Comprehensive Journal of Science
Volume (10), Issue (37), (NOV. 2025)
SICST2025, www.sicst.ly
ISSN: 3014-6266

مجلة العلوم الشاملة
عدد خاص بالمؤتمر الدولي الثالث للعلوم والتقنية
المجلد (10)، العدد (37)، (نوفمبر2025)
ردمد: 3014-6266

Study the Recording Adverse Drug Reaction of Chemotherapy Among Patients Undergoing in Department of Medical Oncology in Elmegriaf Hospital

Mohammed Saad Elgeroshi

Oncologist in Elmegriaf Hospital

ABSTRACT

Chemotherapy, a widely used treatment for cancer, is known not only for its immune-suppressing effects but also for triggering various side effects. These include toxic secondary reactions and inflammation, which collectively contribute to a diminished quality of life for patients. This review examines strategies aimed at minimizing the collateral damage caused by chemotherapy. Research suggests that the use of certain medications, antioxidants, and herbal remedies has shown promise in mitigating these adverse effects. The research took the form of a cross-sectional study conducted at Elmegriaf Hospital over a six-month period, spanning August 2024 to March 2025. Prior to commencing the study, approval was obtained from the relevant ethics committee. The project was a collaborative effort between the Department of Pharmacology and the Department of Medical Oncology. Among the 100 patients participating in the study, females comprised the majority, making up 65% (82 individuals) of the group. The highest concentration of patients fell within the 51-60 age range, with 38 individuals, representing 30% of the total sample. Cancer treatments frequently result in notable side effects, which can adversely affect nutritional status and overall quality of life. Acknowledging the importance of addressing this challenge, this review outlines strategies for managing these side effects that healthcare professionals can integrate into their care protocols. Although some methods have demonstrated potential in human studies, they should not be adopted independently by cancer patients without professional oversight. Treatment requires consistent monitoring by a multidisciplinary medical team to ensure safety and effectiveness. Additionally, cultivating trust in healthcare providers plays a crucial role in facilitating the safe use of complementary care approaches in conjunction with established supportive therapies.

1. INTRODUCTION

Cancer stands among the most life threatening diseases, defined as a group of disorders marked by the uncontrolled growth and spread of abnormal cells. Following cardiovascular diseases, cancer ranks as the second leading cause of death in Europe. According to data from the World Cancer Research Fund International, the five countries with the highest cancer incidence rates are Denmark, metropolitan France, Australia, Belgium, and Norway. Commonly prescribed cancer medications include Bevacizumab, Cyclophosphamide, Cisplatin, Methotrexate, and Paclitaxel, though these drugs are often linked to severe side effects, such as thromboembolic events, gastrointestinal perforation, pulmonary embolism, cerebral hemorrhage, gastrointestinal hemorrhage, hypersensitivity reactions, anaphylaxis, and alopecia. Historically, plants have served as a vital source of medicinal preparations for the prevention and treatment of various diseases.. [1]

1.1 Objectives: The objectives of the study are as follows:

1. To study the pattern of adverse drug reactions of anticancer agents of patients admitted in the oncology ward.

2. To assess the causality, severity, and preventability of the adverse drug reactions observed.

2. REVIEW OF LITERATURE

Chemotherapy, one of the most prevalent cancer treatments, along with immune impairing effects, can produce many side effects. Some of these include its toxic secondary effects and associated inflammation which all lead to a poor quality of life for patients. This review focuses on the approaches developed to prevent chemotherapy-induced “spill-over” damage. It has been reported that administration of some drugs, antioxidants and herbal preparations can be effective in reducing these side effects. The overall objective is to identify strategies that optimize a compromise between tumor suppression, chemotherapy-induced complications and immune competence. However, the journey to achieve these enhancements is paved with obstacles. Major challenges include opaque mechanisms of action, possible interactions of herbal remedies and pharmaceutical agents, and variability in the composition and quality of herbal extracts, all of which impede their clinical application. Chemotherapy works on active cells. Active cells are cells that are growing and dividing into more similar cells. Cancer cells are active, but some healthy cells are also active. Side effects occur when chemotherapy damages these healthy cells . Some chemotherapy drugs can damage the cells of the heart, kidneys, bladder, lungs, and nervous system. Sometimes you can use drugs with chemotherapy to protect your body's normal cells. Also, there are ways to relieve side effects . Today, there are more drugs for the side effects of chemotherapy than ever before. Preventing and treating side effects, called palliative care or supportive care, is an important part of cancer treatment . The severity of side effects varies from person to person. .[(2)]

2.1 Antimetabolites

Antimetabolites are among the earliest classes of oncology drugs, with all agents in this category recognized as small molecules. Among them, methotrexate serves as a key folic acid analog and prototype drug. A significant adverse effect associated with methotrexate is acute renal failure, which can worsen when used alongside nephrotoxic agents, such as cisplatin. Concurrent administration of methotrexate with other substances that impair kidney function may slow its excretion, Neurotoxicity is another possible complication, often linked to high-dose regimens or intravenous delivery. Additionally, hepatotoxicity frequently occurs in patients with compromised renal Hepatotoxicity is also commonly observed in individuals with compromised kidney function, stemming from disrupted DNA and RNA synthesis processes in the liver.

2.2 Alkylating Agents

This class of anticancer drugs includes small molecules, such as cyclophosphamide, a nitrogen mustard-type alkylating agent known for its association with myelosuppression, neutropenia, anemia, and thrombocytopenia. Another key agent, cisplatin, a widely used platinum-based compound, is notable for its black box warnings related to myelosuppression and nephrotoxicity. While the exact mechanism behind such severe toxicities remains unclear, the dose-dependent nature of these effects has been well-established.

