severe scalp pruritus, which in turn can lead to infection associated with impetigo and abscesses (Motovali-Eman *et al.*, 2008; Speare and Buettner, 1999) [37, 60]. Pediculosis is highly infectious, spreading most directly via the sharing of combs and hair brushes but also via contact between clothes, bed sheets, pillowcases, towels and other household fabrics (Bailey and Prociw, 2000) [10]. In addition to the removal of lice and nits from the hair of infected individuals, proper management of outbreaks requires careful cleaning and disinfecting of such fabrics, including furniture (Ibarra, 2008; Wurzbach, 2002) [29, 62]. Many factors such as; poor hygiene, socioeconomic status, lack of medical treatment and resistance to the treatment leads to increase in the prevalence of head lice (Koch *et al.*, 2001 & AL-Shaw, 2008) [33, 6]. It is well confirmed that other *Pediculus* species are transmitters of some diseases like typhus and relapsing fever (Ogunrinade &

Oyejide, 1984) [43].

Deficient knowledge about pediculosis management can also be dangerous in ways unrelated to the infestations themselves. Moreover, lack of awareness of proper head lice treatment leads to the use of traditional 'remedies', which can be harmful specially children to whom such measures are applied, (Sidoti *et al.*, 2009) [57]. Such practices have been observed in many developing countries (Ebomoyi, 1994; Khokhar, 2002) [17, 31]. In Saudi Arabia, traditional, people used to apply 'remedies' like kerosene or insecticides to the scalps of infested cases. The lack of information, misdiagnosis and panic generated by fear of disgusting or bad social image from the community may lead to misuse of insecticides with consequent toxicity (Ebomoyi, 1994; Khokhar, 2002) [17, 31].

In worldwide Research works including those of Saudi Arabia, most of the studies were about the prevalence of pediculosis. However, little is known about evaluation of knowledge and behavioral practice regarding head lice among those populations. So, the aim of the present study is to evaluate the knowledge and behavioral practice about pediculosis among Hail population, Saudi Arabia.

Material & Methods

- 1. Setting:** The current study was conducted in Hail city, which is located in north of Saudi Arabia, and found at distance of 690 km from Riyadh, the capital city of Saudi Arabia during the year 2017-2018.
- 2. Sampling:** A total of 1000 participants agreed to participate in the current study. Samples were randomly

chosen from urban and rural districts

3. **Data Collection:** Data were collected through individual interviews to fill a structured questionnaire including information regarding:
 - a. Socio-demographics: Age, sex, and educational status.
 - b. General knowledge about pediculosis, mode of transmission, symptoms, prevention and treatment.
 - c. Behavioral practice of the participants regarding the preventive measures and treatment of pediculosis. The question formats included a mixture of yes/no (closed-ended).

Data analysis

All data collected were analyzed and expressed as percentage distribution.

Ethical Considerations

A full orientation of the approached participants about the study purposes was carried out with the emphasis on their right of not to participate. An individual verbal consent to participate and fill the questionnaire was taken from each participant and data confidentiality was maintained all through.

Results

Table 1: General Knowledge about pediculosis among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

| Knowledge about | Participants having knowledge according to age | | Participants having knowledge according to education | | | Participants having knowledge according to Sex | | Total 1000 (100%) |
|--|--|---------------|--|-----------------------|------------------------|--|------------|-------------------|
| | <25 yrs (376) | >25 yrs (624) | Illiterate (331) | School education(303) | Higher education (366) | Female (794) | Male (206) | |
| Correct causative agent (insect) | 122 32.44% | 387 62.01% | 108 32.62% | 198 65.34% | 208 56.83% | 403 50.75% | 143 69.41% | |
| Main sex affected by pediculosis (females) | 289 76.86% | 567 90.86% | 188 56.79% | 218 71.94% | 304 83.06% | 578 72.79% | 136 66.01% | |
| Common age affected by pediculosis (young) | 279 74.20% | 554 88.78% | 54 16.31% | 288 95.04% | 331 90.43% | 533 67.12% | 131 63.59% | |
| Lice favors dirty hair (true) | 189 50.26% | 402 64.42% | 101 30.51 % | 141 46.53% | 229 62.56% | 509 64.10% | 135 65.53% | |

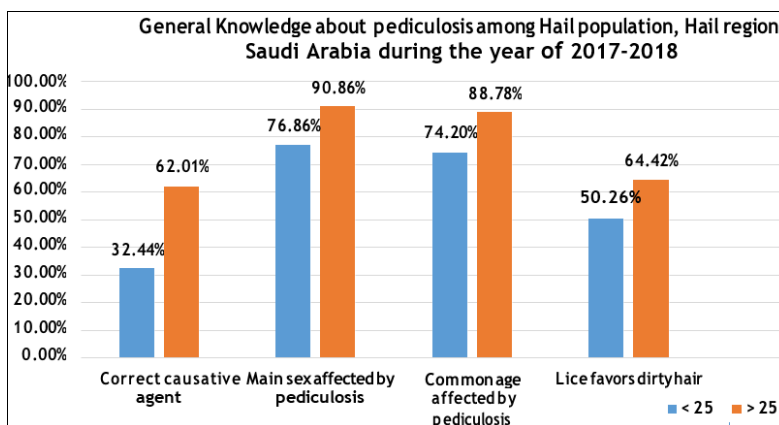


Fig 1a: General Knowledge about pediculosis among Hail population, Hail region, Saudi Arabia according to age, during the year of 2017-2018

