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Prevalence and risk factors of Pediculus capitis among primary schools children in Al-Mukalla city, Hadhramout governorate, Yemen: A school-based cross-sectional study

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Abstract. Head lice infestations (Pediculus humanus capitis) are the most common parasitic condition among children in the world, especially in poor communities. A descriptive cross-sectional study was conducted to determine the prevalence and risk factors of head lice infestation among children in Al-Mukalla city schools, Hadhramout governorate, Yemen. Data were collected from 467 students from six different primary schools in Al-Mukalla city. A pretested questionnaire was used to collect demographic data, social-economic factors, practice hygiene and treatment history. The overall prevalence of pediculosis capitis was (58.5%). a significantly higher prevalence was showed among: female gender; long and medium hair; age group of 11-14 years; students in the 4th and 5th Class levels, students in classes with more than 40 students capacity; students in government schools; students who sharing items; those coming from previously infested family members ($P<0.001$). This study shows a high prevalence of Head lice infestations among children in a primary school in Al-Mukalla city. There is a significant association between Head lice infestations with socio-economic; personal hygiene factors and history of Head lice infestations in one family member that indicated the difficulties of eradication of head lice, especially from girls. Health education and good personal hygiene programmed are needed to increase awareness in our community.

Keywords: Prevalence, Risk factors, Pediculosis Capitis, Head lice, Hadhramout, Yemen.

1. Introduction:

Pediculosis capitis or head lice infestations (HLIs) is regarded as one of the frequent community health concerns in the

world that mostly invades the human's scalp hair, especially children in primary-school-age [1]. Despite improvement in health and medical sciences, HLIs is one of the most threats to public health, and it's still a health problem due to the ease transmission, stigmatization and treatment cost [2, 3]. Mostly infestation is occurred in children aged 5 - 13 years at primary schools and their families in both developed and in developing countries [2, 4-8].. Most of cases were reported among females [8]. HLIs is transmitted directly from the infested person to another or indirectly by sharing such items as combs or hairbrushes, infested clothes, hats, towels, sheets, bedding and other personal belongings [9-11]. The main symptoms of the HLIs is itching, also patients with lice can be asymptomatic [11]. In general, no any pathogenic agents can be transmitted by head lice but the complications resulting from parasitism, such as scalp lesions due to scratches, secondary bacterial infection might be occurred in extreme cases, recently, detection of pathogenic bacteria have been identified in Pediculus humanus capitis but the transmition role of that bacteria by head lice is not yet defined [11-13]. The prevalence of head lice have a significant association with many risk factors such as socio-demographic, personal hygiene practices, behavioral and environmental factors in addition to host related factors [14, 15]. In previous studies, a high prevalence of head lice has been reported in Kuwait (46.2%) [16], Egypt (33%) [17] and followed by the Saudi Arabia 31.2% [18], On the contrary, a low prevalence of head lice has been reported in Jorden (26.6%) [19], in different regions in Iran (0.47 to 23.9%) [2], Thailand (23.32%) [20], South Africa (15.3%) [21], Iraq (14.43%) [22], and in Mexico (13.3%) [23].

However, only one study was conducted in Yemen, which reported the prevalence of head lice among school children in Al-Mahweet governorate to be (13.3%) [24]. In achieving effective and sustainable control program strategies for HLIs, awareness and identifying the factors that influence the infestation by head lice are regarded as significant tools. Hence, evaluating an individual's knowledge and associated risk factor with HLIs helps in recognizing the planning of intervention health programs at primary schools. To date, there is no published data about the prevalence and risk factors associated with HLIs in primary school's Children in Al-Mukalla city, Hadhramout Governorate. The main purpose of this study was to determine the prevalence of HLIs and its associated risk factors among children in Al-Mukalla city schools, Hadhramout governorate, Yemen. Established baseline data and understanding the local epidemiology of HLIs that will aid in controlling this health problem

2. Subjects and Methods:

2.1 Study Area and Population:

The study was carried out in Hadhramout governorate, Yemen. Hadhramout is a largest governorate in Yemen, represent 36% of whole area of Yemen (74030 Km²) with a population of 1,611,000 [25], located in the south-eastern of Yemen, Al-mukalla district is the capital and largest coastal plain city. During the year, Hadhramout governorate has a hot climate Hadhramout has a coastal plain area and low rainfall ranging from 50 to 100 mm per annum. The study population was students from some governmental and private primary schools in Al-Mukalla city, Hadhramout governorate.

