

## EXPLORING AND COMPARING THE KNOWLEDGE, ATTITUDE, AND PRACTICE OF 2ND YEAR MBBS STUDENTS REGARDING PESTICIDES, FOOD ADULTERANTS, POLLUTANTS, AND INSECT REPELLENTS IN A TERTIARY CARE TEACHING HOSPITAL

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### ABSTRACT

Exposure to pesticides, food adulterants, environmental pollutants, and insect repellents represents a significant public health concern, particularly in developing countries. As future healthcare providers, medical students must be well-informed about these hazards to promote safe practices and community awareness. This study aimed to assess and compare the knowledge, attitude, and practices (KAP) of second-year MBBS students before and after an educational intervention at a tertiary care teaching hospital. A questionnaire-based cross-sectional study was conducted among 250 students at GSVM Medical College, Kanpur, using a pre-test and post-test design. A total of 85 students participated in the pre-test and 81 in the post-test. The structured questionnaire included 14 items evaluating KAP domains, and responses were analyzed using percentage comparisons. Following the intervention, there was a marked improvement in knowledge across multiple areas,

including pesticide mechanisms (18.52% to 74.07%), adulterants in pulses (32.10% to 76.54%), mosquito-repellent components (41.98% to 92.59%), and lathyrism awareness (50.62% to 93.83%). Awareness of environmental pollutants also increased significantly (83.95% to 96.30%). Attitudes toward spreading awareness were already high and showed slight improvement. Overall, the findings demonstrate that structured educational

interventions effectively enhance knowledge, attitude, and practices among medical students, thereby strengthening their role in public health education and advocacy.

**KEYWORDS:** Pesticides, Food Adulteration, Environmental Pollutants, Insect Repellents.

## INTRODUCTION

Pesticides are natural or synthetic compounds that are applied to prevent, control, and eliminate insects, weeds, and pests that affect the growth of plants.<sup>[1]</sup> Pesticides are classified into Insecticides, Fungicides, Herbicides, Rodenticides. Fruits, vegetables, processed foods, water, air, and soil can all contain pesticide residues. Since the mid-1940s, global pesticide demand has risen sharply and steadily, owing primarily to commercial farming.<sup>[2]</sup> Excessive and uncontrolled pesticide use resulted in food contamination as well as environmental, agricultural, and aquatic pollution.<sup>[3]</sup> Ingestion, inhalation, and skin or dermal absorption are the three main ways that pesticides can enter a person's body.<sup>[4]</sup>

Acute and chronic health effects from agricultural pesticides and dietary exposure are serious public health concerns, especially in developing countries. For human health, chemical pesticides can be carcinogenic, cytotoxic, and mutagenic.<sup>[5]</sup> In the field of public health, pesticides are employed to control disease-carrying insects like ticks, mosquitoes, and fleas, helping to avert the spread of diseases such as dengue fever, malaria, and Lyme disease.<sup>[6]</sup> Harmful effects of Pesticides on the health can be immediate or long-term. Immediate effects include allergic reactions, headaches, dizziness, nausea, vomiting, excessive saliva, and sneezing.<sup>[7]</sup> In the long term, pesticides have been linked to more serious health problems. Some pesticides have been found to have cancer-causing properties (carcinogenic). Others can disrupt the body's hormone system (endocrine-disrupting).

As future healthcare professionals, medical students must possess adequate knowledge regarding the health hazards related to occupational and environmental exposure to pesticides, food adulterants, pollutants, and insect repellents to ensure effective patient care. In addition, they can contribute significantly to public awareness by educating their patients, families, and communities about these risks.

Therefore, this study aims to evaluate the knowledge, attitudes, and practices of second-year MBBS students concerning occupational and environmental pesticides, food adulterants, pollutants, and insect repellents in a tertiary care teaching hospital.

### **Types of Pesticides**

**Insecticides:** Includes Carbamates(Carbaryl), Organochlorine(Endosulfan), Organophosphorus (Monocrotophos), Pyrethroids (permethrin) etc.

**Fungicides:** Includes aliphatic nitrogen fungicides (dodine), amide fungicides (carpropamid), aromatic fungicides (chlorothalonil), dicarboximide fungicides (famoxadone), dinitrophenol fungicides (dinocap), and others.

**Herbicides:** Include phenoxy acetic herbicides (2, 4-D), quaternary ammonium herbicides (Paraquat), chlorotriazine herbicides (atrazine), sulfonyleurea herbicides (chlorimuron), etc.