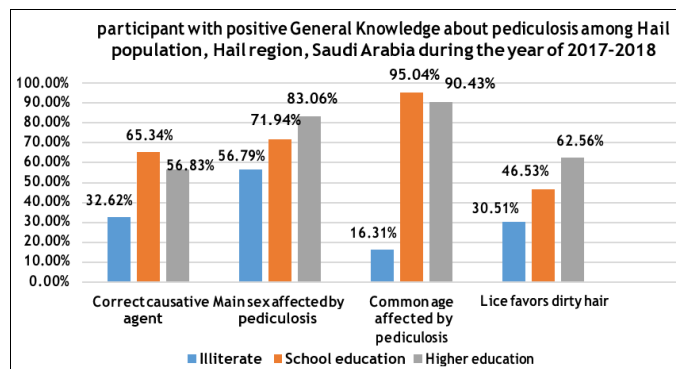


Fig 1b: General Knowledge about pediculosis among Hail population, Hail region, Saudi Arabia according to education, during the year of 2017-2018

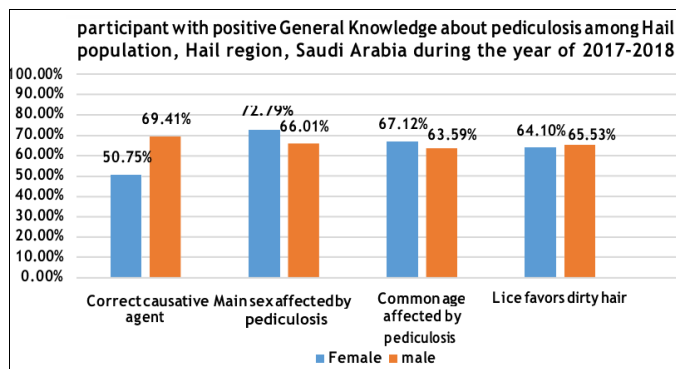


Fig 1c: General Knowledge about pediculosis according to gender, among Hail population, Hail region, Saudi Arabia according to gender, during the year of 2017- 2018

Table 2: Knowledge about transmission of pediculosis among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

| | Participants | Participants | Participants | Total | Participants | Participants |
|--|--------------|--------------|--------------|-------|--------------|--------------|
|--|--------------|--------------|--------------|-------|--------------|--------------|

| Knowledge about | having knowledge according to age | having knowledge according to education | having knowledge according to Sex | 1000 | Knowledge about | having knowledge according to age | having knowledge according to education |
|--|-----------------------------------|---|-----------------------------------|------------------------|------------------------|-----------------------------------|---|
| | <25 yrs 376 | >25 yrs 624 | Illiterate (331) | School education (303) | Higher education (366) | Female (794) | Male (206) |
| Head lice can fly from person to person (false) | 21356.64% | 34755.6% | 14744.41% | 17056.1% | 23363.66% | 427 53.77% | 128 62.1% |
| The ability of lice to live outside the human body (false) | 31282.97% | 51883.01% | 30491.84% | 25885.14% | 27474.86% | 623 78.46% | 192 93.20% |
| Transmission from animals (false) | 28676.06% | 42968.75% | 24273.11% | 20968.97% | 25469.39% | 522 65.74% | 188 91.26% |
| Prolonged direct contact with infected person increase risk of transmission (true) | 11931.64% | 30749.19% | 3510.57% | 13343.9% | 154 42.1% | 407 51.25% | 120, 58.3% |
| Crowded places increase the risk of transmission (true) | 14237.76% | 26542.46% | 5416.31% | 16755.11% | 30382.78% | 450 56.7% | 152 73.78% |
| Risk of transmission increase during the winter season | 15340.69% | 30448.71% | 288.45% | 8929.37% | 13536.88% | 234 29.47% | 92 44.66% |
| Overuse of hair oils increase the risk of pediculosis (true) | 11931.64% | 28745.99% | 13239.87% | 144M 47.52% | 12734.69% | 441 55.54% | 4823.30% |
| Leaving hair wet for prolonged period increases the risk of transmission (true) | 9124.20% | 20833.33% | 10632.1% | 19865.34% | 25369.12% | 435 54.78% | 71 34.46% |

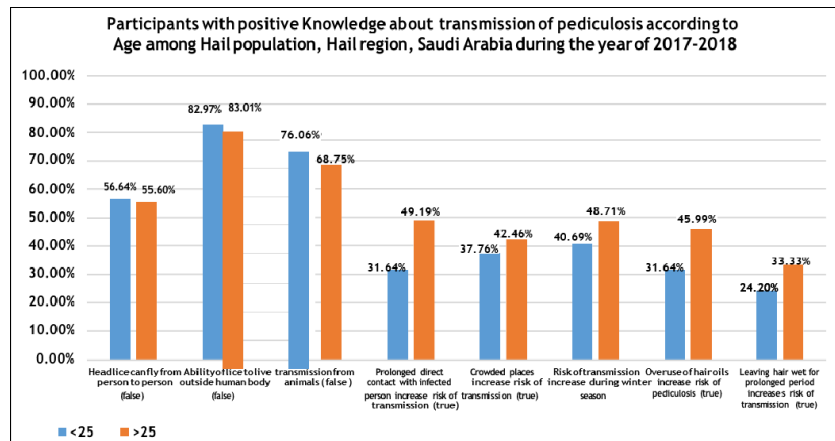


Fig 2a: Knowledge about transmission of pediculosis according to age among Hail population, Hail region, Saudi Arabia during the year of 2017-18