2.2 Study Design and Sample Size:

A descriptive cross sectional study was performed during the period from the first of January to the end of March in 2020. The data were collected by well-training students from the college of Medical and Health Science, Medical Laboratory Sciences Department, Hadhramout University. By using a simple random method, six primary governmental and private schools, including 251 females and 216 males from 1st to 5th classes, were selected and examined (Figure 1). The formula for applied health sciences was used to calculate the sample size, where the hypothesized expected prevalence was 50%, the confidence level was set at 95%, and 5 % of relative precision resulting in a minimum sample size equal to 384 students; however the sample size was increased (20% = 76.8= 460) to include all eligible students in the chosen schools in order to maximize the power and validity of the study.

2.3 Data Collection:

To determine the prevalence of HLIs and its risk factors, pre-test questionnaire was designed to collect data about socio-demographic profile including age, gender, student's grade father's education level, mother's education level, father's job, mother's job, family monthly income, and bathing facilities in the house; also personal hygiene factors including frequency of hair-washing and bathing, sharing items, and hair length, in addition to treatment history (Tables 1, 2, 3). The questionnaire was distributed hand by hand to students and asked them to fill in by their parents, and then All the participated students who returned the questionnaire were eligible for hair screening. The hair was examined by two qualified inspectors for the head lice, as well as for the eggs/nits, by a full-head inspection using disposable fine-toothed combs at three main areas: frontal, temporal behind ears, and occipital by using disposable gloves, mouth mask, white paper, hand lens. If live lice or nits were detected, a student was considered an infested case. The height and weight of the students was measured using a standard electronic digital scale and tape meter to find the magnitude of body mass index.

2.4 Statistical Analysis and Ethical Issues:

The data were analyzed by using SPSS version 20 (SPSS Inc, Chicago, IL, USA). Frequencies and percentages of Independent and dependent variables were presented using cross-tabulations and Chi-square tests. $P < 0.05$ was considered statistically significant. Ethical approval was granted by the Ethics Committee of College of Medicine and Health Sciences, Hadhramout University.

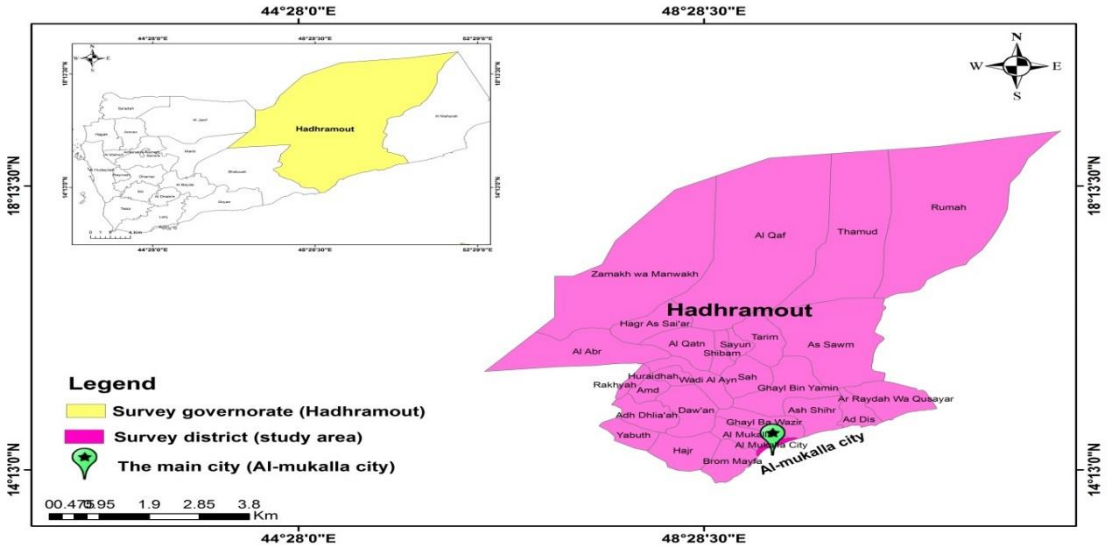

Figure 1. Map of Yemen and Hadhramout governorate highlighting the sites of different schools in Al-Mukalla city by using the Esri ArcGIS 10.7 software

