REVIEW DERLEME

DOI:10.5336/pharmsci.2023-98344

Pharmacists' Contributions to Anemia Treatment: A Systematic Review of Evidence and Best Practices

Anemi Tedavisinde Eczacının Rolü: İyi Uygulamalara ve Kanıta Dayalı Bir Sistematik Derleme

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ABSTRACT Anemia comprises various causative factors such as traumatic blood loss, insufficient intake of essential nutrients for red blood cell production (iron, B_{12} or folic acid), chronic diseases, thalassemia or enzymatic abnormalities along with bone marrow suppression caused by various factors. This study aimed at exploring the impact and effectiveness of pharmacist on management of anemia-related issues. A comprehensive literature review was undertaken from various databases like PubMed®, ScienceDirect®, Google Scholar® and Web of Science® to gather relevant information. Clinical studies investigating the effects of pharmaceutical care on anemia treatment were included into this review. According to available literature findings suggest that pharmacist-led intervention improve the level of adherence to medical recommendations given to patients thus resulting in higher quality levels delivered through enhanced healthcare practices leading to favorable health outcomes especially concerning anemic conditions where patients require compliance with complex medical regimens. Pharmaceutical care provided by the pharmacist leads to healthy consumption levels of iron supplements. These services result in lower costs as well as increased haemoglobin levels. In addition, cognitive pharmacy services reduce the workload of physicians, resulting in less risk of drug overdose among patients. Hence pharmacists must play a more active role during anemia treatment management to improve patient outcomes.

Keywords: Anemia; pharmacist; pharmaceutical care; evidence-based pharmaceutical care; anemia treatment

ÖZET Anemi, kan kaybı, eritrositlerin üretimi için gerekli besinlerin (demir, B_{12} veya folik asit) yetersiz alımı, kronik hastalıklar, talasemi veya enzimatik anormallikler ile belirli ilaçların neden olduğu kemik iliği baskılanması gibi çeşitli nedensel faktörlerden dolayı ortaya çıkan bir durumdur. Bu çalışma, eczacıların anemi ile ilgili sorunların yönetimi ve tedavisi üzerindeki etkisini ve etkinliğini araştırmayı amaçlamıştır. PubMed®, ScienceDirect®, Google Scholar® ve Web of Science® veri tabanlarından kapsamlı bir literatür taraması yapılarak, eczacılar tarafından yürütülen, anemik hastaların tedavisine yönelik farmasötik bakımla ilgili klinik çalışmalar ve eczacıların sağlık hizmeti sunumu sırasında hastalara sundukları hizmetler aracılığıyla anemi tedavisi ve yönetimi gibi sağlık durumunu iyileştirmeye yönelik katkıları derlenmiştir. Mevcut literatür bulgularına göre eczacıların yönettiği anemi tedavisinde, hastalara verilen farmasötik bakım hizmeti uyum düzeyini artırmakta ve böylece hastaların karmaşık tıbbi rejimlere uyum sağlamalarını gerektiren anemik durumlarla ilgili olarak faydalı sağlık sonuçlarına yol açarak tedaviden elde edilerek faydayı artırmaktadırlar. Eczacı tarafından sunulan farmasötik bakım hizmeti, demir takviyelerinin akılcı ilaç kullanımı çerçevesinde kullanılmasınayol açmaktadır. Bu hizmetler hemoglobin düzeylerinin yükselmesinin yanı sıra daha düşük maliyetlerle sonuçlanmaktadır. Ayrıca kognitif eczacılık hizmetleri hekimlerin iş yükünü azaltırken, hastalar arasında daha az ilaç doz aşımı riskine neden olmaktadır. Bu nedenle eczacılar, hasta sonuçlarını iyileştirmek için anemi tedavisi yönetimi sırasında daha aktif bir rol oynamalıdır.

Anahtar Kelimeler: Anemi; eczacı; farmasötik bakım; kanıta dayalı farmasötik bakım; anemi tedavisi

Anemia is characterized by a reduction in the number of red blood cells (RBCs) or a decrease in the ability of the blood to carry oxygen.[1] It is commonly defined as a decrease in the concentration of hemoglobin (Hb) or RBCs.[2] Hb levels may vary, typically between 13.5 and 18.0 g/dL in men, 12.0 to 15.0 g/dL in women, 11.0 to 16.0 g/dL in children, and for pregnant women a level above 10 g/dL is generally considered acceptable by the scientific community. Signs of anemia are typically observed when

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Peer review under responsibility of Journal of Literature Pharmacy Sciences.

