ORIGINAL ARTICLE

PRESCRIPTION PATTERN OF DRUGS IN HEMODIALYSIS PATIENTS AT A TERTIARY CARE HOSPITAL
Anjan Palikhey, Sonal Paudel, Krishna Kumar Agrawaal, Laxmi Shrestha, Jharana Shrestha

PRESCRIPTION PATTERN OF DRUGS IN HEMODIALYSIS PATIENTS AT A TERTIARY CARE HOSPITAL

Anjan Palikhey,[1] Sonal Paudel,[2] Krishna Kumar Agrawaal,[3] Laxmi Shrestha,[1] Jharana Shrestha[4]

ABSTRACT

INTRODUCTION

Chronic kidney disease is a worldwide issue with increasing incidence and prevalence. Patients with chronic kidney disease undergoing hemodialysis have associated co-morbidities that necessitate treatment. Consequently, the rational prescription of medications for these patients is a challenging endeavour. Investigations into the prescription patterns of medications can elucidate the drug utilization trends among hemodialysis patients and facilitate the rational use of drugs. This study aimed to evaluate the prescription pattern of drugs in hemodialysis patients at a tertiary care hospital.

MATERIAL AND METHODS

A hospital-based cross-sectional study was conducted at the hemodialysis unit of Universal College of Medical Sciences to assess the drug prescription patterns in patients undergoing hemodialysis. The purposive sampling technique was employed. The study involved a total of 100 patients. The data was gathered and analysed utilising SPSS version 20, with the results presented as number and percentages.

RESULTS

Among 100 patients, 62% were male and 38% were female. Anti-hypertensive drugs (97%) were the most prescribed drugs, followed by phosphate binders (75%), hematopoietic agents (63%), alkalinizing agents (48%). Calcium based phosphate binders were most commonly prescribed (70%) compared to non-calcium based (23%). The mean number of drugs prescribed was found to be 6.84 and the percentage of drugs prescribed from Nepal's national essential drug list was 34.35%.

CONCLUSION

This study concludes that polypharmacy is prevalent among hemodialysis patients due to associated co-morbidities with chronic kidney disease. The analysis of prescribing trends is crucial for evaluating drug utilization patterns and should be conducted with greater regularity. Likewise, prescriptions should be encouraged in accordance with the national essential medicines list.

KEYWORDS

Chronic kidney disease, Hemodialysis, Prescription pattern

1. Department of Pharmacology, Universal College of Medical Sciences, Bhairahawa, Nepal
2. Department of Pharmacy, Arghakhanchi Hospital, Sandhikharka-1, Arghakhanchi, Nepal
3. Nephrology Unit, Department of Internal Medicine, Universal College of Medical Sciences, Bhairahawa, Nepal
4. Department of Biochemistry, Universal College of Medical Sciences, Bhairahawa, Nepal

For Correspondence
Dr. Anjan Palikhey
Department of Pharmacology
Universal College of Medical Sciences,
Bhairahawa, Nepal
Email: anjanpalikhey@gmail.com

INTRODUCTION

Chronic kidney disease (CKD), characterized by a gradual reduction in glomerular filtration rate (GFR), represents a significant global public health concern and is linked to elevated morbidity and mortality rates.[1] The estimated prevalence of CKD patients under maintenance hemodialysis in Nepal is 4.57%,[2] posing a significant public health threat to developing countries such as Nepal due to its rising incidence, unfavourable outcomes, and substantial treatment costs.[3]

Renal transplantation and hemodialysis remain the main stay of treatments in the later stages of CKD.[4] CKD patients under hemodialysis have various complications that require frequent use of multiple medications like anti-hypertensives, anti-platelets, hypoglycemics, hypolipidemic, potassium binders, phosphate binders, erythropoietin stimulating agents, diuretics, antimicrobials, alkalinizing agents, etc.[5,6] Non-adherence to the pharmacological regimen and drug-drug interactions also pose potential issues in hemodialysis patients.[6] Proper medication selection for CKD patients is crucial to prevent adverse drug reactions and to guarantee optimal patient outcomes. Improper medication usage can exacerbate adverse drug reactions, resulting in prolonged hospitalisations, increased healthcare utilization, and elevated costs. Prescribing medication rationally in patients with CKD is a challenging endeavour.[7] Due to intricate therapeutic protocols; these patients necessitate regular monitoring and dosage modification.[8] Drug utilization studies are routinely conducted globally; however, in Nepal, there is a lack of a comprehensive overview of the medication profile in CKD patients undergoing hemodialysis. The primary objective of this study is to ascertain the prescription pattern of drugs in hemodialysis patients at a tertiary care hospital.

