



Original Research Article

Knowledge and Practice of Foot Care amongst Diabetics in India: Comparison between Urban and Rural Setting- A Reality Check

Pothiraj Pitchai¹, Juhika Joshi²

¹Lecturer, ²Intern, MGM College of Physiotherapy, Navi Mumbai, India.

Corresponding Author: Pothiraj Pitchai

Received: 28/02/2015

Revised: 26/03/2015

Accepted: 27/03/2015

ABSTRACT

Diabetes is now an epidemic affecting both developed as well as developing countries. This study aims at comparing knowledge & practice of foot care and association of demographic factors with it in Indian population of urban and rural settings.

Methodology: The cross-sectional study was conducted in Raigad and Thane district. Self-made Foot care Knowledge questionnaire, Nottingham Assessment of Functional Foot-care Questionnaire (NAFF) were administered. Descriptive analysis was done. Level of knowledge and practice of foot care were calculated as absolute frequencies and were reported as overall percentages. Mann-Whitney Test and Kruskal-Wallis Test were used to find out association between demographic factors with it.

Results: Of 100 subjects, 58% in urban and 8% in rural had good knowledge of diabetic foot care. Majority of both 68% of urban and 90% of rural diabetics were not aware how often one should check footwear for damage. 6% of urban 48% rural diabetics had a poor practice score. Majority of diabetics were not aware to inspect feet that include 64% of urban and 82% of rural diabetics. Moreover 4% of urban and 36% of rural diabetics walk outside with bare feet. Socioeconomic and education had an influence in knowledge and foot care practice among rural diabetics.

Conclusion: Knowledge and practice of foot care in rural diabetics were less than urban. Education and Socioeconomic status were significantly associated with rural populations. Intensive Foot care educational program need to be adhered to overcome these deficiencies

Keywords: Diabetic foot care, knowledge, Practice, Urban, rural, India.

INTRODUCTION

Diabetes is no longer a disease it is now considered to be an epidemic affecting both developed as well as developing countries. Globally, it affects about 382 million people. ^[1] World health organization (WHO) estimates 60 % of diabetic population will be from developing countries of Asia by 2025. ^[2] India ranks

second among top ten territories and house 65.1 million People with Diabetes. ^[1]

Diabetes is a major source for increased morbidity and mortality in India. ^[3-5] Despite increased expenditure on health care by person with diabetes there is a huge financial burden in the form of low income to lost income and leading to financial burden on national economics. ^[6] Diabetes is considered to be a multisystem and multi-

organ disease as it damages different types of tissues. Major causative factor for tissue damage has been attributed to vascular disease in diabetes which affects both micro and macro vasculature. Diabetic Neuropathy is a highly prevalent complication among Indian diabetic population [7] and there are Urban-rural differences in prevalence of foot complications in South-Indian diabetics and reported that Diabetic foot is a common complication with high prevalence of 52% among diabetics. [8] Experts even suggest that around 10 per cent of people with diabetes bound to develop a foot ulcer at some point of time.

Diabetic Foot Ulcer (DFU) is one such common clinical entity which results from continuous and widespread pathological processes. Clinically prevalence of DFU in India is 3%. [9] A disruption in micro vasculature leads to classical triad of neuropathy, ischemia and infection. This triad is responsible for development of diabetic foot syndrome. However it is a multifactorial aetiology arises from numerous pathophysiologic pathways that can potentially lead to this disorder.

DFU tend to affect not just physical but also psychosocial, economic domains and affects overall quality of life of diabetics. Lower Extremity Amputation (LEA) is one of most devastating consequences of DFU. [10] Almost 85% of all amputations are preceded by DFU. Management of DFU and LEA is extensive, requiring prolonged hospital stay as well as expensive. In India where most patients are not medically insured, DFU management is beyond their economic capacity. The duration of hospital stay and physical disability are likely to lead them into depression and affecting overall quality of life. [11,12] In view of this there are studies done on the role of self-Care in management of Diabetes Mellitus (DM) and

recommended Diabetes Self Care activities which includes foot care practice to avert long term complications and improve quality of life which is likely to be effective in reducing the burden of diabetic foot ulcer. [13-15]

As patient education is an important primary aspect of prevention of DFU, assessment of patient's understanding of foot care is imperative. Even after possessing some knowledge regarding foot care, compliance and adherence to practice of foot care might vary between each diabetic patient. Unequal distribution of diabetic population as well as health care providers also reported between rural and urban settings in India. [16,17] Hence there exists a difference in accessing health care between these groups even today. Furthermore differences in many factors such as socio-economic, demographic, cultural, educational or even lifestyle between rural and urban diabetic populations might interfere with their knowledge and practice of foot care.