Received: 06 Jun 2023 ***Received in revised form:*** 06 Nov 2023 ***Accepted:*** 07 Nov 2023 ***Available online:*** 08 Nov 2023

the Hb concentration falls below 7.0 g/dL.[3] The initial signs and symptoms observed in patients with anemia can be attributed to tissue hypoxia and the activation of physiological compensatory mechanisms.[2]

Anemia affects approximately 24.8% of the world's population, with a higher prevalence being observed in certain demographic groups, such as young children, pregnant women and elderly. Risk factors for anemia include advancing age, gender, nutritional deficiencies and chronic diseases.[2]

Identifying and treating the underlying cause of anemia is critical to effective management. The etiology of the anemia, the initial condition and any associated comorbidities, particularly cardiovascular disease, all contribute to the course of the disease.[3] Based on their mechanism and erythrocyte size, anemias can be categorized into two types.[4] The different types of anemia are illustrated in Figure 1.

Treating the underlying cause of anemia is the main approach to the treatment and management of anemia.[3] Maintaining a balanced diet and including iron-rich foods in the diet are preventive measures for anemia. Oral supplements are often preferred because of their cost-effectiveness and safety. Experts suggest a daily iron intake ranging from 100 to 200 mg as the recommended dosage. However, intravenous (IV) iron therapy offers a more efficient and rapid replenishment of iron stores.[1]

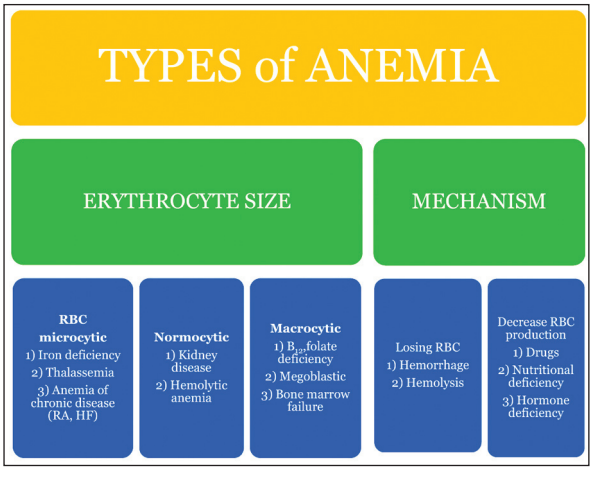

FIGURE 1: Types of anemias.
RBC: Red blood cell.

Clinical pharmacists contribute to primary care through a range of activities including health promotion, disease prevention, health protection, counselling and patient education. The contribution of pharmacists' active participation in treatment management in primary health care provision from different perspectives such as treatment success, compliance, side effect management is available in the literature. Ensuring that medicines are administered correctly is essential for patient safety and the provision of high-quality care.[5]

Studies show that when clinical pharmacists are actively involved in treating anemia, there are significant improvements in Hb levels and overall health. Pharmacists have played an important role in providing physicians with relevant drug information, suggesting effective treatment strategies, evaluating medication use, and counselling patients on appropriate medication use and lifestyle changes. Their input has turned out to be very important in the course of treatment. Regular monitoring of iron levels and recommendation of appropriate supplements has been facilitated by the active involvement of pharmacists. Interventions to optimize treatment outcomes have also included adjustments to erythropoietin dose and patient education.[6]

Pharmacists have been shown to have a positive impact on patients' overall well-being when involved in the management of anemia. Using a variety of interventions, pharmacists provide valuable counselling to patients by carefully assessing pharmacotherapy, analyzing laboratory data, and addressing issues related to drug interactions and potential side effects. By effectively addressing barriers to medication adherence, pharmacists play a critical role in helping non-adherent patients adhere to their prescribed treatment regimens. In particular, studies have looked at the impact of pharmacist management on changes in Hb levels. To ensure optimal treatment outcomes, pharmacists focus on optimizing erythropoietin and iron doses.[6] Through a comprehensive review of the existing literature, this study aims to examine the impact of pharmacists on the treatment and management of anemia.

