

**PREVALENCE OF ITCH MITES (*Sarcoptes scabiei* De Geer,
1778) AMONG SUSPECTED PATIENTS VISITING
DERMATOLOGY DEPARTMENT OF KMCTH,
KATHMANDU, NEPAL.**



Kabita Bharati

T.U Reg. No. 5-2-50-206-2010

Exam Roll. No: 122

Batch: 2071

A thesis submitted for the partial fulfillment of the requirements for Master's Degree of Science in Zoology with special paper "Parasitology".

Submitted To
Central Department of Zoology
Institute of Science & Technology
Tribhuvan University
Kirtipur, Kathmandu
Nepal

28th December 2017

DECLARATION

I hereby declare that this thesis entitled “**PREVALENCE OF ITCH MITES (*Sarcoptes scabiei* De Geer, 1778) AMONG SUSPECTED PATIENTS VISITING DERMATOLOGY DEPARTMENT OF KMCTH, KATHMANDU, NEPAL**” has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by references to the authors or institutions.

.....

Kabita Bharati

T.U Reg. No. 5-2-50-206-2010

Roll NO. 18

28/12/2017



TRIBHUVAN UNIVERSITY

01-4331896

CENTRAL DEPARTMENT OF ZOOLOGY

Kirtipur, Kathmandu, Nepal.

Ref.No.:

RECOMMENDATION

This is to recommend that this thesis entitled “**PREVALENCE OF ITCH MITES (*Sarcoptes scabiei* De Geer, 1778) AMONG SUSPECTED PATIENTS VISITING DERMATOLOGY DEPARTMENT OF KMCTH, KATHMANDU, NEPAL**” has been carried out by Miss. Kabita Bharati for the partial fulfillment of Masters Degree of Science in Zoology with special paper “Parasitology”. This is her original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted to any other degree in any institutions.

I recommend that this thesis has been accepted for partial fulfillment and of the requirements for the degree of Masters of Science in zoology especially in Parasitology.

.....
Supervisor
Dr. Mahendra Maharjan
Assoc. Professor
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu, Nepal.

28/12/2017



TRIBHUVAN UNIVERSITY

01-4331896

CENTRAL DEPARTMENT OF ZOOLOGY

Kirtipur, Kathmandu, Nepal.

Ref.No.:

LETTER OF APPROVAL

On the recommendation of supervisor “Dr. Mahendra Maharjan”, this thesis submitted by Miss. Kabita Bharati entitled “**PREVALENCE OF ITCH MITES (*Sarcoptes scabiei* De Geer, 1778) AMONG SUSPECTED PATIENTS VISITING DERMATOLOGY DEPARTMENT OF KMCTH, KATHMANDU, NEPAL**” is approved for the examination and submitted to the Tribhuvan University in partial fulfillment of the Master`s Degree of Science in Zoology with special paper “Parasitology”.

.....
Prof. Dr. Ranjana Gupta
Head of the Department
Central Department of Zoology
Tribhuvan University
Kirtipur, Kathmandu
Nepal

28/12/2017



TRIBHUVAN UNIVERSITY

01-4331896

CENTRAL DEPARTMENT OF ZOOLOGY

Kirtipur, Kathmandu, Nepal.

Ref.No.:

CERTIFICATE OF ACCEPTANCE

This thesis work is submitted by Miss. Kabita Bharati entitled “**PREVALENCE OF ITCH MITES (*Sarcoptes scabiei* De Geer, 1778) AMONG SUSPECTED PATIENTS VISITING DERMATOLOGY DEPARTMENT OF KMCTH, KATHMANDU, NEPAL**” has been accepted as a partial fulfillment of the Masters Degree of Science in Zoology with special paper “Parasitology”.

EVALUATION COMMITTEE

.....
Dr. Mahendra Maharjan
Supervisor
Central Department of Zoology,
Tribhuvan University,
Kirtipur, Kathmandu, Nepal

.....
Prof. Dr. Ranjana Gupta
Head of the Department
Central Department of Zoology,
Tribhuvan University,
Kirtipur, Kathmandu, Nepal

.....
(Scientist)
External Examiner

.....
Internal Examiner
Central Department of Zoology,
Tribhuvan University,
Kirtipur, Kathmandu, Nepal

Date of examination: 28/12/2017

ACKNOWLEDGEMENTS

I am amiably thankful and grateful towards my respected supervisor Dr. Mahendra Maharjan, Associate professor, Central Department of Zoology, Tribhuvan University for his continuous guidance, advice, constructive comments and endless effort from the beginning of the research to the thesis finalization. I am indebted to Dr. Rupak Ghimire (MD, Dermatologist), Lecturer, Department of Dermatology, Kathmandu University for his untiring help and suggestions. I would like to express my gratitude towards Dr. Govind Pokhrel (HOD of dermatology) for allowing me to do research in KMCTH and the entire team for a comfortable environment in KMC and those who supported me during my research.

I would like to show my gratitude towards Prof. Dr. Ranjana Gupta, Head of CDZ, T.U. for her kind support. Special thanks to Prof. Dr. Lechoslaw Kuczynski, Prof. Dr. Anna Skoracka, Alicja Laska, Agnieszka Kiedrowicz from Population Ecology Lab, Adam Mickeiwicz University, Poland for their friendly support, remarks and suggestions in thesis writing.

I am cordially thankful towards Mr. Janak Raj Subedi for the suggestions and ideas, Pradip Subedi and Pooza Upadhayay for their kind help, lab assistants in the CDZ, all the supporters and well wishers. I appreciate everyone whom I may have missed to remember and contributed unknowingly or unknowingly.

Kabita Bharati

CONTENTS

	Page No.
DECLARATION	ii
RECOMMENDATION	iii
LETTER OF APPROVAL	iv
CERTIFICATE OF ACCEPTANCE	v
ACKNOWLEDGEMENTS	vi
CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
LIST OF PHOTOGRAPHS	xi
LIST OF ABBREVIATIONS	xii
ABSTRACT	xiii
1. INTRODUCTION	1-3
1.1 Background	1
1.2 Epidemiology of itch mites	2
1.3 Risk factors associated with itch mite infestation	2
1.4 Problem statements	2
1.5 Objectives	3
1.5.1 General objective	3
1.5.2 Specific objectives	3
1.6 Significance of the study	3
2. LITERATURE REVIEW	4-8
2.1 In global context	4
2.2 In national context	7
3. MATERIALS AND METHODS	9-11
3.1 Study area	9
3.2 Materials	9
3.3 Methods	9
3.3.1 Clinical diagnosis	9
3.3.2 Sample collection	10
3.3.3 Laboratory examination	10
3.3.4 Permanent slide preparation	10
3.3.5 Microphotographs	10
3.3.6 Data analysis	10
3.3.7 Analysis of skin problems among patients	10
3.3.8 Assessment of risk factors	10

4. RESULTS	12-16
4.1 Prevalence of itch mites (<i>S. scabiei</i>) among suspected patients	12
4.2 Assessment of risk factors associated with itch mite infestation	12
4.3 Skin problems besides scabies among hospital visiting patients	15
5. DISCUSSION	17-22
6. CONCLUSION AND RECOMMENDATIONS	23-24
6.1 Conclusion	23
6.2 Recommendations	24
7. REFERENCES	
8. ANNEXES	
Questionnaire for scabies patients	
PHOTOPLATES	

LIST OF TABLES

Table	Title of table	Page
1.	Prevalence of itch mites infestation among suspected patients in different age groups	12
2.	Itch mite infestation pattern among suspected patients	13
3.	Risk factor of itch mite infestation among suspected patients	14
4.	Age and sex wise distribution of various skin problems among hospital visiting patients	16

LIST OF FIGURES

Figure	Title of figure	Page
1.	Prevalence of scabies patients with respect to gender	12
2.	Prevalence of scabies patients with respect to locality	13
3.	Prevalence of skin problems among the hospital visiting patients	16

LIST OF PHOTOGRAPHS

Photo	Title of photo	Page
1.	<i>Sarcoptes scabiei</i> in skin scrapings	17
2.	Microphotograph of the <i>Sarcoptes scabiei</i>	17
3.	Scabies in abdomen and genitals	37
4.	Scabies in abdomen	37
5.	Scabies in hand and wrist	37

LIST OF ABBREVIATIONS

KMCTH	Kathmandu Medical College and Teaching Hospital
STD	Sexually Transmitted Disease
ICD	Irritant Contact Dermatitis
ACD	Allergic Contact Dermatitis
PMLE	Polymorphus Light Eruption
P. Alba	Pityriasis Alba
AA	Alopecia Areata
CDZ	Central Department of Zoology
WHO	World Health Organization
UK	United Kingdom
DPX	Distyrene, Plasticizer, and Xylene
PCR	Polymerase Chain Reaction

ABSTRACT

Scabies in human is caused by an arthropod parasite *Sarcoptes scabiei* var. *hominis*. The present study was designed to determine itch mite (*S. scabiei*) infestation among suspected patients visiting dermatology Department of KMCTH, Kathmandu, Nepal. Total 93 samples were taken by skin scrapping methods from clinically suspected patients and examined under microscope for confirmation. Beside scabies, prevalence of other skin problems was also assessed on the basis of the patient's report card, and a well structured questionnaire survey was carried out among the suspected scabies patients for the assessment of risk factors. Result revealed the prevalence of scabies among suspected patients to be 3.23% with higher in male (2.15%) than female (1.08%). Scabies was equally distributed in all age and ethnic groups. All the scabies patients were sharing their room with more than two people and took bath twice a week. Most of them were living in a room without the presence of direct sunlight. However Dermatitis and eczema (23.86%) was the most common problem among all the patients followed by fungal (14.71%) infection which was very high in male patients. Another common problem was acne and was more in female of age group 15-25 years. Although, scabies can be diagnosed on the basis of characteristic symptoms on clinical ground, some advanced methods like dermatoscopy and serology can increase the efficiency in the diagnosis of scabies.

1. INTRODUCTION

1.1 Background

Sarcoptes scabiei is commonly called “itch mite” that causes prurities which itself leads to distress, outbreaks in epidermis due to burrowing of mites, while itching, scratching and excoriation can open a way for secondary infection with pathogenic bacteria. The term “seven year itch” and “camp itch” originated due to the ill- famed reputation of scabies during Napoleonic wars and American civil wars (Trice & Manson, 1966; Parish, 1975). The disease is considered as neglected tropical disease (Fuller, 2013) with higher rate of infestation among tropical people due to overcrowded living conditions, poverty and poor hygiene and associated with bacteria *Streptococcus pyogenes*, group A streptococci (McCarthy *et al.*, 2004). Transmission is common among family members and people with direct skin-skin contact. It is not a life threatening condition, rather it produces extremely enfeebling situation and has been described to be very troublesome during military campaign (Gordon and Insworth, 1945). In adults, scabies presents intensely pruritic rash prone to inter digital web spaces, flexure creases, wrists and arms, elbows, soles and insteps of the feet, waist, axillary folds, and pelvic girdle including buttocks, genitals, and the periareolar region in females (Alexander, 1984; Mellanby, 1977; Mellanby, 1977; Mellanby, 1985).

Sarcoptoid mites are slowly moving obligate parasites that burrow into the skin of warm blooded animals (Rehbein *et al.*, 2003). The adult males of *S. scabiei* are smaller in comparison to female measuring 0.2×0.15 mm and 0.4×0.3 mm, respectively (Arlian *et al.*, 1989). Female mite burrows into the epidermis for about 30 minutes (Arlian *et al.*, 1984) and male mite explores the skin and search for an unfertilized female (Mellanby, 1985) and it can crawl up to 2.5 cm per minute. However, the male mite spends most of its time on the epidermis and enters into the burrow occasionally to feed or to mate (Gordon and Insworth, 1945; Mellanby, 1985; Parlette, 1975).