3. Results:

Out of 467 students (251 girls and 216 boys) from six primary schools (from 1st to 5th classes) in different areas in Al-Mukalla city, Hadhramout Governorate was involved in the study. Their mean age ranged from 6.0 to 14.0 years, with a mean of 10.0 years. 273 (58.5%) were found positive for head lice infestation. A high significant relationship was reported between HLIs and gender; age group of 11-14 years; 4th and 5th grades; type of school; number of students per class; a past history of infestation in family members; and who had previous treatment history. Highly significance of HLIs was found in girls (73.3%) than in boys (41.2%). The highest rate of HLIs among students was recorded in Alseda-zinab school (76%) followed by Al-Mukalla schools for girls (74.4%). The high prevalence of HLIs was occurred in government schools (66.2%) than in private schools (51.8%) (Table 1). In the present study, a significant association were observed between HLIs and type of school (P= 0.002); with number of students per class with more than 40 students (P= 0.02); and with changes in abnormal nutritional status (Obese > 95th percentile) (79.5%, P=0.042) (Table 1 and 3). No any significant association between the head lice infestation and other risk factors such as the education level of parents, family income, number of a bed rooms, house characters, and bathing facilities (Table 1). On the other side, the finding shows the association between HLIs and hygiene practices among schoolchildren. The prevalence of HLIs was significantly higher among children who shared items (59.9%, P=0.04) and among those with long or medium hair length (66.7%, 66.5%, respectively, P=0.0001) (Table 2). Many traditional treatment method used by mothers who had infested children such as daily hair combing, frequently washing, using hair creams, shampoo, spraying, and combination treatment method.

Table 1. Demographic and socio-economic factors regarding to head lice infestation

Characteristic		No. of exam	No. of infestation	Prevalence (%)	P-value
Gender	Male	216	89	41.2	0.000
	Female	251	184	73.3	
Age group	6-10 years old	324	179	55.2	0.03
	11-14 years old	143	94	65.7	
Class level	Grade I	100	42	42.0	0.003
	Grade II	77	45	58.4	
	Grade III	80	48	60.0	
	Grade IV	105	70	66.7	
	Grade V	105	68	64.8	
Name of schools	Al-mukalla schools (boys)	130	47	36.2	0.000
	Al-mukalla schools (girls)	82	61	74.4	
	Alsedazinab	96	73	76.0	
	AlsikhNaser	67	34	50.7	
	Ibnkhaldon	53	36	67.9	
	Al sadara	39	22	56.4	
Type of school	Private	251	130	51.8	0.002
	Government	216	143	66.2	
Number of students in class	20-25	74	37	50.0	0.025
	25-30	109	58	53.2	
	30-40	92	50	54.3	
	More than 40	192	128	66.7	
Father education level	Illiterate	24	17	70.8	0.454
	Primary education	155	94	60.6	
	Secondary education	190	105	55.3	
	Universal or above	98	57	58.2	
Mother education level	Illiterate	119	78	65.5	0.205
	Primary education	197	109	55.3	
	Secondary education	102	55	53.9	
	Universal or above	49	31	63.3	
Father job	Employed	411	244	59.4	0.280
	Unemployed	56	29	51.8	
Mother job	Employed	56	32	57.1	0.831
	Unemployed	411	241	58.6	
Family monthly income	Less than 40000	154	99	64.3	0.068
	40000-80000	214	113	52.8	
	More than 80000	99	61	61.6	
Family members	Less than 5	102	55	53.9	0.346
	5-10	312	183	58.7	
	More than 10	53	35	66.0	
House character	House	274	168	61.3	0.294
	Apartment	185	100	54.1	
	Villa	8	5	62.5	
Number of bed rooms	1-2	239	147	61.5	0.383
	3-5	216	119	55.1	
	>5	12	7	58.3	
Bathing facilities in the house	Yes	444	258	58.1	0.500
	No	23	8	34.8	