MATERIAL AND METHODS

This study was conducted as a literature survey, encompassing systematic reviews, meta-analyses, and clinical studies that assess the impact of pharmacist interventions in anemia patients. The literature review focused on focused on the papers published between 2005-2021. Various study designswere inclueded into the final literature review, such as retrospective and prospective cross sectional, cohort, and randomized controlled trials. The literature review was performed using the keywords “Anemia, clinical pharmacist, pharmaceutical care, anemia and pharmacist, anemia treatment and management”, in databases PubMed® (National Library of Medicine, National Center for Biotechnology Information, United States of America), ScienceDirect® (Netherlands), Web of Science® (Clarivate Analytics), and Google Scholar® (United States of America). Animal studies and experimental models were excluded from the analysis. The final screening was conducted on December 31, 2021.

The extracted data from the included studies consisted of the following: 1) Participant characteristics including gender, presence of chronic diseases, genetic factors, and medication usage; 2) Details regarding the type, duration, and frequency of pharmacist interventions; and 3) Outcome measures encompassing parameters such as achieving normal Hb levels, symptom improvement, and cost reduction.

RESULTS

In this review, the benefits of pharmacists on anemia treatment investigated through articles published in different databases. In our study, 13 articles that met the research criteria were included. Among 13 articles, 5 were randomised controlled trial, 4 were cross-sectional studies, 3 were observational and 1 was a cohort study.

Anemia is a prevalent health problem observed in various populations such as pregnant women, elderly, individuals with chronic diseases, and cancer patients, often attributable to malnutrition or other underlying factors. The primary approach for managing anemia involves identifying the cause of iron deficiency and restoring iron stores through the use of oral iron preparations. In this literature review investigating the role of the pharmacist in the treatment of anemia, 13 articles with different methods were examined. Table 1 provides an overview of studies conducted by various researchers in the field.

DISCUSSION

The pharmacist's active involvement in anemia treatment has shown positive correlations not only with improved health outcomes but also with notable pharmacoeconomic benefits. Various studies underlined the contributions pharmacists make, including personalized patient education, medication management, and collaboration within healthcare teams. This involvement, positions pharmacists as integral healthcare professional in achieving comprehensive and impactful results in the management of anemia. The study conducted by Tahaineh and Khasawneh involved an analysis of complete blood count and ferritin values of patients in the intervention group after a duration of 4-6 weeks from the initiation of the study.[7] The research was conducted as a randomized controlled trial and included a total of 82 participants, with 43 individuals assigned to the intervention group and 39 individuals assigned to the control group. Both groups had similar dietary patterns; however, the intervention group received a specific recommendation for vitamin C intake, which differed from the control group. Upon the recommendation of the clinical pharmacists, the initial iron dosage administered to the patients exceeded 100 mg of elemental iron per day.[7]

The study findings indicated that 86.0% of the patients in the intervention group, who received pharmacist interventions, successfully achieved the target Hb value, whereas only 59.0% of the patients in the control group achieved the same outcome. This difference between the 2 groups was statistically significant. Although some patients demonstrated good compliance with the treatment, others encountered difficulties. In such cases, the clinical pharmacists played a crucial role by collaborating with physicians. They requested further examinations for unresponsive patients, suggested adjustments in medication formulations or iron salt type to

TABLE 1: Characteristics and overview of the included studies.

