Survey Based Study on Exposure to Everyday Carcinogens and Evaluation of Pharmacist Led Awareness Programs

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***Abstract*—Cancer remains one of the leading causes of morbidity and mortality worldwide, with increasing evidence suggesting that continuous exposure to everyday carcinogens significantly contributes to its rising incidence. This survey-based study aims to assess the level of exposure to common carcinogens in daily life and to evaluate the effectiveness of pharmacist-led awareness programs in improving public knowledge and preventive practices. The study was conducted using a structured questionnaire distributed among participants from different demographic backgrounds. The survey included questions related to dietary habits, lifestyle factors, environmental exposure, use of personal care products, and awareness regarding carcinogenic risks.**

The results indicated that a significant proportion of participants were unknowingly exposed to carcinogens such as tobacco smoke, processed foods, air pollutants, and chemical-based household products. Additionally, a lack of adequate awareness regarding these risks was observed among the majority of respondents. Pharmacist-led educational interventions, including counselling and awareness sessions, showed a positive impact in enhancing knowledge and promoting safer practices among participants.

The study highlights the critical role of pharmacists as accessible healthcare professionals in spreading awareness and encouraging behavioural changes to reduce carcinogen exposure. It also emphasizes the need for continuous public health education programs to minimize cancer risk factors in everyday life.

***Index Terms*—Carcinogens, Cancer awareness, Pharmacist intervention, Environmental exposure, Public health, Survey study.**

Aim:

To assess exposure to everyday carcinogens and evaluate the effectiveness of pharmacist-led awareness programs in improving public knowledge and preventive practices.

I. INTRODUCTION

1. Overview of Cancer

Cancer is a group of diseases characterized by uncontrolled cell proliferation, invasion of surrounding tissues, and metastasis to distant organs. It is one of the leading causes of death globally and represents a major public health burden[1]. The global incidence of cancer continues to rise due to population growth, aging, and increased exposure to environmental and lifestyle-related risk factors[23]. A significant proportion of cancers are preventable, as they are strongly associated with modifiable exposures such as diet, tobacco use, alcohol consumption, and environmental pollutants[40].

1.1 Concept and Definition of Carcinogens

Carcinogens are defined as substances, agents, or exposures capable of causing cancer by inducing genetic mutations or altering cellular metabolic processes[6]. These agents may act directly by damaging DNA or indirectly by generating oxidative stress, chronic inflammation, and hormonal imbalance[7]. International classification systems categorize carcinogens based on the strength of evidence for their carcinogenicity, highlighting that many commonly encountered substances fall under confirmed or probable carcinogens[8].

2. Classification of Carcinogens

Carcinogens can be broadly classified into chemical, physical, and biological categories.

2.1 Chemical Carcinogens

Chemical carcinogens include tobacco smoke, alcohol, industrial chemicals, pesticides, and food additives9,10. These substances are widely present in daily life, making continuous exposure unavoidable.

2.2 Physical Carcinogens

Physical carcinogens include ultraviolet radiation and ionizing radiation, which can directly damage DNA and initiate cancer development[11].

2.3 Biological Carcinogens

Biological agents such as viruses and bacteria contribute to cancer development through chronic infection and inflammation[12].

3. Mechanism of Carcinogenesis

Carcinogenesis is a multistep process involving initiation, promotion, and progression[13]. During initiation, genetic mutations occur due to exposure to carcinogens. Promotion involves the proliferation of mutated cells, while progression leads to malignant transformation and metastasis[4,5].At the molecular level, cancer development involves several biological alterations, including sustained proliferative signalling, resistance to apoptosis, angiogenesis, and genomic instability[14]. Carcinogens contribute to these processes through DNA damage, oxidative stress, and disruption of cellular signalling pathways[15].

4. Exposure to Everyday Carcinogens

Exposure to carcinogens occurs through multiple routes, including inhalation, ingestion, and dermal contact[16]. In modern society, individuals are continuously exposed to carcinogens through various everyday sources[39].

4.1 Dietary Exposure

Dietary habits significantly influence carcinogen exposure. Consumption of processed foods, preserved meats, and high-fat diets introduces harmful compounds such as nitrates, nitrites, and heterocyclic amines[17]. These compounds are associated with increased risk of gastrointestinal and colorectal cancers.