A larva emerges after 2-3 days from the egg, moults to become nymph and then it again moults twice to become adult and be ready to mate (Mellanby, 1977; Arlian, 1988) and it matures in about 15 days (Walton *et al.*, 2004). The lifespan of mite is estimated to be 30-60 days (Mellanby, 1977; Orkin and Maibach, 1985; Chosidow, 2006). It has been known that the mite can cause scabies in seven orders of mammals, 17 families and in 40 different hosts (Fain, 1978) with an average burden of about 10-12 mites per host (Johnston and Sladden, 2005). It takes about one to 10 minutes for penetration and 30 minutes to burrow in humans (Arlian *et al.*, 1984). Sarcoptic mite dies within 10 minutes at 120F away from the host body (Parish, 1975) while some studies showed that the mite can live three to four days outside the host body (Arlian *et al.*, 1984; Lane, 1987). The mites must obtain water from the host body for survival otherwise it dies because of desiccation (Arlian *et al.*, 1984). Therefore its survival depends on ambient relative humidity. However human and canine scabies mites can survive up to 24- 36 hours at room temperature and can re-establish infestation (Arlian *et al.*, 1989).

1.2 Epidemiology of itch mites

Various papers suggested many factors affecting the epidemiology of scabies that includes social attitude changes, immune status of the individual, wars, misdiagnosis and inadequate treatment, lifestyle and migration. The incidence of skin diseases is common in children all over the world as well as in Nepal (Hassan *et al.*, 2014; Shrestha *et al.*, 2012). Besides being high rate of occurrence in children, it constitutes the most common problem among homeless people (Moy and Sanchez, 1992) and sometimes it can be worsen by the use of alcohol or drugs or by psychiatric problems (Vredevoe *et al.*, 1992; Stergiopoulos *et al.*, 2015). The prevalence may differ with homeless people sleeping in the street and homeless people provided with shelter as it's occurrence was normal among housed homeless people in Boston (Stratigos *et al.*, 1999).

Crusted scabies (Norwegian scabies) contrasting ordinary scabies infestation has been found in immunocompromised individuals with AIDS (Rau and Baird, 1986) and in HTLV-1 seropositive patients (del Giudice *et al.*, 1997), drug induced immunosuppression (Wolf and Krakowski, 1987), renal transplant recipients (Espy and Jolly, 1976) or prolonged treatment with steroids (Jaramillo *et al.*, 1998). It has also been suggested to be associated with the incidence of crusted scabies. Scabies has been suggested to be more frequent in urban areas and in winter months (Poudyal *et al.*, 2016; Christophersen, 1978; Kimchi *et al.*, 1989; Downs *et al.*, 1999; Mimouni *et al.*, 2003; Herrmann and Humann, 1969; Andrews, 1979; Tuzun *et al.*, 1980; Downs, 2004) probably due to crowded living condition.

1.3 Risk factors associated with itch mite infestation

Poor hygiene and poor sanitation (Poudyal *et al.*, 2016) overcrowded living condition (Currie *et al.*, 1994; McCarthy *et al.*, 2004, Heukelbach *et al.*, 2005), fomites (Arlian *et al.*, 1984, 1984, 1988, 1988, 1988, 1988) has been considered as possible risk factors for scabies infestation. However living in a room where there is no entry of sunlight may promote the scabies infestation as *Sarcoptes scabiei* can live few days outside the body depending on humidity (Arlian *et al.*, 1984; Lane, 1987) and sometimes it is difficult to diagnose (Orkin, 1995) leading to misdiagnosis (Jessica *et al.*, 2017) which may prolong the period of infestation. It has been observed that the outbreaks are occurred frequently in nursing homes, care facilities, prisons (Stoevesandt *et al.*, 2012; Capobussi *et al.*, 2014; Hay *et al.*, 2013; Leppard and Naburi, 2000), workshops for disabled people (Stoevesandt *et al.*, 2012), Schools (Ejidokun *et al.*, 2007), Kindergartens, orphanage and childcare centres (Ariza *et al.*, 2013; Sargent and Martin, 1994).

1.4 Problem statements

Scabies is one of the commonest of skin problem seen in developing countries affecting all age group. According to the study in Nepal, the widespread presence of skin diseases amongst school children in Western Nepal was 13.46% (Kumar *et al.*, 2010) and the scabies is more commonly seen among pediatric age groups (Poudyal *et al.*, 2016; Neupane and Pandey, 2012; Shrestha *et al.*, 2012; Shrestha *et al.*, 2013) but the complete

data of scabies from all over the country is almost under reported may be due to poor diagnostic facility.

1.5 Objectives

1.5.1 General objective:

- To determine itch mites (*S. scabiei*) infestation among suspected patients visiting dermatology Department of KMCTH, Kathmandu, Nepal.

1.5.2 Specific objectives:

- To find the prevalence of itch mites (*S. scabiei*) among suspected hospital visiting patients.
- To assess risk factors associated with itch mites among suspected patients.
- To document the various skin problems among hospital visiting patients.

1.6 Significance of the study

In the present study, prevalence of scabies (confirmed by microscopic examination) as well as pattern of various skin problems among hospital visiting patients has been documented and risk factors associated with itch mite infection have been assessed. Finding from this study will help in documenting distribution and magnitude of scabies infestation and other skin related problem in Kathmandu.

2. LITERATURE REVIEW

Sarcoptes scabiei was first described by Avenzoar and his student Averroes in Spain in 12th Century (Beeson, 1927; Parish, 1977) but they did not associated the infestation of mite with the skin eruption. In 1844 (Von Hebra, 1868) Ferdinand Von Hebra showed that the scabies is not an internal disease but an ectoparasitic infestation. In the text book of skin diseases, Thomas Hillier wrote that the *Sarcoptes scabiei* (mite) is the cause of scabies (Hillier, 1865). Scabies in human is caused by *Sarcoptes scabiei* var. *hominis* and in animal is caused by *S. Scabiei* var. *canis* which infests dogs. There is a possibility that some mites from different host represent different species of genus *Sarcoptes* (Arlan *et al.*, 1984) and the variability is due to interbreeding between strains affecting man and domestic animals (Fain, 1978).

2.1 In global context

WHO (2005) reviewed (a review collated data) 18 prevalence studies from 1971 to 2001 and found scabies prevalence ranging from 0.2% to 24%. However, yearly prevalence of scabies has been estimated to be about 300 million cases (Chosidow, 2006). (WHO (2009) suggested that hundreds of millions of people are infested with scabies all over the world. On the basis of some reports, scabies may represent a threat for hospitals, prisons, kindergartens, nursing homes and long term care facilities (Hengge *et al.*, 2006). Some of the authors even reported that scabies fluctuates at every 7 years (scabies is commonly called 7-year itch) and yet other reports a peak every 15-25 years and reasons are yet unknown (Johnston and Sladden, 2005).

In sub-Saharan Africa Mahé *et al.*, (2005) reported high prevalence of scabies, presence of diffuse itching and visible lesions which were associated with either at least two typical locations of scabies or a household member. Meanwhile, African children of about 40-80% could be infested with scabies while in Australian aboriginal communities the prevalence was up to 50% while their study in children of Fiji, Vanuatu and the Solomon Islands reported prevalence to be 18.5%, 24%, and 25%, respectively (Currie and Carapetis, 2000; Carapetis *et al.*, 1997; Kristensen, 1991; Terry *et al.*, 2001).

Though scabies is commonest skin problem in developing countries but remarkable number of scabies cases has also been reported from developed countries. An outbreak of scabies was detected in August 2003 reported by de Beer *et al.*, (2006) in a Canadian long term facility which was associated with 2 index cases; involving classic scabies and Norwegian scabies (Crusted scabies). A study conducted in England by Hewitt *et al.*, (2015) for 6 months reported attack rates ranging from 2% to 50%, and most cases had dementia (37/39, 95%) and the cases were diagnosed clinically by GPs (59%) or home staff (41%), none by dermatologists. In Spain 1.5% of patients were affected with scabies (Otero *et al.*, 2004). Meanwhile, Shaw and Juranek (1976) reported that 2-4% of patients visiting dermatologist in United States were suffering from scabies.

Scabies can affect 40 different host in seven orders of mammals with an average burden of about 10-12 mites per host Fain (1978). Similarly, McCarthy *et al.*, (2004) found the average burden of itch mite on a normal host to be 10-12 but leprosy patients may harbour up to many millions of mites. Mellanby (1977) reported the increase in mite population in a patient during the first month of infection which reaches up to 25 adult mites (females) after 50 days and 500 mites by 100 days. Roberts *et al.*, (2005) found as many as 4700 mites in one gram of crusted skin.

However, Maier and Maier (2013) suggested considering scabies as a childhood disease from a global point of view because of its high incidence in children with the incidence of skin diseases in children; 9–37% all over the world (Hassan *et al.*, 2014). In a rural Indian village Nair *et al.*, (1977) studied skin diseases of young people with 70% infestation rate. A case report regarding the scabies infestation in eight years old girl child in Korea where she was misdiagnosed to have a folliculitis at a local clinic was presented with scaly pustules and was reported by Seok *et al.*, (2015). A study was conducted at Institute of Public Health, Lahore and result showed a main stream of the boys and girls were living in extended family system and less than half of children had skin rashes while boys were in majority than girls children; reported by Qasim (2015). Another study was conducted in Pakistan by Khatoon *et al.*, (2016) where children belonging to four age groups 0-3 years, 4-6 years, 7-9 years and 10-12 years attending Baqai Institute and Hospital Gadap were examined and mentioned the association between scabies of different human parts and age for boys was significant ($p < 0.01$), while for girls it was highly significant ($p < 0.001$). Scabies has been suggested to be more frequent in males than in females (Qasim, 2015; Otero *et al.*, 2004).

Scabies occurs in both sexes, all ages and in all ethnic groups (Chosidow, 2006). Besides being high rate of occurrence in children (Feldmeier *et al.*, 2009; Jackson *et al.*, 2007; Taplin *et al.*, 1990; Haar *et al.*, 2014; Romani *et al.*, 2015; Eason and Tasman, 1985; dos Santos *et al.*, 2010; Harris *et al.*, 1992; Badiaga *et al.*, 2005) it constitutes the most common problem among homeless people (Moy and Sanchez, 1992) with varying prevalence of 3–56.5% in France and can sometimes worsen by the use of alcohol or drugs or by psychiatric problems (Vredevoe *et al.*, 1992; Stergiopoulos *et al.*, 2015). The prevalence may differ with homeless people sleeping in the street and homeless people provided with shelter as it's occurrence was normal among housed homeless people in Boston (Stratigos *et al.*, 1999). Crusted scabies (Norwegian scabies) contrasting ordinary scabies infestation has been found in immunocompromised individuals with AIDS (Rau and Baird, 1986) and in HTLV-1 seropositive patients (del Giudice *et al.*, 1997). On the other hand, drug induced immunosuppression (Wolf and Krakowski, 1987), renal transplant recipients (Espy and Jolly, 1976) or prolonged treatment with steroids (Jaramillo *et al.*, 1998) has been suggested to be associated with the incidence of crusted scabies. Scabies has been suggested to be more frequent in urban areas and in winter months (Christophersen, 1978; Kimchi *et al.*, 1989; Mimouni *et al.*, 2003; Tuzun *et al.*, 1980; Downs, 2004). On the other hand a 14- year nationwide study conducted in Taiwan reported the incidence of scabies to be negatively correlated with temperature but

positively correlated with humidity (Liu *et al.*, 2016). In addition poor hygiene and poor sanitation (Poudyal *et al.*, 2016) overcrowded living condition (Currie *et al.*, 1994; McCarthy *et al.*, 2004, Heukelbach *et al.*, 2005), fomites (Arlan *et al.*, 1984, 1984, 1988, 1988, 1988, 1988) has been considered as possible risk factors for scabies infestation.