**Rodenticides:** Inorganic rodenticides (Zinc phosphide, Aluminium Phosphide) or organic coumarin rodenticides (bromadiolone, coumatetralyl).

### **Food Adulteration**

Food adulteration is intentionally lowering food quality to make more money.<sup>[8,9]</sup> It's food fraud where people purposely compromise food for profit.<sup>[10-12]</sup> Food adulteration is possible in several ways. The first method is adding chalk or lead to powdered milk or turmeric. Honey blended with sugar syrup is an example of blending substandard and superior quality. The third is adding unlawful preservatives and colouring dyes, such colouring wine or spices, and the fourth is substituting milk fat with vegetable fat. For artificially ripening fruits and vegetables, Ethylene, ethanol, methanol, propylene, ethylene glycol, and calcium carbide are commonly used.<sup>[13-19]</sup> Food adulteration renders our common food dangerous and dirty due to mishandling. Adulterated food can cause cancer, diarrhoea, asthma, and ulcers etc.

### **Pollutants**

Pollutants are solid, liquid, or gaseous substances that occur in concentrations higher than normal and degrade environmental quality, thereby adversely affecting living organisms. The sources of pollutants can be broadly categorized as major sources, including emission from power plants, oil refineries, petrochemical units, and the chemical and fertilizer industries. indoor sources, such as domestic cleaning processes, dry-cleaning facilities, printing units, and petrol stations. Mobile sources, which comprise automobiles, trains, aircraft, and other forms of transportation. Natural sources, arising from events like forest fires, volcanic activity, dust storms, agricultural burning, and other natural disasters.

Clean air is essential for human health, but rapid economic growth has led to severe air pollution, mainly from energy consumption. Air pollution has caused millions of premature deaths, large disease burdens, and huge economic losses.<sup>[20]</sup> Pollutants and greenhouse gases also contribute to climate change, worsening air quality and health risks including respiratory, cardiovascular, mental and prenatal issues leading to higher morbidity and mortality in adulthood. Water pollution occurs when harmful substances enter water bodies, degrading water quality and posing serious risks to human health and the environment. Safe drinking water is essential, yet a large proportion of global diseases are water-borne due to contaminated water. Major sources of water pollution include domestic sewage, industrial effluents, population growth, pesticides, and improper waste disposal. Untreated sewage and industrial waste introduce toxic chemicals and pathogens into rivers, reducing aquatic life and threatening water security worldwide.<sup>[21]</sup>

### **Insect Repellents**

Across the world, particularly in regions where vector-borne diseases are common, the use of prophylactic insect repellents can help prevent disease transmission and also reduce the severity of allergic reactions caused by insect bites.<sup>[22-23]</sup> **Cassia mimosoides** extracts possess strong larvicidal and mosquito-repellent activity against *Anopheles gambiae*, with petroleum ether extract showing the highest efficacy and causing 100% larval mortality. Phytochemical analysis identified bioactive compounds such as flavonoids, tannins, and saponins. Formulated creams containing 2–6% extract provided complete mosquito repellency, highlighting the plant's potential as an eco-friendly vector control agent.<sup>[24]</sup>

### **MATERIALS AND METHOD**

A questionnaire-based cross-sectional study was conducted among 250 second-year MBBS students in GSVM Medical College, Kanpur, UP. A pre-test was conducted before taking the lecture about topic and the post-test was conducted after teaching and making the students aware of food adulterants, pesticides, and insect repellents. The pre-test identified the students' baseline understanding, attitude, and behavior with regard to pesticides used in the workplace and environment, as well as food adulterants, pollutants, and insect repellents. The questionnaires were made available to the students through a Google form link sent to the WhatsApp group. The questionnaire consisted of 14 questions in total divided into three parts of knowledge, attitude, and practice sections.

20 minutes of time was given to submit their responses. We collected all of the responses in the Google sheet and analyzed them accordingly.

## RESULTS

Demographic details of the students are shown in the table below. Out of a total of 250 students, 85 participated in the pre-test and 81 students participated in post-test.

