

A study on prescription analysis and utilization of antibiotics in geriatric in-patients admitted in Shimoga institute of medical sciences tertiary care hospital, Shimoga, Karnataka, India

Nagaraja Prasad S.¹, Shreenivas Revankar^{2*}, Vedavathi H.³, Chidanand KN⁴, Jean L. Murray⁴, Harini Manjunath⁴

¹Assistant professor, ²Associate professor, ³Professor and HOD, ⁴Post graduates, Department of Pharmacology, Shimoga Institute of Medical Sciences Shimoga -577201, Karnataka, India

Received: 14 March 2016

Accepted: 15 April 2016

***Correspondence to:**

Dr. Shreenivas Revankar,
Email: sprevanekar@yahoo.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Geriatrics is concerned with population aged 60 and above. Elderly suffer from various problems of the old age and hence prone to suffer from various adverse effects due to multiple drug use. In this regard rational use of drugs assumes importance. Hence the present study was conducted to study the rationality of prescriptions and utilization of antibiotics in the geriatric age group.

Methods: 126 inpatient prescriptions were chosen and analysed for their rationality according to WHO core drug use indicators. The prescriptions were chosen randomly during the months of July to November 2013 from inpatients at district MCGann teaching hospital. Descriptive statistics were used to analyse data.

Results: 97% of total drugs prescribed were from essential drug list (EDL). Cephalosporins were the most commonly prescribed group of antibiotics. Respiratory diseases were the maximum cause of admission to the hospital followed by cardiovascular diseases. Prescription by brand name was 57.93% while generic drug prescription was 40.65% of total drugs prescribed. 7.81% of total drugs were prescribed as fixed drug combination average of 6.25 drugs were prescribed per person and 1.39% of prescriptions were illegible.

Conclusions: Most of drugs prescribed were from WHO model list of essential drugs which conforms to WHO rational drug use. Also prescription by generic name has to be emphasized to promote rationality of prescriptions. Antibiotic prescriptions should be preceded by microbiological testing wherever indicated and illegible prescriptions should be prevented at all costs. Adherence to guidelines regarding drug use in the elderly can help in rational drug use in elderly.

Keywords: Prescription, Geriatric, Antibiotics, EDL, Rational prescribing.

INTRODUCTION

Ageing can be described as a progressive functional decline or a gradual deterioration of physiological function with age.¹ The national policy on older persons adopted by government of India in 1999 defines senior citizen or elderly as a person who is 60 years or above.²

The word geriatrics is derived from Greek word 'geras' meaning 'old age' and 'iatrika' meaning 'medical treatment'. Ignatz Leo Nascher coined the term geriatrics

in 1909. The royal college of physicians (London) describes geriatric medicine as that branch of general medicine concerned with the clinical, preventive, remedial and social aspects of illness in older people".³

The elderly are prone to various problems like musculoskeletal stiffness, poor nutrition, sexual dysfunction etc. The presentations of diseases are also particular to older population. These presentations of diseases have been described as the "giants of geriatrics".⁴ The modern geriatric giants in elderly people

are: “Instability, incontinence, intellectual impairment, incoherence (delirium), insulin resistance, immobility, inanition (malnutrition), and improvishment”. India has around 100 million elderly populations and is expected to further increase to 323 million, constituting 20% of total population by 2050.⁵

The prescribing process is complex and consists of various steps⁶

- Determining that the drug to be given is actually correct to the particular patient
- Selecting the best drug from among the available drug groups
- Selecting the appropriate dose and frequency of administration of drugs
- Regular and periodic monitoring for the drug’s effectiveness and adverse effects
- Educating the patient about expected side effects relating to drug use.