However living in a room where there is no entry of sunlight may promote the scabies infestation as *Sarcoptes scabiei* can live few days outside the body depending on humidity (Arlan *et al.*, 1984; Lane, 1987) and sometimes it is difficult to diagnose (Orkin, 1995) leading to misdiagnosis (Jessica *et al.*, 2017) which may prolong the period of infestation promoting many other complications like pyoderma, streptococcal, glomerulo nephritis and subsequent renal impairment and rheumatic fever with different occurrence rate ranging from 2.71 per 1000 to 46 % (Hay *et al.*, 2012; Fuller, 2013). Scabies is also a problem for immunocompromised patients like HIV, Organ transplant recipient (OTR), including recipients of various organs like kidney (Yates *et al.*, 2013; Langer *et al.*, 2005; Venning and Millard, 1992; Wolf *et al.*, 1985; Gregorini *et al.*, 2011; Abdo *et al.*, 2009; Cakmak *et al.*, 2008; Mansy *et al.*, 1996; Youshock and Glazer, 1981; Espy and Jolly, 1976; Anolik and Rudolph, 1976) liver (Garofalo *et al.*, 2016) and bone marrow allografts (Barnes *et al.*, 1987; Vyas *et al.*, 1990; Ortega-Loayza *et al.*, 2013). However the definite incidence of scabies in Organ transplant recipients is not well known. Institutes where the out breaks occurs more frequently include nursing homes, care facilities, prisons (Ladbury *et al.*, 2012; Stoevesandt *et al.*, 2012; Capobussi *et al.*, 2014; Fuller, 2013; Hay *et al.*, 2013; Leppard and Naburi, 2000), workshops for disabled people (Stoevesandt *et al.*, 2012), Schools (Ejidokun *et al.*, 2007), Kindergartens, orphanage and childcare centres (Ariza *et al.*, 2013; Sargent and Martin, 1994).

Generally the diagnosis is made on the basis of the symptoms like characteristics rashes and itching on clinical grounds. But the precise diagnosis relies on microscopic examination of skin scrapings from the patients with a scalpel blade, placing it on a glass slide with 10% potassium hydroxide or mineral oil, tetracycline fluorescent tests for the identification of mites, eggs, burrows, scybala, etc. (Burkhart *et al.*, 2000; McCarthy *et al.*, 2004; Johnston and Sladden, 2005) Burrow ink test and dermoscopy (Roberts *et al.*, 2005). Differential diagnosis includes eczema, tinea, atopic dermatitis, Langerhans cell histiocytosis, bullous pemphigoid and papular urticaria (Heukelbach and Feldmeier, 2006). Incidence of the infection with canine scabies in human is unknown and can be misdiagnosed as insect bites, papular urticaria, etc. with an intense pruritic rash that starts within 24-96 hours after the contact with infected pet that lasts around 5-13 weeks and is self limiting (Hicks and Elston, 2009). Increasing number of failures in topical therapy leads to the suggestion of the development of drug resistance may be due to overuse (Brown *et al.*, 1995; Boix *et al.*, 1997; Walker and Johnstone, 1999). Failure rate for scabies diagnosis in French pediatric emergency unit has been reported to be 41% in children who were examined by more than one physician before (Pouessel *et al.*, 2012)

Clinical presentation of scabies in children, homeless, elderly people are different with Eczema and Impetigo common in children who may be confused with atopic dermatitis or acropostulosis (Olivier, 2006) and atypical scabies is difficult to diagnose than the classic

scabies (Orkin, 1995). However, many studies suggested the mimicry of clinical presentation of the scabies in its early form may look like other skin conditions such as Psoriasis, Atopic dermatitis, Diaper dermatitis, Allergic contact dermatitis, and Irritant contact dermatitis, Herpetiformis, Eczema, Impetigo, Furunculosis, similar allergic reactions to other mites and insects, Syphilis, Urticaria related syndromes (Arlian, 2015; Arlian, 1989; Alexander, 1984). Meanwhile, it has been hypothesized that scabies can trigger other diseases because of a Koebner phenomenon (Aboud and Aboud, 2011) and rare or overlooked granulomatous reaction can be caused by scabies infestation that could potentially lead to misdiagnosis (Jessica *et al.*, 2017).

In national context

The dermatological conditions are considered as one of the top five problems among patients attending outpatients' clinics in 2067/2068 B.S (2010/2011 A.D) according to Annual Health Report (2010-2011) (Department of Health Services of Nepal). A total of 878 people of all ages on villages of rural area were studied by Walker *et al.* (2008) that showed 4.7% prevalence of scabies and in Universal Medical College Teaching Hospital, Western Nepal showed the prevalence of scabies 4.4% (Poudyal *et al.*, 2016).

Most of the studies in Nepal are based on paediatrics, school children, and young teens. The incidence of skin diseases is common in children with being almost 13.4% in Nepal (Shrestha *et al.*, 2012). While according to Shakya *et al.*, (2004) 818 students from Grade I to V (governmental primary school children) in the Eastern Nepal, skin diseases was most common among them (20%) with pediculosis more common among girls. It has been observed that a pediatrician encounter 30% of (outpatient) children with dermatological problems on the other hand dermatologists receives 30% of children visiting outpatient department in Nepal (Thappa, 2002). Joshi and Dahal (2008) studied ten small industries of Kathmandu valley and among 545 workers 24.8% were child workers and the majority of them were suffering from otitis media, scabies, anaemia, upper respiratory diseases etc. Also, Subedi (2000) reported among 33 orphan students, 107 students and 135 people, 27.3%, 22.4% and 22.2% were infested with mites respectively in Kathmandu Metropolitan city. On a cross-sectional study conducted by Gauchan *et al.* (2015) in the Pediatric and Dermatology Department, Manipal Teaching Hospital, Pokhara; it appeared that among 226 patients, most common category was Infections and Infestations (51.3%) followed by Dermatitis (27.9%).

A similar result with that of Shrestha *et al.*, (2012) Kumar *et al.* (2010) reported the widespread presence of skin diseases (13.46%) among school children in Western Nepal. Shrestha *et al.*, (2012) found that a total of 1086 (22.64%) patients out of 4795 patients, prevalence of scabies was 54 (5.03%) in the pediatric age group of a tertiary care centre in Nepal. Meanwhile, Kumar *et al.*, (2010); Neupane and Pandey (2012) claimed that the prevalence of pediatric dermatoses in Universal Medical College Teaching Hospital, Western Nepal among children aged one day to 17 years were more than the previous studies conducted in the country but the prevalence of pediatric dermatoses in hilly region of Nepal was higher according to Shrestha *et al.*, (2013). Also, Poudyal *et al.*, (2016)

studied 23992 patients visiting the dermatology outpatient department (OPD) in Western Nepal where 22.5% were of pediatric age groups and most of them were young teens and teenagers and three most common dermatoses were fungal infections (18.5%), Eczema (14.4%), and Acne (10.1%); while scabies was more in winter. Meanwhile, skin problem has been found to be more common in males (53.77%) than female (46.23%) (Shrestha *et al.*, 2012) and Scabies as well as Fungal infections was common among boys (Shakya *et al.*, 2004). On the other hand Shrestha and Kayastha (2011) mentioned that out of total 211 dermatological cases in rural area of Nepal, Eczema was the commonest presenting 47.64% and dermatophytosis was the leading presentation among infectious dermatoses with 12.79% cases.

3. MATERIALS AND METHODS

3.1 Study area

The study was carried out at Kathmandu Medical College and Teaching Hospital (KMCTH) which is a medical school located in Kathmandu, the capital city of Nepal. KMCTH is a private medical college in Nepal established in 1997 and is affiliated to Kathmandu University. It is fully recognized by the Medical Council of Nepal, Sri Lankan Medical Council, General Medical Council (UK) and Medical Council of India. KMCTH has also been listed in the WHO's World Directory of Medical Schools electronic format as from June 2002.

Kathmandu Medical College & Teaching Hospital (KMCTH) is situated at Sinamangal, Kathmandu, Nepal. There are 900 beds including general and cabin. Among the other departments of KMCTH, Dermatology department has 2 Associate Professors, 2 Assistant Professors and 2 Lecturers (KMCTH, 2011). For collecting skin scrapings consent from the patients were taken.

3.2 Materials

Following materials were used during the study:

- Surgical blades
- Glass slide
- Cover slip
- Microscope
- Gloves
- Camera
- Blank sheets
- Mineral oil
- Potassium Hydroxide 10% etc.
- Notebook and stationary
- Normal saline
- DPX for mounting (for permanent slide)

3.3 Methods

Diagnosis of the scabies and other dermatological condition was done by doctor himself (Dr. Rupak Ghimire). Data and scrapings were taken from the people who were suspected to be infested with scabies.

3.3.1 Clinical diagnosis:

- The diagnosis of scabies was made clinically in patients with a pruritic rash, itching and characteristic linear burrows.

3.3.2 Sample collection:

- A total of 93 skin scrapings were collected from patients who were clinically suspected as scabies. Scrapings were taken from the skin rashes, especially on the hands between the fingers, the folds of the wrist, etc.
- Scrapings were taken by the doctor from the rashes in non-excoriated and non-inflamed areas using a sterile scalpel blade. Sometimes also with a drop of mineral oil. The mineral oil enhanced the adherence of the mites to the blade and was transferred to a plain white paper which was immediately transferred to the parasitology laboratory of CDZ.

3.3.3 Laboratory examination:

- Scrapings were transferred from the plain white paper to the glass slide without adding mineral oil.
- A drop of normal saline was added in a sample then covered by cover slip for microscopic examination with 10x or 40x magnification.

3.3.4 Permanent slide preparation:

- Sample with mite was cleared. Mite was isolated and cleaned in normal saline. After that, mite was transferred to the next slide with DPX for mounting and cover slip was placed carefully.

3.3.5 Microphotographs:

- After the preparation of the permanent slide, microphotographs were taken in the CDZ.

3.3.6 Data analysis:

- Statistical analyses were performed with R 3.4.1 (R Core Team 2017. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>).

3.3.7 Analysis of skin problems among patients:

- Both qualitative and quantitative analysis was done for the data collected from the patients. Assessment of risk factors in scabies patients were qualitatively analysed in Microsoft Excel 2010 and analysed quantitatively using R 3.4.1.

3.3.8 Assessment of risk factors:

A set of structured questionnaire was prepared including closed as well as open ended questions, appropriate for assessment of risk factors (Annex). The questionnaire was pretested among friends for assessment of appropriateness of questions and on the basis of responses from friends, the questions were modified. Further, the questions were tested among few dermatology patients other than the study sample and again

the questions were modified for the final sets of questions that were conducted among suspected scabies patients. Finally, appropriate statistical tools were used to analyze the obtained data.

4. RESULTS

4.1 Prevalence of itch mites (*S. scabiei*) among suspected patients.

A total of 93 patients visiting dermatology department of KMCTH have been suspected on the clinical ground by the dermatologist. Microscopic examination of the skin scrapings revealed 3.23% suspected patients to be positive for itch mite.

Table 1: Prevalence of itch mites infestation among suspected patients in different age groups

Age wise	Suspected (N=93)	P value	Scabies (N=3)	P value
<10	22.58%	0.001063	--	0.7064
11 - 20	33.33%		1.08%	
21 - 30	21.51%		--	
31 - 40	15.05%		1.08%	
> 40	7.53%		1.08%	

Age wise distribution of itch mite infestation in suspected cases and laboratory confirmatory examination was carried out. The result showed that itch mite infestation has been suspected more or less equal in all age group <40 years compared to >40 years which is statistically significant. But laboratory confirmation showed that scabies infestation was distributed equally in all age group without any significant difference. Although one each scabies patients revealed in only three age groups (Table 1).

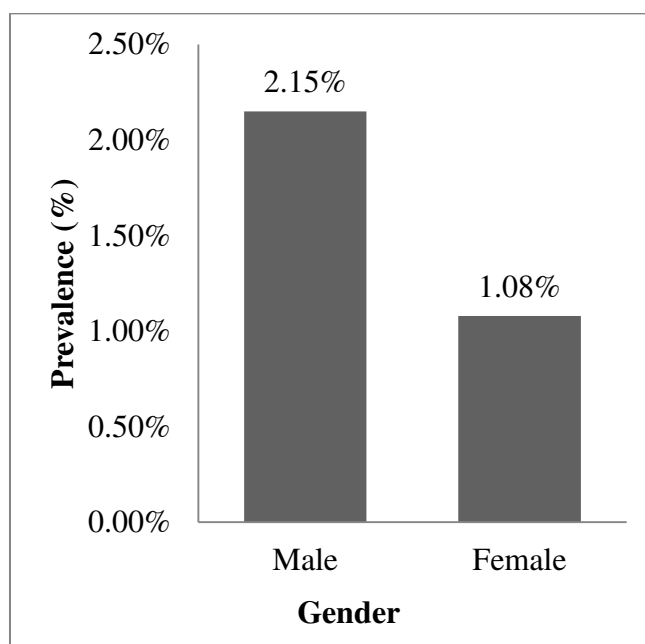


Figure 1: Prevalence of scabies patients with respect to gender

The distribution of itch mite infestation is significantly different between male and female among suspected patients ($P= 2.74E-05$) indicating that males were found to have more

skin problems related to scabies infestation compared to female. While laboratory confirmatory test showed that there is no significant difference between the distribution of itch mite infestation among male and female. Although male have comparatively high infestation in comparison to females (Figure 1).