Despite many intensive researches on similar background in the last two decades, implementation and incorporation of health education in addressing diabetic population is not measured and comparison of foot care practices between rural and urban population of India also not explored. Thus this study aims at comparing knowledge & frequency of practice of foot care and association of demographic factors with it in Indian population.

MATERIALS AND METHODS

This is a cross-sectional study involving 100 patients. Urban diabetics were recruited from one tertiary health centre in Raigad and Thane district. Rural diabetics were selected from Rural Health Centre & Primary Health centre from respective districts based on purposive sampling method.

Clinically diagnosed cases of type 1 and 2 Diabetes for at least 6 months who never developed foot ulcer including both sexes were included. Patients with a history of development of foot ulcer, patients who have undergone amputation, patients with obvious disability that could interfere with independent foot care behaviour, patients with altered mental state, medical and allied health professionals were excluded from this study.

Subjects upon fulfilling inclusion and exclusion criteria were selected, explained purpose of study and informed consent was taken. Two questionnaires were administered to each subject. Self-made Foot care Knowledge questionnaire was used to assess knowledge after content validity was developed, it consist of 12 components. Nottingham Assessment of Functional Foot-care Questionnaire (NAFF) was used to assess practice of foot care. It was proved to be valid and reliable to assess diabetic foot care behavior.^[18] It consists of 29 questions. Some of the components were modified to enhance its cultural sensitivity. Question number 12 was modified to ‘Do you use sports shoes?’ And Question number 26 was modified to ‘Do you check the temperature of water before washing your feet?’ Patients were asked to rate on Likert scale ranging from 0-3 to indicate frequency of occurrence of behaviours. Questionnaires were preceded by basic demographic input from subject regarding age, sex, education, occupation, socioeconomic status and their address. The questionnaires translated in Marathi and Hindi for the local dialect. Higher total score indicated better practice of foot care. Questionnaires were administered between July 2014 to December 2014. Outcome variables such as knowledge and practice of foot care in diabetic patients were measured. Data obtained was analysed using Microsoft Excel Datasheet version 2010 and SPSS

Statistical Software version 17 (SPSS Inc., Chicago, IL, USA). General characteristics of respondents were examined by using Frequency and descriptive statistics. Response to questions on knowledge, foot care practice were analysed and score of each respondent was determined. Association of demographic factors such as age and sex with respect to foot care practise and knowledge was assessed by Mann-Whitney Test and Kruskal-Wallis Test were used for level of education and socioeconomic status with p value of 0.05.

RESULTS

Mean age of urban and rural diabetes population were 56.86 ± 10.868 , 56.88 ± 10.588 respectively. 80% of populations were > 50 years of age in both groups. In rural diabetic population 28% found uneducated. Majority of urban population (68%) belongs to middle socioeconomic status whereas lower socioeconomic status was topped in rural diabetic population that amount to 76%. Demographic details are shown in Table 1.

Table: 1 Demographic Data.

URBAN		CHARACTERISTICS	RURAL	
Age				
18		Minimum	34	
83		Maximum	85	
40		≥50	40	
10		<50	10	
56.86		Mean	56.88	
±10.868		SD	±10.588	
Gender				
27	54%	Males	27	54%
23	46%	Females	23	46%
Education				
0	0%	Uneducated	14	28%
4	8%	Primary	27	54%
13	26%	Secondary	6	12%
33	66%	Tertiary	3	6%
Socioeconomic Status				
11	22%	Upper	0	0%
34	68%	Middle	12	24%
5	10%	Lower	38	76%

Knowledge of foot care:

With maximum possible score of 12, mean knowledge score of urban diabetics is

8.28±2.2 whereas 4.32±2.5 by rural diabetics. 54% of urban diabetic population was not aware of what to do if they had found dead/ tough skin over or under foot. 94% of rural diabetics were aware that diabetics should take medicines regularly and 68% said controlling blood sugar within normal range can reduce complications. 82% of urban and 44% of rural diabetics were aware the importance of exercise. However majority of both 68% of urban and 90% of

rural diabetics were not aware how often one should check footwear for damage.