Study	Type of the study	Follow-up time	Study population	Type of intervention	Results
Walton et al.[17]	Cross-sectional study	6 months	278 hemodialysis receiving anemia patients	Medication review and dose management	Pharmacists' intervention in CKD patients reduced the cost.
Ohnishi et al.[13]	Observational study	6 months	84 ESA receiving anemia patients	Medication review and dose management	Pharmacist intervention significantly increased Hb levels in HD patients.
Debenito et al.[11]	Cohort study	6 months	101 CKD-associated anemia patients	Medication review	The intervention group reached the target Hb levels at better rate, for a shorter time and with lower dose.
Weil and Oxencis[14]	Observational study	2 months	39 ESA receiving anemia patients	Medication review, dose management and monitoring	Healthcare professionals were satisfied with the active role of pharmacists in treatment.
Han et al.[12]	Cross-sectional study	-	161 sickle cell disease anemia patients	Patient education and counselling	Pharmacists' intervention to CKD patients has led to better outcomes in terms of dose, side effects and treatment management.
Wee et al.[18]	Cross-sectional study	24 months	311 MBD related anemia patients	Health record evaluations and quality of life assessment	Polypharmacy decreased the quality of life were seen in anemia patients.
Bahnasawy et al.[9]	Randomized controlled trial	6 months	48 BTM patients	Patient education and counselling	In BTM patients who received clinical pharmacy intervention, improvements in drug-related problems, treatment compliance, ferritin levels, and patient satisfaction were reported.
Heryadi et al.[10]	Randomized controlled trial	9 months	192 pregnant women	Medication review, patients counselling and education	A significant difference observed in Hb value of 1.13 g/dL between patients before and after pharmacist consultation.
Tahaineh and Khasawneh[7]	Randomized controlled trial	4 to 6 weeks	82 iron deficiency anemia patients	Medication review, patients counselling and education	The participation of pharmacists increased the treatment success.
Marouf et al.[6]	Randomized controlled trial	16 weeks	120 CKD-associated anemia patients	Patients counselling and education	With the recommendations of pharmacists, patients' adherence to treatment increased.
Nasir et al.[8]	Cross-sectional study	9 months	232 pregnant women	Medication review, patients counselling and education	The prevalence of anemia with the participation of pharmacists was 4.8%. Pharmacist contribution increased the compliance 63.6%.
van den Oever et al.[15]	Randomized controlled trial	13 months	100 CKD-associated anemia patients	Medication review and dose management	The dosing schedule directed by the pharmacists is superior to the normal schedules in terms of Hb level.
Wall et al.[16]	An observational study	14-28 days	238 iron deficiency anemia patients	Medication review and dose management	With the intervention of pharmacists, significant increases in Hb values were observed, and the treatment was well tolerated.

ESA: Erythropoietin stimulating agents; CKD: Chronic kidney disease; MBD: Mineral and bone disorders; BTM: Beta-thalassemia major; HD: Hemodialysis; Hb: Hemoglobin.

address side effects reported by patients, and recommended continuation of treatment for patients who failed to reach the target Hb value despite the absence of evident issues.[7]

In a 2016 study conducted in Ethiopia by Nasir et al., was aimed to assess the prevalence of anemia in pregnant women and evaluate compliance with iron and folate supplementation, along with associated factors.[8] The study involved 250 participants, among whom 232 reported taking iron and folic acid supplements based on recommendations. Clinical pharmacists played a significant role in enhancing compliance by providing information about potential side effects, suggesting visible placement of tablets, and recommending consumption with food to mitigate issues like nausea.[8] Compliance was determined based on taking at least 65% of the prescribed dose and consuming a minimum of 4 tablets per week. Starting supplementary support in the first trimester resulted in 1.87 times higher compliance compared to starting in subsequent trimesters. This higher compliance could be attributed to receiving more counseling services through early pharmaceutical care. The overall treatment compliance rate was 63.6%, with forgetfulness and concerns about side effects being the primary reasons for non-compliance. The study also revealed that a majority of patients (78.2%) had good knowledge about the disease.[8] The educational level of the patients and the timing of treatment initiation were found to have a statistically significant association with disease management. Participants with university and higher education were 4 times more likely to be compliant with disease management compared to those with only secondary education.[8] The study concluded that the prevalence of anemia in pregnant women was 4.8%. This rate was lower compared to previous studies, which reported rates ranging from 16% to 46.3%. The contributions of pharmacists were instrumental in reducing the prevalence of anemia through patient education, early initiation of folic acid and iron treatment, and informing patients about potential side effects.[8]