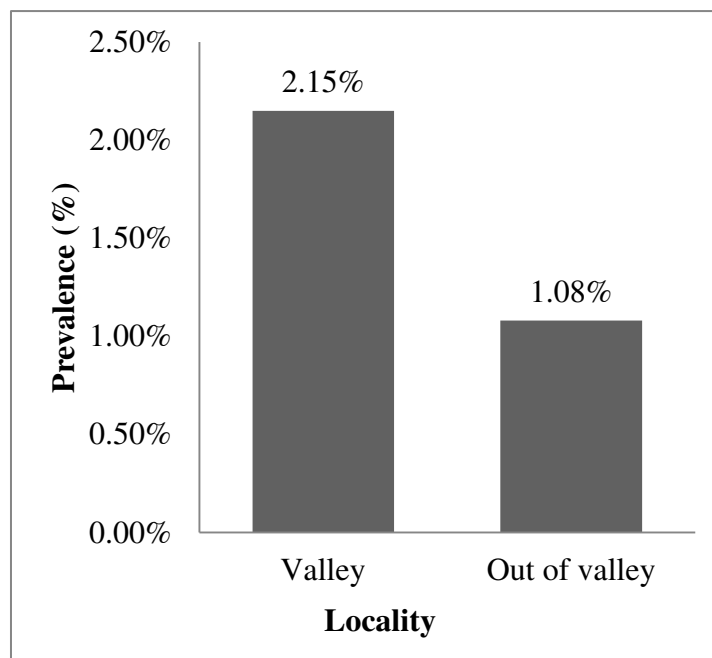


Figure 2: Prevalence of scabies patients with respect to locality

Suspected patients were categorized into “Valley and Out of valley” to assess the difference in itch mite infestation pattern. Suspected patients were more from the valley in compared to the patients outside the valley which is statistically significant ($P=0.01336$). However patients from outside the valley were comparatively less in a whole sample. But laboratory confirmation showed that scabies infestation was distributed equally in patients from and out of valley without any significant difference (Figure 2).

Table 2: Itch mite infestation pattern among suspected patients

Ethnic group	Suspected (N=93)	P value	Scabies (N=3)	P value
Caucasian	52.68%	0.592	2.15%	0.5516
Mongloid	47.32%		1.08%	
Organs involved				
Finger	53%	2.20E-16	2.15%	0.1738
Abdomen + finger	27%		1.08%	
Abdomen + genitalia	8%		--	
Finger + genitalia	12%		--	

It has been obtained from the study that there is no significant difference in infestation pattern among ethnic groups. Skin problems like itching and rashes that are more common in fingers were suspected to be scabies. Beside, similar symptoms were noticed in other parts of the body such as abdomen and genitalia. But skin problems suspected to

be scabies was found significantly high in fingers ($P = 2.20E-16$) compared to other parts of the body which is supported also by laboratory confirmation (Table 2).

4.2 Assessment of risk factors associated with itch mite infestation

A set of structured questionnaire were administered to 93 suspected scabies patients related to the various risk factors. The survey was focused to ferret out some of the behavior and practices of the patients. The information collected was further analyzed to determine the association between scabies and risk factors.

Table 3: Risk factor of itch mite infestation among suspected patients

Residence	Suspected (N=93)	P value	Scabies (N=3)	P value
Home	75%	2.20E-16	2.15 %	0.1738
Hostel	20%		1.08%	
Hotel worker	3%		-	
Barrack	2%		-	
Living condition	Suspected (N=93)	P value	Scabies (N=3)	P value
1 person in a room	6%	2.20E-16	-	0.02812
1-4 people in a room	90%		3.23%	
>5 people in a room	4%		-	
Bathing habit	Suspected (N=93)	P value	Scabies (N=3)	P value
Daily	6%	2.20E-16	-	0.02812
Twice a week	77%		3.23%	
Weekly	17%		-	
Presence of sunlight in room	Suspected (N=93)	P value	Scabies (N=3)	P value
No	75%	4.33E-07	2.15%	0.5787
Yes	25%		1.08%	

Various risks factors were categorized and four of those factors (Residence, Living condition, Bathing habit and Presence of sunlight in the room) were analyzed statistically. The analysis revealed that most of the suspected scabies patients were residing at home or with the relatives with significant difference. Scabies has been found to be more prevalent among people sharing their room with more or less four people. Meanwhile scabies was negative in people who took bath everyday and living in a single room. However, Presence of sunlight has been found to be an important factor to enhance scabies infestation. Among the total suspected patients, people having room without direct sunlight were significantly higher. Similarly scabies infestation was also found comparatively higher among them although it was statistically not significant (Table 3).

Other risk factors that were assessed from the questionnaire revealed that among suspected patients; 67% had family history of scabies. In case of symptoms; itching and rashes both were common in 61% of the patients while 25% experienced only itching and 14% had only rashes. In contrast to this, laboratory confirmatory test resulted 2.15% scabies patients had family history and experienced symptoms like itching and rashes both. But 1.08% scabies patients experienced only itching. 67% suspected patients visited after 3 weeks of persistent symptoms including all positive scabies patients.

4.3 Skin problems besides scabies among hospital visiting patients

During the study period, besides scabies, information regarding other skin problems and diseases were also taken from patient’s record file. All the diseases were categorized and analyzed statistically. Problems like pruritus, rashes, urticaria, ICD, characteristic rashes, ACD etc, were included in “Dermatitis and eczema”. Infections with *Tinea* spp., candidal infections, etc. were categorized under “Fungal”. Chicken pox, viral exanthem and herpes infections were included under “Viral”. While, paronychia, impetigo, abscesses, etc. was categorized under “Bacterial”.

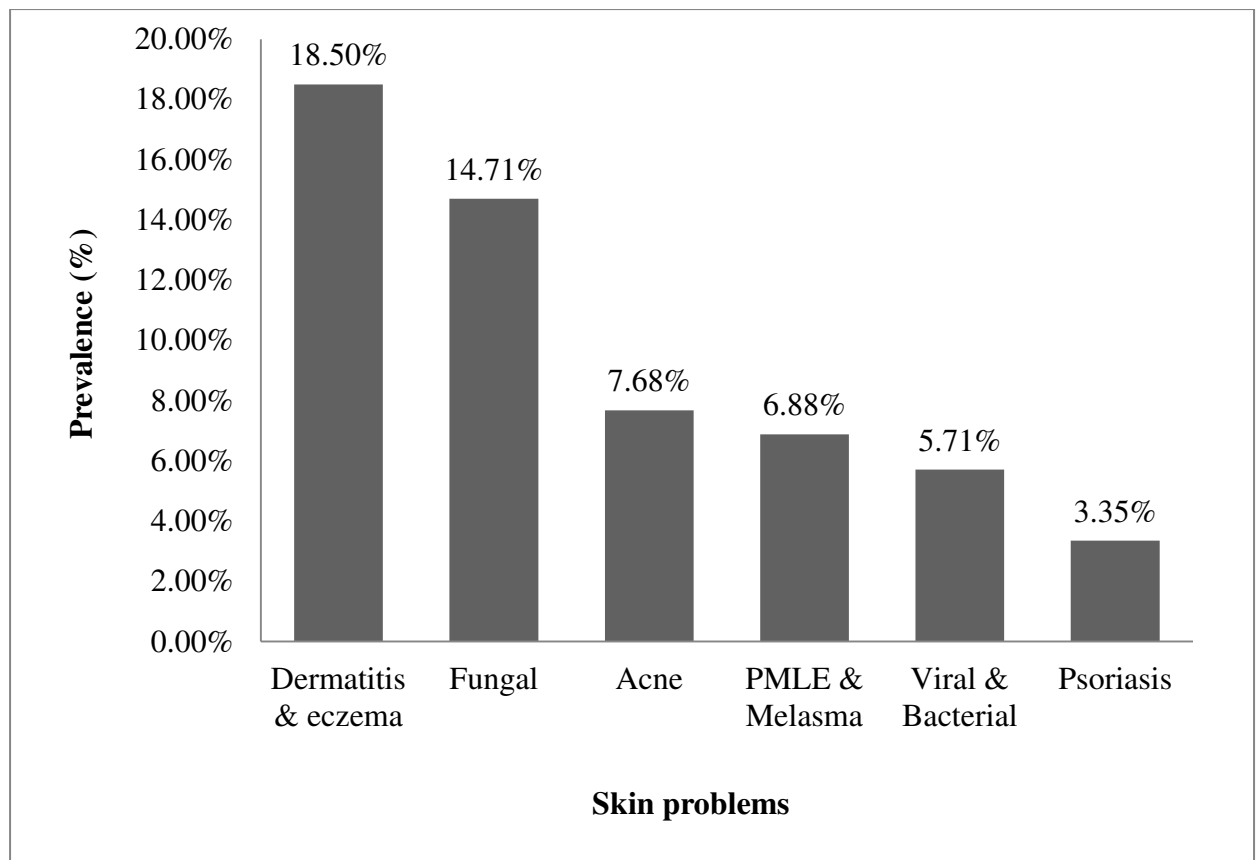


Figure 3: Prevalence of skin problems among the hospital visiting patients.

Prevalence of all the diseases was assessed comparatively among total hospital visiting patients. Statistical analysis revealed that “Dermatitis and eczema” were the most common problem followed by “Fungal” infections. Prevalence of “Viral and bacterial” is comparatively less. Problems like Warts & cysts (5.38%) and AA & Folliculitis (2.93%)

was also common among patients beside Other (Keloid, Xerosis, Syringoma, Nevus, etc.) skin problems (Figure 3).