MATERIAL AND METHODS

This descriptive cross-sectional study was conducted at the hemodialysis unit of Universal College of Medical Science-TH, Ranigaun, Bhairahawa, Nepal, from October 2023 to March 2024, following approval from the Institutional Review Committee of UCMS-TH, reference number (UCMS/IRC/035/23). All CKD patients, regardless of sex and aged 18 years or older, undergoing maintenance hemodialysis were included following verbal and written consent. Patients undergoing hemodialysis for acute renal failure, as well as pregnant and lactating women, were excluded. The purposive sampling technique was employed, selecting all respondents who met the inclusion criteria.

The sample size was determined using the single proportion formula for a cross-sectional study, utilising a prevalence of CKD patients on maintenance hemodialysis at 4.57%[2] with a confidence level of 95% and a precision degree of 5%.

Sample size (N) = $[Z^2 * P (1-P)] \div d^2 = [1.96^2 * 0.0457 (1-0.0457)] \div 0.05^2 = 67$
Where, P = 4.57% = 0.0457, Z = 1.96, d = 5% = 0.05. A total of 100 patients were finally enrolled in the study.

Data was collected from the semi-structured questionnaire. The questionnaire had socio-demographic details of the patients and questions to study the commonly prescribed drugs to CKD patients and co-morbidities associated with CKD. Information on commonly prescribed drugs to CKD patients on hemodialysis were collected from patients themselves by direct interview. Data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 20. Descriptive statistics were computed in terms of frequency and percentage.

RESULTS

Of the total 100 participants, 62 (62%) were male and 38 (38%) were female. The mean age of the participants was 51.66±15.10 years. 85% of the patients were literate, while 15% were illiterate, as shown in table 1.

Table 1. Socio-demographic characteristics of the participants (N=100)

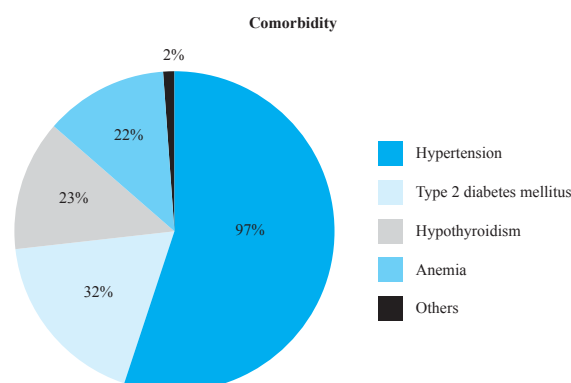| Characteristics	Categories	N (%)
Age (years)	20-40	27 (27%)
	41-60	46 (46%)
	61-80	24 (24%)
	>80	3 (3%)
Gender	Male	62 (62%)
	Female	38 (38%)
Education	Literate	85 (85%)
	Illiterate	15 (15%)
Duration of hemodialysis	3 months- 24 months	69 (69%)
	25 months- 48 months	16 (16%)
	49 months- 72 months	11 (11%)
	73 months- 96 months	4 (4%)

Figure 1. Co-morbidities of the participants associated with CKD (N=100)

Table 2. WHO drug prescribing indicator

Indicators	Value
Total number of drugs prescribed	684
Average number of drugs per prescription	6.84
Percentage of prescription with an antibiotic prescribed	9%
Percentage of prescription with an injection prescribed	13.45%
Percentage of drugs prescribed from national essential medicine list	34.35%

A total of 684 drugs were prescribed among 100 prescriptions. The mean number of drugs prescribed was found to be 6.84 and the percentage of drugs prescribed from national essential drug list of Nepal was 34.35%, as shown in table 2.