2.3 Antitumor Antibiotics

2.3.1 Anthracyclines: Doxorubicin

Antitumor antibiotics form a crucial category of older small-molecule chemotherapies, with doxorubicin serving as a quintessential example within the anthracycline subclass. This drug's signature toxicity is cardiomyopathy, driven by the generation of oxygen free radicals and lipid peroxidation within the myocardial tissue**.**

2.3.2. Topoisomerase I Inhibitor:

Camptothecin, a small molecule that functions as a topoisomerase I inhibitor, induces DNA damage by creating torsional strain. Among the commonly used camptothecins, irinotecan is notable for its characteristic black box warnings, which include diarrhea and myelosuppression. (3)

2.3.3. Anthracenedione

Mitoxantrone, the most widely used small molecule classified as an anthracenedione, is associated with a reduced risk of cardiomyopathy due to its inability to form quinone-type free radicals. However, it carries black box warnings for conditions such as extravasation, neutropenia, and secondary leukemia. Additional side effects include gastrointestinal and menstrual disorders, as well as blue discoloration of urine. (4)

2.3.4 Antimitotic Agents

2.3.4.1 Vinca Alkaloids

Currently, four major vinca alkaloids are used in practice, and all these are small molecules: vincristine, vinblastine, vindesine, and vinorelbine. Among these, vincristine needs to be used intravenously, and some of its major adverse reactions comprise of leukopenia, thrombocytopenia, and anemia due to the inability of the cells to replicate. (5)

2.3.4.2. Taxanes

Constitute a class of small molecules, with paclitaxel being the most widely recognized member. Paclitaxel carries a black box warning due to the risk of anaphylactic reactions associated with its infusion. To mitigate this risk, patients are typically pretreated with antihistamines, corticosteroids, and H2 antagonists. Additional adverse effects include neutropenia and peripheral neuropathy. Patients

treated with docetaxel often experience febrile neutropenia, infusion-related reactions, and fluid retention. Conversely, cabazitaxel is primarily associated with hematological adverse effects, including neutropenia, leukopenia, and anemia.

2.4 Immunotherapy Immunotherapy represents a compelling approach to chemotherapy, incorporating both large and small molecule agents.

2.4.1. Immunomodulatory

Small Molecules Thalidomide is the most well-known agent in this category, carrying a black box warning due to severe embryo-fetal toxicity. The disruption of angiogenesis stands out as the primary mechanism underlying this fetotoxicity..

2.4.2 Cluster of Differentiation (CD)-Targeted Monoclonal Antibodies

This class of drugs comprises biologics, with rituximab being one of the most widely used monoclonal antibodies. Rituximab specifically targets the CD20 antigen located on the surface of B cells, which is often overexpressed in certain types of cancer. (4)

The medication comes with a standard black box warning for infusion-related reactions as well as for pancytopenia. While the precise mechanism behind cytopenia remains unclear, it is theorized to involve the binding of bone marrow cells.

2.4.3 Bispecific Monoclonal Antibodies

Blinatumomab represents a unique biologic therapy that simultaneously binds to CD19 on tumor cells and CD3 on T-cells. This dual targeting allows T-cells to directly lyse tumor cells. The drug carries significant black box warnings, including risks for fatal infusion-related reactions and severe neurological toxicities. Other notable adverse effects include tumor lysis syndrome, neutropenia, and liver damage.

2.4.4 Cytotoxin–Protein Conjugate

Cytotoxin–protein conjugates can be useful when the target of the drug is interleukin instead of an antigen. Denileukin diftitox is indicated in the treatment of cutaneous T-cell lymphoma.

2.5 Comparison between Toxicities from the Old (Small Molecules) Drugs and New (Biologics) Drugs

Oncologic drugs exhibit a broad spectrum of toxicities, each with unique advantages and limitations. A key differentiation between small molecule drugs and biologics lies in their mode of interaction with targets and the subsequent effects following administration.. (5)

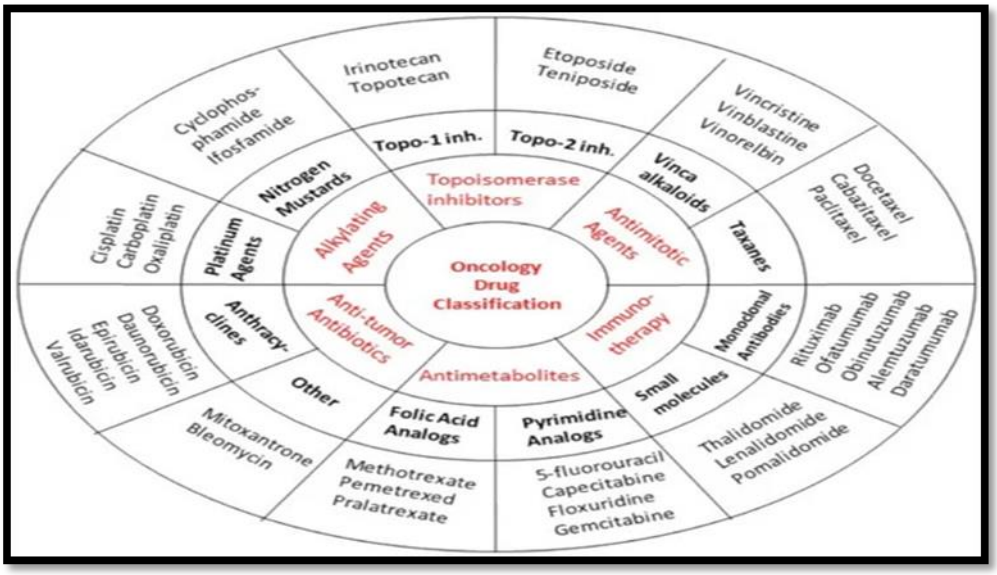

Figure 2.1. Classification of major anticancer drugs along with their subclasses. This is a representative classification based on mechanism of action. The red letters indicate the major anticancer drug classes, and the black bold letters represent the corresponding examples of drug subclasses.

2.6 Dermatologic Toxicities

Dermatologic adverse reactions are not a predominant feature of oncology drugs overall, but they are associated with specific classes. These reactions tend to occur more frequently in newer, large-molecule drugs such as panitumumab and cetuximab compared to older agents. Nevertheless, certain smaller-molecule drugs like gefitinib, erlotinib, sorafenib, and afatinib have also been linked to dermatologic reactions. Among these, large-molecule drugs such as panitumumab and cetuximab exhibit significantly higher levels of dermatologic toxicity.