On classifying knowledge score of study participants, 58% in urban and 8% in rural had good knowledge of diabetic foot care (score >70%), 30% and 20% had satisfactory score (score 50-69%), 12% and 72% had a poor knowledge of diabetic foot care (score <50) in urban and rural diabetics respectively. Response of knowledge of foot care is given in table 2.

Table 2: Responses to knowledge of foot care.

Questions related to knowledge of foot care	Correct Agree (%)		Wrong Disagree/ Don't know (%)	
	Urban	Rural	Urban	Rural
DM patients should take medicines regularly to prevent complications associated with diabetes	98	94	2	6
Controlling blood sugar within normal range can reduce complications due to diabetes	94	68	6	32
DM should look after feet daily because they may not feel a minor injury.	80	22	20	78
DM patients may get an open wound/ injury on foot.	70	18	20	82
The wound/ injury may not heal quickly in DM patients.	82	22	18	78
Smoking/ chewing tobacco will further affect the healing process in DM patients	76	30	24	70
How often do you think you should inspect your feet	52	28	48	72
How often do you think you should inspect footwear for damage?	32	10	68	90
How often do you think you should Exercise.	82	44	18	56
What would you do if you had found dead/dry/ tough skin over or under your foot	46	28	54	72
If you found redness / swelling in between your toes what would you do?	66	48	34	52
At what temperature do you think you should wash your feet in?	50	20	50	80

Practice of foot care:

Out of 87 maximum possible score for foot care practice, minimum score secured by urban diabetic was 23 & maximum being 65 whereas rural diabetics secured 18 and 49 respectively. Mean score of foot care practice in urban is 45.96±8.129 and rural it is 31.7±6.025. Majority of diabetics were not aware regarding inspection of feet which included 64% of urban and 82% of rural diabetics. More than half of respondent, 74% of urban & 66% of rural, wash their feet regularly. 62% of urban and 94% of rural diabetics don't

check their footwear before wearing, 4% of urban and 36% of rural diabetics walk outside with bare feet. Only 2% of urban and 6% of rural diabetics often check temperature of water before washing feet. Foot care practice score is shown in figure 1. Where score of 30 and below considered as poor, 31 to 45 as satisfactory, 46 to 60 as good and 61 and above as excellent.

Association of Demographic factor with knowledge and practice of foot care:

To determine impact of demographic factors between Urban and Rural diabetics

Mann-Whitney U Test and Kruskal-Wallis Test were applied wherever is applicable, to compare mean rank of scores. Only Socio economic factor had an influence on both

knowledge and practice on rural diabetics. Among urban, males are better in their practice of foot care. (Table 3)

Table 3: Impact of Demographic factors on knowledge and practice of foot care.

Urban				Demographic Factors	Rural			
p value	Practice	p value	Knowledge		Knowledge	p value	Practice	p value
Age								
0.526	28.15	0.711	23.9	< 50	26.4	0.772	28.57	0.328
	24.84		25.9	> 50	25.11		24.19	
sex								
0.014	30.15	0.804	25.96	Male	27.07	0.402	24.09	0.457
	20.04		24.96	Female	23.65		27.15	
Education								
0.112		0.899		Uneducated	14.88	0.003	21.92	0.230
	24.25		22.5	Primary	28.29		27.43	
	32.73		25.27	Secondary	25.33		18.75	
	22.80		25.95	Tertiary	45.83		36.5	
Socioeconomic Status								
0.896	23.4	0.961	24.2	Lower	22.59	0.011	23.24	0.050
	26.13		25.87	Middle	34.71		32.67	
	24.5		24.95	Upper				

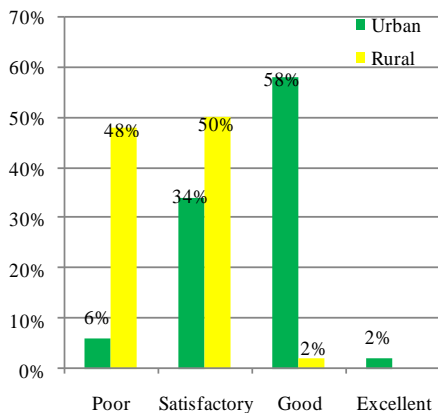


Figure 1. Comparison of Practice of Foot Care Scores

DISCUSSION

This study has highlighted the differences in knowledge and practice of foot care amongst diabetics in rural and urban area. Rural diabetics had a poor knowledge and practice score when compared to urban diabetics who had 12% and 6% respectively. Similar findings were reported by Kide et al in 2014. [19] Lack of knowledge, among rural diabetics, rises from the fact that they are prone to develop a minor injury on foot which needed to

inspect frequently including the footwear, immediate attention for any new lesion, poor circulation lead by smoking and ideal temperature of water to be used to wash their feet. Developing countries like Nigeria, Iran and Saudi Arabia reported poor awareness regarding foot care. [20-22]