Table 4: Age and sex wise distribution of various skin problems among hospital visiting patients

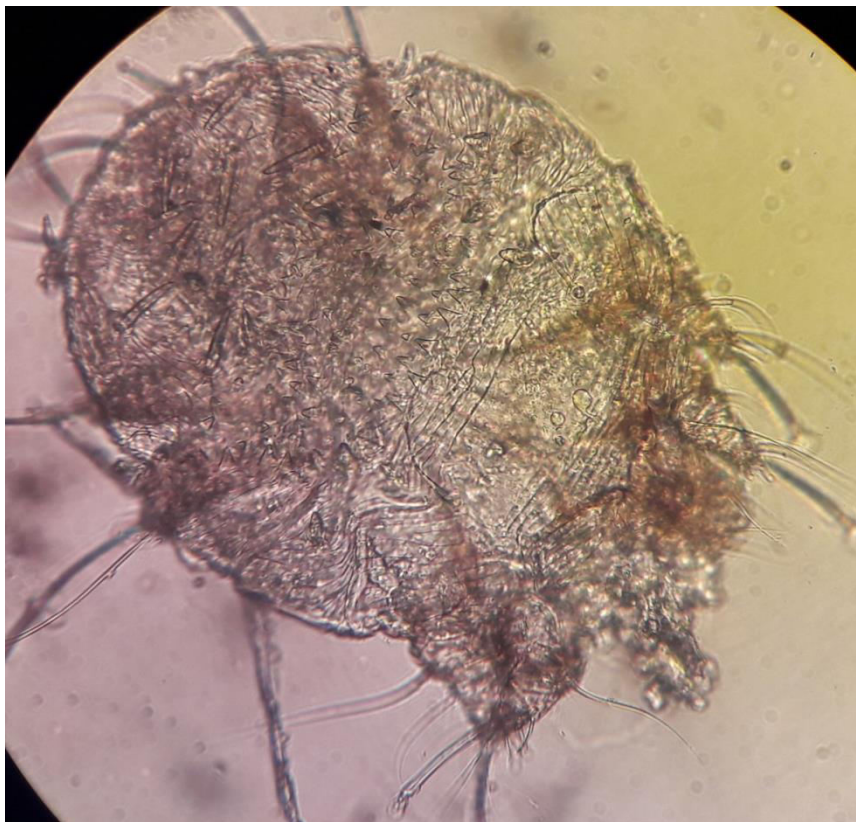
Age (yrs)	Dermatitis & Eczema	Fungal	Acne	PMLE & Melasma	Viral & Bacterial	Psoriasis
>20	24.41 %	10.59%	9.11%	1.17%	5%	--
20-39	16.34%	16.51%	9.05%	8.7%	2.49%	2.84%
40-59	10.32%	14.19%	--	5.8%	5.13%	8.38%
60-79	17.14%	12.86%	--	1.43%	1.43%	15.71%
>80	1.43%	--	--	--	--	--
Sex						
Male	49.01%	70%	35.37%	23.81%	47.62%	50%
Female	50.99%	30%	64.63%	76.19%	52.38%	50%

Analysis of age and sex wise distribution pattern of disease revealed very interesting results. In case of Dermatitis & eczema, it shows almost equal chances of infection among all age group but very less in patients >80years. Similarly, Fungal infection, Acne, PMLE & Melasma, Viral & Bacterial and Psoriasis is absent in the age group >80 years. It does not mean that the chance of dermatitis and other infection decreases in older people but the fact is; there were very less patients of this age group visiting dermatologist. Meanwhile, there is an equal chance for male and female to be affected with Dermatitis & eczema. On the other hand, fungal infection was more common in male than in females.

Acne and PMLE & Melasma was highly prevalent in females than in male patients and common among age group 15-25 years and 25-60 years respectively. However there is no difference in prevalence of Viral & Bacterial infection in male and female among all age groups. Meanwhile, Psoriasis is highly prevalent in patients above 50 years old with equal chances in male and female (Table 4).



Picture 1: *Sarcoptes scabiei* in skin scrapings



Picture 1: Microphotograph of the *Sarcoptes scabiei*

5. DISCUSSION

Scabies along with the skin related problems like itching, rashes, ICD, ACD is prevalent worldwide. In most of the cases, prevalence of scabies was assessed on the basis of clinical diagnosis and few studies are followed by the differential diagnosis including molecular methods. In present study, a total of 93 clinically suspected scabies patients visited dermatology department of KMCTH and were sampled by skin scraping method. On the basis of microscopic examination of the samples, the prevalence of scabies has been found to be 3.23% with higher prevalence in males (2.15%) than females (1.08%). The result was comparable to the worldwide review published by WHO (2005).

Several studies carries out in Australian aboriginal communities showed remarkably high prevalence of scabies ranging from 18.5% to 50% (Currie *et al.*, 1994; Carapetis *et al.*, 1997; Kristensen, 1991; Terry *et al.*, 2001). An attack rate in England was similar to that of Australian aboriginal communities (Hewitt *et al.*, 2015). High rate of scabies in aboriginal communities may reflect their overcrowded living condition and health practices. Meanwhile it is comparable to the attack rate in England (6 month) being one of the developed countries among the world. It can be a part of the discussion because the situation and living conditions between the subjects of the studies have much difference and still it has similarities in result.

Some studies (Spain and United States) indicated comparatively low prevalence of scabies infestation than the present study (Otero *et al.*, 2004; Shaw and Juraneck, 1976). Besides being developed countries it maybe probably because of the living condition and availability of the health services. There is high difference in shelter based investigations and among hospitalized homeless persons (from 3.8% to 56.5%) (Hicks and Elston, 2009). It again throws a light on the health practices and daily health care measures which can influence the infestation. But some paper shows low scabies prevalence in general population and is unevenly distributed within a community (Burgess, 1994; Downs *et al.*, 1999; Green, 1989). While it is common in resource poor communities in rural and urban areas in general population (Chakrabarti, 1985; Kristensen, 1991; Heukelbach *et al.*, 2005; Stanton *et al.*, 1987; Figueroa *et al.*, 1998; Hegazy *et al.*, 1999; Oduoko *et al.*, 2001; Gibbs, 1996). In resource poor communities as well, the health measures are ignored and many even don't know the fact that scabies is caused by the parasitic mite but not by allergic reactions. It eventually leads to people's ignorance towards general but important symptoms like itching and rashes.

A study in Universal Medical College Teaching Hospital, Western Nepal's result is similar to that of the present study i.e. 4.4% (Poudyal *et al.*, 2016) and 4.7% in villages of rural area (Walker *et al.*, 2008) and 5.03% in the pediatric age group of a tertiary care centre, Nepal (Shrestha *et al.*, 2012). Among them, pediatric age group showed prevalence of scabies with high risk of infestation in children. Slightly high infestation rate has been reported from western and rural Nepal.

Scabies may represent a threat for hospitals, prisons, kindergartens, nursing homes and long term care facilities (Hengge *et al.*, 2006). Some of the authors even reported that scabies fluctuates at every 7 years (scabies is commonly called 7-year itch) and yet other reports a peak every 15-25 years and reasons are yet unknown (Johnston and Sladden, 2005).

Present result revealed that scabies was suspected more or less equal in all the age groups <40 years compared to >40 years which is statistically significant (Table 1). But laboratory confirmation showed that scabies infestation was distributed equally in all age group without any significant difference and more in male than in female ($p= 0.5516$) (Figure 1). However Maier and Maier (2013) suggested considering scabies as a childhood disease from a global point of view and supported by the study in Lahore where less than half of children had skin rashes while boys were in majority than girls children (Qasim , 2015). Another study conducted in Pakistan by Khatoon *et al.*, (2016) where children below 12 years were examined and mentioned the association between scabies of different body region and age for boys was significant ($p < 0.01$), while for girls it was highly significant ($p < 0.001$). Scabies has been suggested to be more frequent in males than in females (Qasim, 2015; Otero *et al.*, 2004) and it has high rate of occurrence in children (Feldmeier *et al.*, 2009; Jackson *et al.*, 2007; Taplin *et al.*, 1991; Haar *et al.*, 2014; Romani *et al.*, 2015; Eason and Tasman, 1985; Harris *et al.*, 1992; Badiaga *et. al.*, 2005). Scabies is suggested to be a childhood disease and it is frequent in children than in adults. Various factors can relate to this suggestion such as; children share close contact between their groups and friends as well as sharing fomites. It enhances the chance of acquiring infection from the other individual easily which is also accompanied by the immune system. Generally there is high chance for a child to be infected by a parasite. As human becomes immune towards the parasite if once they are infected with it in their early age.

There is a contrasting difference in the results of our study and the results from various studies done all over the world. Most of the studies were based on pediatrics department, school children and with age group below 10-12 years. However, the present study is based on overall age group of all ethnic groups with skin problems visiting dermatology department of KMCTH. Itch mite infestation has been suspected to be high within age group <20 years in comparison to other age group but laboratory confirmation shows no significant difference in the infestation pattern. It was also very difficult to find the mite in skin scrapings of the suspected patients to confirm the infection as there is average burden of scabies mite of about 10-12 mites per host (Fain, 1978 and McCarthy *et al.*, 2004).

There was no difference in infestation pattern among ethnic groups both in suspected cases and in laboratory confirmation. Supported by Chosidow (2006); scabies occurs in both sexes, all ages and in all ethnic groups. In case of organ involvement, Finger, Abdomen and finger, Abdomen and Genitalia, Finger and Genitalia were most affected parts beside other organs in suspected patients. In infants and children face and neck are often affected but rarely in other age groups (Chakrabarti, 1985; Burgess, 1994;

Heukelbach *et al.*, 2005). As scabies is a parasitic infestation, it prefers the soft part of the body to feed on and make burrow. All parts of the infant's body are soft but in comparison to other parts, the skin in face and neck is softer. But in adults, scabies presents intensely pruritic rash prone to inter digital web spaces, flexure creases, wrists and arms, elbows, soles and insteps of the feet, waist, axillary folds, and pelvic girdle including buttocks, genitals, and the periareolar region in females (McCarthy *et al.*, 2004; Alexander, 1984; Mellanby, 1977; Mellanby, 1977; Mellanby 1985). Mite infestation also depends on the temperature and moisture of the skin besides softer parts. The parts which gets moist and warm very often, are preferred by the parasite as mentioned above. While mite was extracted from the scrapping collected from fingers. Other parts of body like, abdomen, genitalia are more sensitive to take skin scrapings which can further open a way for secondary infection that's why the scrapings were only collected from fingers.

Meanwhile, assessment of risk factors via questionnaire resulted quite interesting results among the scabies patients. It has been found to be significantly high scabies infestation rate ($P= 0.1738$) in those people living in their own home or as a guest with their relatives. Scabies was significantly higher ($P= 0.02812$) in people who were sharing room with more than other two people. Members in a family living together usually share beds, chairs, towels, etc. and this can act as an important source for transmission and infestation. More crowded the living condition the higher is the prevalence of scabies in a population (Currie *et al.*, 1994; McCarthy *et al.*, 2004). This was also shown in a study where scabies was twice as prevalent in a population living in the urban (crowded living condition) areas than in a fishing community in Brazil where families were living in a large space (Heukelbach *et al.*, 2005). In addition to this, it is suggested to be more frequent in urban areas and in winter months (Poudyal *et al.*, 2016; Kimchi *et al.*, 1989; Downs *et al.*, 1999; Mimouni *et al.*, 2003; Herrmann and Humann, 1969; Andrews, 1979; Tuzun *et al.*, 1980).

On the other hand a 14- year nationwide study conducted in Taiwan reported the incidence of scabies to be negatively correlated with temperature but positively correlated with humidity (Liu *et al.*, 2016). In addition poor hygiene and poor sanitation (Poudyal *et al.*, 2016) overcrowded living condition (Currie *et al.*, 1994; McCarthy *et al.*, 2004, Heukelbach *et al.*, 2005), fomites (Arlan *et al.*, 1984, 1984, 1988, 1988, 1988, 1988) has been considered as possible risk factors for scabies infestation. Meanwhile, volunteer climbed naked into the beds in a study that were just left by the scabies patients that resulted 1.33% of infection when earlier patients had <20 mites and infection was 15% when patients had >50 infective mites (Heukelbach and Feldmeier, 2006). While analyzing bathing habit, all the positive scabies (3.23%) patients took bath twice a week and it was negative in people who took bath every day. It looks like scabies is more common in people who ignore common health measures. However, mites can survive in the epidermis and are resistant to water and soap and may continue to be viable even after daily hot baths; therefore a study suggested that the role of poor hygiene has been overestimated (Mellanby, 1985).

In case of the entry and absence of sunlight into the room, there was no significant difference in the itch mite infestation pattern. But infection was more in patients living in a dark room and Sarcoptic mite can survive three to four days outside the body (Arlan *et al.*, 1984; Lane, 1987) depending on the ambient relative humidity. If the room is dark and without the entry of sunlight, it can promote the scabies infestation as *Sarcoptes scabiei* can live few days outside the body depending on humidity (Arlan *et al.*, 1984; Lane, 1987) and sometimes it is difficult to diagnose (Orkin, 1995) leading to misdiagnosis (Jessica *et al.*, 2017) which may prolong the period of infestation promoting many other complications with different occurrence rate ranging from 2.71 per 1000 to 46 % (Hay *et al.*, 2012; Fuller, 2013).