Elderly tend to suffer from multiple comorbid age related illnesses like hypertension, diabetes mellitus etc. and also have age related changes in pharmacokinetics and pharmacodynamics of drugs like changes in renal and hepatic function, changes in drug absorption, altered protein binding, the apparent volume of distribution may be decreased in elderly because of changes in lean body mass. These changes increases the chances of adverse drug events and drug-drug interactions because of multiple medications prescribed in this age group.⁷ In one study by Munir pir Mohammed et al drug related hospitalizations accounted for 2.4 to 6.5% of all medical admissions in the general population.⁸ In another study by Samoy L J et al the frequency of drug related hospitalizations was 24.1% of which 72.1% were preventable.⁹ Another study by Silverman JB et al showed that overall rate of adverse drug reactions is estimated to be 6.5 per 100 admissions, 28% of which are preventable.¹⁰

Polypharmacy is defined as the prescription, administration or use of more medication than are clinically indicated or when a medical regimen includes at least one unnecessary medication and it occurs in 20-40% of older people.^{11,12} Now a day’s poly-pharmacy is used to denote that a particular patient receives too many drugs, drugs for too long a time or drugs in exceedingly high dose. Thus poly-pharmacy increases the chances of “prescribing cascades”.¹³ Prescribing cascades occur when a new drug is prescribed to treat symptoms arising from unrecognized adverse drug event relating to the concurrent treatment.

Rational drug prescribing is defined as the use of least number of drugs to obtain the best possible effect in shortest period and at a reasonable cost.¹⁴ The five important criteria for rational drug use are accurate diagnosis, proper prescribing, correct dispensing, suitable packing and patient adherence.¹⁵ The rational use of

drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time and at the lowest cost to them and their community.¹⁶ Inappropriate prescribing is that when alternate therapy that is either more effective or associated with a lower risk exists to treat the same condition. The study of prescribing patterns seeks to monitor, evaluate and if necessary suggest modification in prescribing patterns so as to make medical care rational and cost effective.¹⁷

The rational use of drugs depends upon three perspectives namely patient, physician and healthcare perspectives. The drug use indicators recommended by WHO cover all three perspectives.¹⁸ Hence the present study was undertaken to study the rationality of prescriptions and utilization pattern of antibiotics at SIMS tertiary care hospital and teaching centre.

METHODS

The study was cross-sectional retrospective carried on geriatric inpatients admitted in McGann teaching hospital attached to Shimoga institute of medical sciences (SIMS). The study carried out in 126 patients admitted during the period of July 2013 to November 2013 by detailed analysis of case records of geriatric inpatients. WHO core drug use indicators along with other parameters were included in our study.¹⁸

Demographic characteristics studied were age, sex etc. The age groups were divided into three categories categorized based on legibility and further the legible prescriptions were subcategorized based on generic and brand names. Disorders responsible for admission were based on the system involved like git, blood, bones, reproductive system etc. The antibiotics used were categorized based on groups. The duration of stay by the patient was also recorded. The percentage of prescriptions where an injection was prescribed was also recorded.

- Age and sex statistics
- Average number of drugs per prescription
- Duration of stay and disease cause of admissions
- Percentage of drug with an antibiotic prescribed
- Percentage of drugs prescribed by their generic name
- Percentage of prescriptions with injection prescribed
- Percentage of drugs prescribed from essential drug list or formulary.

The age groups were divided into three categories; 60-65years, 66-70 years and above 70 years age group. The sexes of patients were grouped into male and female patients. The prescriptions were categorized as legible or illegible based on readability of prescriptions. The legible prescriptions were further subcategorized based on generic or brand names. Disorders responsible for admission were based on system involved like GIT,

blood, skeletal, reproductive systems etc. the antibiotics used were categorized based on various groups of antibiotics given. The duration of stay by the patient was also analysed.

RESULTS

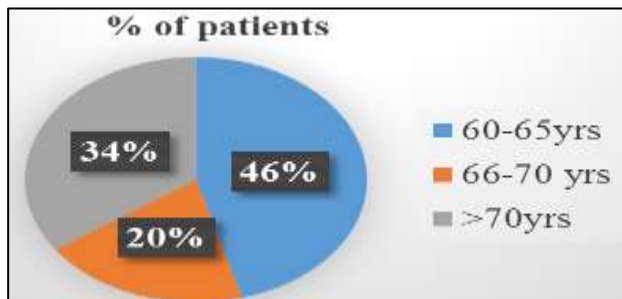


Figure 1: Age group of patients.