Management of Diabetes and its complications in rural settings poses a formidable challenge. 76% of rural population under this study consisted of low socioeconomic population. Due to inadequate access to healthcare, they considered home remedies as a means of treatment (56%). Inaccessibility to health care could be attributed to various factors like lack of specialized diabetes centres in rural areas and expensive treatment at tertiary hospitals. Though the previous studies have shown to increase glucose control by aerobic exercises and thereby prevent complications, 56% of rural unaware of importance of exercise in diabetes.

Current study demonstrates poor foot care practice among rural diabetics due to lack of knowledge which act as a barrier to

achieve good foot care and is in agreement with other previous studies. [19,23] Only 18% of rural population examined their feet whereas Saurabh et al in 2014 found that 52.4% of his subjects examined feet. This highlighted the inconsistencies in patient education. People in rural areas will have to be dealt more intensively when it comes to patient education. Viswanathan et al reported between 40 and 90% of patients with neuropathy are unaware of having it. Protective behaviours might be especially beneficial to these patients who are unaware of their impaired nociception and its potential consequences.

Rural populations were more prone to foot ulcers than urban for various reasons. Common predisposing factor is barefoot walking, inappropriate footwear which can result in injury to feet. [8] Extrinsic factors such as uneven roads, pebbles and stones on fields posing as a risk factor to rural population and may remain unnoticed. In present study, greater number of urban people wore footwear within their homes as compared to rural; they had better approach to footwear selection for different activities. Rural population were lacking an understanding towards importance of both footwear selection and inspection of footwear for damage, paid least attention to warning signs such as corn, cut, burn or blister and existence of bare foot walking (36%). Abnormal plantar pressures due to abnormal footwear and foot deformities also contribute to ulcer formation.

Though knowledge of urban population about foot care was significantly greater, only 2% achieved an excellent score. Foot care practice could be underestimated due to a fast track lifestyle, choice of aesthetic foot wear or simple ignorance while walking barefoot at home and overlooking to dry between toes. These minute details were often unnoticed by patients in daily life and contribute to poor

foot care. Access to social media, informational technology and dialectologists are more popular concepts in urban than rural which also acts as an instrument to keeping them alarmed. Diabetes Speciality Clinics which provide regular follow ups and specialized tests for blood sugar analysis contribute to preventing morbidity. Hanu George et al in 2013 reported urban performed better and multiple specific inputs to this cohort of Diabetes was thought to be possible reason for better performance. [24]

Practice scores of urban population in this study was less as compared to other studies. Ramachandran et al revealed that there is greater prevalence of cardiovascular complications due to diabetes in urban areas as compared rural. [25] Urban areas were therefore more prone to development of peripheral arterial disease. This keeps them equally at risk of developing foot ulcer and in such a scenario poor practice of foot care could lead to fatal outcomes.

Impact of age on knowledge and practices of foot care shows statistically no difference among rural and urban diabetics however younger age group demonstrates higher practice score. Though gender doesn't have a significant influence on practise and knowledge score in rural diabetics, urban male demonstrate significant difference in their practice score. Education does not positively influence urban diabetics but has effect on rural ($p=0.003$) this may account for poor knowledge and practice of foot care among them. Positive relationship on knowledge and education also supported by similar studies in Iran and Pakistan. [20,21] As level of socioeconomic status increases knowledge and practice of foot care were statistically significant among rural diabetics but not on urban, this may be due to self-negligence because they can't afford to utilize medical facility.