Table 2. Personal hygiene factors regarding to head lice infestation

Characteristic		No. of exam	No. of infestation	%	P-value
Hair washing frequency per week	Once per week	93	56	60.2	0.489
	Twice per week	184	113	61.4	
	Three times per week	105	60	57.1	
	More than three per week	85	44	51.8	
Hair combing frequency daily	Once per day	61	31	50.8	0.363
	Twice per day	247	151	61.1	
	Three times per day	91	55	60.4	
	More than three per day	68	36	52.9	
Sharing items	Yes	419	251	59.9	0.044
	No	48	22	45.8	
Hair length	Long, > shoulder level	48	32	66.7	0.000
	Medium, > 3cm to shoulder level	239	159	66.5	
	Short, <3cm	180	82	45.6	
Type of Hair	Curly	19	14	73.7	0.061
	In-between	278	151	54.3	
	Silky	170	108	63.5	
Color of hair	Black	352	202	57.4	0.505
	Blonde	29	16	55.2	
	Brown	86	55	64.0	
Thickness of hair	Thick	112	64	57.1	0.877
	Medium	288	171	59.4	
	Light	67	38	56.7	
Using hair creams or oils	Yes	409	241	58.9	0.587
	No	58	32	55.2	

Table 3. Family factors and nutritional status regarding to head lice infestation

Characteristics		Infested	Not infested	Total	p-value
Type of treatment	Lice comb	73 (26.7%)	28 (14.4%)	101 (21.6%)	0.000
	Oil	13 (4.8%)	5 (2.6%)	18 (3.9%)	
	Shampoo	25 (9.2%)	18 (9.3%)	43 (9.2%)	
	Spraying	9 (3.3%)	5 (2.6%)	14 (3.0%)	
	Lice comb + oil	8 (2.9%)	3 (1.5%)	11(2.4%)	
	Lice comb + shampoo	31 (11.4%)	20 (10.3%)	51 (10.9%)	
	Shampoo + oil	5 (1.8%)	4 (2.1%)	9 (1.9%)	
	Spraying + lice comb	3(1.1%)	4(2.1%)	7(1.5%)	
	All	34(12.5%)	13(6.7%)	47(10.1%)	
	None	72(26.4%)	94(48.5%)	166 (35.5%)	
Previous infestation	Yes	197 (72.2%)	97 (50.0%)	173(37.04%)	0.000
	No	76 (27.8%)	97 (50.0%)	173(37.04%)	
Previous treatment	Yes	193(70.7%)	97 (50.0%)	290(62.10%)	0.000
	No	80 (29.3%)	97 (50.0%)	177(37.90%)	
Nutritional Status	Underweight < 5^{th} percentile	143 (57.2%)	107 (42.8. %)	250(53.53%)	0.042
	Healthy weight (5^{th} < 85^{th} percentile)	57(57.0%)	43 (43%)	100 (21.41%)	
	Overweight (85^{th} - <95^{th} percentile)	41(53.2.0%)	36 (46.8%)	77 (16.48%)	
	Obese (> 95^{th} percentile)	31 (79.5%)	8(20.5%)	39 (8.35%)	

4. Discussions:

For the first time in Hadhramout governorate, this study was conducted to determine the HLIs status in primary school children that have been considered the most group at risk [9, 26]. In present study, Out of 467 primary school children, 273 (58.5%) were Infested with Pediculosis capitis egg and/or nit, suggesting that it is a common condition among our primary school children. This study finding is higher than previously reported in other mountain areas in Al-Mahweet governorate, Yemen (13.3%) [24]. Furthermore, the previous survey in Al-Mahweet governorate was conducted around 12 years before our study. There may be a variety of potential reasons for these differences, including lifestyle and environmental concerns as a result of high level of temperature and humidity of coastal areas that weather factors effect on the rate of incidence as compared to other mountain areas in Yemen. On other hands, high prevalence of HLIs in our study probably because of Yemen complains for crisis war until nowadays lead to weakness in public health system. This infestation rate is similar to some of previous studies in Iran (56.15 %) [27], and in Argentina (61. 4%) [28], but higher than in Kuwait (46.2%) [16] in Egypt (33%) [17], in Saudi Arabia (31.2%) [18], in Thailand (23.32%) [20] and Malaysia (35.5%) [29]. However, the highest rate of HLIs was reported in Pakistan (74.24%) [30]. In general, the prevalence of HLIs in the world varied from 5% to 78% with highest rates in females [2, 30, 31]. These differences in HLIs rates can be due to several factors such as socio-economic, environmental factors and personal hygiene factors [19, 32]. However, visual inspection method is less sensitive than wet combing method for detection of HLIs [33]. In this study, both visual inspection and combing was used to detect HLIs.