4.2 Environmental Exposure

Environmental pollution is a major source of carcinogen exposure. Air pollutants, including particulate matter and industrial emissions, are strongly linked to respiratory cancers[18,19].Water contamination with heavy metals and chemicals further contributes to cancer risk[38].

4.3 Lifestyle-related Exposure

Lifestyle factors such as smoking and alcohol consumption are major contributors to carcinogen exposure[20,21]. Tobacco smoke contains numerous carcinogenic compounds that directly damage DNA, while alcohol promotes oxidative stress and impairs cellular repair mechanisms[2,3].

4.4 Household and Occupational Exposure

Daily-use products such as cosmetics, plastics, and cleaning agents contain chemicals that may act as carcinogens[22]. Occupational exposure to hazardous substances further increases risk, especially in industrial settings[23].

5. Burden of Everyday Carcinogen Exposure

The increasing prevalence of cancer is closely associated with rising exposure to carcinogens in daily life[24]. Urbanization, industrialization, and changes in lifestyle have significantly increased exposure levels[25]. Unlike occupational exposure, everyday exposure is often unrecognized and unregulated, making it a hidden but significant risk factor.

6. Role of Lifestyle and Behavioural Factors

Lifestyle and behavioural factors play a crucial role in determining cancer risk. Unhealthy diet, physical inactivity, obesity, smoking, and alcohol consumption are major contributors to cancerburden[26]. These factors not only increase exposure to carcinogens but also enhance susceptibility to their harmful effects.

7. Lack of Awareness Regarding Carcinogens

Despite widespread exposure, awareness regarding carcinogens and their sources remains limited[27,28]. Many individuals are unaware of the risks associated with daily habits and environmental exposures. This lack of awareness leads to continued exposure to preventable risk factors and increased disease burden[29].

8. Role of Pharmacist-led Awareness Programs

Pharmacists play an essential role in public health education due to their accessibility and frequent interaction with the community[30,31]. They can provide information on lifestyle modification, safe product use, and risk reduction strategies.Pharmacist-led awareness programs have been shown to significantly improve knowledge and promote preventive behaviors[31,32]. These interventions are cost-effective and can reach a large population, making them an important tool in cancer prevention.

9. Need for the Present Study

Although the association between carcinogen exposure and cancer is well established, there is limited data on everyday exposure patterns and public awareness levels[33,34]. Furthermore, the effectiveness of pharmacist-led awareness programs in reducing exposure remains underexplored[35].Exposure to everyday carcinogens is a significant but often overlooked contributor to cancer risk. Increasing awareness and promoting preventive practices are essential to reduce this burden[36]. Pharmacists, as accessible healthcare professionals, have a vital role in educating the public and encouraging behavioural changes. Therefore, this study aims to assess exposure levels and evaluate the effectiveness of pharmacist-led awareness programs[37].

II. BACKGROUND OF STUDY

Cancer has emerged as one of the most significant public health challenges worldwide, contributing substantially to morbidity and mortality. Over the past few decades, there has been a noticeable rise in cancer incidence across both developed and developing countries. This increase is attributed not only to genetic predisposition but also to environmental, occupational, and lifestyle-related factors. Among these, exposure to carcinogens in everyday life plays a crucial and often underestimated role in the development of cancer.

1. Increasing Burden of Cancer Globally

Globally, cancer incidence has been increasing at an alarming rate due to rapid urbanization, industrialization, population growth, and aging. Changes in lifestyle patterns, including unhealthy dietary habits, physical inactivity, tobacco use, and alcohol consumption, have further contributed to this rising trend. In developing countries like India, the burden of cancer is particularly concerning due to limited healthcare resources, late diagnosis, and lack of awareness.

Epidemiological studies indicate that a significant proportion of cancers are preventable if risk factors are identified and controlled early. However, the growing exposure to carcinogens in the environment has made prevention more challenging. The shift from traditional lifestyles to modern, convenience-based living has increased dependence on processed foods, packaged products, and chemical-based household items, all of which may contain carcinogenic substances.

2. Everyday Exposure to Carcinogens

One of the major concerns in modern society is the continuous exposure to low levels of carcinogens in daily life. Unlike occupational exposure, which is often regulated, everyday exposure occurs unknowingly and affects a larger population.