2.7 Cardiotoxicities

Alkylating agents and anthracenediones are well-documented for their association with cardiotoxic effects. Notably, their therapeutic applications share a primary overlap in the management of leukemia among older-generation agents. Cyclophosphamide, a widely utilized nitrogen mustard alkylating agent, is linked to several forms of cardiotoxicity, including myocarditis, myopericarditis, pericardial effusion, arrhythmias, and congestive heart failure. · Mitoxantrone presents a particularly significant risk, with its cardiotoxic effects deemed severe enough to warrant a black box warning for congestive heart failure. Similarly, doxorubicin has been frequently identified as a causative agent of severe cardiac toxicity. [6]

2.8 Bone Marrow Suppression, Myelosuppression

Bone marrow suppression and myelosuppression are common side effects across various drug classes, encompassing both older and newer medications, though their severity differs. Fulvestrant, a selective estrogen receptor degrader (SERD) used to treat breast cancer, has been associated with causing bone pain. Notably, fulvestrant exhibits a binding affinity 100 times greater than that of tamoxifen. Unlike fulvestrant, tamoxifen, which belongs to the related class of selective estrogen

receptor modulators (SERMs), primarily acts as an agonist in bone tissue and is not linked to this specific toxicity.

2.9 Peripheral Neuropathy

Both newer and older oncologic drugs are widely recognized for their potential to induce peripheral neuropathy. Older agents like paclitaxel, cisplatin, and doxorubicin, as well as newer drugs such as trastuzumab and bortezomib, have been linked to this adverse effect. [7] Paclitaxel contributes to neuropathy by triggering mitotic alterations within cellular processes. Among the newer options, trastuzumab has been associated with peripheral neuritis and neuropathy in over 5% of treated patients..

2.10 Pulmonary Toxicities

Peripheral neuropathy is a well-documented adverse effect associated with a diverse range of oncologic drugs, including both traditional and contemporary agents. Established chemotherapeutics such as paclitaxel, cisplatin, and doxorubicin, as well as newer agents like trastuzumab and bortezomib, have been implicated in the development of this condition.

The mechanism by which paclitaxel induces peripheral neuropathy is linked to its interference with mitotic processes within cellular structures. Meanwhile, trastuzumab, a more recent therapeutic agent, has demonstrated incidences of peripheral neuritis and neuropathy in over 5% of treated patients..

2.11 Hepatotoxicity

Hepatotoxicity represents a significant adverse reaction due to the liver's critical role in drug metabolism and drug-drug interactions.

Impairment of hepatic function has far-reaching consequences, as it limits therapeutic options available to patients, making the evaluation and monitoring of hepatotoxic agents a matter of utmost importance. Methotrexate, a widely utilized antimetabolite, has been implicated in hepatotoxicity through its activation of inflammatory pathways, cytokine release, and the production of reactive oxygen species (ROS). Similarly, doxorubicin contributes to liver damage by inducing membrane lipid peroxidation and disrupting mitochondrial energy metabolism

2.12 Nephrotoxicity represents a critical adverse reaction observed in chemotherapy patients, as a considerable proportion of individuals undergoing such treatments exhibit impaired renal function. This issue is further exacerbated by the presence of pre-existing renal abnormalities in many patients, potentially complicating therapeutic outcomes and worsening overall prognosis.

2.13 Common Adverse Effects

1. Fatigue

Fatigue, characterized by feelings of tiredness and a lack of energy, is a prevalent side effect arising from various causes such as the underlying illness, chemotherapy, radiation therapy, surgical interventions, anemia, sleep disturbances, pain, psychological stress, reduced appetite, and a multitude of other factors. [8]

2. Dermatological and Nail-Related Effects

Patients may experience diverse dermatological issues, including redness, rashes, itching, peeling, dryness, acne, and heightened sensitivity to sunlight. In some cases, the skin along the veins may darken due to treatment. Nail-related changes are also common; these may include discoloration (darkening or yellowing), brittleness, cracking, and the development of vertical ridges or bands.

3. Pain Chemotherapy-induced neuropathy can manifest as burning sensations, numbness, tingling, or sudden shooting pain, particularly in distal extremities such as the fingers and toes. Furthermore, certain chemotherapeutic agents may cause additional adverse effects like oral sores, headaches, musculoskeletal pains, and gastrointestinal discomfort. If the severity of such pain disrupts daily life, implementing strategies for symptom management may help alleviate these issues effectively.

4. Hair Loss (Alopecia)

Hair may become thinner or fall out completely during treatment. This can affect areas all over the body, including the scalp, face, arms, legs, underarms, and pubic region. Typically, hair begins to regrow after the treatment ends.

In some cases, regrowth may start even during the course of treatment itself. Staying hydrated is recommended, so drink plenty of fluids like water, sports drinks, or ginger ale to support overall health.

6. Constipation

This condition may arise as a side effect, requiring attention to dietary fiber and hydration levels for relief.

7. Nerve and Muscle Effects

Peripheral neuropathy refers to a disruption in the normal signaling through neurons, potentially impacting movement and sensation. This condition may lead to tingling, numbness, or weakness.

8. Mouth, Gum, and Throat Problems

Chemotherapy drugs can irritate and dry out these tissues, sometimes causing bleeding or painful sores. Mouth sores can become infected due to the presence of bacteria in the mouth, which may lead to serious complications during treatment. Preventative measures should be taken to avoid infections, as they can be difficult to manage during chemotherapy. Regularly drinking water or juice can help keep these tissues hydrated and reduce discomfort. [9]

9. Diarrhea

If you experience loose stools lasting more than 24 hours or if diarrhea is accompanied by pain or cramping, consult your doctor immediately. Avoid using over-the-counter medications for diarrhea without medical guidance. In relation to hair loss, it's worth noting that hair may sometimes regrow with a different texture or color after treatment.

Hair loss typically does not happen right after the first session it may begin weeks into treatment or after several cycles. The hair may fall out gradually or in clumps.

10. Anemia Chemotherapy can hinder the bone marrow's capacity to produce red blood cells responsible for delivering oxygen throughout the body. This condition, known as anemia, may leave you feeling extremely fatigued, weak, and breathless. Prioritizing rest is important—try to sleep more during the night and incorporate naps into your daily routine.

11. Infection

Chemotherapy impacts the bone marrow's ability to generate white blood cells, which are crucial for combating infections. Many infections stem from naturally occurring bacteria on the skin, in the mouth, intestines, or genital tract. Maintaining hygiene and monitoring your health closely can help reduce risks.