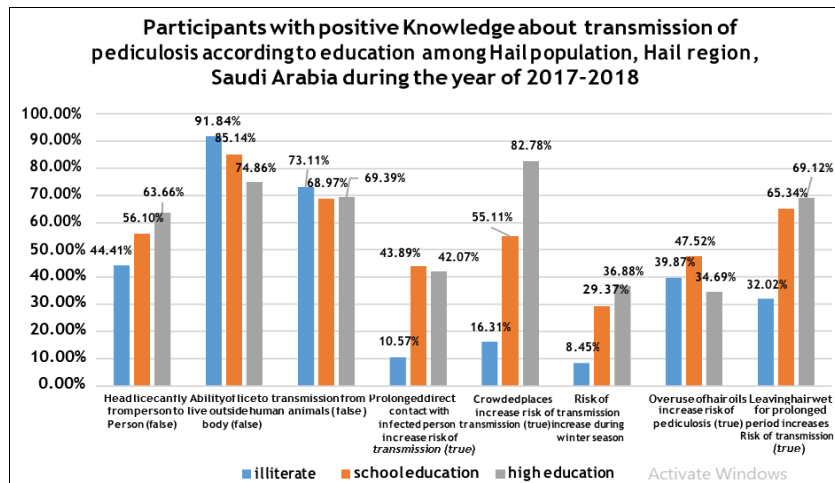


Fig 2b: Knowledge about transmission of pediculosis according to education among Hail population, Hail region, Saudi Arabia during the year of 2017- 2018

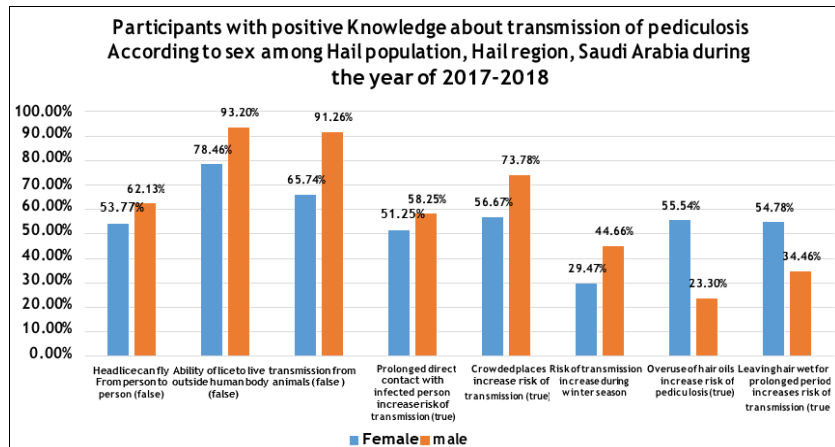


Fig 2c: Knowledge about transmission of pediculosis according to gender among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

Table 3: Knowledge about clinical manifestations of pediculosis, according to age, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

| Knowledge about | Participants having knowledge according to age | | Participants having knowledge according to education | | | Participants having knowledge according to Sex | | Total 1000 (100%) |
|--|--|---------------|--|------------------------|------------------------|--|------------|-------------------|
| | <25 yrs (376) | >25 yrs (624) | Illiterate (331) | School education (303) | Higher education (366) | Female (794) | Male (206) | |
| Most infected people scratch their head (true) | 22660.10% | 54387.01% | 17853.77% | 23176.23% | 32989.89% | 56671.28% | 14670.87% | |
| Other types of pediculus transmits diseases (true) | 5614.89% | 20332.53% | 5616.91% | 13945.87% | 18550.54% | 46258.18% | 8842.71% | |
| Pediculosis affect sleep (true) | 12533.24% | 34354.96% | 4714.19% | 15751.81% | 19854.09% | 26132.87% | 7837.86% | |

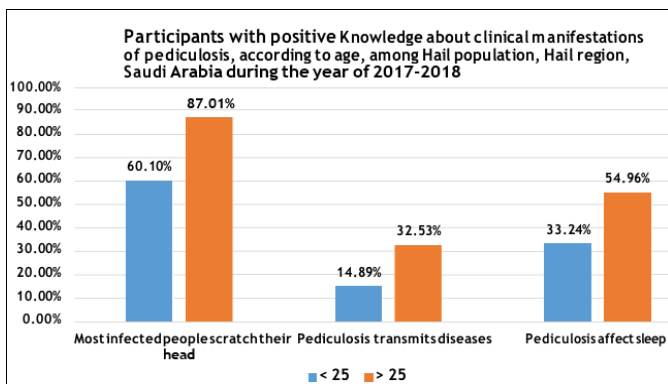


Fig 3a: Knowledge about clinical manifestations of pediculosis, according to age, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