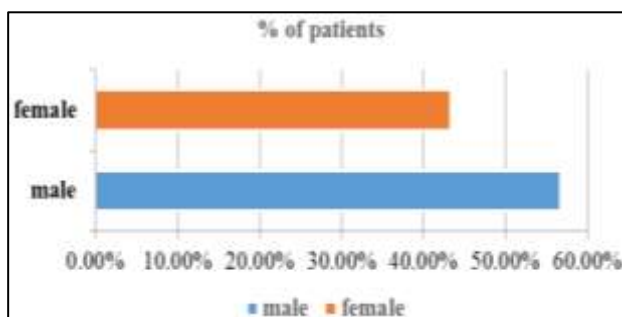


Figure 2: Sex of inpatients.

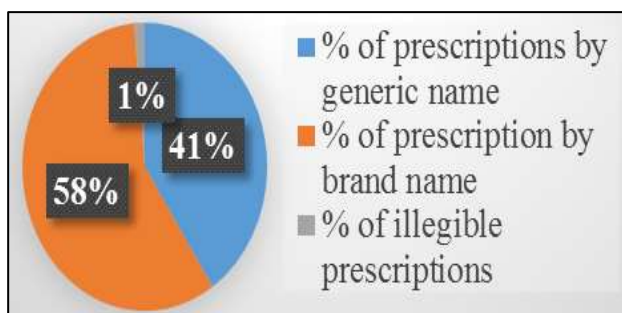


Figure 3: Percentage of prescriptions prescribed by generic, brand names and percentage of illegible prescriptions.

- Patients above 70 years accounted for 34.14% of total inpatients admitted (Figure 1).
- Males accounted for 56.69% of inpatients while females comprised 43.31% of inpatients (Figure 2).
- Prescribing by brand name was 57.93% while generic drug prescribing comprised 40.68% of total prescriptions (Figure 3).
- 7.81% of total drugs prescribed were in form of fixed dose combinations.
- 56.93% of total drugs prescribed were in form of injections.

- Averages of 6.25 drugs were prescribed per person.
- 97% of total drugs prescribed were from essential drug list.
- 1.39% of prescriptions were illegible.
- Respiratory disease were the maximum cause of hospital admissions (19.33%) followed by cardiovascular diseases (15.79%) (Figure 4).
- Cephalosporin's were most commonly prescribed antibiotics (39.83%) followed by penicillin group of drugs (Figure 5).
- The total duration of stay in the hospital was maximum in the 3-5 days treatment group (Figure 6).

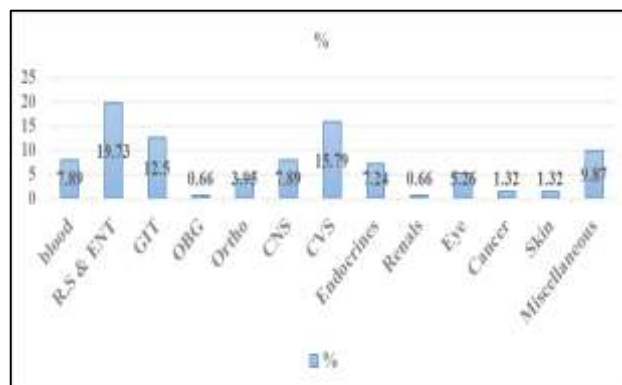


Figure 4: Percentage of diseases causing admission in the hospital.

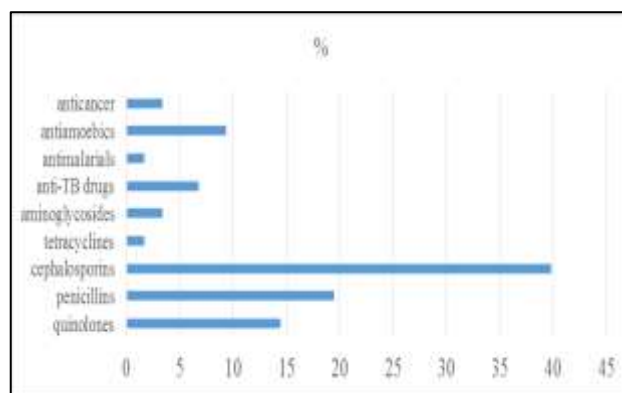


Figure 5: Percentage of antibiotics prescribed.