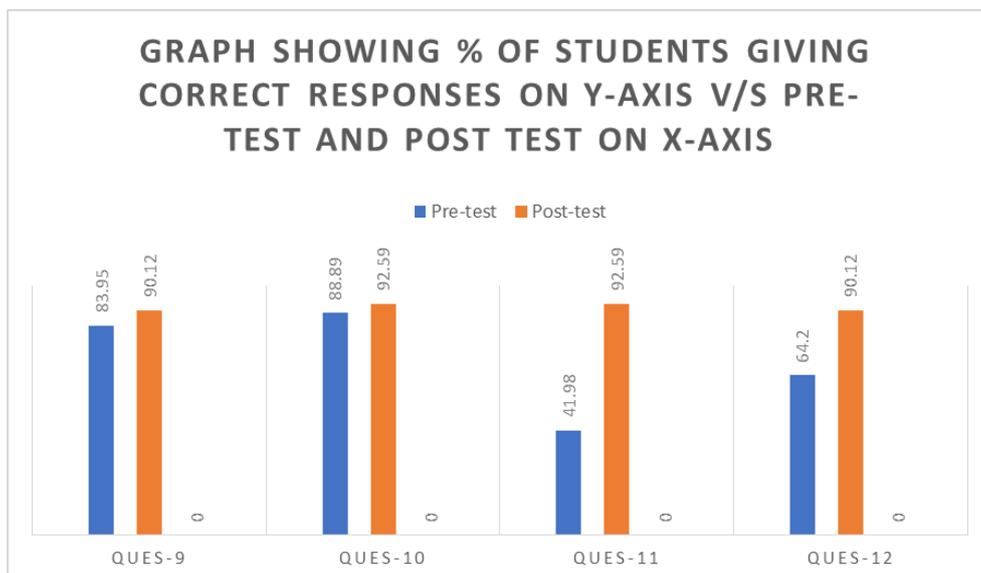
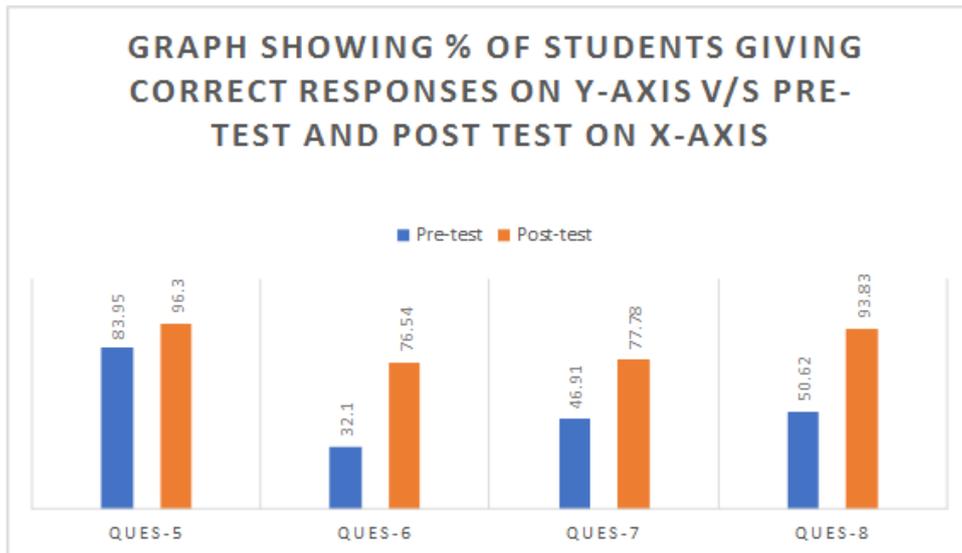
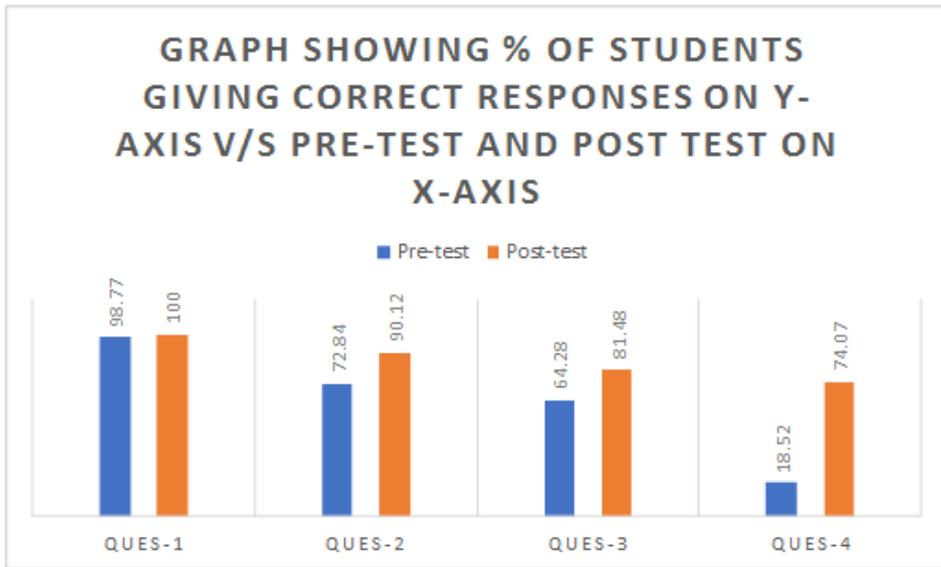
**Table1: Demographic details of the participants.**