2.1 Sources of Everyday Carcinogen Exposure

a) Dietary Sources:

Consumption of processed and preserved foods has increased significantly. These foods often contain additives such as nitrates, nitrites, artificial colorants, and preservatives, which have been linked to cancer risk. Additionally, high intake of fried and charred foods can produce harmful compounds.

b) Environmental Sources:

Air pollution is a major contributor to carcinogen exposure, especially in urban areas.

Pollutants such as particulate matter, carbon monoxide, and industrial emissions are associated with respiratory and lung cancers. Contaminated water sources containing heavy metals and chemicals also pose a risk.

c) Lifestyle Factors:

Tobacco smoking and alcohol consumption remain the leading causes of preventable cancers. Passive smoking further increases exposure among non-smokers. Sedentary lifestyles and obesity also contribute indirectly to cancer risk.

d) Household and Personal Care Products:

Daily-use products such as cleaning agents, cosmetics, plastics, and pesticides contain chemical substances that may act as carcinogens. Prolonged and repeated exposure, even in small amounts, can have cumulative effects.

2.2 Routes of Exposure

Carcinogens enter the human body through:

• Inhalation (air pollutants, smoke)
• Ingestion (food and water contaminants)
• Dermal contact (cosmetics, chemicals)

Chronic exposure through these routes increases the likelihood of DNA damage and cancer development over time.

3. Lack of Awareness Among the General Population

Despite the widespread presence of carcinogens, awareness regarding their sources and harmful effects remains inadequate among the general population. Many individuals are unaware that their daily habits and environmental exposures may increase their cancer risk.

3.1 Knowledge Gaps

• Limited understanding of carcinogens present in food and consumer products
• Lack of awareness about the long-term effects of low-dose exposure
• Misconceptions regarding “safe” lifestyle practices

3.2 Behavioural Factors

Even when some awareness exists, it does not always translate into behaviour change due to:

• Habitual lifestyle patterns
• Lack of access to reliable health information
• Influence of marketing and social trends

3.3 Impact of Low Awareness

Low awareness leads to:

• Continued exposure to preventable risk factors
• Delay in adopting preventive measures

4. Role of Pharmacists in Public Health Awareness

Pharmacists are uniquely positioned within the healthcare system to provide accessible and reliable health information. As frontline healthcare professionals, they interact regularly with the community and can play a vital role in educating the public about carcinogen exposure and prevention strategies.

4.1 Pharmacist-led Awareness Programs

These programs may include:

• Patient counselling on lifestyle modifications
• Distribution of informational materials
• Community awareness campaigns

4.2 Importance of Pharmacist Intervention

• Easily accessible to the general population
• Ability to influence behaviour change
• Bridging the gap between healthcare system and community

5. Need for the Present Study

Although carcinogen exposure is a well-recognized risk factor, there is limited data regarding:

• The extent of everyday exposure among the general population
• Awareness levels related to carcinogens
• Effectiveness of pharmacist-led educational interventions

This study is therefore designed to:

• Evaluate exposure patterns to everyday carcinogens
• Assess awareness levels among individuals

6. Significance of the Study

Understanding public exposure and awareness is essential for developing effective prevention strategies. By identifying knowledge gaps and behavioural patterns, targeted interventions can be designed to reduce carcinogen exposure. Furthermore, this study highlights the expanding role of pharmacists in preventive healthcare and emphasizes their contribution in reducing the burden of cancer.

III. RESULT AND DISCUSSION

Survey Analysis

Table 1: Demographic Distribution

Category	Number(n=100)	Percentage(%)
Male	58	58%
Female	42	42%

Age Group	Number	Percentage(%)
18-30 years	35	35%
31-50 years	40	40%
Above 50	25	25%