Scabies is also a problem for immunocompromised patients like HIV, Organ transplant recipient (OTR), including recipients of various organs like kidney (Yates *et al.*, 2013; Langer *et al.*, 2005; Venning and Millard, 1992; Wolf *et al.*, 1985; Gregorini *et al.*, 2011; Mansy *et al.*, 1996; Youshock and Glazer, 1981; Espy and Jolly, 1976; Anolik and Rudolph, 1976) liver (Garofalo *et al.*, 2016) and bone marrow allografts (Barnes *et al.*, 1987; Vyas *et al.*, 1990; Ortega-Loayza *et al.*, 2013). However the definite incidence of scabies in Organ transplant recipients is not well known. Institutes where the outbreaks occur more frequently include nursing homes, care facilities, prisons (Ladbury *et al.*, 2012; Capobussi *et al.*, 2014; Hay *et al.*, 2013; Leppard and Naburi, 2000), workshops for disabled people (Stoevesandt *et al.*, 2012), Schools (Ejidokun *et al.*, 2007), Kindergartens, orphanage and childcare centres (Ariza *et al.*, 2013; Sargent and Martin, 1994). It may be because the patient's immune system is weakened after the organ transplant and body is unable to defend against the common and general infective agents and parasite. The fact behind nursing homes is that, patients use the same bed for over a long period of time creating favorable environment for the survival of mite and thus enhancing the infestation causing the outbreak.

Family history in 67% of suspected patients and microscopic examination revealed family history in 2.15% confirmed scabies patients. All of them experienced symptoms like itching and rashes both. With a family history, it increases the chance of spreading infection within family members via fomites and even by direct contact. There is even more chances of infection when family members share bedding and towels. In Sub-Saharan region, scabies was present in the form of diffuse itching and visible rashes with 13% prevalence (Mahé *et al.*, 2005). In case of the attitude of the patients towards the common symptoms like itching and rashes, result revealed 67% suspected patients visited after 3 weeks of persistent symptoms including all positive scabies patients elucidating people's ignorance towards scabies. It reflects people's negative attitude towards the general skin problems which can potentially lead to further complications. However scabies is also considered as a neglected tropical disease (Fuller, 2013). It constitutes the most common problem among homeless people (Moy and Sanchez, 1992) can sometimes worsen by the use of alcohol or drugs or by psychiatric problems (Vredevoe *et al.*, 1992; Stergiopoulos *et al.*, 2015). Generally, people use alcohol to be intoxicated during their difficult times and depression. During this time the person avoids general routine.

Symptoms in depression also state that along with other behavior, he/she ignores some general health measures like bathing and changing clothes. It is described by the psychiatric problems which increase a chance of acquiring infection by the individual.

The prevalence may differ with homeless people sleeping in the street and homeless people provided with shelter as its occurrence was normal among housed homeless people in Boston (Stratigos *et al.*, 1999). Crusted scabies (Norwegian scabies) contrasting ordinary scabies infestation has been found in immunocompromised individuals with AIDS (Rau and Baird, 1986) and in HTLV-1 seropositive patients (Del Giudice *et al.*, 1997). On the other hand, drug induced immunosuppression (Wolf and Krakowski, 1987), renal transplant recipients (Espy and Jolly, 1976) or prolonged treatment with steroids (Jaramillo *et al.*, 1998) has been suggested to be associated with the incidence of crusted scabies. The condition is again explained by the fact of the immune system. There is more number of mites in crusted scabies than in classical scabies. However, in HIV patients and in transplant recipients mite gets suitable opportunity to invade and multiply.

Besides scabies, other skin diseases and problems were analyzed to create a general pattern of skin problems. The diseases were broadly classified as Dermatitis & Eczema, Fungal, Acne, PMLE & Melasma, Viral & Bacterial and Psoriasis. Among all the categories, Dermatitis & Eczema exhibited highest prevalence with 23.86% followed by Fungal and Acne. Under the category of Dermatitis and Eczema, ACD and ICD were most prevalent with Rashes and patches. It may be due to the increase in pollution in Kathmandu valley since past few months. Lack of water supply in the valley where most of the people are unable to take bath every day, and wash their cloths after wearing it once! In case of ACD and ICD, patients must change his/her cloth and take shower every day. But it is almost impossible for most of the people residing in valley.

A study at pediatric care center Nepal reported Dermatitis and Eczema to be the most common skin problem (26.46%), bacterial infection (16.3%), Urticarial (15.71%), Fungal (7.3%), etc. and others (6.53%)(Shrestha *et al.*, 2012). Also Poudyal *et al.*, (2016) reported three most common dermatoses were Fungal infections (18.5%), Eczema (14.4%), and Acne (10.1%). Gauchan *et al.* (2015) carried out the study in Pediatric and Dermatology Department, Manimal Teaching Hospital, Pokhara; it appeared that among 226 patients, most common category was Infections and Infestations (51.3%) followed by Dermatitis (27.9%). Out of total 211 dermatological cases in rural area of Nepal, Eczema was the commonest presenting 47.64% (Shrestha and Kayastha, 2011). For Fungal infection, there is a myth that soap should not be used in ringworms and *Tinea* related infections. But according to Dr. Rupak Ghimire, the infected part of the body should be washed properly with soap and water and keep it dry avoiding sweat. It also needs to be cleaned properly with adequate water regularly in order to treat it. The possible reason for more Fungal infection may be again inadequate water supply. Acne showed 6.88% prevalence over other skin problems. However acne is more affected by age and hormonal changes, it can also be triggered by pollution inside the valley (Figure 3).

Many study suggested the mimicry of clinical presentation of the scabies in its early form may looks like other skin conditions such as Psoriasis, Atopic dermatitis, Diaper dermatitis, Allergic contact dermatitis, and Irritant contact dermatitis, Herpetiformis, Eczema, Impetigo, Furunculosis, similar allergic reactions to other mites and insects, Syphilis, Urticaria related syndromes (Arlan, 2015; Arlian, 1989; Alexander, 1984). Meanwhile, it has been hypothesized that scabies can trigger other diseases because of a Koebner phenomenon (Aboud and Aboud, 2011) and rare or overlooked granulomatous reaction can be caused by scabies infestation that could potentially lead to misdiagnosis (Jessica *et al.*, 2017).

Analysis of age and sex wise distribution pattern of disease revealed equal chances of infection with Dermatitis & Eczema among all age group but very less in patients >80years. As a whole, number of patients >80 years visiting dermatology department were much less in number in comparison to other age groups. Similarly, Fungal infection, Acne, PMLE & Melasma, Viral & Bacterial and Psoriasis is absent in the age group >80 years. On the other hand, fungal infection was more common in male than in females. According to Shrestha *et al.*, (2012) and Shakya *et al.*, (2004) Skin problems and Fungal infections has been found to be more common in males (53.77%) than female (46.23%). The reason behind high Fungal infection in males (70%) may be that most of the men wear closed shoes/ leather shoes with socks either it`s summer or winter. Wearing shoes for very long time in a day for more than 5/6 hours creates warm and humid environment suitable for fungal growth. However females are fascinated to wear sandal and open shoes in summer thus increasing the air flow and that keeps feet dry hence preventing fungal infections.

Acne and PMLE & Melasma was highly prevalent in females than in male patients and common among age group 15-25 years and 25-60 years respectively. Acne has been found to be more influenced by age and hormones rather than pollution. But it`s interesting that females (64.63%) are highly affected by acne than males. Generally females are more concerned about their beauty and skin than males and visit dermatologist in order to get rid of acne. However there is no difference in prevalence of Viral & Bacterial infection in male and female among all age groups. Meanwhile, Psoriasis is highly prevalent in patients above 50 years old with equal chances in male and female (Table 4).

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Among all the suspected patients, prevalence of scabies was found to be 3.23% and is distributed equally in all age groups without any significant difference. In case of gender based assessment, scabies was slightly more in male (2.15%) than female (1.08%). The result was also analyzed on the basis of the patient's residence, ethnic groups and organ involved which resulted equal distribution of scabies infestation in patients with all categories. Most of the patients shared their room with more than two people and lived in their own house or with their relatives. All the positive patients took bath twice a week. The result showed that, scabies was comparatively higher in patients living in a room without the presence of direct sunlight. Most of them had family history of scabies and experienced symptoms like itching and rashes both. Interestingly, all the positive patients visited hospital after three weeks of persistent symptoms.

Meanwhile, prevalence of other skin problems was also assessed in hospital visiting patients. Dermatitis and eczema was the most common problem among patients which was equally distributed in all age groups with equal chances in both male and female. Other most common problems were fungal infection with higher prevalence in male equally distributed in all age groups and Acne which was higher in female of age group 15-25 years. The least common problem was Psoriasis distributed equally in both gender with high prevalence in patients above 50 years old.

6.2 Recommendations

Although scabies has been reported from some parts of Nepal before, no studies related to scabies prevalence was carried out in KMCTH before. Therefore, based on the research results and the observation, following points are recommended for the further research of scabies:

1. More advanced tool such as dermatoscopy and serology should be used to diagnose scabies.
2. Patients should make aware that scabies is caused by a parasite and is not any kind of allergic reactions.
3. Study recommends that scabies infestation is mainly prevalent in people ignoring basic health measures. Therefore, taking regular bath (daily or thrice a week) and changing clothes regularly can prevent/ reduce scabies infestation in people.

REFERENCES

- Abdo, A., Kouri, V. and Burgos, D. 2009. Norwegian scabies associated with herpes simplex infection in a renal transplant patient. *Transplantation*, **87**: 943-944.
- Aboud, Al, and Aboud, D. 2011. Multiple lesions of granuloma annulare on the hand in a patient with scabies. *Clinic Cosmetic and Investigational Dermatology*, **14**: 131–132.
- Alexander, J.O. 1984. Scabies. *Arthropods and Human Skin*, **422**: 227-32.
- Andrews, J.R. 1979. Scabies in New Zealand. *International Journal of Dermatology*, **18**: 545–52.
- Annual Health Report. 2010- 2011, Department of Health Services. Ministry of Health, Kathmandu.
- Anolik, M.A. and Rudolph, R.I. 1976. Scabies simulating Darier disease in an immunosuppressed host. *Archives of Dermatology*, **112**: 73-74.
- Ariza, L., *et al.*, 2013. Investigation of a scabies outbreak in a kindergarten in Constance, Germany. *European Journal of Clinical Microbiology and Infectious Diseases*; **32**: 373–380.
- Arlian, L. G., Estes, S. A. and Vyszynski Moher, D.L. 1988. Prevalence of *Sarcoptes scabiei* in the environment of scabietic patients. *Journal of The American Academy of Dermatology*, **19**(5): In press.
- Arlian, L.G. 1989. Biology, host relations, and epidemiology of *Sarcoptes scabiei*. *Annual Review of Entomology*, **34** (1): 139–61.
- Arlian, L.G. and Vyszynski-Moher, D.L. 1988. Life cycle of *Sarcoptes scabiei* var. *canis*. *Journal of Parasitology*, **74**: 427-430.
- Arlian, L.G., Feldmeier, H. and Morgan, M.S. 2015. The potential for a blood test for scabies. *PLoS Neglected Tropical Disease*, 9: e0004188.
- Arlian, L.G., Runyan, R. A., Sorlie, L. B. and Estes, S. A. 1984. Host seeking behavior of *Sarcoptes scabiei*. *Journal of the American Academy of Dermatology*, **11**: 594-98.
- Arlian, L.G., Runyan, R.A. and Estes, S.A. 1984. Cross infestivity of *Sarcoptes scabiei*. *Journal of the American Academy of Dermatology*, **10**: 979-86.
- Arlian, L.G., Runyan, R.A., Achar, S. and Estes, S.A. 1984. Survival and infectivity of *Sarcoptes scabiei* var. *canis* and var. *hominis*. *Journal of the American Academy of Dermatology*, **11**: 210-214.
- Arlian, L.G., Vyszynski-Moher, D. L. and Cordova, D. 1988. Host specificity of *Sarcoptes scabiei* var. *canis* and the role of host odor. *Journal of Medical Entomology*, **25**: 52-56.