Bahnasawy et al. conducted a study focusing on the impact of clinical pharmacist intervention on beta-thalassemia major (BTM) patients. The study investigated the relationship between patients' non-compliance and drug-related issues, and families of patients were also educated by clinical pharmacists about BTM. Pharmacists specifically addressed three key factors: maladministration, drug interactions, and adverse effects. In 4 patients, missed doses were observed due to taste and other problems associated with the oral dosage form. In such cases, pharmacists advised switching to the tablet form of the medication.[9] The study findings indicated that after 6 months of clinical pharmacy intervention in BTM patients, improvements were observed in drug-related problems, treatment compliance, ferritin values, and patient satisfaction within the intervention group. At the end of 6 months, serum ferritin levels were significantly lower for the intervention group than for the control group.[9] A significant reduction in ferritin levels (-35.89% vs. -16.48%, $p<0.0001$) was observed with the pharmacist intervention. These improvements observed in the intervention group may be attributed to increased patient compliance and resolved medication-related issues. In addition, the study showed a significant increase in the overall quality of life score for the pediatric population. Resolution of medication-related problems, increased patient satisfaction and improved compliance may explain this improvement. Therefore, clinical outcomes in patients with BTM may be improved by the active involvement of pharmacists in the healthcare team.[9]

To investigate the impact of pharmacist counselling on Hb levels in pregnant women with anemia, Heryadi et al. conducted a study in Indonesia in 2013.[10] The study found that only 33.3% of pregnant women received iron supplementation. This suggests that there is a need to improve adherence to anemia treatment. Lack of knowledge among pregnant women also contributes to the incidence of anemia, according to Heryadi et al.[10] The study conducted by Heryadi et al. showed a remarkable difference of 1.13 g/dL in Hb levels between the group of pregnant women who sought advice from a pharmacist and those who did not.[10] These findings indicate a significant increase in Hb levels among pregnant women who received support and advice from pharmacists. The counseling service offered by healthcare professionals played a vital role in promoting adherence to the disease management protocols.[10]

Debenito et al. conducted a study involving 101 participants using erythropoiesis-stimulating agents (ESA), with active involvement of 31 individuals by pharmacists and no pharmacist participation in the remaining 70 individuals.[11] A comparison between the 2 groups revealed that anemia-related hospital visits and adverse drug reactions occurred in only one person from the pharmacist-controlled group, whereas it was observed in 14 individuals from the other group, predominantly associated with cardiovascular events. The results indicated equivalent safety outcomes and reduced drug utilization in the patient group that received pharmacist intervention, in comparison to the regular patients.[11] The pharmacist-administered group had a mean dose of 5,509 units of ESA, whereas the normal group had a higher mean dose of 6,877 units. Consequently, the involvement of pharmacists resulted in an annual cost savings of $1,288 per patient for this medication. Furthermore, the group managed by pharmacists achieved the target value within 28 days, whereas the group without pharmacist involvement reached the target value in 41 days. The findings indicate that clinical pharmacist led-treatments enhance patient adherence and lead to a reduction in drug dosage. Effective therapy management and the valuable contribution of clinical pharmacists contributed to the positive results and dose reductions observed in this study. More comprehensive studies are needed to improve the results even further.[11]

A collaborative approach involving both clinical pharmacists and physicians was used to improve patient care in a study by Han et al. Clinical pharmacists received additional sickle cell disease (SCD)-specific training as part of this study. They reviewed the patients' laboratory results and assessed the dosage of hydroxyurea, while also educating the patients about potential side effects such as bone marrow suppression. Immunization and screening advice was also provided by the pharmacists. Afterwards, the pharmacists documented potential interventions and communicated them to the appropriate physicians. The study also investigated the use of opioids for pain management in patients with SCD. Key areas of investigation included the impact of dose adjustments of hydroxyurea on the side effects of bone marrow suppression and the rates of vaccination.[12] According to the results of Han et al., the implementation of clinical pharmacy services in SCD management led to improvements in hydroxyurea dose escalation, immunisation rates and healthcare outcomes. This study also underlines the contribution of the pharmacist in rare disease management.[12]

Anemia due to renal dysfunction is a common problem among hemodialysis patients. Ohnishi et al. conducted a study to evaluate the impact of pharmacists on patients undergoing treatment with ESAs. Several studies have been conducted in this area because it is believed that the involvement of pharmacists in the management of ESA therapies can improve the quality of drug therapy. This particular study, involving 84 participants, aimed to investigate the therapeutic changes in Hb levels with the involvement of pharmacists.[13] The results of the study demonstrated the positive impact of pharmacist involvement in reducing their workload by showing a correlation between changes in albumin and Hb levels. In particular, there was a significant increase in Hb levels in the low Hb group, albeit over a longer period. In contrast, a decrease was observed in the high Hb group, highlighting the effectiveness of pharmacists in the management of anaemia.[13]