12. Blood Clotting Issues

Anticancer medications can impair the bone marrow's ability to produce sufficient platelets, leading to an increased risk of bleeding or bruising—even without apparent injury. It's essential to consult your doctor if you experience any of these symptoms:

- Unexplained bruising or the appearance of tiny red spots under the skin.

- Urine that appears reddish or pink.

- Black or bloody stool.

Additionally, it’s critical to exercise caution with vitamins, herbal supplements, and over-the-counter medications, as many contain aspirin, which may further impact platelet function. Always consult your doctor or nurse before taking any of these products.

To minimize risk:

- Use an ultra-soft toothbrush when cleaning your teeth.

- Be extra vigilant when handling scissors, needles, knives, or other sharp objects to avoid cuts or injuries. [10]

How can chemotherapy side effects be managed?

Most times, the side effects from chemotherapy can be managed with medication or adjustments to your chemo dosage. Nausea, vomiting and fatigue can be managed with medication. To manage neuropathy, physicians will often lessen a patient's dosage and prescribe medications to help restimulate the growth of the nerves. That's why it's important to see your physician before every chemo cycle, especially if the on a very strong chemo regimen. Patients should disclose their full medical history before beginning chemotherapy.

diabetic patients can receive chemotherapy, but it's done with caution to prevent more nerve damage and other side effects that are more common in diabetics.

To help manage symptoms at home Patients are advised to do the following

- Stay hydrated by drinking 1 to 2 liters of water every day.
- Keep items the use frequently, like a phone, close by to cut down on having to move back and forth in the house. Less back and forth movement can help curb fatigue.
- Make a daily task list and use the smartphone or alarms of important things of experiencing chemobrain.
- Going to sleep and wake up at the same time every day, the body gets used to a routine. (10)

3. MATERIALS AND METHODS

3.1 STUDY DESIGN

The study was carried out as a cross-sectional investigation at Elmegriaf Hospital over a six-month timeframe, running from August 2024 to March 2025. Approval from the appropriate ethics committee was secured before the research began. The work was conducted in collaboration between the Department of Pharmacology and the Department of Medical Oncology.

3.2 INCLUSION CRITERIA

- Individuals aged 18 years or older

- Patients of any gender

- All cancer patients admitted to the oncology department throughout the study period

- Patients who received at least one anti-cancer medication

- Patients who experienced at least one documented adverse drug reaction (ADR)

Sample size section:

Patients diagnosed with cancer and admitted to the oncology ward within the specified period who fulfilled the inclusion criteria were recruited for the study. The research cohort comprised 100 participants whose data were systematically analyzed.

3.3 STUDY INSTRUMENTS

Patient-related data were gathered using a standardized proforma designed to capture essential information. This document encompassed demographic profiles, clinical details, and an extensive record of drug therapy administered to each individual included in the study.

4. RESULTS

Figure 1 presents the demographic characteristics of the patients based on gender. Out of the 100 patients enrolled in the study, the majority were female. accounting for 65% (82 individuals) of the population. The largest proportion of patients belonged to the 51-60 age group, totaling 38 individuals and representing 30% of the overall sample. Additionally, 21 patients were either below the age of 41 or above 70, while 19 patients were distributed across other age groups.