ORIGINAL ARTICLE

PRESCRIPTION PATTERN OF DRUGS IN HEMODIALYSIS PATIENTS AT A TERTIARY CARE HOSPITAL
Anjan Palikhey, Sonal Paudel, Krishna Kumar Agrawaal, Laxmi Shrestha, Jharana Shrestha

Table 3. Therapeutic groups of drugs prescribed to the participants (N=100)

Drug Classes	N (%)
Anti-hypertensive drugs	97 (97%)
Anti-diabetic drugs	32 (32%)
Thyroxine Hormone analogues	23 (23%)
Anti-platelet drugs	20 (20%)
Phosphate binders	75 (75%)
Alkalinizing agents	48 (48%)
Vitamin D analogues	19 (19%)
Hematopoietic agents	63 (63%)
Hypolipidemic drugs	21 (21%)
GIT drugs	24 (24%)
Anti-hyperuricemia drugs	34 (34%)
Antibiotics	9 (9%)
Anti-allergic drugs	4 (4%)
Miscellaneous	7 (7%)

In this study, it was found that anti-hypertensive drugs were prescribed most (97%), followed by phosphate binders (75%), hematopoietic agents (63%). Least prescribed drugs were anti-allergic drugs (4%), as depicted in Table 3.

Table 4. Anti-hypertensive drugs used in CKD patients (N=100)

Anti-hypertension agents	N (%)
Diuretics	84 (84%)
Calcium Channel Blockers	64 (64%)
Alpha blockers	40 (40%)
Beta blockers	5 (5%)
Alpha-Beta blockers	21 (21%)
Central sympatholytic	6 (6%)

Among various anti-hypertensive drugs prescribed in CKD patients, diuretics were prescribed most frequently (84%), followed by calcium channel blockers (CCB) (64%), alpha blockers (40%) as shown in Table 4.
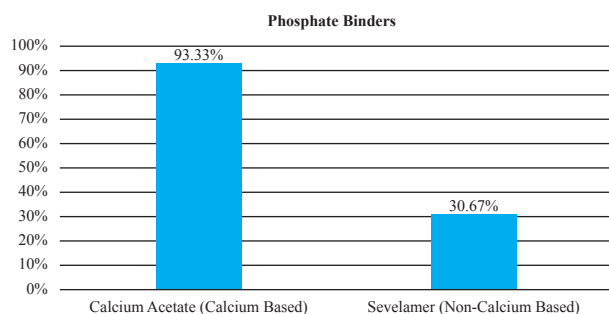
Figure 2. Phosphate binders used in CKD patients (N=75)

In this study, most commonly prescribed phosphate binder was Calcium acetate 70 (93.33%) followed by Sevelamer 23 (30.67%), as shown in figure 2.

Table 5. Overall drug utilization pattern in CKD patients

Drug Classes	Drugs	N (%)
Diuretics	Torsemide	83 (83%)
	Metolazone	15 (15%)
Calcium Channel Blockers	Amlodipine	57 (57%)
	Nifedipine	8 (8%)
	Diltiazem	2 (2%)
Alpha blockers	Prazosin	47 (47%)
Beta blockers	Metoprolol	6 (6%)
Hematopoietic drug	Erythropoietin	60 (60%)
	Iron Sucrose	32 (32%)
	Folic Acid	4 (4%)
GIT agents	Ranitidine	24 (24%)
Anti-platelets drugs	Aspirin	21 (21%)
	Clopidogrel	2 (2%)
Anti-diabetic agents	Linagliptin	19 (19%)
	Gliclazide	7 (7%)
Thyroxine hormone analogue	Thyroxine	23 (23%)
Vitamin D analogues	Calcitriol	19 (19%)
Anti-hyperuricemia drug	Febuxostat	34 (34%)
Hypolipidemic drug	Atorvastatin	21 (21%)
Alkalinizing agent	Sodium bicarbonate	48 (48%)

In the study, diuretic like torsemide was the most prescribed drug (83%) followed by hematopoietic agents like erythropoietin (60%), as shown in table 5.

DISCUSSION

The present study was conducted among 100 patients for the evaluation of prescription pattern of drugs on patients undergoing maintenance hemodialysis. The predominant age group of patients in our study was 41-60 years (46%), followed by 20-40 years (27%). This observation is quite similar to the study done by Ghimire M et al,[9] where majority of patients were also the age group of 41-60 years (41.6%). This result shows that the risk of developing CKD increases with the increase in age. Conversely, in the study conducted by Anil A et al,[5] the predominant age group of patients was 61-80 years, comprising 55.6% of the sample. The majority of patients were of middle age group in our study may be due to the lower number of participants.