A significantly higher of HLIs was recorded in females (73.3%) in comparison to males (41.2%), as same as many studies were occurred in Kuwait [16], Egypt [34], Iran [6], Jordan [19, 26], Angola [35], and Malaysia [29, 36]. In contrast, the males have a high rate of HLIs than females in primary schools as reported in Saudi Arabia [37], Kenya [38], Belgium [39] and Israel [40]. In present study, the highest rate of HLIs was in females due to their long hairs, which may provide a suitable environment for reproduction and survival of head lice's [41]; while males have their short hairs and cut from time to time; resulting in decrease the HLIs rate, also the males have less direct contact with others during life activities as opposite as females tend to be closer or directly contact with each other in small groups [6, 42, 43], also can be explained by the hair length variations, the HLIs have a significant associated with who had a longer hair, also many interfere factors lead to high lice infestation such as social cultural for girls in Hadhramout governorate, girls who have a head cover due to their Islamic practice can minimize hair contact between girls by covering the head., But at the same time, as a result of

rising scalp temperature and humidity, the rate of HLIs increases [6]. Gender behavior may influence in the variation rate of infestation; hence the lice transmission is more frequently in girls [9]. Student age also had a significant correlation with the infestation of lice (p=0.03). In general age groups between 11-14 years were more suspected to acquire the lice infestation than 6-10 years old group, this can be illustrated by behavioral influences in which children have more overt physical interaction with each other at this age, also due to their age and head-to-head contact. This finding was similar to other studies obtained in Egypt [34], Brazil [44]. Furthermore, in present study showed a significant relationship between HLIs and students in the fourth class (66.7%) followed by fifth class (64.8%) and in the first class; the lowest infestation rate was recorded (42.0%). High rate of HLIs among students in some classes probably because of a heavily crowded of students per classroom as same as reported in Saudi Arabia [45], Jordan [46] and Iran [47], and hence transmission of HLIs is more possible to occur.

Many socio-economic and personal hygiene factors associated with HLIs were reported in previous studies such as hair colour was identified as one of risk factor in primary school children, particularly girls with brown color hair had high rate of infestation more than those with black color [26, 48]. This can be explained by unable to detect lice in hairs of these colours. On the same line of present study, high rate of infestation was observed among children with brown and black colors as compared with those who had blonde colour, but no significant difference was recorded (P > 0,05). In addition, low monthly income of some families may act as risk factor with high rate of HLIs as reported by Willems, Lapeere [39]. In present study, no significant relationship was recorded between HLIs among school children and monthly income factor as same as reported results in Mexican children [49], Kuwait [16], Libya [50], Saudi Arabia [45] and Pakistan [51]. The only socio-economic factors in present study that showed a high significant association with HLIs were the type of school (P= 0.002), and with the number of students per class with more than 40 students (P= 0.02), and this may be due to the large number of students in the class and the lack of follow-up of students' personal hygiene in the government schools comparison to private schools. Similar results were obtained in Argentina [28] and Egypt [52]. Also the number of students in class had a significant (P=0.02) effect on lice infestation. Infestation rate was highest in population of more than 40 students per class (66.7%). this result may be due to the more students, the greater the closeness between them and this facilitates the spread of infestation. on other hands, no any significant association between the head lice infestation and other risk factors such as the education level of parents, monthly income of family, number of bed room, house characters, and bathing facilities. It could be explained that private schools have high level of cleaning and care for their students and with a suitable number of students with enough distances between them in each class as compared with government schools. The socio-economic and family factors such as the parents job, The mother job, The family members, showed negative correlation with head lice infestation (p>0.05). in agreement with other studies conducted in Ethiopia [53]; Jordan [19, 26] and Iran [54] that showed no significant differences between parents education level, and HLIs.

For personal hygiene factors, the finding of this study reveal that no significant difference between HLIs and hair washing frequency and hair combing frequency, as same as other studies conducted in Turkey [55]; Kuwait [16]; and Abidjan [55]. However, sharing items had a highly significant relationship with HLIs among students (p=0.000). His phenomenon may be explained by the fact that fast transfer of lice from head to head is encouraged by exchanging items such as clothes, hair care items and accessories (combs, hair brushes, head ribbons) and sleeping items (pillows and bed linen) owing to the prevalence of head lice; this is in agreement with Heukelbach and Feldmeier [56].