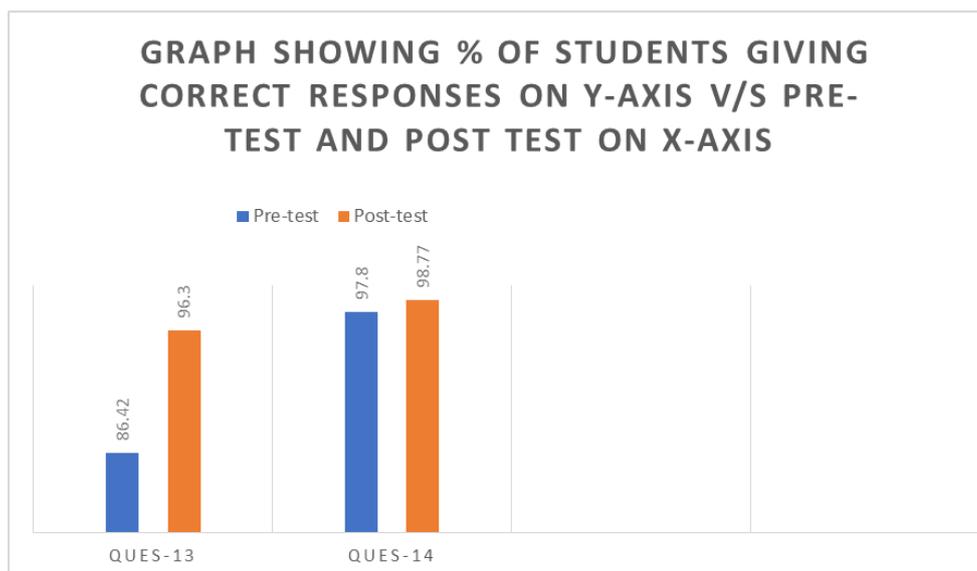
Variable	Characteristics	Pre-test (n=85)	Post-test (n=81)
Gender	Male	47(58.0%)	47(58.0%)
	Female	34(41.9%)	34(41.9%)

### Comparison of Pre- and Post-Lecture Responses

Questions	Pre-Lecture(%)	Post-Lecture(%)
1. Are you aware of the term pesticides?	98.77	100
2. If yes, name the source of knowledge.	72.84	90.12
3. Do you think food adulterants are good for health?	64.28	81.48
4. Mechanism of action of Insecticides	18.52	74.07
5. Commonly known environmental pollutants	83.95	96.30
6. Adulterant used in pulses	32.10	76.54
7. Frequency of spraying pesticide	46.91	77.78
8. Lathyrism is known to be caused by which among the following?	50.62	93.83
9. Personal Hygiene must after the use of Pesticides includes?	83.95	90.12
10. Pesticides enter into the human body through.	88.89	92.59
11. Mosquito-repelling coils contain	41.98	92.59
12. Pesticides are the chemicals that are used to kill	64.20	90.12
13. Possible reason for using adulterants?	86.42	96.30
14. Once in practice, one should be able to spread awareness regarding the proper knowledge of different types of food adulterants.	97.8	98.77

The table below summarizes the key findings from the pre- and post-lecture assessments conducted on the students.