Deficiency in Knowledge and practices of foot care is more pronounced on rural diabetics than urban which indicates that there is a wide gap in the delivery system. Moreover there is a greater challenge between the health care providers and the diabetic populations for continuous need of care and regular follow up services. In averting long term complications and disability limitation, prevention of DFU should be first and foremost priority. It can be prevented through patient education and the promotion of foot care behaviours to minimize foot trauma and avoid delayed presentation. This requires a multidisciplinary team approach of professionals from different branches of medicine and allied health care. [26] This approach has reduced the number of amputations in western countries. In India however, this concept remains conceptualized. The intensity of Referrals to multidisciplinary specialist of foot care is very uncommon. Health education program should commence at root level by involving Accredited Social Health Activists (ASHAs) workers, staging a street play for an effective sensitization, forming a support group, telephonic or online support, and mobile clinic to reach each and every one. [12,27]

CONCLUSION

Knowledge and practice of foot care in rural diabetics were less than Urban Diabetics. Education and Socioeconomic status were significantly associated with rural populations. Intensive Foot Care educational program needs to be shaped and adhered via a multidisciplinary approach. Revision of existing educational approach needs to be undertaken and practiced at all levels to overcome these deficiencies. Strength of this study which identified existence of differences between urban and rural diabetics can lead into explore at the

national level to understand the situation better. This study is limited to two districts of Maharashtra and it didn't identify whether these population had received any means of health education program on their foot care practice. Further research include validating the knowledge instrument used in this study and adopting it for routine clinical use prior to health education program also perception of patients on self-care management.

ACKNOWLEDGEMENTS

We acknowledge participation of all the patients in the study. We like to thank all the centres who allowed us to conduct our study. Also my colleagues for their active support and my parents for their encouragement.

REFERENCES

1. Richard.S, Shah.J, Zimmet.P, The Global burden In: the world fact book. <http://www.cia.gov/library/publications/the-world-factbook/> (accessed 2013-07-26).
2. Viswanathan Mohan, Mathur P, Deepa R, Deepa M, Shukla MDK, Geetha R.M, Anand K, Nimesh G.D, Prashant P.J, Mahanta J, Thankappan K.R, Bela Shah. Urban rural differences in prevalence of self-reported diabetes in India-The WHO-ICMR Indian NCD risk factor surveillance. *Diabetes research and clinical Practice*, 2008 April; 80(1):159–68. doi:<http://dx.doi.org/10.1016/j.diabres.2007.11.018>
3. Mohan V, Shanthirani CS, Deepa M, Deepa R, Unnikrishnan RI, Datta M. Mortality rates due to diabetes in a selected urban south Indian population — The Chennai Urban Population Study (CUPS-16). *J Assoc Physicians India* 2006; 54:113-7.
4. Raheja BS, Kapur A, Bhoraskar A, Sathe SR, Jorgensen LN, Moorthi SR, Pendsey S, Sahay BK. *Diabetes Care Asia—India study: diabetes care in*