For family disease history, there were more infested schoolchildren whose family members were previously infested with head lice (72.2%) than those coming from families who had never lice infested (27.8%) (P < 0.05). This is in agreement with observations obtained in Turkey [57] and Iran [27, 58]. For abnormal nutritional status of primary school children, this study revealed a significant association of HLIs with (52.6%) students who had abnormal nutritional status (Obese > 95th percentile) (79.5%, P=0.042), it can be concluded that the prevalence of HLIs was increased with changes in abnormal nutritional status as risk factors and Because of children's sleep disturbances due to itching triggered by head lice at night [59].

Many traditional treatment method used by mothers who had infested children such as daily hair combing to picking up of lice, frequently washing to remove some of lices, using hair creams or oils, shampoo, spraying, and two combination treatment method to kill all stages of head lices. However, all used of mechanical or chemical methods were incompletely effective to eradicate head lice as shown as in girls (73.3%) or boys (41.2%) and this study revealed no significant association between HLIs and traditional treatment factors (p<0.05). However, the most effective method to kill head a louse was reported by previous studies (60-62) was in line with the result of the present study. Furthermore, the study highlights the need for a health campaign for early and continuously screening and treatment for head lice among school children to decrease the infestation rates.

5.Conclusion:

This is the first study of the prevalence of pediculosis in primary schools in Hadhramout governorate, which shows high prevalence (58.5%) of HLIs among children in Al-mukalla city. There is a significant association between HLIs with socio-economic; personal hygiene factors and previous infestation history that were identified in this study included female gender; age group of 11-14 years; type of school; affected high number of students per class (>40 student); shared items; long and medium hair length; abnormal nutritional status; history of HLIs in one family member; previous treated; and type of treatment. That indicated the difficulties of eradication of head lice especially from girls. Health education and good personal hygiene programmed are needed to increase awareness of pediculosis in primary school children to prevent spread pediculosis in our community.

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مدى انتشار الإصابة بطفيلي قمل الرأس وعوامل الخطورة المصاحبة للعدوى بين أطفال المدارس في مدينة المكلا، محافظة حضرموت، اليمن: دراسة وصفية مقطعية على طلاب المدارس"

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الملخص: إن الإصابة بعدوى قمل الرأس (Pediculus humanus capitis) هي الحالة الطفيلية الأكثر شيوعا بين الأطفال حول العالم خصوصا في المجتمعات الفقيرة. أجريت دراسة وصفية مقطعية لتحديد مدى انتشار الإصابة بعدوى قمل الرأس وعوامل الخطورة المصاحبة للعدوى بين الأطفال في مدارس مدينة المكلا، محافظة حضرموت، اليمن. تم جمع البيانات من 467 طالباً وطالبة من ست مدارس ابتدائية مختلفة في مدينة المكلا. تم استخدام الاستبيان الذي تم اختباره مسبقًا لجمع البيانات الديموغرافية والعوامل الاجتماعية والاقتصادية وعوامل ممارسة النظافة والتاريخ العلاجي. حيث بلغ معدل انتشار قمل الرأس (58.5٪). ووجد الباحثون أن هناك ارتباطاً ذا دلالة إحصائية عالية بين معدل انتشار الإصابة بعدوى قمل الرأس و الجنس الأنثوي ذي الشعر الطويل والمتوسط، والفئة العمرية 11–14 سنة، وطلاب في الصفين الرابع والخامس، والطلاب في الفصول التي يزيد عدد طلابها عن 40 طالبًا، والطلاب في المدارس الحكومية، والطلاب الذين يتشاركون الأدوات، وأولئك القادمين من أفراد الأسرة المصابين سابقًا ($P < 0.001$). هذه الدراسة أظهرت أن معدل انتشار الإصابة بعدوى قمل الرأس مرتفع بين الأطفال في المدارس الابتدائية في مدينة المكلا. وأيضا وجد الباحثون أن هناك ارتباطاً ذا دلالة إحصائية عالية بين الإصابة بعدوى قمل الراس مع عوامل اجتماعية واقتصادية وعوامل النظافة الشخصية والتاريخ المرضي لأحد أفراد الأسرة وهذا مؤشر على صعوبة القضاء على قمل الرأس، وخاصة الإصابة بين الفتيات. لذا هناك حاجة إلى برامج التثقيف الصحي والنظافة الشخصية الجيدة لزيادة مستوى الوعي في مجتمعنا.

كلمات مفتاحية: معدل الانتشار، عوامل الخطورة، طفيلي قمل الراس، قمل الراس، حضرموت، اليمن.