The gender distribution of our study indicated that the proportion of male patients (62%) exceeded that of female patients (38%). The result aligns with the research conducted The main limitations of the present study was that this study was only confined to the Universal College of Medical Sciences in Bhairahawa due to time constraints, resulting in a limited sample size. The interactions between drugs and their adverse effects were not assessed. The patient's quality of life and adherence were not evaluated. Additional research must be undertaken, emphasizing drug interactions, adverse effects, patient quality of life, and adherence.by Ali et al,[10] which indicated a higher proportion of male patients (65%) compared to female patients (35%). This indicates that males are more susceptible to chronic kidney disease (CKD) than females due to their unhealthier lifestyles, including alcohol consumption and smoking. Men typically exhibit elevated calcium and protein consumption, which correlates with the onset of kidney disease.[11] Additionally, elevated testosterone levels in males may lead to a decline in kidney function. In females, estrogen provides renal protection, which is diminished in males.

ORIGINAL ARTICLE

PRESCRIPTION PATTERN OF DRUGS IN HEMODIALYSIS PATIENTS AT A TERTIARY CARE HOSPITAL
Anjan Palikhey, Sonal Paudel, Krishna Kumar Agrawaal, Laxmi Shrestha, Jharana Shrestha

The literacy status of patients in our study was 85% and illiteracy status was 15%. However, in the study done by Nepal R et al,[12] literacy status is low compared to our study which is 61.6% and illiteracy status is 38.4%. The majority of the patients (65%) had been undergoing hemodialysis from 3-24 months in our study. In the study done by Nepal R et al,[12] majority of patients (71%) had been undergoing hemodialysis from 1 to 3 years.

In our study, the average number of drugs per prescription was 6.84 across 100 prescriptions showing polypharmacy. High number of drugs were prescribed to treat the multiple co-morbidities associated with CKD. In the studies done by Narayana Murthy et al[4] and Al-Ramahi R et al,[7] the number of drugs per prescription were 8.61 and 9.3 respectively which are high compared to our study. The disparity in the average number of medications may be attributed to the size of the participants, co-morbidities and doctor prescribing practices.

In our study, the most prevalent co-morbidity among patients undergoing hemodialysis was hypertension (97%), followed by type 2 diabetes mellitus (32%), thyroid disorder (23%), and anaemia (22%). A study done by Pothen C et al,[13] stated the most common co-morbidities found were hypertension (93.75%) followed by anemia (87.5%), type 2 diabetes mellitus (41.45%), thyroid disorders (7.5%). However, In the study conducted by Chakraborty S et al[8], it was noted that the predominant co-morbidities were anaemia (89%) and hypertension (85%). The most likely reason for the hypertension to be major co-morbidity may be because renin-angiotensin system which helps in controlling blood pressure is affected in patient of CKD.[14] Increased activity of renin-angiotensin system increases the levels of Angiotensin II which promotes the sodium reabsorption that causes hypertension. Decreased GFR results in decreased urinary output which leads to increased extracellular volume which in turns leads to increased peripheral tissue perfusion, which stimulates vasoconstriction and hence increase hypertension.[15]

In the present study, anti-hypertensive drugs were the most frequently prescribed drugs (97%), followed by phosphate binders (75%), hematopoietic (63%), alkalinizing agents (48%), anti-hyperuricemia drugs (34%), anti-diabetics (32%), thyroxine hormone analogous (23%), drugs acting on GIT (24%). In a study done by Narayana M et al,[4] majority of drugs prescribed were anti-hypertensive drugs (42.18%) followed by hematopoietic (15.17%), phosphate binders (11%), drugs for GIT (10%), anti-diabetics (8.92%). This shows that patients undergoing hemodialysis are frequently prescribed with anti-hypertensive drugs, hematopoietic, anti-diabetic drugs, phosphate binders and drugs acting on GIT. These commonly prescribed drugs are based on treating of co-morbidities and complications associated with treating patients.