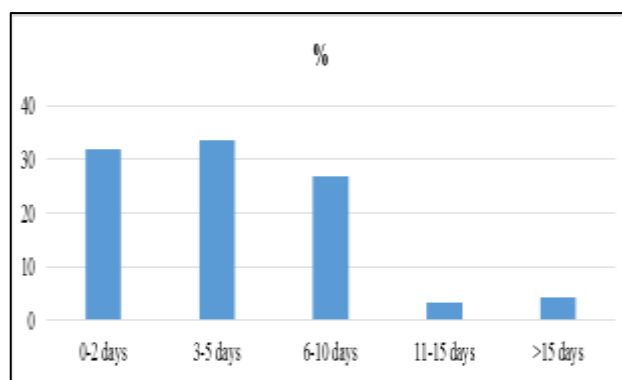


Figure 6: Duration of stay in the hospital.

Out of total 126 patients males were 56.69% of patients and females were 43.31% of inpatients. Based on age of patients 45% of patients were 60-65 years of age, 20% of patients 66-70 years of age and 35% patients belonged to >70 years of age. Patients suffering from respiratory related diseases constituted 19.73% of inpatients followed by cardiovascular related 15.79%, GIT 12.5%, renal 0.66% and reproductive 0.66% was the other minor causes of admission to hospital. Regarding duration of stay in the hospital 8% of patients stayed for less than one day, 24% for 1-2 days, 34% for 3-5 days, 26% for 6-10 days, 3% for 11-15 days while 4% of patients stayed for >15 days. 7.81% of total drugs were prescribed as fixed dose combinations. Prescribing by brand name was 57.93% while generic drug prescribing was 40.68% of total prescriptions. Averages of 6.25 drugs were prescribed per person. 97% of total drugs prescribed from essential drug list. Cephalosporin's were the most commonly used antibiotic (39.83%) followed by penicillin group (19.49%), quinolones (14.41%), while tetracycline's and anti-malarial were least used antibiotics 1.39% of prescriptions were illegible.

DISCUSSION

Patients at greatest risk of poly-pharmacy include^{19,20}

- Age 75 years and older and those suffering from multiple comorbid conditions.
- Recently hospitalized patients.
- Patients taking multiple medications (high risk-8 or more drugs, 5-7 drugs-moderate risk), OTC drugs.
- Patients with multiple physician prescriptions.
- Purchasing prescription medication from multiple pharmacies.

The elderly fulfil most of these criteria and hence a careful and periodic drugs review of prescription practices in the elderly is necessary.

In our present study persons aged more than 70 years accounted for 34.14% of total inpatients admitted among elderly, while 56.69% of these elderly patients were males, females constituted 43.31% of inpatients. Averages of 6.25 drugs were prescribed per person which is very high when compared to W.H.O prescribed average of two drugs per person.¹⁸ This gives an impression of poly-pharmacy which is not actually true as the above recommendation of WHO is would not be completely applicable to inpatients of the hospital.

Nearly 7.81% of total drugs prescribed were prescribed as fixed drug a combination which is not in the higher value range. Nearly 56.93% of total drugs were prescribed as an injection which is naturally expected because of inpatient nature of our study. Nearly 97% of total drugs prescribed were from EDL, this is much more than the study done by Ghosh et al where it was found that only 41.76% of drugs were prescribed form EDL.²¹ This could probably be because the patients being analysed were admitted to a

tertiary care government teaching hospital. Regarding prescribing by brand name in our study it was found that nearly 57.93% of drugs were prescribed by brand name while generic drug prescribing was only 40.65% of total prescriptions. This result is nearly similar to their study by Joshi et al where nearly 53.6% of drugs were prescribed by their generic name.²²

Regarding percentage of antibiotics prescribed Cephalosporin's were the most commonly prescribed antibiotics (39.83%) followed by penicillin group of antibiotics which is to be anticipated because of the inpatient nature of our study. However adequate microbiological cultures for antibiotic susceptibility was not performed in all the inpatients before commencing the antibiotics among inpatients, this factor could be improved by taking proper antibiotic susceptibility testing before starting antibiotics among inpatients.

Regarding number of prescriptions that were illegible or were having inadequate prescription information in our study was found to be 1.39%. This has to be absolutely avoided by taking proper precautions during prescription writing. With regard to the cause of admissions respiratory diseases were most common cause of admissions (19.33%) followed by cardiovascular diseases (15.79%).