- India-current status. *J Assoc Physicians India*. 2001; 49:717–22.
5. Viral N. Shah, P. K. Kamdar, and Nishit Shah. Assessing the knowledge attitudes and practice of type 2 diabetes among patients of saurashtra region, Gujarat. *Int J Diabetes Dev Ctries*. 2009 Jul-Aug; 29(3): 118–22. doi: 10.4103/0973-3930.54288
 6. Ambady Ramachandran, Shobhana Ramachandran, Chamukuttan Snehathala, Christina Augustine, Narayanasamy Murugesan, Vijay Viswanathan, Anil Kapur, Rhys Williams. Increasing expenditure on health care incurred by diabetic subjects in a developing country: A study from India. *Diabetes Care* 2007; 30: 252-56.
 7. Potluri R, Purmah Y, Dowlut M, Sewpaul N, Lavu D. Microvascular diabetic complications are more prevalent in India compared to Mauritius and the UK due to poorer diabetic control. *Diabetes Res Clin Pract*. 2009 Nov; 86(2):e39-40.
 8. Viswanathan V, Madhavan S, Rajasekar S, Chamukuttan S, Ambady R. Urban-rural differences in the prevalence of foot complications in South-Indian diabetic patients. *Diabetes Care*, 2006 March; 29 (3):701-3.
 9. Sunil Gupta. Management of diabetic foot. *Med upd* 2012; 22:287-93.
 10. Pendsey SP. Diabetic Foot Syndrome. *RSSDI Text book of Diabetes Mellitus*, 2nd Edition, In: Tripathi BB, Chandalia HB editors, Hyderabad: 2008; 2:959-72.
 11. Willrich A, Pinzur M, McNeil M, Juknelis D, Lavery L. Health related quality of life, cognitive function, and depression in patients with foot ulcers or amputation: A preliminary study. *Foot Ankle Int*. 2005 Feb; 26(2):128-34.
 12. Snehil Dixit and Shashi Kumar. Awareness of Diabetic Foot Complications in Type 2 Diabetes Population in Rural India: Are we doing enough? *J Diabetes Metab* 2014, 5:4. 1000363
 13. Saurabh RS, Prateek SS and Jegadeesh Ramasamy. Role of self-care in management of diabetes Mellitus. *Journal of Diabetes & Metabolic Disorders* 2013; 12:14.
 14. Glasgow RE, Strycker LA. Preventive care practices for diabetes management in two primary care samples. *Am J Prev Med* 2000, 19(1):9–14.
 15. Suman Saurabh, Sonali Sarkar, Kalaiselvi Selvaraj, Sitanshu Sekhar Kar, S. Ganesh Kumar, and Gautam Roy. Effectiveness of foot care education among people with type 2 diabetes in rural Puducherry, India. *Indian Journal of Endocrinology and Metabolism*, 2014 Jan-Feb; 18(1):106-10. doi:10.4103/2230-8210.126587
 16. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004, 27(5):1047–53.
 17. Pradeepa R, Mohan V: The changing scenario of the diabetes epidemic: Implications for India. *Indian J Med Res* 2002; 116:121–32.
 18. NB Lincoln, WJ Jeffcoate, P Ince, M Smith, KA Radford. Validation of a new measure of protective footcare behaviour: the Nottingham Assessment of Functional Footcare (NAFF). *Pract Diab Int* May 2007; 2(4):207-11.
 19. Shivkant Kide, Ashish Rangari, Rajshree Shiral et. al. Knowledge and awareness of diabetes amongst diabetes patients in Wardha region. *Int J Diabetes Dev Ctries* 2014 Jan. doi: 10.1007/s13410-013-0178-3
 20. Khamseh ME, Vatankhah N, Baradaran HR. Knowledge and practice of foot care in Iranian people with type 2 diabetes. *Int Wound J*. 2007;4(4):298-302.
 21. Hasnain S, Sheikh NH. Knowledge and practices regarding foot care in diabetic patients visiting diabetic clinic in Jinnah Hospital, Lahore. *J Pak Med Assoc*. 2009; 59(10):687-90.

22. Abdullah S. Aljoudia and Attia Z. A. Taha. Knowledge of diabetes risk factors and preventive measures among attendees of a primary care center in eastern Saudi Arabia .Ann Saudi Med. 2009 Jan-Feb; 29(1):115–19. doi:10.4103/0256-4947.51813
23. O. O. Desalu, F. K. Salawu, A. K. Jimoh, A. O. Adekoya, O. A. Busari And A. B.Olokoba.Diabetic Foot Care: Self-Reported Knowledge and Practice among Patients Attending Three Tertiary Hospital in Nigeria. Ghana Medical Journal 2011 June; 45(2):60-65.
24. Hanu George, Rakesh PS, Manjunath Krishna, Reginald Alex, Vinod Joseph Abraham, Kuryan George, Jasmin H. Prasad. Foot Care Knowledge and Practices and the Prevalence of Peripheral Neuropathy among People with Diabetes Attending a Secondary Care Rural Hospital in Southern India. Journal of Family Medicine and Primary Care. 2013 January; 2(1):27-32.
25. Ramachandran A, Mary S, Yamuna A, Murugesan N, Snehalatha C. High Prevalence of Diabetes and Cardiovascular Risk Factors Associated With Urbanization in India. Diab Care 2008 May 31(5):893-8.
26. Neal R. Barshes, MD, MeenaSigireddi, James S. Wrobel, DPM, Archana Mahankali, Jeffrey M. Robbins, Panos Koungias and David G. Armstrong.The system of care for the diabetic foot: objectives, outcomes, and opportunities. Diabetic Foot & Ankle 2013; 4: 21847 – doi: <http://dx.doi.org/10.3402/dfa.v4i0.21847>
27. Bharathi R. Bhatt. ASHAs in rural India, the ray of hope for diabetes care. Journal of Social Health and Diabetes.2014 Jan-Jun; 2(1):18-24.

How to cite this article: Pitchai P, Joshi J. Knowledge and practice of foot care amongst diabetics in India: comparison between urban and rural setting- a reality check. Int J Health Sci Res. 2015; 5(4):181-189.