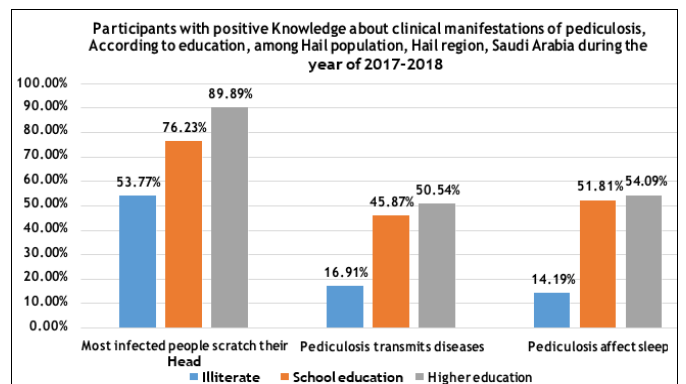


Fig 3b: Knowledge about clinical manifestations of pediculosis, according to education, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

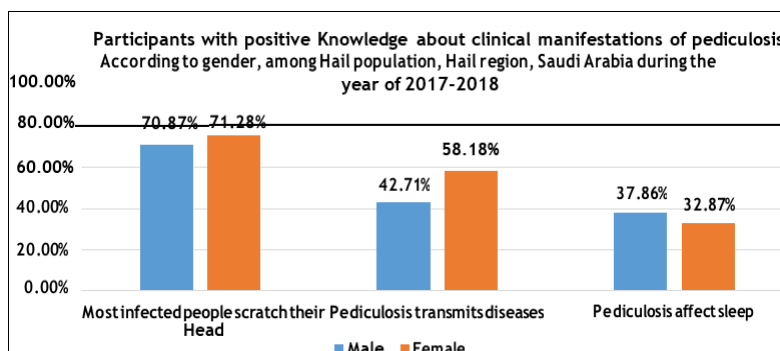


Fig 3c: Knowledge about clinical manifestations of pediculosis, according to gender, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

Table 4: Knowledge about prevention and treatment of pediculosis among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

| Knowledge about | Participants having knowledge according to age | Participants having knowledge according to education | Participants having knowledge according to Sex | Total 1000 | Knowledge about | Participants having knowledge according to age | Participants having knowledge according to education |
|--|--|--|--|-----------------------|------------------------|--|--|
| | <25 yrs 376 | >25yrs 624 | Illiterate (331) | School education(303) | Higher education (366) | Female (794) | Male (206) |
| Pediculosis can resolve without intervention (false) | 276 73.40% | 38762.01% | 18856.79% | 13343.89% | 21257.92% | 44756.29% | 13264.07% |
| School observation by health workers help decrease the risk of transmission (true) | 118 31.38% | 26642.62% | 14644.10% | 14848.84% | 21759.28% | 41852.64% | 13565.53% |
| Treatment of pediculosis should be by medical methods | 136 36.17% | 16426.28% | 7823.56% | 9832.34% | 16946.17% | 28736.14% | 8541.26% |
| Treatment of pediculosis should be by traditional methods | 202 53.72% | 37660.25% | 21063.44% | 15149.83% | 12935.24% | 33942.69% | 8842.71% |
| Treatment of pediculosis could be through the pharmacist | 3810.10% | 8413.46% | 4312.99% | 5417.82% | 6216.93% | 10813.60% | 3316.01% |
| Using extra amounts of lice-killing medication gets the best result (false) | 177 47.07% | 29747.59% | 9127.49% | 10735.31% | 18555.89% | 39850.12% | 8943.20% |
| You should wash your hair thoroughly after applying lice-killing medication (true) | 115 30.58% | 276 44.23% | 9829.60% | 14246.86% | 12634.42% | 37647.35% | 9144.17% |
| All available products kill all the lice and their eggs (false) | 341 90.69% | 567 90.86% | 31294.25% | 25483.82% | 31184.97% | 66483.62% | 19795.63% |

(100 %)

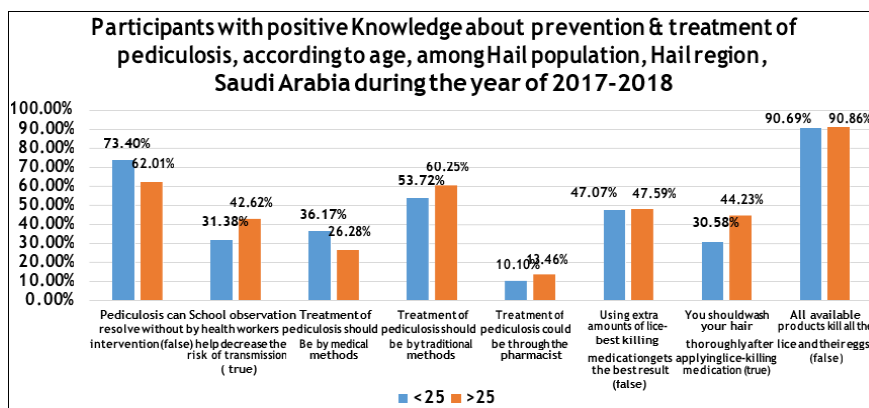


Fig 4a: Knowledge about prevention and treatment of pediculosis, according to age, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