In order to improve prescribing practices in the elderly various criteria have been put forth to improve prescribing practices these include;

- Beers criteria.²³
- STOPP (screening tool of older person's prescriptions) and START (Screening tool to alert doctors to right treatment) criteria.²⁴
- Drug burden index (DBI).²⁵
- Improved prescribing in elderly tool (IPET).²⁶
- ACOVE (assessing care of vulnerable elders) indicators.²⁷
- FORTA (fit for the aged) list.²⁸

Use of the above methodologies and strategies most of the errors in prescribing in the elderly can be minimized as well as prevented to a great extent.

Also based on the above tools the following common guidelines can be made regarding prescribing in the elderly.

- Medication should be used only where necessary and which are familiar to the doctor.
- Make a proper diagnosis before prescribing and a careful drug history is essential.
- Changes in pharmacokinetics and pharmacodynamics of drugs in elderly should be considered before prescribing in elderly.
- Avoid prescribing cascade effect in elderly; remember that drugs themselves can cause illness.
- Periodic brown bag checkups should be done.

- Anticipate drug-drug interactions and measures should be taken to try to minimize them.
- Periodic and regular review of prescriptions should be done and unnecessary drugs should be removed wherever possible. Review medications at least twice in a year.
- Maintain a medication diary to accurately identify drugs being prescribed and involve caretakers wherever feasible.
- Elderly may be more sensitive to the effects of some drugs and reduced doses may be required in these age groups.
- Advise non-pharmacological therapies like yoga, regular physical exercise, reduction in salt intake where ever feasible in the elderly.

CONCLUSION

In conclusion the present study reveals that a more rational approach is necessary to improve prescription patterns. Poly-pharmacy is widely prevalent which can cause adverse drug events these can be avoided by adhering to various criteria and tools for prescribing in the elderly. Males constituted majority of inpatients admitted but the difference among males and females patients was not very large. Nearly 56.93% of total drug were prescribed as injections which is considerably more than average because of inpatient nature of our study. Cephalosporins were most commonly prescribed antibiotics however antibiotic susceptibility test have to be performed before starting a new antibiotic. 97% of total drugs prescribed were from Essential drug list which is a good indicator of rational drug prescribing in our present study. The percentage of illegible prescriptions has to be brought down to improve rationality of prescriptions. Respiratory diseases were the major cause of admissions closely followed by cardiovascular diseases. In brief majority of deficiencies in the prescription practices can be avoided by following a proper approach to rational drug prescribing practices and by strictly adhering to the various standards laid down to improve prescribing practices in the elderly.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the director and the medical superintendent, Shivamogga Institute of Medical Sciences for their kind permission for allowing collecting the data for the study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Patridge L, Mangel M. Messages from mortality: the evolution of death rates in the old. *Trends Ecol Evol.* 1999;14(1):438-42.