A study by Weil and Oxencis investigated the impact of pharmacist intervention on blood pressure side effects among patients with anemia treated with ESAs.[14] It was noted that ESA should not be administered to patients who had not received chemotherapy within the past 2 months. The study included patients who had received at least one dose of epoetin alfa or darbepoetin alfa. However, none of the patients met the criteria for ESA examination as necessary pre-treatment assessments such as Hb, erythropoietin values, and iron measurements were not performed.[14] Upon completion of the study, nurses were asked about their satisfaction with the involvement of pharmacists in the treatment process. Approximately 45.45% of the nurses expressed their satisfaction with the new process. Similarly, when pharmacists were surveyed, approximately 85.71% of them reported that the new situation improved the quality of care, and 57.14% expressed their satisfaction with assuming such an active role in the treatment. A comparison between the group that received

pharmacist intervention and the group that did not revealed a 100% improvement rate in the former group, whereas the latter group demonstrated a 71.4% improvement rate. Specifically, the proportion of individuals with blood pressure readings below 170/110 mmHg was 148 out of 152 in the group without pharmacist intervention, whereas it was 13 out of 14 blood pressure measurement in the group with pharmacist intervention. This difference could be attributed to the active involvement of pharmacists in the study, including their literature review and the development of guidelines.[14]

In a research conducted by Marouf et al., which involved a sample of 120 individuals, the impact of pharmacists on the management of chronic kidney disease (CKD)-associated anemia was investigated.[6] The pharmacists actively collaborated with physicians and nurses by providing drug information, suggesting treatment interventions, monitoring serum levels, and alleviating workload. Throughout the 4-month study duration, the pharmacists thoroughly examined patient records and assessed potential drug interactions. When evaluating the influence of pharmacists during the 4-month treatment period, it was observed that 65% of patients in the pharmacist intervention group (39 individuals) achieved the target Hb level, while only 41.6% of the other group (25 patients) reached the desired value. The statistical analysis indicated a significant difference with a p-value of 0.017.[6] The observed enhancement in Hb levels can be attributed to the diverse strategies employed by pharmacists and their provision of counseling services to patients. The study primarily investigated the factors contributing to a suboptimal response to treatment. A notable finding emerged when comparing the 2 groups: the crucial role of pharmacists in supporting treatment adherence, particularly concerning iron supplementation, dietary guidance, oral iron administration, and potential interactions between food and/or drugs. This outcome underscores the significance of pharmacists in improving treatment outcomes for individuals with CKD-associated anemia undergoing hemodialysis.[6]

In the study conducted by van den Oever et al., pharmacists played a crucial role in assisting nephrologists by providing dose recommendations for the intervention group.[15] Collaboration between pharmacists and nephrologists in managing darbopoetin alfa and ESAs potentially led to reduced drug dosage and improved patient outcomes, complemented by the pharmacists' other suggestions such as supplements. Throughout the study, pharmacists made a total of 916 dose recommendations, of which 894 were accepted by the physicians. The remaining 22 suggestions were discussed between the pharmacists and physicians, with 13 being rejected. The dose of iron sucrose was 75 mg in the intervention group and 0 mg in the control group, and the use of darbopoetin was lower in the pharmacist intervention group than in the control group. The number of erythrocytes transfused per patient was similar in both groups (0-41 and 0-36 for control and intervention groups, respectively).[15] Comparing dosing between the 2 groups, the median dose in the pharmacist-intervention group was 34.0 mcg, significantly lower than the other group, which had a median dose of 46.9 mcg. This discrepancy roughly equates to an additional 7-day dose of darbopoetin alfa. It should be noted that a comprehensive comparison between the 2 groups in this aspect was challenging due to the lower frequency of transfusions in the pharmacist-directed group.[15]