Hypertension, the predominant co-morbid condition among study participants, was most frequently managed with diuretics (84%), calcium channel blockers (64%), alpha-blockers (40%), beta-blockers (5%), alpha + beta blockers (21%), and central sympatholytics (6%). Narayana M et al[4] conducted a study revealing that diuretics were the most frequently prescribed medications at 41%, followed by calcium channel blockers at 38%. However, in the study done by Anil A et al,[5] calcium channel blockers were

commonly prescribed (32%) followed by beta-blockers (27%), central sympatholytic (25%), alpha-blockers (15%). Diuretics were most prescribed because it helps to treat fluid retention (edema) that is caused due to kidney disease and it also helps to lower the blood pressure.[14]

In the present study, diuretics were the most commonly prescribed anti-hypertensive drugs. Among diuretics, loop-diuretic like torsemide was frequently prescribed (83%) followed by thiazide like diuretics like metolazone (15%). In the study done by Anil et al,[5] torsemide was also the commonly prescribed diuretic (56.3%). Similarly, calcium channel blockers like amlodipine (57%) and nifedipine (8%) were also frequently prescribed. Alpha-blocker like prazosin was also the commonly prescribed anti-hypertensive drug (47%).

Hyperphosphatemia is a prevalent complication of chronic kidney disease (CKD). In our study, phosphate binders ranked as the second most frequently prescribed medication. Among which calcium-based phosphate binder (calcium acetate) was most frequently prescribed (93.33%) compared to non-calcium-based phosphate binder (sevelamer) which is (30.67%). In the study done by Ahlawat R et al,[14] 14.5% phosphate binders were prescribed with calcium acetate being prescribed 91% and Sevelamer being prescribed 4%. But in the study done by Ali et al,[10] 93.47% of sevelamer was prescribed while 6.52% of calcium acetate was prescribed. calcium acetate was predominantly prescribed in comparison to sevelamer owing to its cost-effectiveness and affordability.[16] Phosphate binders are most frequently prescribed to reduce the serum phosphate level of patient with CKD and lower the risk of bone disorders and progression of CKD that may develop from hyperphosphatemia.[17]

Hematopoietic drugs were prescribed to majority of patients to treat anemia. Erythropoietin (60%), followed by iron sucrose (32%) and folic acid (4%) were given as hematinic. In the study done by Pothen C et al,[13] 86.25% erythropoietin was prescribed which is high compared to our study. Kidney is unable to produce enough erythropoietin in CKD patients so erythropoietin along with other iron supplements were given to stimulate bone marrow for erythrocyte production.[18]

Thirty-four percentage of patients were prescribed with anti-hyperuricemia drugs like febuxostat to lower the level of uric acid. Febuxostat was preferably prescribed because of its reno-protective effect in CKD patients.[19] Acid-base imbalance is one of the common metabolic complications of CKD. Forty-eight percentage of patients were prescribed with sodium bicarbonate which is an alkalinizing agent to rectify acid-base imbalances in individuals with CKD. It also slows the progression of CKD and improves vascular function in individuals with CKD.[20]

The main limitation of the present study was that this study was only confined to the Universal College of Medical Sciences in Bhairahawa due to time constraints, resulting in a limited sample size. The interactions between drugs and their adverse effects were also not assessed. The patient's quality of life and adherence too were not evaluated. Therefore, additional research must be undertaken, emphasizing drug interactions, adverse effects, patient quality of life, and adherence.

ORIGINAL ARTICLE

PRESCRIPTION PATTERN OF DRUGS IN HEMODIALYSIS PATIENTS AT A TERTIARY CARE HOSPITAL
Anjan Palikhey, Sonal Paudel, Krishna Kumar Agrawaal, Laxmi Shrestha, Jharana Shrestha

CONCLUSION

This study concludes that polypharmacy is prevalent among hemodialysis patients due to associated co-morbidities with chronic kidney disease. The analysis of prescribing trends is crucial for evaluating drug utilization patterns and should be conducted with greater regularity. Likewise, prescriptions should be encouraged in accordance with the national essential medicines list.

ACKNOWLEDGEMENTS

CONFLICT OF INTEREST

None

SOURCE OF FUNDING

REFERENCES

1. Jha V, Wang AYM, Wang H. The impact of CKD identification in large countries: The burden of illness. Nephrology Dialysis Transplantation. 2012;27(3):32-8.

2. Agrawaal KK. Maintenance Hemodialysis among Patients Visiting Nephrology Unit in a Tertiary Care Centre: A Descriptive Cross-sectional Study. JNMA Journal of Nepal Medical Association. 2022;60(255):931–4.

3. Levey AS, Coresh J. Chronic kidney disease. Lancet. 2012;379(9811):165-80.

4. Murthy B. V. N, V. S. Prescribing pattern of drugs in chronic kidney disease patients on hemodialysis at a tertiary care hospital. Int J Basic Clin Pharmacol. 2017;6(4):928-32.