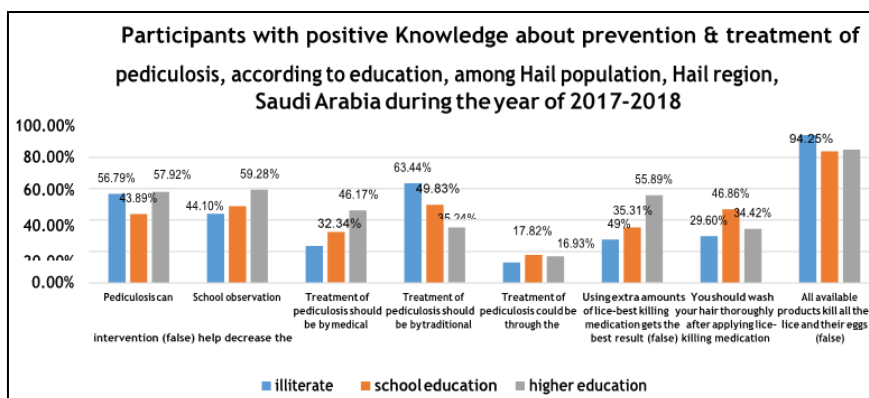


Fig 4b: Knowledge about prevention and treatment of pediculosis, according to education, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018

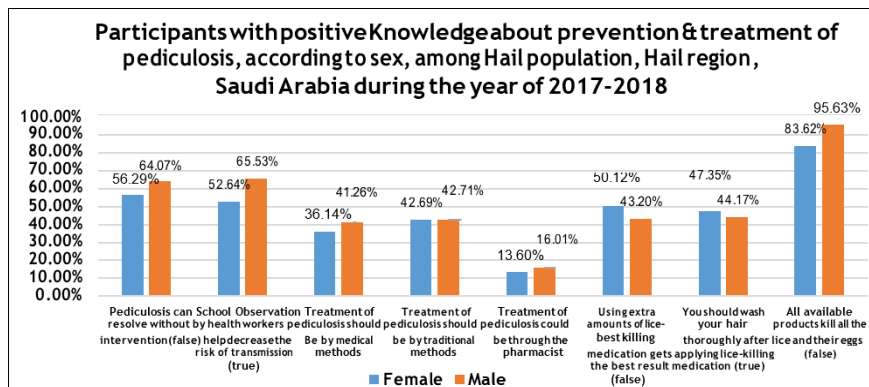


Fig 4c: Knowledge about prevention and treatment of pediculosis, according to gender, among Hail population, Hail region, Saudi Arabia during the year of 2017-2018.

Table 5: the Behavioral practice of pediculosis among Hail people experienced infection by pediculus capitis, Hail region, Saudi Arabia during the year of 2017-2018

| Behavioral practice | Participants having +ve practice | | Participants having +ve practice according to education | | | Participants having +ve practice according to sex | | Total participants experienced infection |
|---|----------------------------------|---------------|---|-----------------------|-----------------------|---|-----------|--|
| | according to age | | Illiterate | School Education (81) | Higher Education (46) | Female (208) | Male (32) | |
| | <25 yrs (98) | >25 yrs (142) | | | | | | |
| Have you seen Pediculosis insect? | 77 | 122 | 98 | 79 | 33 | 194 | 28 | 240 (24%) |
| Did you experience disgusting feeling from people around? | 81.63% | 77.46% | 82.30% | 86.41% | 91.30% | 82.21% | 93.75% | |
| Did you ask for sick leave till the infection resolves (yes) | 44 | 89 | 53 | 46 | 23 | 111 | 12 | |
| Did you used to wash your hair once or more/week? | 44.89 % | 62.67% | 46.90% | 56.79% | 50% | 53.36% | 37.5% | |
| Was you able to differentiate between lice, dandruff and nits? | 59 | 79 | 41 | 43 | 34 | 102 | 28 | |
| Did you use hair oils before or during the time of infection? | 60.2% | 55.63% | 36.28% | 53.08% | 73.91% | 49.03% | 87.5% | |
| Did you treat pediculosis by medical methods? | 75 | 111 | 74 | 62 | 40 | 173 | 25 | |
| Did you treat pediculosis by traditional methods? | 76.53% | 78.16% | 65.48% | 76.54% | 86.95% | 83.17% | 78.12% | |
| Did you take the treatment according to the pharmacist advice? | 72 | 89 | 93 | 45 | 31 | 163 | 18 | |
| Did you get complications like skin sores and skin infections | 73.46% | 62.67% | 82.30% | 55.55% | 67.39% | 78.36% | 56.25% | |
| Did your family used to have common combs, brushes, or hair ribbons | 36.73% | 39.43% | 32.74% | 27.16% | 65.21% | 35.09% | 65.62% | |
| | 47 | 56 | 52 | 42 | 8 | 92 | 7 | |
| | 47.95% | 39.43% | 46.01% | 51.85% | 17.3% | 44.23% | 21.87% | |
| | 15 | 20 | 24 | 27 | 8 | 43 | 4 | |
| | 15.30% | 14.08% | 21.23% | 33.33% | 17.39% | 20.67% | 12.5% | |
| | 7 | 8 | 11 | 6 | 5 | 13 | 2 | |
| | 7.14% | 5.63% | 9.73% | 7.40% | 10.86% | 6.25% | 6.25% | |
| | 71 | 113 | 92 | 59 | 27 | 142 | 22 | |
| | 72.44% | 79.57% | 81.41% | 72.83% | 58.69% | 68.26% | 68.75% | |

Discussion

To our knowledge, the current study is the first study in Hail region that went through the awareness of population towards pediculosis. The present results demonstrated that there is marked deficiency in knowledge concerning pediculosis capitis among Hail population.

Hence the need for Health Educational programs covering Hail population about that issue is important.