In the study conducted by Wall et al., the impact of pharmacists on iron dosing and adherence within the healthcare team was evaluated.[16] Clinical pharmacists played a vital role in collaborating with the healthcare team to identify patients suitable for IV iron therapy and determining the appropriate dosage for them. The study specifically examined the effectiveness and safety of a total dose infusion (TDI) protocol using IV iron sucrose for the treatment of anemia. The desired Hb value was set at 14 g/dL for men and 12.5 g/dL for women, based on gender. A comparison was made between patients' conditions before and after TDI administration. The involvement of pharmacists in the treatment process ensured good tolerability and resulted in notable improvements in Hb levels. It is worth noting that IV iron infusion leads to faster elevation of blood values compared to other methods. However, since iron sucrose is not Food and Drug Administration-approved, close monitoring for potential side effects during the infusion

is advised.[16] The study revealed that the patients' Hb levels were measured as 8.3 g/dL before TDI and 10.4 g/dL after TDI. The p-value was found to be <0.001, indicating a significant increase in Hb values following the intervention of pharmacists.[16] Although the study was conducted with a limited number of participants, the desired Hb level was attained after TDI without significant adverse effects.[16]

In the study conducted by Walton et al., a total of 278 patients participated. At the beginning of the study, the average Hb value of the patients was 9.5 g/dL, which increased to 11.8 g/dL after 6 months. Initially, 25% of the patients had a Hb value above 11 g/dL, but this percentage rose to 80% after 6 months. Among human immunodeficiency viruses patients, the percentage with a Hb value above 11 g/dL was 20% at the beginning, and it increased to 42% within 6 months. The average weekly dose of erythropoietin administered was 121.6 units/kg/week (equivalent to 9,300 units), which was 46% lower than the United States (US) average of 229 units/kg/week (approximately 16,000 units/kg/week). Iron parameters improved from 21%±7.9% at the beginning to 33%±8% at the end of the 6-month period. Additionally, this approach resulted in an annual cost savings of $3,000 per individual. As this study did not include a control group, direct comparisons with other interventions could not be made.[17] The findings of this study underscore the significant role of pharmacists in the management of erythropoietin therapy for anemic patients with CKD. The patients in this study received more appropriate doses of Hb and erythropoietin compared to the US average. The pharmacist-led protocol employed in this study proved to be an effective treatment approach for CKD patients.[17]

The concept of health-related quality of life (HRQoL) is negatively impacted in patients with anemia, and the use of ESAs has shown improvements in this aspect. Wee et al. conducted a study to investigate the additional benefits of pharmacist involvement on HRQoL in anemia patients. It is common for patients with CKD to experience mineral and bone disorders, which are believed to be associated with poor HRQoL. Poor compliance with anemia treatment may be influenced by factors such as inadequate nutritional status, depression, and inflammation, as patients may not directly perceive improvements in HRQoL. Anemia patients in the study exhibited higher serum phosphorus levels, lower calcium levels, and were taking more medications compared to non-anemic patients. This medication usage in anemia patients was associated with a lower quality of life. The study findings revealed a significant association between anemia and low HRQoL (p=0.002). Furthermore, patients with bone and mineral disorders had a higher daily pill intake rate (15.5) compared to individuals without these conditions (10.8). The study did not identify a significant difference in HRQoL before and after dialysis in anemia patients.[18] This study, which involved the participation of pharmacists, highlights the importance of medication usage in CKD patients. The findings suggest that healthcare professionals, including doctors and pharmacists, should carefully evaluate the medications used by such patients to prevent unnecessary drug usage. Although further research is needed to obtain more precise results, this study suggests that the involvement of pharmacists can contribute to improving the quality of life for anemia patients.[18]

This study has some limitations. Firstly, we would like to state that the number of studies included is an important limitation. On the other hand, the low number of participants in the included studies can be considered as a limitation in terms of generalizability. The different types of studies included in the scope of our research stand out as another limitation that may be an obstacle to clearly see the results of the services that the pharmacist can offer in the treatment of anemia.

CONCLUSION

In the management of anemia, pharmacists should establish regular communication with patients to monitor their medication usage, ensuring adherence and evaluating potential interactions between the prescribed drugs and the patients' dietary choices. Additionally, pharmacists can provide valuable recommendations regarding the incorporation of supplementary foods to enhance the effectiveness of anemia treatment. Notably, clinical pharmacists employed in hospital settings possess the ability to as-

sess laboratory tests and offer insights to physicians, thereby facilitating informed decision-making. Consequently, the involvement of pharmacists aids in preventing unnecessary medication use and minimizing healthcare costs.

Acknowledgments

The authors of this study are grateful to Bezmiâlem Vakıf University for providing opportunities and support.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

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