2. Geriatric knowledge today elderly population. Available at <http://www.gktoday.in/indias-elderly-population-some-fundamentals/>.
3. British Geriatric Society-definition-geriatrics. Available at <http://www.bgs.org.uk/index.php/policy-digest/228-about/administration/981geriatricsdefined>.
4. Madgaonkar CS. Family medicine. A clinical and applied orientation 2nd Ed Jaypee medical publishers (p) ltd; 2015:247.
5. Public relations bureau-reports-elderly population 2012. Available at <http://www.prb.org/publications/reports/2012/india-older-population.aspx>.
6. Cho S, Lau SW, Tandon V, Kumi K, Pfuma E, Abernathy D. Geriatric drug evaluation. Where are we now and where should we be in future? *Arch Intern Med.* 2011;171(10):937-40.
7. Gupta M, Agarwal M. Understanding medication errors in the elderly. *The New Zealand Medical journal.* 2013;126:62-70.
8. Pir Mohammad M, James S, Meakin S, Green C, Scott AK, Walley TJ. Adverse drug reactions as a cause of admission to hospital: prospective analysis of 18,200 patients. *BMJ.* 2004;329:15.
9. Samoy LJ, Zed PJ, Wilbur K, Balen RM, Abu-Laban RB, Roberts M. Drug related hospitalizations in a tertiary care internal medicine service of a Canadian hospital; a prospective study. *Pharmacotherapy.* 2006;26(11):1578-86.
10. Silverman JB, Stapinski CD, Churchill WW, Nepl C, Bates DW, Gandhi TK. Multifaceted approach to reducing preventable adverse drug events. *Am J Health Sys Pharm.* 2003;60(6):582-6.
11. Austin RP. Poly-pharmacy a risk factor in the treatment of type 2 diabetes. *Diabetes Spectrum.* 2006;19(1):13-6.
12. Payne RA, Avery AJ. Poly-pharmacy; one of the greatest prescribing challenges in general practice. *Br J Gen Pract.* 2011;61(583):83-4.
13. Rochon PA, Gurwitz JH. Optimizing drug treatment for elderly people: the prescribing cascade. *BMJ.* 1997;315:1096-9.
14. Gross F. Drug utilization therapy and practice: the present situation in federal republic of Germany. *Eur J Clin Pharmacol.* 1981;19:387-94.
15. Alam K, Mishra P, Prabhu M, Shankar PR, Palaian S, Bhandari RB, et al. Study on rational drug prescribing and dispensing in outpatients in a tertiary care teaching hospital of western Nepal. *Kathmandu Univ Med J.* 2006;4:436-43.
16. World health organization. The rational use of drugs. Report of conference of experts. Nairobi, 25-29 November 1985. Geneva, World Health Organization; 1987.
17. Shankar PR, Kumar P, Rana MS, Partha P, Upadhyay DK, Dubey AK. Morbidity profile and drug utilization in a sub-health post in western Nepal. *Calicut Medical Journal* 2004;2(4):4.
18. International network for rational use of drugs (INRUD) and WHO. How to investigate drug use in

- health facilities. Selected drug use indicators. Geneva: World health organization. 1993;1:1-87.
19. Zorowitz BJ, Stebelsky LA, Muma BK, Romain TM, Peterson EL. Reduction of high risk polypharmacy drug combinations in patients in a managed care setting. *Pharmacotherapy*. 2005;25(11):1636-45.
 20. Mackinnon NJ, Hepler CD. Preventable drug related morbidity in older adults. Part 1. Indicator development. *J Manag Care Phar*. 2002;8(5):365-71.
 21. Ghosh R, Neogi JN, Srivatsava BS, Sen P. Prescribing trends in a teaching hospital in Nepal. *Journal of Nepal medical association*. 2003;42:346-9.
 22. Joshi MP, Sugimoto T, Santoso B. Geriatric prescribing in the medical wards of a tertiary hospital in Nepal. *Pharmacoepidemiology and drug safety* 1997;6:417-21.
 23. American geriatric society updated beers criteria for potentially inappropriate medication use in older adults. *Journal of the American geriatrics society*. 2012;60(4):616-31.
 24. Gallagher P, Ryan C, Byrne S, Kennedy J, O'Mahony D. Screening tool for older persons prescriptions and Screening tool to alert doctors to right treatment. Consensus validation. *Int J Clin Pharmacol Ther*. 2008;42(2):72-83.
 25. Hilmer SN, Mager DE, Simonsick EM, Ling SM, Windham BG, Harris TB, et al. Drug burden index score and functional decline in older people. *Am J Med*. 2009;122(12):1142-9.
 26. Naugler CT, Bryme C, Stolee P, Arcese ZA. Development and validation of an improving prescribing in the elderly tool. *Can J Clin Pharmacol*. 2000;7(2):103-7.
 27. Shekelle PG, Mac Lean CH, Morton SC, Wenger NS. ACOVE quality indicators. *Ann intern Med*. 2001;235:653.
 28. Wehling M. Multimorbidity and polypharmacy: how to reduce the harmful drug load and yet add needed drugs in the elderly? Proposal of a new drug fit for the aged. *J Am Geriatric Soc*. 2009;57:560.

Cite this article as: Prasad SN, Revankar S, Vedavathi H, Chidanand KN, Murray JL, Manjunath H. A study on prescription analysis and utilization of antibiotics in geriatric in-patients admitted in Shimoga institute of medical sciences tertiary care hospital, Shimoga, Karnataka, India. *Int J Basic Clin Pharmacol* 2016;5:904-9.