Unfortunately, the Illiterate category of the participants was found to have highly deficient knowledge (32.6%, 56.7%, 16.3) about the correct causative agent of pediculosis, the

main sex affected by pediculosis being females and the common age affected by pediculosis being young respectively. However, the awareness was much better among highly educated (56.8%, 83.1%, 90.4) respectively. Positive answers that pediculosis is more common among younger children, in the current work, is expected as younger children usually have some behavioral factors like engagement in close contact during play (Al-Shaw, 2006; Motovali-Eman *et al.*, 2008) [6, 37]. Moreover, it is well known that pediculosis is more prevalent among female girls due to long hair and difficulty to clean it. (ALBashtawy and Hasna, 2012; Al-

Shaw, 2006; Speare and Buettner, 1999)^[1, 2, 6, 60]. Similar to the current study and unexpectedly, A study conducted by Kirchofer, Price, and Telliophann on American primary-school teachers, revealed that most teachers possessed only a rudimentary level of knowledge concerning head lice and that nearly 71% received their knowledge from the school nurse (Kirchofer *et al.* 2001)^[32]. Similar findings were also encountered in Australian parents, who demonstrated a lack of knowledge of pediculosis, with 35% of respondents failing to answer half of the survey questions correctly (Counahan *et al.*, 2007)^[14]. Moreover, a surprising worldwide study revealed that lack of knowledge about pediculosis is not limited to parents and families but extended also to healthcare professionals (Olowokure *et al.*, 2003; Price *et al.*, 1999)^[44, 50].

In contrast to the present study, a study in Nigeria revealed that general knowledge including knowledge about mode of transmission of head lice and their control is also limited even in both low and high sociodemographic settings (Counahan *et al.*, 2007 & Parison *et al.*, 2010 & Sidoti *et al.*, 2009)^[14, 47, 57]. Surveys involving pharmacists, community nurses, and physicians have shown that knowledge on transmission and control is also insufficient in health professionals (Mumcuoglu *et al.*, 2010 & Olowokure *et al.* 2003 & Philips *et al.* 2001)^[38, 44, 48].

Moreover, a study from the United Kingdom suggested that a considerable number of health professionals had insufficient knowledge on the prevention and treatment of pediculosis (Olowokure *et al.* 2003)^[44]. Similarly, a recent study has shown that physicians' knowledge on transmission and prevention was generally low, which is a major drawback in control of the disease (Mumcuoglu *et al.*, 2010)^[38].

Concerning the knowledge about the mode of transmission of head lice, it was found that there was deficient knowledge regarding the role of common combs, brushes, or hair ribbons in the transmission of pediculosis (44.41%, 63.66%). Surprisingly, most of the participants believed erroneously in the ability of lice to live outside the human body (78.46%, 93.20%) and (65.74%, 91.26%) thought that it could be transmitted from animals. It is well known that pediculosis is highly contagious, spreading most directly via the sharing of combs and hairbrushes but also via contact between clothes, bed sheets, pillowcases, towels and other household fabrics (Bailey and Prociw, 2000)^[10]. It is also well confirmed that lice can't live outside the human body and if a louse falls off a person, it dies within 2–3 days. Moreover, correct answers of participants in the present study were not sufficient as regards to the risks of infection when prolonged direct contact with infected person, attending crowded places, leaving hair wet for a prolonged period, overuse of hair oils, and during the winter season. It is well confirmed from the previous studies that direct physical contact between infected individuals is also known as a common reason for infestation. The large amount of physical contact occurring in poor and overcrowded living conditions, such as those found in the large-family households of rural Jordan, greatly increases the risk of transmission. As expected, attending crowded areas specially in absence of bathing facilities and poor hygiene are linked to greater rates of lice infestation (ALBashtawy and Hasna, 2012; Al-Shaw, 2006)^[1, 2, 7]. Similarly many

researchers reported the same wrong belief that lice have jumping or flying ability to live outside human body (Madeira *et al.* 2015)^[34].

It is previously confirmed that there are some risk factors associated with transmission of pediculosis capitis in all communities in the world such as occupation, rate of hair washing and bathing per week, crowded places, leaving hair wet for prolonged period and presence or absence of health education (Shayeghi *et al.*, 2010 Al-Shawa *et al.* 2006 & Soleimani *et al.*, 2007)^[56, 7, 59]. Many participants in different studies similarly indicated that bad hygiene habits rather than economic status, was responsible for lice transmission (Kirchofer *et al.*, 2001)^[32] and they showed a concept that poverty is not an excuse for an individual to not practice good hygiene.

Results of the current study found that knowledge about the clinical manifestation of head lice was deficient. Except for that of scratching the head which showed good knowledge (53.77%, 89.89%) The symptoms of lice infestation may include fatigue, irritation, sleep disturbance, and lethargy. Because it can bite several times and its saliva is injected into the body repeatedly. Repeated inoculation of the louse saliva may cause allergies and severe itching, and if the feces dust is inspired can cause symptoms like allergic rhinitis. The affection of sleep in cases infected by head lice is also common a picture. (Nutanson *et al.*, 2008)^[42].