5. Anil A, Joseph J, Varghese RM, Chacko S, Abraham E. Assessment of the prescription pattern of drugs used in chronic kidney disease patients undergoing haemodialysis in a tertiary care hospital. Indo American Journal of Pharmaceutical Research. 2020;10(4):681-88.

6. Tozawa M, Iseki K, Iseki C, Oshiro S, Higashiuesato Y, Yamazato M, et al. Analysis of drug prescription in chronic haemodialysis patients. Nephrology Dialysis Transplantataion. 2002;17(10):1819-24.

7. Al-Ramahi R. Renal Data from Asia-Africa Medication Prescribing Patterns among Chronic Kidney Disease Patients in a Hospital in Malaysia. Saudi Journal of Kidney Disease Transplantation. 2012;23(2):403-8.

8. Chakraborty S, Ghosh S, Banerjea A, De R, Hazra A, Mandal S. Prescribing patterns of medicines in chronic kidney disease patients on maintenance hemodialysis. Indian J Pharmacol. 2016;48(5):586–90.

9. Ghimire M, Vaidya S, Upadhyay HP. Prevalence of newly diagnosed end-stage renal disease patients in a tertiary hospital of central Nepal, Chitwan: A descriptive crosssectional study. Journal of the Nepal Medical Association. 2021;59(233):61–4.

10. Ali A, Kumar P, Ansari JA, Fatima M, Irrum F. A prospective observational study on medication use pattern in patients with risk factors of chronic kidney disease. Asian J pharm Clin Res. 2021;14(12):144-48.

11. Babu N, Venkatesh JS, George NP, Samuel N, G MM, Chikkamath V. Drug prescribing patterns and quality of life among chronic kidney disease patients in a tertiary care hospital. World Journal of Pharmaceutical Research. 2022;11(10):1015-30.

12. Nepal R, Sapkota K, Paudel M, Sah KK, Adhikari BN, Bajgain S, et al. Clinical Profile of End Stage Renal Disease Patients Undergoing Hemodialysis in Chitwan, Nepal. J Nepal Health Res Counc. 2021;19(3):467–73.

13. Pothen C, Baby B, Ashokan A, Chacko C, Shenoy P, Nandakumar UP. Drug usage pattern in chronic kidney disease patients undergoing maintenance hemodialysis. Res J Pharm Technol. 2019;12(10):5024–8.

14. Ahlawat R, D'cruz S. Drug Utilization Pattern in Chronic Kidney Disease Patients at a Tertiary Care Public Teaching Hospital: Evidence from a Cross-Sectional Study. Journal of Pharmaceutical Care & Health Systems. 2015;03(1):149.

15. Ku E, Lee BJ, Wei J, Weir MR. Hypertension in CKD: Core Curriculum 2019. American Journal of Kidney Diseases. 2019;74(1):120–31.

16. Konduru SST, Kumar JNS, Siva KL, Varshini KJ. Assessment of drug use patterns and quality of life in hemodialysis patients. European Journal of Pharmaceutical and Medical Research. 2018;5(6):628-37.

17. Ruospo M, Palmer SC, Natale P, Craig JC, Vecchio M, Elder GJ, et al. Phosphate binders for preventing and treating chronic kidney disease-mineral and bone disorder (CKD-MBD). Cochrane Database of Systematic Reviews. 2018;8(8):CD006023.

18. Chandra NS, Lella M, Gujjarlamudi H, Kambar C, Kurli S. Drug utilization pattern among patients of chronic renal failure on maintenance hemodialysis in a tertiary care teaching hospital. Natl J Physiol Pharm Pharmacol. 2023;13(9):1837-43.

19. Lin TC, Hung LY, Chen YC, Lo WC, Lin CH, Tam KW, et al. Effects of febuxostat on renal function in patients with chronic kidney disease. Medicine (Baltimore). 2019;98(29):e16311.

20. Cheng F, Li Q, Wang J, Wang Z, Zeng F, Zhang Y. The Effects of Oral Sodium Bicarbonate on Renal Function and Cardiovascular Risk in Patients with Chronic Kidney Disease: A Systematic Review and Meta-Analysis. Therapeutic and Clinical Risk Management. 2021 12(17):1321–31.