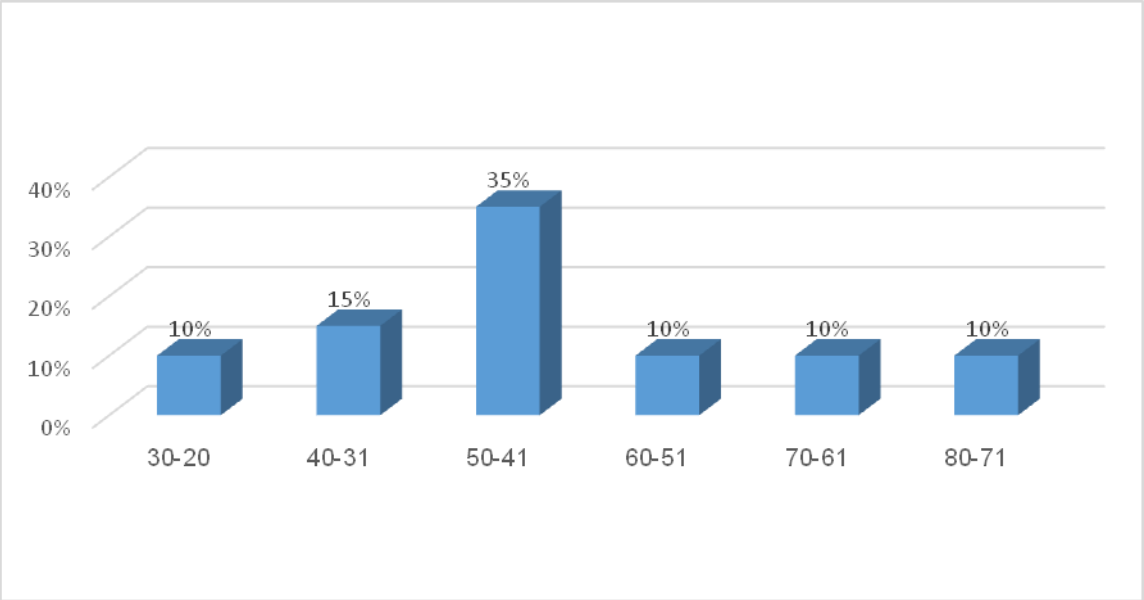

Figure 4.1: Patient demographic characteristics categorized by age

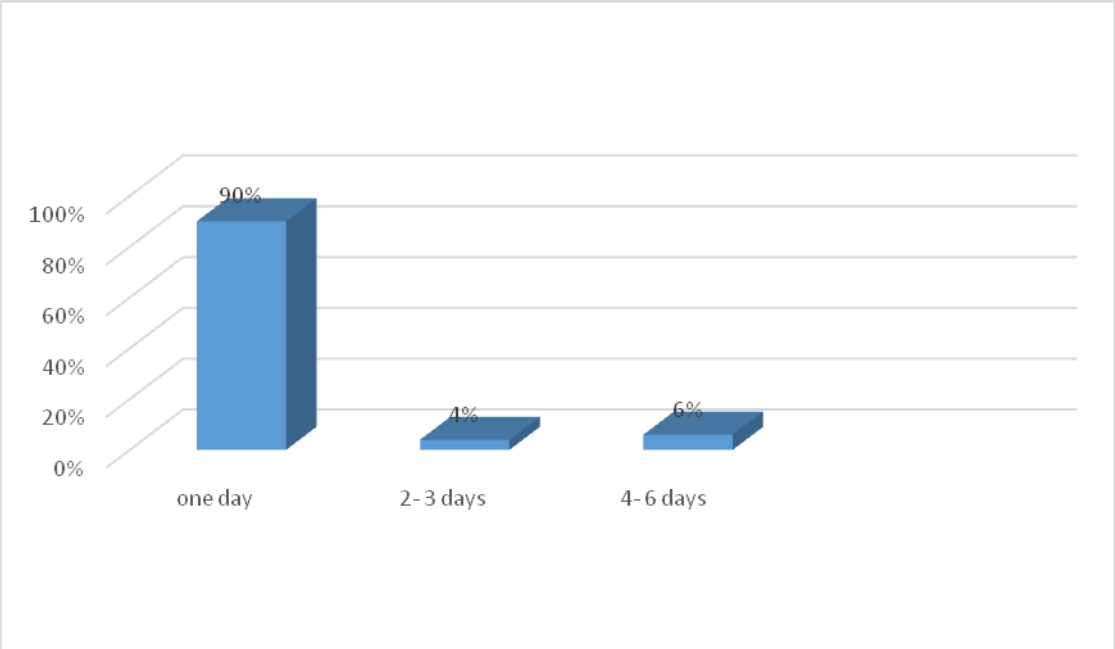

Figure 4.2 Duration of hospital residence

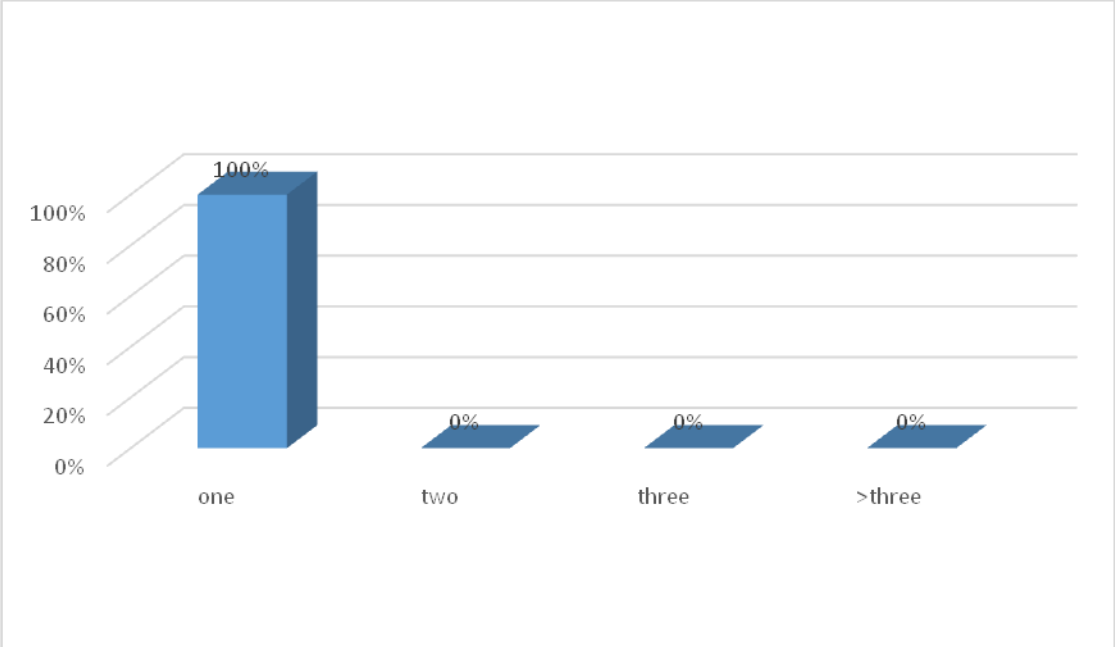

Figure 4.3 Number of anticancer taken at same time

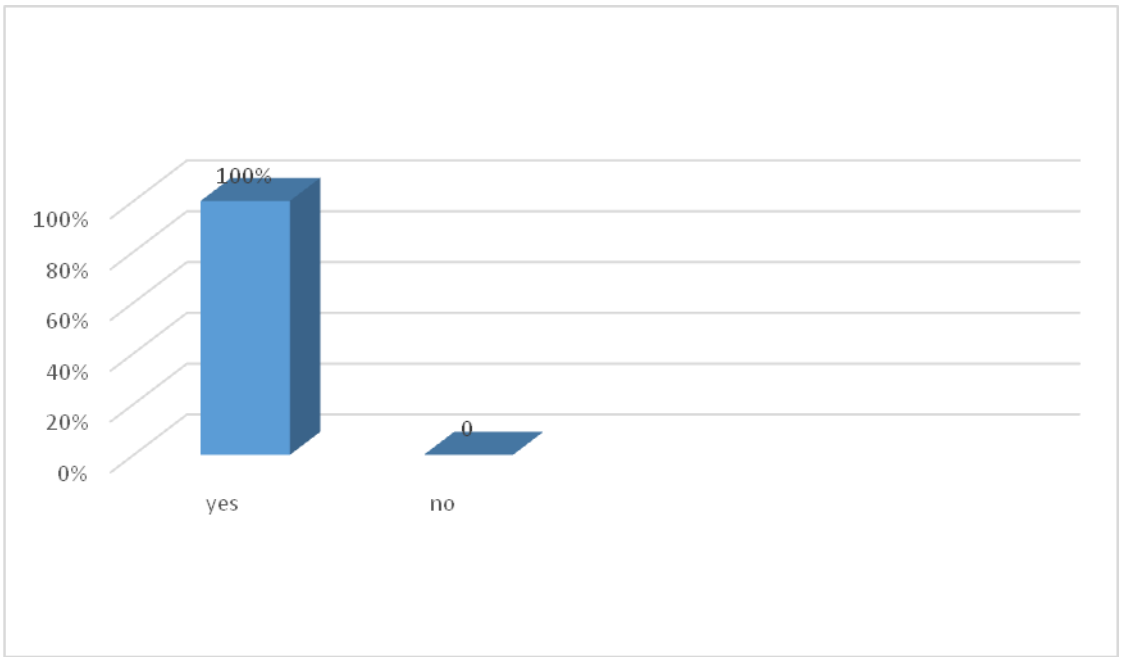

Figure 4.4 Is there any drugs (other than anticancer) in Rx?