Regarding knowledge about prevention and treatment of pediculosis, it was noted in the present study that high percentages (63.44%, 35.24%) of people thought that traditional treatment is the best for treatment of pediculus humanus while those who had information that medical treatment is the best were less (23.56%, 46.17). Actually, it will be very beneficial if education concerning the dangers of applying traditional head lice treatment which often includes some toxic or flammable substances. This was evidenced by a study in Australia which found that ignorance about the correct head lice therapy is directly linked to the use of incorrect or dangerous substances and this ignorance was linked to the shortages in local health education programs regarding these issues (Counahan *et al.*, 2007)^[14]. Moreover, a lack of knowledge about proper management of pediculosis can also be dangerous in ways leads to the use of traditional remedies, which can be harmful to all household members (Sidoti *et al.*, 2009)^[57]. Such practices have been observed in many developing countries (Ebomoyi, 1994; Khokhar, 2002)^[17, 31]. Traditional 'remedies' include direct application of kerosene or insecticides to the scalps of infested children. Unfortunately, a high percentage (43.89%, 73.40%) of our sample believed that head lice infestation can be resolved spontaneously without treatment. Some people however, have the same concept worldwide and used not to apply any treatment. Similar results were reported in Brazil where people did not present to health care center due to pediculosis, which points to a similar perception of the disease in the affected population (Heukelbach *et al.*, 2003)^[26]. Likewise, in Australia, parents believed in the importance of governmental cleanliness of the environment (Canyon *et al.*, 2010)^[47] but they didn't have enough knowledge about the preventive and treatment methods on the individual level. In other studies, the researchers found that there were many participants reported

that they used insecticide for a regular basis for their school children (Speare *et al.*, 1999 & Frankowski *et al.* 2002 & Roberts, 2002) ^[60, 20, 53]. In the present work, it was clear that knowledge about treatment material or insecticides was very deficient as (94.25%, 84.97%) of the participant thought wrongly that pediculicides kill all eggs, insects and all stages of the life cycle. Other similar studies that revealed knowledge gaps were those done among Norwegian population where more than half of the participants erroneously thought the same (Birkemoe *et al.*, 2012) ^[11]. Unfortunately, in the present work, there were big gaps in knowledge concerning prevention and treatment of pediculosis as only (31.38%, 65.53%) of the correspondents believed that school observation help decreases the risk of transmission. On the other hand, it is well known that health worker or nurse also plays an important role in education, as he or she is ideally suited to provide students and teachers with the required information on head lice treatment and prevention, as well as providing of psychological support and reassurance to the infected children and their parents (Ibarra, 2008; Wurzbach, 2002) ^[29, 62]. In addition, it was well known that there is a relation between knowledge about pediculosis and infestation. It was observed that in schools where the teachers did not provide information on the prevention and control of pediculosis, a high prevalence was detected than in other places where such information was provided (Paredes *et al.*, 1997) ^[45].

Another dangerous gap of knowledge, about treatment of head lice, was encountered in the present study as few percentages of the correspondents (29.60%, 34.42%) knew that they should wash hair thoroughly after applying lice-killing medication and many (27.49%, 55.89%) thought wrongly that using extra amounts of lice-killing medication can get the best result. The lack of knowledge on these issues sadly can pose a serious health hazard if they are not used according to pesticide regulations that guard against the health hazards (Hamad *et al.* 2016) ^[24]. Many insecticides usually absorbed through the skin and hence wearing gloves, and washing hair and scalp as indicated by the physicians is very important (Nutanson *et al.*, 2008) ^[42]. Application of pesticides, unfortunately, caused many toxicities as pesticide misuse in as shown in many studies (Hamad *et al.* 2016) ^[24]. Health workers should educate the population to be aware of the high risk of pesticide poisoning and should be trained on early diagnosis and appropriate management of cases of pediculicide poisoning.

In the present study, it was found that 24% of the participants acquired pediculosis throughout their lives. However, fewer rates were detected in Om Al-Jamal (Jordan) (14.6%). Moreover, fewer rates were also found in Jordan (Nosier and Amr, 2000; Shakkoury and Abu-Wandy, 1999) ^[41, 55]. Much Lower rates were detected in Jeddah city (12%), and (7-9%) in a study conducted among primary schoolgirls in the same city (Al-Zanbagi and Al-Hashdi) On the centrally, the rate was found higher in Al-Baha (45.45%). This rate is considerably higher than rates recorded in the present work as well as the earlier studies conducted in Saudi Arabia. a Higher rate was also reported in Al Hassa (49%) (Bosely *et al.*, 2011 & Amin *et al.*, 2011) ^[12, 8]. Approximately similar results were detected in Albaha (19.8%) (Gharsan *et al.* 2016) ^[21], in Jazan (20.5%)