Table 2: Awareness of Carcinogens

Response	Number	Percentage(%)
Aware	38	38%
Not Aware	62	62%

Inference: Majority of participants lack of awareness

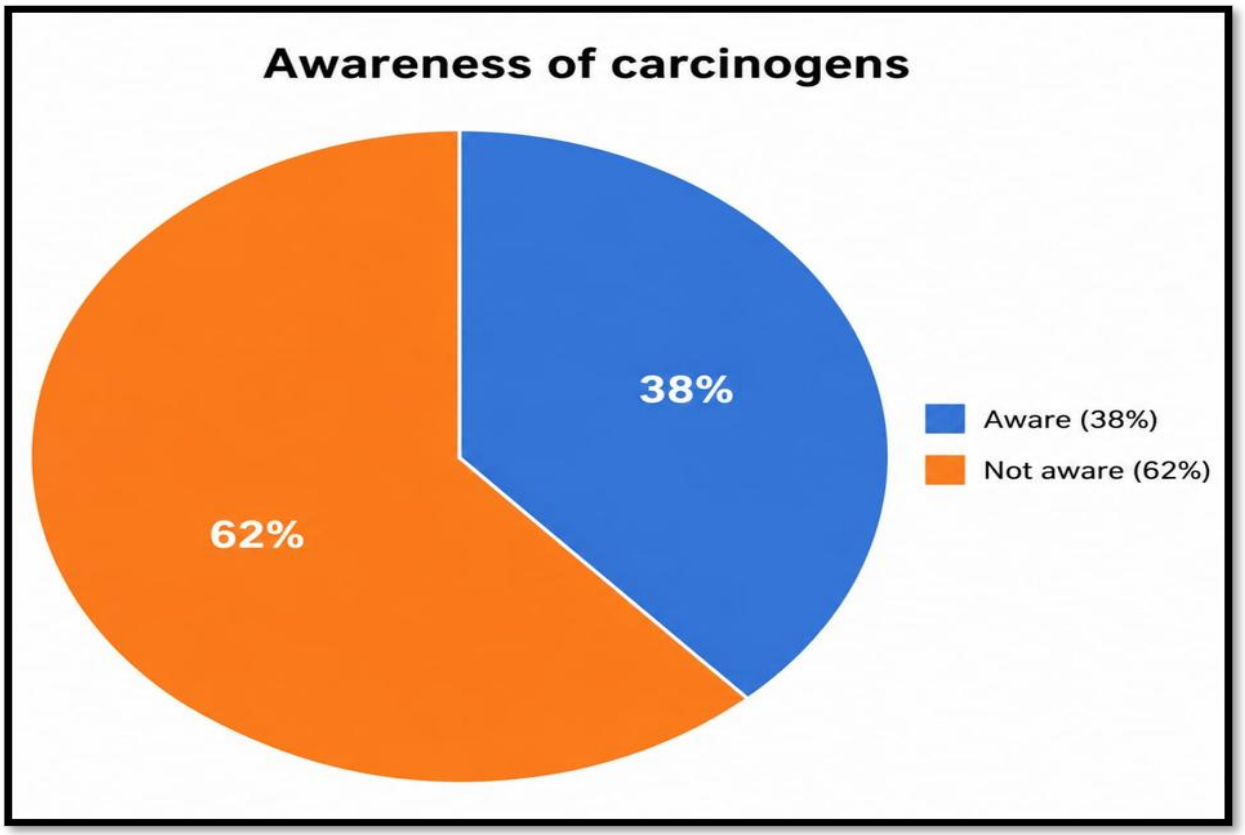

Fig.1.Pie Chart of Awareness of Carcinogens

Table 3: Exposure to common carcinogens

Source of Exposure	Yes	No
Tobacco use	45	55
Alcohol consumption	32	68
Junk/processed food	70	30
Air pollution exposure	80	20
Reused cooking oil	60	40