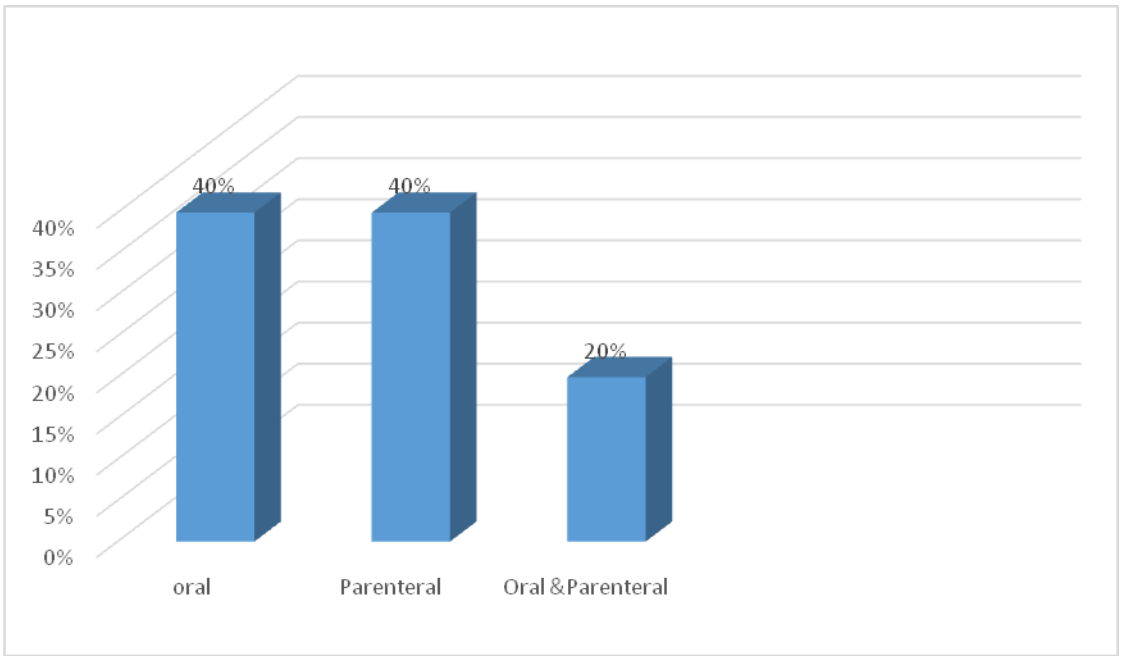

Figure 4.6 Rout of anticancer drugs

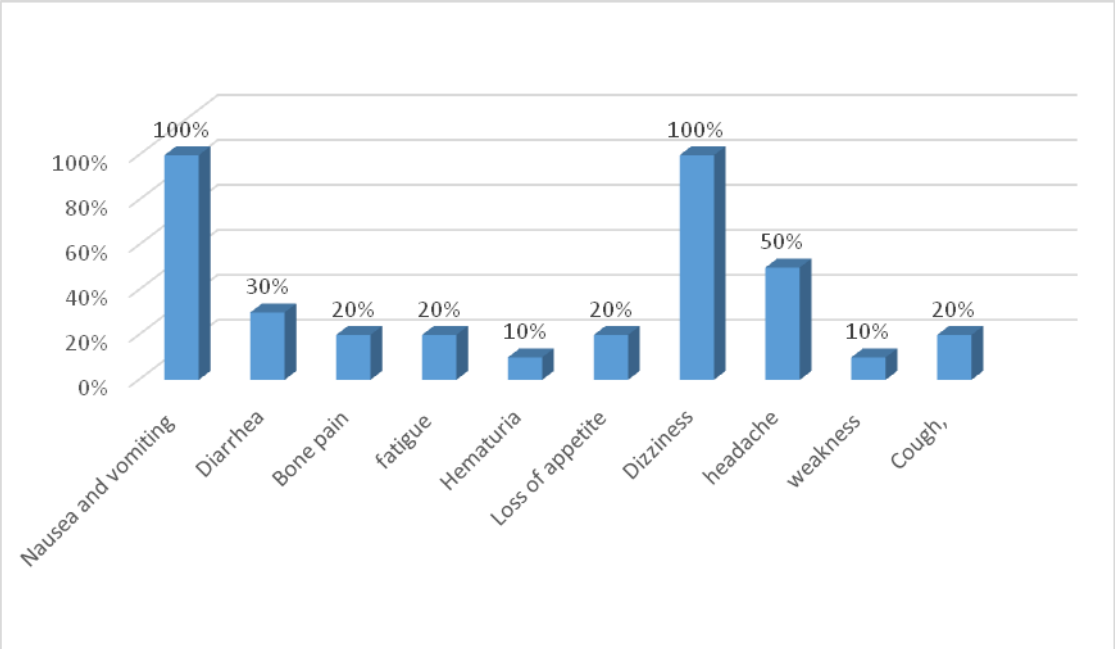

Figure 4.7(a) Pattern of adverse drug reactions

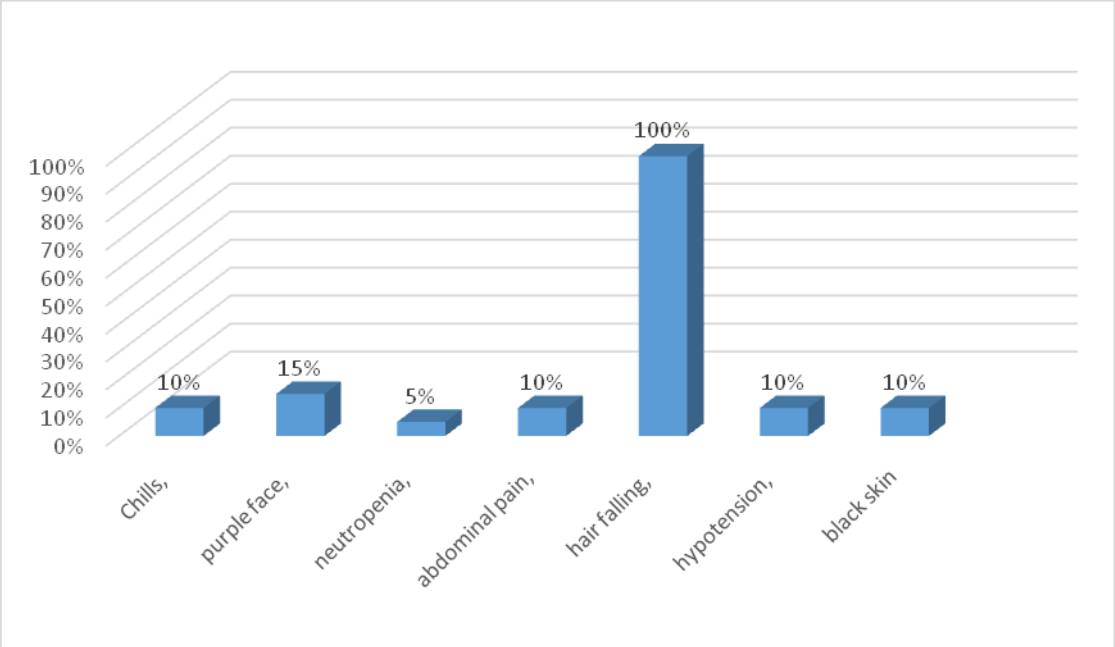

Figure 4.7(b) Pattern of adverse drug reactions

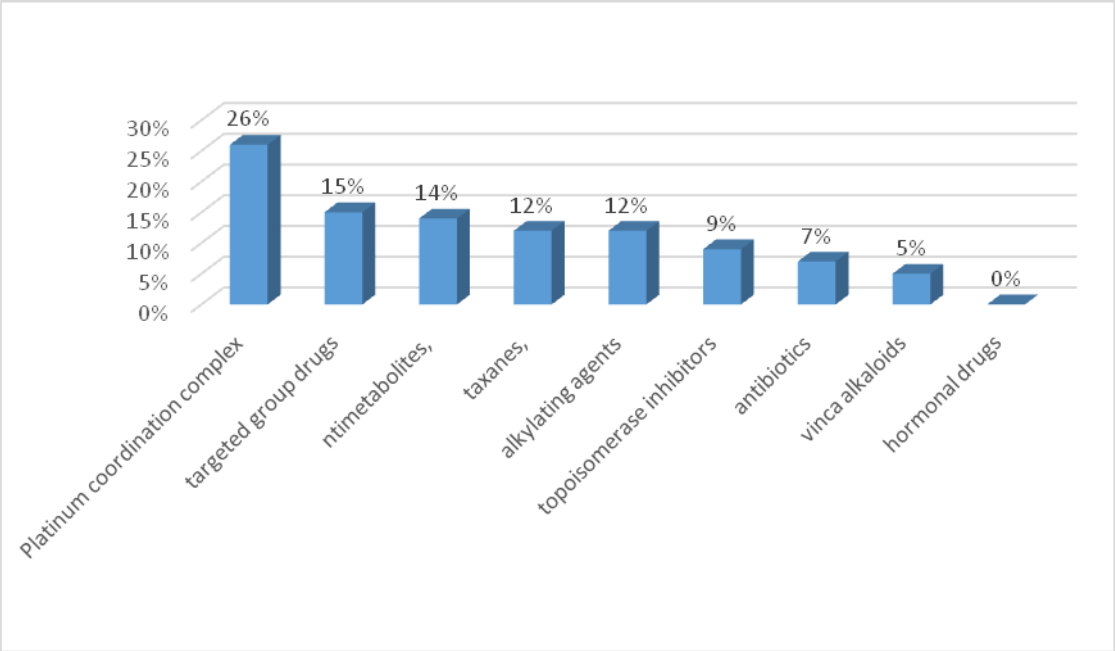

Figure 4.8 Anti-cancer drugs implicated in causing ADRs

5.DISCUSSION

Adverse drug reactions (ADRs) caused by anti-cancer drugs manifest in various forms, significantly impacting patient compliance, extending hospital stays, and exacerbating patient suffering. Consequently, strict monitoring of ADRs is imperative, alongside proactive efforts to minimize their occurrence. According to data from the Food and Drug Administration (FDA) Adverse Event Reporting System (AERS), women tend to experience more ADRs compared to men. This disparity may stem from factors such as pharmacodynamic or pharmacokinetic variations, polypharmacy, or differing patterns in ADR reporting. In our current study, we observed a higher susceptibility among females, with 65% of adverse reactions occurring in this group. Similar observations were made in studies conducted by Priya Saji Koliyakodu et al. and Krishnarajan et al., which also indicated a female predominance in ADRs. Conversely, studies by Ramasubbu et al. and Julie Birdie Wahlang presented contrasting results, showing a male preponderance. The findings of this study indicate that the majority of adverse drug reactions (ADRs) were observed among individuals within the 41-50-year age group, with a notable prevalence in the 51-60-year age cohort. Out of the 126 patients included in the analysis, 30%, representing 38 individuals, belonged to the 51-60-year age group. This pattern is consistent with data reported in prior investigations by Rout A and Prasad A. Furthermore, the age group of 61-70 years accounted for 21% of reported ADR cases, underscoring the elevated occurrence in older populations, particularly those aged 41-50 years and above. contributed to 17%. While some studies have highlighted the 41-50 years age group as being more prone to ADRs, findings remain mixed across different research contexts.