- Arlian, L.G., Vyszenski-Moher, D.L. and Pole, M.J. 1989. Survival of adults and development stages of *Sarcoptes scabiei* var. *canis* when off the host. *Experimental and Applied Acarology*, **6**: 181-7.
- Badiaga, S., Menard, A. and Tissot, D.H. 2005. Prevalence of skin infections in sheltered homeless. *European Journal of Dermatology*, **15**: 382–386.
- Barnes, L., McCallister, R.E. and Lucky, A.W. 1987. Crusted (Norwegian) scabies. Occurrence in a child undergoing a bone marrow transplant. *Archives of Dermatology*, **123**: 95-97.
- Beeson, B.B. 1927. *Acarus scabiei*: a study of its history. *Archives of Dermatology*, **16**: 294-307.
- Boix, V., Sanchez-Paya, J., Portilla, J., and Merino, E. 1997. Nosocomial outbreak of scabies clinically resistant to lindane. *Infection Control and Hospital Epidemiology*, **18**: 677.
- Brown, S., Becher, J., and Brady, W. 1995. Treatment of ectoparasitic infections: review of the English-language literature, 1982-1992, *Clinical Infectious Diseases*, **20**(Suppl. 1): S104-9.
- Burgess, I.F. 1994. *Sarcoptes scabiei* and scabies. *Advances in Parasitology*, **33**: 235–92.
- Burkhart, C.G., Burkhart, C.N. and Burkhart, K.M. 2000. An epidemiologic and therapeutic reassessment of scabies. *Cutis*, **65**: 233–240.
- Cakmak, S.K., Gönül, M., Gül, U., Unal, T. and Dağlar, E. 2008. Norwegian scabies in a renal transplant patient. *Australasian Journal of Dermatology*, **49**: 248-249.
- Capobussi, M., Sabatino, G. and Donadini, A. 2014. Control of scabies outbreaks in an Italian hospital: an information-centered management strategy. *American Journal of Infection Control*, **42**: 316–20.
- Carapetis, J.R., Connors, C., Yarmirr, D., Krause, V. and Currie, B.J. 1997. Success of a scabies control program in an Australian aboriginal community. *The Pediatric Infectious Disease Journal*, **16**: 494-499.
- Chakrabarti, A. 1985. Some epidemiological aspects of animal scabies in human population. *International Journals of Zoonoses*, **12**: 39–52.
- Chosidow, O. 2006. Scabies: Clinical practices. *New England Journal of Medicine*, **354** (16): 124–129.
- Christophersen, J. 1978. The epidemiology of scabies in Denmark, 1900 to 1975. *Archives of Dermatology*, **114**: 747–50.
- Currie, B.J. and Carapetis, J.R. 2000. Skin infections and infestations in Aboriginal communities in northern Australia. *Australasian Journal of Dermatology*, **41**(3): 139–143.

- Currie, B.J., Connors, C.M. and Krause, V.L. 1994. Scabies programs in aboriginal communities. *Medical Journal Australia*, **161**: 636-637.
- De, Beer, G., Miller, M.A., Tremblay, L. and Monette, J. 2006. An outbreak of scabies in a long-term care facility: The role of misdiagnosis and the costs associated with control. *Infection Control and Hospital Epidemiology*, **27**(5): 517-518.
- Del Giudice, P., Sainte, Marie, D., Gerard, Y., Couppie, P. and Pradinaud, R. 1997. Is crusted (Norwegian) scabies a marker of adult T cell leukaemia/lymphoma in human T lymphotropic virus type I seropositive patients? *Journal of the Infectious Diseases*, **176**: 1090-92.
- Dos Santos, M.M., Amaral, S., Harmen, S.P., Joseph, H.M., Fernandes, J.L. and Counahan, M.L. 2010. The prevalence of common skin infections in four districts in Timor-Leste: a cross sectional survey. *BMC Infectious Diseases*, **10**: 61.
- Downs, A.M. 2004. Seasonal variation in scabies. *British Journal of Dermatology*, **150**: 602-03.
- Downs, A.M., Harvey, I. and Kennedy, C.T. 1999. The epidemiology of head lice and scabies in the UK. *Epidemiology and Infection*, **122**: 471-77.
- Eason, R.J. and Tasman-Jones, T. 1985. Resurgent yaws and other skin diseases in the Western Province of the Solomon Islands. *PNG Medical Journal*, **28**: 247-50.
- Ejidokun, O., Aruna, O. and O, Neill, B. 2007. A scabies outbreak in a further education college in Gloucestershire. *Epidemiology and Infection*, **135**: 455.
- Espy, P.D. and Jolly, H.W. 1976. Norwegian scabies: Occurrence in a patient undergoing immune suppression. *Archives of Dermatology*, **112**: 193-196.
- Fain, A. 1978. Epidemiological problems of scabies. *International Journal of Dermatology*, **17**: 20-30.
- Feldmeier, H., Jackson, A. and Ariza, L. 2009. The epidemiology of scabies in an impoverished community in rural Brazil: presence and severity of disease are associated with poor living conditions and illiteracy. *Journal of the American Academy of Dermatology*, **60**: 436-43.
- Figueroa, J.I., Fuller, L.C., Abraha, A. and Hay, R.J. 1998. Dermatology in southwestern Ethiopia: rationale for a community approach. *International Journal of Dermatology*, **37**: 752-58.
- Fuller, L.C. 2013. Epidemiology of scabies. *Current Opinion In Infectious Disease*, **26**(2-4): 123-126.
- Garofalo, V., Saraceno, R. and Milana, M. 2016. Crusted scabies in a liver transplant patient mimicking rupioid psoriasis. *European Journal of Dermatology*, **26**: 495-496.

- Gauchan, E., Kumar, A., B.K, G., Thapa, S.P. and Pun, J. 2015. Relation of Socio demographics and Personal Hygiene on Different Childhood Dermatoses. Kathmandu University Medical Journal, **49**(1): 29-33.
- Gibbs, S. 1996. Skin disease and socio-economic conditions in rural Africa: Tanzania. International Journal of Dermatology, **35**: 633–39.
- Gordon, R.M. and Insworth, K. 1945. A review of scabies since 1939. British Medical Bulletin, **3**: 209-15.
- Green, M.S. 1989. Epidemiology of scabies. Epidemiologic Reviews, **11**: 126–50.
- Gregorini, M., Castello, M., Rampino, T., Bellingeri, A., Borroni, G. and Dal Canton, A. 2011. Scabies crustosa in a 61-year old kidney transplanted patient. Journal of General Internal Medicine, **27**: 257.
- Haar, K., Romani, R. and Filimone, R. 2014. Scabies community prevalence and mass drug administration in two Fijian villages. International Journal of Dermatology, **53**: 739–45.
- Harris, M., Nako, D. and Hopkins, T. 1992. Skin infections in Tanna, Vanuatu in 1989. PNG Medical Journal, **35**: 137–43.
- Hassan, I., Ahmad, K. and Yaseen, A. 2014. Pattern of pediatric dermatoses in Kashmir valley: a study from a tertiary care center. Indian Journal of Dermatology Venerology and Leprosy, **80**(5): 448–451.
- Hay, R.J., Steer, A.C., Chosidow, O. and Currie, B.J. 2013. Scabies: a suitable case for a global control initiative. Current Opinion in Infectious Diseases, **26**: 107–9.
- Hay, R.J., Steer, A.C., Engelman. D. and Walton, S. 2012. Scabies in the developing world- its prevalence, complications and management. Clinical Microbiology and Infection, **18**: 313-323.
- Hegazy, A.A., Darwish, N.M., Abdel-Hamid, I.A. and Hammad, S.M. 1999. Epidemiology and control of scabies in an Egyptian village. International Journal of Dermatology, **38**: 291–95.
- Hengge, U.R, Currie, B.J., Jager, G., Lupi, O. and Schwartz, R.A. 2006. Scabies: a ubiquitous neglected skin disease, The Lancet Infectious Disease. **6**: 769–779.
- Herrmann, W.P. and Humann, B. 1969. Jahreszeitliche Morbiditätsschwankungen bei der Scabies (Seasonal morbidity variation in scabies). Hautarzt, **20**: 467.
- Heukelbach, J. and Feldmeier, H. 2006. Scabies. The Lancet, **367**: 1767–1774.
- Heukelbach, J., Wilcke, T., Winter, B. and Feldmeier, H. 2005. Epidemiology and morbidity of scabies and pediculosis *capitis* in resource-poor communities in Brazil. British Journals of Dermatology, **153**: 150–56.

- Hewitt, K.A., Nalabanda, A., Cassell, J.A. 2015. Scabies outbreaks in residential care homes: Factors associated with late recognition, burden and impact. A mixed methods study in England. *Epidemiology and Infection*, **143**(7): 1542-1551.
- Hicks, M.I. and Elston, D.M. 2009. Scabies. *Dermatologic Therapy*, **22**(4): 279-292.
- Hillier, T. 1865. *Handbook of skin diseases*. Walton and Maberly, London. pp. 251.
- Jackson, A., Heukelbach, J., Filho, A.Fd.S., Junior, Ed.B. and Feldmeier, H. 2007. Clinical features and associated morbidity of scabies in a rural community in Alagoas, Brazil. *Tropical Medicine and International Health*, **12**: 493–502.
- Jaramillo-Ayerbe, F. and Berrio-Munoz, J. 1998. Ivermectin for crusted Norwegian scabies induced by use of topical steroids. *Archives of Dermatology*, **134**: 143–45.
- Jessica, H., Rajiv, N. and Vladimir, V. 2017. *Case Reports in Dermatology*. Department of Dermatology, University of Florida College of Medicine, Gainesville, FL, USA. **9**: 60–64.
- Johnston, G. and Sladden, M. 2005. Scabies: diagnosis and treatment. *British Medical Journal*, **17**: 619–622.
- Joshi, S.K. and Dahal, P. 2008. Occupational health in small scale and household industries in Nepal: A situation analysis. *Kathmandu University Medical Journal*, **6**(22): 152-160.
- Khatoon, N., Khan, A., Azmi, M.A., Khan, A., Shaukat, S.S. 2016. Most common body parts infected with scabies in children and its control. *Pakistan Journal of Pharmaceutical Sciences*, **29**(5): 1715-1717.
- Kimchi, N., Green, M.S. and Stone, D. 1989. Epidemiologic characteristics of scabies in the Israel Defense Force. *International Journal of Dermatology*, **28**: 180–2.
- KMCTH. 2011. Kathmandu Medical College and Teaching Hospital. <http://www.kmc.edu.np>. Accessed on 9 November, 2016.
- Kristensen, J.K. 1991. Scabies and Pyoderma in Lilongwe, Malawi. Prevalence and seasonal fluctuation. *International Journal of Dermatology*, **30**: 699–702.
- Kumar, A., Mishra, A. and Devkota, S. 2010. Pattern of pediatric skin disorders in tertiary care center in western Nepal. *Nepal Journal of Dermatology Venereology and Leprosy*, **10**: 37-9.
- Ladbury, G., Morroy, G., van and Hoeven-Dekkers, S. 2012. An outbreak of scabies in multiple linked healthcare settings in The Netherlands. *Infection Control and Hospital Epidemiology*, **33**: 1047–50.
- Lane, A.T. 1987. Scabies and head lice. *Pediatric Annals*, **16**: 51-4.