Inference: High exposure to pollution and unhealthy diet

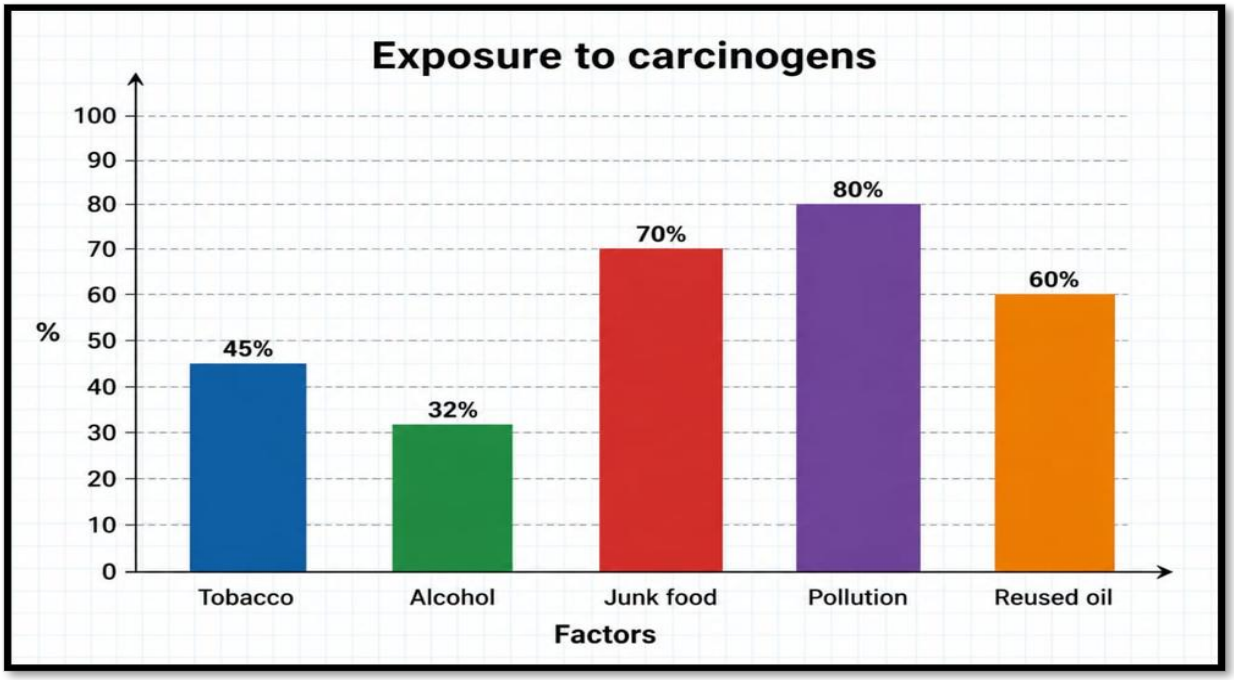

Fig.2.Exposure to Carcinogens

Table 4: Knowledge About Reused Cooking Oil

Response	Number	Percentage
Aware of risk	28	28%
Not aware	72	72%

Inference: Very low awareness

Table 5: Awareness after Pharmacist Program

Response	Number	Percentage
Improved awareness	85	85%
No change	15	15%

Inference: Pharmacist intervention is very effective

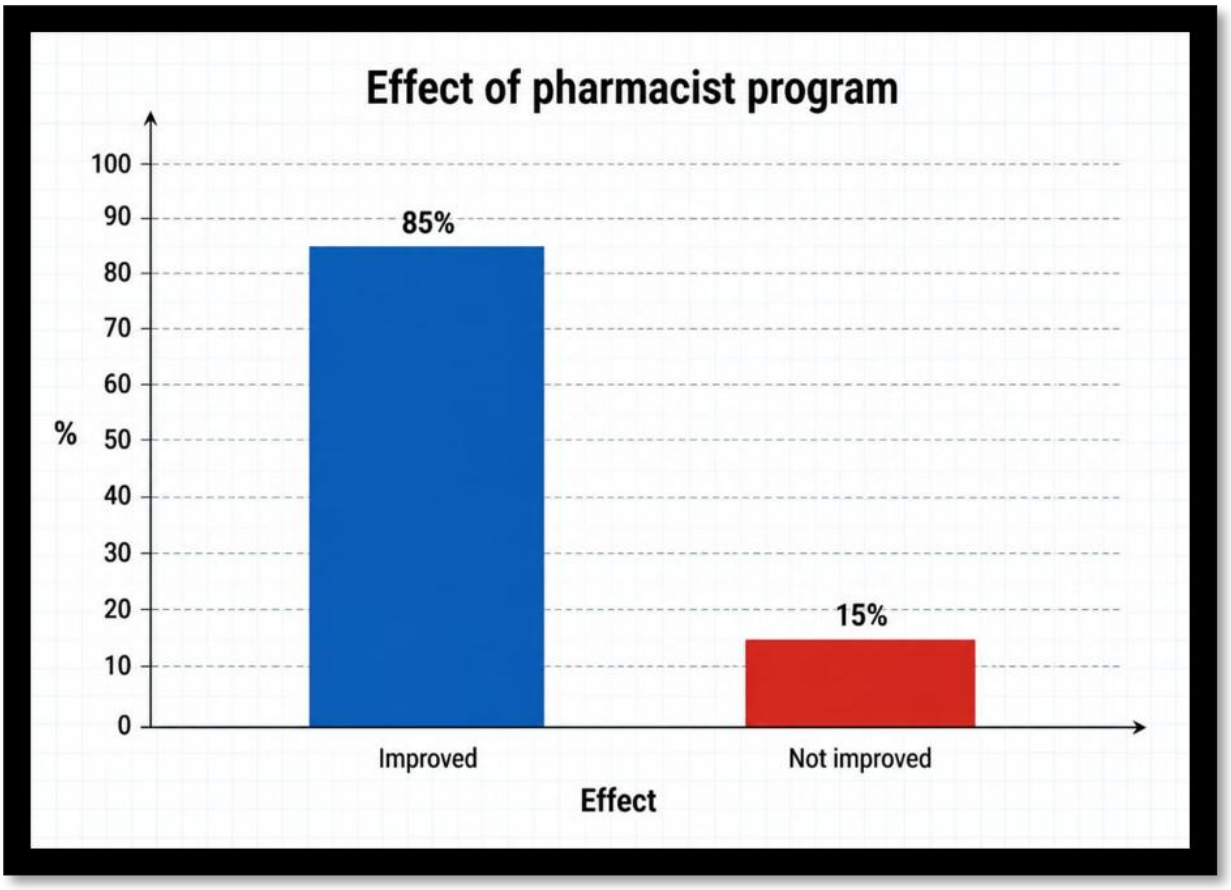

Fig.4.Effect of pharmacist program

IV. DISCUSSION

The present survey-based study was conducted to assess exposure to everyday carcinogens and evaluate the impact of pharmacist-led awareness programs among the village population. The findings indicate that awareness regarding carcinogens is considerably low, with only 38% of participants reporting prior knowledge, while 62% were unaware. This lack of awareness is consistent with earlier studies, which highlight inadequate knowledge about cancer risk factors in the general population, particularly in rural areas.

The study revealed significant exposure to various carcinogens in daily life. A high proportion of participants reported exposure to air pollution (80%) and consumption of junk or processed food (70%). Additionally, 60% of participants reported the use of reused cooking oil, which is a concerning practice due to the formation of toxic compounds during repeated heating. Tobacco use (45%) and alcohol consumption (32%) were also notable, indicating the presence of major lifestyle-related risk factors.

One of the key findings of the study was the very low awareness regarding the harmful effects of reused cooking oil, with only 28% of participants being aware. This suggests that certain