In our study, the platinum coordination complex emerged as the most common class of anti-cancer drugs responsible for adverse drug reactions (ADRs), with carboplatin being the most frequently used, followed by cisplatin. This aligns with findings from

Guduru H et al., where carboplatin and paclitaxel were identified as the most commonly implicated drugs. Additionally, several studies, including those conducted by Ramasubbu and colleagues, indicate cisplatin as the predominant drug linked to ADRs. Beyond the platinum group, targeted therapy drugs ranked as the second most common class causing ADRs, accounting for 15% of cases observed in our study.

6.CONCLUSION AND RECOMMENDATIO

In summary, addressing the side effects of chemotherapy is an essential component of cancer care. Being informed about potential challenges, maintaining open communication with your healthcare team, and utilizing both medical and supportive strategies can significantly enhance your ability to manage treatment more effectively. Keep in mind that everyone's journey is different, so it is crucial to personalize side effect management approach to suit your individual needs

1.For managing symptoms at home, Iheme suggests adopting some practical strategies: **a.**Maintain proper hydration by consuming 1 to 2 liters of water daily.

b.Keep frequently used items, such as the phone, within easy reach to minimize unnecessary movement around the house, which can help reduce fatigue.

c. Create a daily task list and utilize the smartphone or set alarms to remind you of essential activities, especially if dealing with chemobrain.

e.Establish a consistent sleep schedule by going to bed and waking up at the same time each day, helping your body adapt to a stable routine.

2. Psychological Support: Elderly individuals undergoing chemotherapy or radiotherapy often face symptoms that cannot be directly attributed to their treatment but are linked to geriatric syndromes arising from a complex interplay of functional and health-related factors. Issues such as incontinence, cognitive decline, reduced mobility, fatigue, decreased nutritional intake, polypharmacy, mood disturbances, and sleep disorders increase their vulnerability to post-treatment complications, elevating the risk of new or worsened functional impairments. The multifaceted nature of these geriatric syndromes significantly exacerbates the patient's distress.

3. Cancer treatments often lead to significant side effects that can negatively impact both nutritional status and overall quality of life. Recognizing the seriousness of this issue, this review aims to outline some strategies for managing side effects that can be integrated into the care protocols provided by healthcare professionals. While certain approaches have shown promise in human studies, they should not be independently implemented by cancer patients without proper guidance. Continuous monitoring by a multidisciplinary medical team is essential during treatment. Moreover, fostering trust in healthcare providers is vital to encourage the safe incorporation of complementary care methods alongside conventional supportive therapies.

4. Social Support: The relationship between the quality of social support and overall quality of life for cancer patients has gained significant attention, similar to its role in other challenging life situations. Noteworthy is the pronounced connection between

empowerment and improved quality of life among individuals receiving higher levels of support. How someone interprets their interactions within a supportive framework plays a crucial role in determining both their psychosocial and physical well-being during recovery and survivorship. It is essential to give patients the opportunity to articulate their personal understanding of social support and identify what matters most to them during this difficult period. By enabling patients to convey their specific social support needs, healthcare providers can develop tailored interventions for both individual and peer support while also identifying gaps in services that need addressing.

5. Balanced diet: To promote improved management and minimize the severity and extent of adverse effects, various strategies are employed to preserve the integrity of body systems and reduce the impact of these challenges. These approaches are complementary and integrative to conventional cancer therapies, often leading to favorable outcomes. Preventive measures play a crucial role in minimizing the impact of side effects that may impair systems such as the nervous, musculoskeletal, and gastrointestinal systems. Specific dietary adjustments also contribute significantly. A comprehensive balanced diet is particularly essential in providing the necessary energy for the body while mitigating negative effects associated with treatments like chemotherapy and radiation therapy.

REFERENCES:

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: A Cancer Journal For Clinicians. 2021; May; 71(3): 209-49.

2. Arunachalam SS, Shetty AP, Panniyadi N, Meena C, Kumari J, Rani B, Das P, Kumari S. Study on knowledge of chemotherapy's adverse effects and their self-care ability to manage-The cancer survivors impact. Clinical Epidemiology and Global Health. 2021; Jul 1; 11: 100765.

3. Al-Hussaniy HA, Mohammed ZN, Alburghaif AH, Naji MA. Panax ginseng is an antioxidant and anti-inflammatory that reduces the cardiotoxicity of Doxorubicin in the rat module. Research Journal of Pharmacy and Technology. 2022; 15(10): 4594-600.

4. Ansori AN, Fadholly A, Hayaza S, Susilo RJ, Inayatillah B, Winarni D, Husen SA. A review on medicinal properties of mangosteen (Garcinia mangostana L.). Research Journal of Pharmacy and Technology. 2020;13(2):974-82.

5. Yadav AR, Mohite SK. Carbon nanotubes as an effective solution for cancer therapy. Research Journal of Pharmaceutical Dosage Forms and Technology. 2020; 12(4): 301-

6. Sharma V, Vijay J, Ganesh MR, Sundaramurthy A. Multilayer capsules encapsulating nimbin and doxorubicin for cancer chemo-photothermal therapy. International Journal of Pharmaceutics. 2020; 582: 119350.

7. Al-hussaniy HA, AL-Biati HA. The Role of Leptin Hormone, Neuropeptide Y, Ghrelin and Leptin/Ghrelin ratio in Obesogenesis. Medical and Pharmaceutical Journal. 2022; Dec 2; 1(2): 52-63.

8. Al-Hussaniy HA, Alburghaif AH, AL-Zobaidy MA, Alkuraishy HM, Mostafa-Hedeab G, Azam F, Al-Samydai AM, Al-tameemi ZS, Naji MA. Chemotherapy-induced cardiotoxicity: a new perspective on the role of Digoxin, ATG7 activators, Resveratrol, and herbal drugs. Journal of medicine and life. 2023; 16(4): 491.

9. Al-Kuraishy HM, Al-Hussaniy HA, Al-Gareeb AI, Negm WA, El-Kadem AH, Batiha GE, N. Welson N, Mostafa-Hedeab G, Qasem AH, Conte-Junior CA. Combination of Panax ginseng CA Mey and febuxostat boasted cardioprotective effects against doxorubicin-induced acute cardiotoxicity in rats. Frontiers in Pharmacology. 2022; 13: 905828.

10. AL-Hussaniy HA, AL-Tameemi ZS, AL-Zubaidi BA, Oraibi AI, Naji FA, Kilani S. Pharmacological properties of Spirulina