(Bosely *et al.*, 2011) ^[12]. Much lower results were demonstrated in Eastern Saudi Arabia (5.2%) (Al- Saeed, 2006) ^[5]. More recent studies showed a prevalence of 13.3% in Jazan and 12.2% among primary school girls in Riyadh city (AL-Megrin, 2015 & Bosely *et al.*, 2011) ^[12]. Worldwide, in Europe prevalence varied from 0.48% to 22.4%. (Falagas *et al.*, 2008) ^[18]. It was found to be 3.3% in France (Durand *et al.*, 2011) ^[16]. It was also reported to be 13% in Australia (Spear & Buettner, 1999) ^[60] and 40% in Korea (Sim *et al.*, 2011) ^[58]. The higher infestation rate reported in the current work can be explained on the basis of the difference in time of the study, the difference in populations and in climatic regions as well. Other explanation cause may be due to nature of Hail region as a rural area. It was proved in many studies that the rate of lice infestation is higher in rural than urban areas. Other studies also established the same result; in Turkey by (9.7 urban and 20% rural) (Gulgun *et al.*, 2013& Karakus *et al.*, 2014) ^[23, 30]; in Jordan by (23.5 and 31.2%); in Iran by (0.66 and 1.66%) (Moradi *et al.*, 2009) ^[36] and in Yemen by (20.6%) (Al-Maktari, 2008) ^[3]. Similar rates were also reported in Egypt (26.6%) (Raheem *et al.*, 2015) ^[52]. In Saudi Arabia, the highest rate of infestation was among primary school girls (45.45%). while it was 12% in another area of the same city. An infestation rate of 19.8% was reported in Albaha and 13.3% in Jazan and 12.2% among primary school girls in Riyadh city. In addition, the few pediculosis studies conducted of schoolchildren in Jordan have indicated a prevalence of head lice varying from 6.7% to 30% (ALBashtawy, 2012; ALBashtawy and Hasna, 2012; Nosier and Amr, 2000; Rabi *et al.*, 1996; Shakkoury and Abu-Wandy, 1999) ^[1, 2, 41, 51, 55], including rates of 11.1% in Amman (Shakkoury and Abu-Wandy, 1999) ^[55] and 13.4% in north Jordan (Nosier and Amr, 2000) ^[41].

In the current work, according to the education level, 47.1% of illiterates acquired head lice during their lives, while only 19.1% of educated had it. It was also noted that only 54% of illiterates used to wash their hair once or more/week while 95.6% of highly educated participants did. That's means that there is a link between pediculosis socioeconomic status and cleanliness behaviors among the population. (ALBashtawy and Hasna, 2012; Menan *et al.*, 1999; Motovali-Eman *et al.*, 2008) ^[1, 2, 35, 37]. The results indicated that rural residence, sex, long hair, age- group 6- < 8 years old, positive history of previous infestations, sharing of beds and combs, uneducated mother and family overcrowding might be the risk factors for the head lice infestation.

As expected, in the present study, 71.7%-97.5% of the participants were able to diagnose pediculosis by seeing the insects. Interestingly, populations commonly affected by head lice usually diagnose themselves with high accuracy. A previous analysis has shown that the population of Skanko village in Nigeria diagnosed pediculosis with 74% sensitivity and 99% specificity (Ugbomoiko 2008) ^[61]. Figures from resource-poor communities in Brazil, where head lice are highly endemic, were similar (Heukelbach *et al.*, 2006 & Pilger *et al.*, 2008) ^[25, 49].

Unfortunately in the current work, 77.5%- 93.8% of people declared that they experienced disgusting feeling from people around. In contrast, Nigerian study population, stigma was not an important issue. However, and in contrast, the situation is

different in developed economies where distress and persistent stigma about being infested are the predominant feelings with feeling disgust, horror, dirty, frustrated and anxious, and head lice control is a major issue disturbing the quality of life in their families (Parison *et al.*, 2008, Parison & Canyon 2010)^[46, 47]. This behavior, unfortunately, is one of the reasons that the parents avoid seeking medical treatment from health providers. An urgent need for health education and religious programs to prevent this behavior will improve the population acceptance and seeking physicians for treatment. Similar results were reported in Brazil among students which demonstrated the infested students to be objects of ridicule and jokes that damage their self-esteem. With associated sadness, fear and anxiety (Newton *et al.*, 2015)^[40].

In the present work, it was clear that there were differences in the percentages of knowledge as well as the behavioral practice among the participants in relation to sociodemographic data. Knowledge and behavioral practices were found better among females, ages more than 25 years, as well as among the educated correspondents. On the other hands, illiterates, younger ages, and male groups found to have large gaps in the level of awareness. Likewise, in other studies, they got the same differences and gaps according to some sociodemographic factors, such as age, gender, social, economic and cultural status, which influence the difference in knowledge and distribution of pediculosis (Nazariet *et al.*, 2006), (Fasulo *et al.*, 2005)^[19], (De Maeseneer *et al.*, 2005)^[15] (Govere *et al.*, 2003)^[22] and (Al-Shaw, 2006)^[7].

This deficient knowledge noticed in the current work should be an alarming issue in Hail region. It may be due to the lack of periodic health education programs among schoolchildren and their teachers as well as families.

Conclusion

In conclusion, although Pediculosis is common in Hail area, knowledge on head lice, transmission, manifestations, prevention, and treatment is poor and limited. This concern can be effectively resolved by local efforts to increase health education and awareness.

Recommendations

1. Education for the public is particularly important through the application of the campaigns on a public level through different mass media or through the main governmental and private institutions.
2. Health education of health workers about the problem of pediculosis and how to prevent the barriers that hinder its treatment.
3. More researches are needed to address the size of that health problem specially in remote Hail villages.
4. Taking into consideration the feeling sham among the participants in the present work, Health education programs should concentrate on education supporting families regarding that issue.
5. Including head lice prophylactic programs in the curricula of both secondary schools and university students as well

Limitation of the study

Although the sample size was appropriate (1000 participants), it was relatively small, and it was not population-based. To

represent Hail region as a whole, the study should extend to cover more areas of hail region especially the remote villages.

Expected impacts of the study

Dissemination of results in the form of a published paper so as to facilitate the distribution of information to the public and making a cornerstone or base on which other researchers can follow.

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