carcinogenic exposures are not widely recognized by the public, even though they are common in daily life. Such gaps in knowledge highlight the need for targeted educational interventions.

The pharmacist-led awareness program showed a significant positive impact, with 85% of participants reporting improved awareness after the intervention. This demonstrates the effectiveness of pharmacists as accessible healthcare professionals in delivering health education and promoting preventive practices. The use of pamphlets, banners, and direct interaction contributed to better understanding among participants.

Overall, the findings emphasize that everyday exposure to carcinogens is high, while awareness remains low. However, structured awareness programs can significantly improve knowledge and encourage healthier behaviours, thereby reducing cancer risk.

V. CONCLUSION

The present study concludes that exposure to everyday carcinogens such as air pollution, processed food, tobacco, alcohol, and reused cooking oil is highly prevalent among the rural population. Despite this high exposure, awareness regarding carcinogens and their health risks is inadequate.

The study also demonstrates that pharmacist-led awareness programs are highly effective in improving knowledge and promoting preventive practices. Educational interventions using simple communication methods can significantly enhance public awareness and reduce exposure to harmful agents.

Therefore, it is recommended that regular awareness programs be conducted at the community level, with active involvement of pharmacists and other healthcare professionals. Increasing public awareness about everyday carcinogens can play a crucial role in cancer prevention and improving overall public health.

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