- Langer, R.M., Földes, K., Szalay, L. and Járny, J. 2005. Laurence-Moon-Bardet-Biedl syndrome for kidney transplantation at the age of 57 years. *Transplantation Proceedings*, **37**: 4223-4224.
- Leppard, B. and Naburi, A.E. 2000. The use of ivermectin in controlling an outbreak of scabies in a prison. *British Journal of Dermatology*, **143**: 520–523.
- Liu, J., Wang, H., Chang, F., Liu, Y., Chiu, F., Lin, Y., *et al.*, 2016. The effects of climate factors on scabies. A 14-year population-based study in Taiwan. *Parasite*, **23**: 54.
- Mahé, A., Faye, O., N’Diaye, H.T., Ly, F., Konaré, H., Kéita, S. *et al.* 2005. Definition of an algorithm for the management of common skin diseases at primary health care level in sub-Saharan Africa. *Transaction of the Royal Society of Tropical Medicine and Hygiene*, **99**: 39-47.
- Maier, B., Maier, H. 2013. Scabies in infants. A diagnostical and therapeutical problem .
- Mansy, H., Somorin, A., el-Sherif, M., Eze, C., al-Dusari, S. and Filobos, P. 1996. Norwegian scabies complicated by fatal brain abscess in a renal transplant patient. *Nephron*, **72**: 323-324.
- McCarthy, J.S., Kemp, D.J., Walton, S.F. and Currie, B.J. 2004. Scabies: more than just an irritation. *Postgraduate Medical Journal*, **80**: 382– 387.
- Mellanby, K. 1977. Epidemiology of scabies. *Journal of the Royal Society of Health*, **87**: 60-63.
- Mellanby, K. 1977. Scabies in 1976. *Journal of the Royal Society of Health*, **93**: 32-40.
- Mellanby, K. 1985. Biology of the parasite. *Journal of the Royal Society of Health*, **86**: 9-18.
- Mellanby, K. 1985. Epidemiology of scabies. In: Orkin, M., Maibach, H.I., eds. *Cutaneous infestations and insect bites*. Marcel Dekker, New York, pp. 71–74.
- Mimouni, D., Ankol, O.E., Davidovitch, N., Gdalevich, M., Zangvil, E. and Grotto, I. 2003. Seasonality trends of scabies in a young adult population: a 20-year follow-up. *British Journal of Dermatology*, **149**: 157–59.
- Moy, J.A. and Sanchez, M.R. 1992. The cutaneous manifestations of violence and poverty. *Archives of Dermatology*, **128**: 829–39.
- Nair, B.K., Joseph, A. and Kandamuthan, M. 1977. Epidemic scabies. *Indian Journal of Medical Research*, **65**: 513-518.
- Neupane, S. and Pandey, P. 2012. Spectrum of dermatoses among paediatric patients in a teaching hospital of Western Nepal. *Nepal Journal of Dermatology, Venereology & Leprology*, **10**(1): 20–26.

- Odueko, O.M., Onayemi, O. and Oyedeji, G.A. 2001. A prevalence survey of skin diseases in Nigerian children. *Nigerian Journal of Medicine*, **10**: 64–67.
- Olivier, C. 2006. Scabies. *The New England Journal Medicine*, **354**:1718-27.
- Orkin, M. and Maibach, H.I. 1985. Modern aspects of scabies. *Current Problems in Dermatology*, **13**: 109-127.
- Orkin, M., 1995. Scabies: what’s new? *Current Problem in Dermatology*, **22**: 105-11.
- Ortega-Loayza, A.G., McCall, C.O. and Nunley, J.R. 2013. Crusted scabies and multiple dosages of ivermectin. *Journals of Drugs Dermatology*, **12**: 584-585.
- Otero, L., Varela, J.A. and Espinosa, E. 2004. *Sarcoptes scabiei* in a sexually transmitted infections unit: a 15-year study. *Sexually Transmitted Diseases*, **31**(12): 761–765.
- Parish, L.C. 1975.Scabies again. *International Journal of Dermatology*, **14**: 115-16.
- Parish.L.C. 1977.History of scabies. In: Orkin, M., Maibach, H.I., Parish, L.C. eds. *Scabies and pediculosis*, J.B. Lippincott, 1-7. Philadelphia.
- Parlette, H.L. 1975. Scabietic infestations in man. *Cutis*, **16**: 47-52.
- Poudyal, Y., Ranjit, A., Pathak, S. and Chaudhary, N. 2016. Pattern of Pediatric Dermatoses in a Tertiary Care Hospital of Western Nepal. *Dermatology Research and Practice*, 1-6.
- Pouessel, G., Dumortier, J. and Lagrée, M. 2012. Scabies: a common infection in children [in French]. *Archives De Pediatrie*, **19**(11): 1259–1260.
- Qasim, M.M. 2015. Epidemiology of scabies among primary school children in Quetta. *Pakistan Journal of Medical and Health Sciences*, **9**(3): 903-906.
- Rau, R. and Baird, M. 1986. Crusted scabies in a patient with acquired immunodeficiency syndrome. *Journal of the American Academy of Dermatology*, **15**: 1058–59.
- Rehbein, S., Visser, M., Winter, R., Trommer, B., Matthes, H.F., Maciel, A. and Marley, S. 2003. Productivity effects of bovine mange and control with Ivermectin. *Veterinary Parasitology*, **114**: 267-284.
- Roberts, L.J., Huffam, S.E. and Walton, S.F. 2005. Crusted scabies: clinical and immunological findings in seventy-eight patients and a review of the literature. *The Journal of Infectious Disease*, **50**: 375–381.
- Romani, L., Steer, C.A., Whitfeld, M.J. and Kaldor, J.M. 2015. Prevalence of scabies and impetigo worldwide: a systematic review. *Lancet Infectious Disease*, **15**: 960–67.
- Sargent, S.J. and Martin, J.T. 1994. Scabies outbreak in a day-care center. *Pediatrics*, **94**: 1012–1013.

Seok, J., Park, K.Y., Li, K., Kim, B.J., Seo, S.J., Kim, M.N. and Hong, C.K. 2015. A Case of Facial *Sarcoptes scabiei* in a Female Child. Department of Dermatology, Chungang University College of Medicine, Seoul, Korea.

Shakya, S.R., Bhandary, S. and Pokharel, P.K. 2004. Nutritional status and morbidity pattern among governmental primary school children in the Eastern Nepal. Kathmandu University Medical Journal, **4**(8): 307-314.

Shaw, P. K. and Juranek, D.D. 1976. Recent trends in scabies in the United States. The Journal of Infectious Diseases, **134**: 414-16.

Shrestha, D.P., Gurung, D. and Rosdahl, I. 2013. Prevalence of skin diseases and impact on quality of life in hilly region of Nepal. Journal of Institute of Medicine, **34**(3): 44-49.

Shrestha, R. and Kayastha, B.M.M. 2011. Pattern of Skin diseases in a rural area of Nepal. Postgraduate Medical Journal of NAMS, **12**(2): 41-44.

Shrestha, R., Shrestha, D., Dhakal, A.K., Shakya, A., Shah, S.C. and Shakya, H. 2012. Spectrum of pediatric dermatoses in tertiary care center in Nepal. Nepal Medical College Journal, **14**(2): 146-148.

Shrestha, R., Shrestha, D., Dhakal, A.K., Shakya, A., Shah, S.C. and Shakya, H. 2012. Prevalence Study of *H. pylori* infection in Dyspeptic patients coming to Nepal Medical College and Teaching Hospital, Jorpati, Kathmandu. Nepal Medical College Journal, **14**(3): 229-233.

Stanton, B., Khanam, S., Nazrul, H., Nurani, S. and Khair, T. 1987. Scabies in urban Bangladesh. The Journal of Tropical Medicine and Hygiene, **90**: 219-26.

Stergiopoulos, V., Hwang, S.W., Gozdzik, A. et al. 2015. Effect of scattered- site housing using rent supplements and intensive case management on housing stability among homeless adults with mental illness: a randomized trial. JAMA, **313**: 905-15.

Stoevesandt, J., Carlé, L. and Leverkus, M. 2012. Control of large institutional scabies outbreaks. Journal of the German society of Dermatology, **10**: 637-47.

Stratigos, A.J., Stern, R. and Gonzalez, E. 1999. Prevalence of skin disease in a cohort of shelter-based homeless men. Journal of the American Academy of Dermatology, **41**: 197-202.

Subedi, J.R. 2000. Epidemiological surveillance study of human mites (scabies) infestation based on baseline health survey in wards 19 and 20 of Kathmandu metropolitan city. M.Sc. Thesis. Central Department of Zoology, Tribhuvan University, Kathmandu, Nepal.

Taplin, D., Meinking, T.L., Chen, J.A. and Sanchez, R. 1990. Comparison of crotamiton 10% cream (Eurax) and permethrin 5% cream (Elimite) for the treatment of scabies in children. Pediatric Dermatology Journal, **7**: 67-73.

- Taplin, D., Porcelain, S.L. and Meinking, T.L. 1991. Community control of scabies: a model based on use of permethrin cream. *Lancet*, **337**: 1016–18.
- Terry, B.C., Kanjah, F., Sahr, F., Kortequee, S., Dukulay, I., Gbakima, A.A. 2001. *Sarcoptes scabiei* infestation among children in a displacement camp in Sierra Leone. *Public Health*, **115**: 208-211.
- Thappa, D.M. 2002. Common skin problems in children. *Indian Journal of Pediatrics*, **69**(8): 701–706.
- Trice, F.R. and Manson, R.C. 1966. Camp itch: a retrospective study 100 years later. *Southern Medical Journal*, **59**: 10-14.
- Tuzun, Y., Kotogyan, A., Cenesizoglu, E., et al. 1980. The epidemiology of scabies in Turkey. *International Journal of Dermatology*, **19**: 41–44.
- Venning, V.A. and Millard, P.R. 1992. Recurrent scabies with unusual clinical features in a renal transplant recipient. *British Journal of Dermatology*, **126**: 204-205.
- Von, Hebra, F. 1868. On diseases of the skin including exantemata. Fagge, C.H., Rye-Smith, P.H. translators. Vol. 2. New Sydenham Society, London.
- Vredevoe, D.L., Brecht, M.L., Shuler, P. and Woo, M. 1992. Risk factors for disease in a homeless population. *Public Health Nursing*, **9**: 263–9.
- Vyas, P., Kinsey, S.E. and Goldstone, A.H. 1990. Scabies infestation following autologous bone marrow transplantation. *Leukemia and Lymphoma*, **3**: 73-74.
- Walker, G.A., Johnstone, P.W. 1999. Interventions for treating scabies (Cochrane Review). In: *The Cochrane Library*. Issue 2. Oxford: Update Software, www.update-software.com accessed in 31st August 2017.
- Walker, S.L., Shah, M. and Hubbard, V.G. 2008. Skin disease is common in rural Nepal: results of a point prevalence study. *British Journal of Dermatology*, **158**: 334-336.
- Walton, S.F., Holt, D.C., Currie, B.J. and Kemp, D.J. 2004. Scabies: new future for a neglected disease. *Advances in Parasitology Journal*, **57**: 309-376.
- Wolf, R. and Krakowski, A. 1987. Atypical crusted scabies. *Journal of the American Academy of Dermatology*, **17**: 434–36.
- Wolf, R., Wolf, D., Viskoper, R.J. and Sandbank, M. 1985. Norwegian type scabies mimicking contact dermatitis. *Postgraduate Medical Journal*, **78**: 228-230.
- WHO (World Health Organization). 2005. *Epidemiology and management of common skin diseases of children in developing countries*. Geneva.
- WHO (World Health Organization). 2005. *The current evidence for the burden of group A streptococcal diseases*. Geneva.

WHO (World Health Organisation), 2009. Available from: <http://www.who.int/en/>.

Yates, J.E., Bleyer, A.J., Yosipovitch, G., Sanguenza, O.P. and Murea, M. 2013. Enigmatic pruritus in a kidney transplant patient. *Clinical Kidney Journal*, **6**: 194-198.

Youshock, E. and Glazer, S.D. 1981. Norwegian scabies in a renal transplant patient. *JAMA*, **246**: 2608-2609.

ANNEXES

Questionnaire for scabies patients

Name:

Ethnic group:

Age:

Sex:

Address:

Living in: Home/ Hostel/ Barracks/ Orphanage

No. of people living in a single room: 1 / 2 / 3 / more than 3

Primary symptom: Itching/ Skin rashes/ Others

Family history: Yes/ No

Site involvement: Abdomen / Fingers / Genitalia / Face / Other

Duration of symptom:

- 1-7 days
- 7-14 days
- 14-30 days
- > 1 month.

Does the sunlight enter into the room? Yes/ No

Bathing Habit: Daily/ Alternative days/ Two times per week/ Weekly/ More than a week.

Diagnosis:

Secondary infection: Yes/ No

Lab:

Organism isolated: Yes/ No

Eggs isolated: Yes/ No

Treatment given:

Oral

- Ivermectin

Topical

- Lindaine
- Permethrin

PHOTOPLATES



Picture 3: Scabies in abdomen and genitals



Picture 4: Scabies in abdomen



Picture 5: Scabies in hand and wrist