The pre-lecture and post-lecture assessment revealed an overall improvement in knowledge across most of the questions related to pesticides, food adulterants, and environmental pollutants. Awareness of the term pesticides was already high in the pre-lecture test (98.77%) and reached 100% in the post-lecture test. Knowledge regarding the source of information about pesticides increased from 72.84% to 90.12%. Understanding of whether food adulterants are good for health showed a modest rise from 64.28% to 81.48%. Knowledge about the mechanism of action of insecticides significantly increased from 18.52% to 74.07%, while awareness of commonly known environmental pollutants increased from 83.95% to 96.30%. Awareness regarding adulterants used in pulses rose from 32.10% to 76.54%, and knowledge about the frequency of pesticide spraying increased from 46.91% to 77.78%. Correct identification of lathyrism showed an increase from 50.62% to 93.83%. Awareness about personal hygiene practices after pesticide use increased slightly from 83.95% to 90.12%, and knowledge about routes of pesticide entry into the human body improved from 88.89% to 92.59%. Understanding of the contents of mosquito-repelling coils increased from 41.98% to 92.59%, while knowledge regarding the purpose of pesticides (chemicals used to kill pests) improved from 64.20% to 90.12%. Awareness of the possible reasons for using adulterants increased from 86.42% to 96.30%. However, willingness to spread awareness regarding proper knowledge of food adulterants once in practice showed improvement from 97.8% in the pre-lecture test to 98.77% in the post-lecture test. Overall, the findings indicate a positive impact of the lecture on participants' knowledge, with improvement observed in nearly all assessed domains.

## DISCUSSION

The present study demonstrated a substantial improvement in knowledge, attitudes, and practices related to pesticides, food adulterants, environmental pollutants, and insect repellents following an educational intervention. When compared with the study conducted by Kushwaha *et al.*, several similarities as well as notable differences emerge, highlighting the relative effectiveness of the intervention used in the present study.

### Knowledge regarding lathyrism

In the present study, awareness about the cause of lathyrism showed a marked improvement, increasing from 50.62% in the pre-lecture phase to 93.83% post-lecture. In contrast, Kushwaha *et al.* reported a much lower baseline knowledge (32.9% pre-test) with only a modest rise to 40.9% post-test. This comparison suggests that the educational intervention in the present study was considerably more effective in addressing this specific knowledge gap.

### Personal hygiene after pesticide use

Both studies showed relatively high baseline awareness regarding personal hygiene measures after pesticide use. However, the present study reported an increase from 83.95% to 90.12%, whereas Kushwaha *et al.* observed a smaller change (87% to 91%). While both interventions reinforced correct practices, the magnitude of improvement was slightly higher in the present study.

### Entry of pesticides into the human body

Knowledge about routes of pesticide entry was already high in both studies. The present study showed an increase from 88.89% to 92.59%, while Kushwaha *et al.* reported an increase from 91.3% to 94.2%. This indicates that this concept was well understood by participants in both settings, with only marginal post-intervention gains.

### Mosquito-repelling coils

A striking difference was noted in awareness regarding mosquito-repelling coils. In the present study, correct responses increased dramatically from 41.98% pre-lecture to 92.59% post-lecture. In contrast, Kushwaha *et al.* reported a comparatively smaller improvement (32.4% to 46.1%). This highlights a significantly stronger impact of the educational session in the present study for this topic.

#### Understanding of pesticides and adulterants

For the statement “pesticides are chemicals used to kill...”, the present study showed an improvement from 64.20% to 90.12%, whereas Kushwaha et al. reported minimal change (71.6% to 72.5%). Similarly, awareness of the possible reasons for using adulterants increased from 86.42% to 96.30% in the present study, compared with 85.7% to 91% in Kushwaha et al. This indicates better conceptual clarity achieved post-lecture in the present study.

#### Environmental pollutants and general awareness

Both studies reported high baseline awareness regarding commonly known environmental pollutants. However, the present study showed a clear improvement (83.95% to 96.30%), while Kushwaha et al. noted consistently high knowledge (>90%) with limited scope for further improvement.

#### Attitudes and willingness to spread awareness

In both studies, the majority of participants expressed willingness to spread awareness regarding food adulterants and safe practices. In the present study, this attitude was already high (97.8%) and further improved post-lecture (98.77%), aligning with the findings of Kushwaha et al., who also reported a positive attitude and readiness to disseminate knowledge.

#### Overall comparison

Taking the present study as the reference, it demonstrated greater pre-to-post improvement across most domains compared to Kushwaha et al. While both studies confirm that educational interventions positively influence knowledge and attitudes, the magnitude of change—particularly for topics such as lathyrism, insect repellents, adulterants, and mechanisms of action of insecticides—was substantially higher in the present study. This may be attributed to differences in teaching methodology, content emphasis, participant engagement, or baseline characteristics of the study populations.

### CONCLUSION

This study demonstrates that a focused educational intervention significantly improved the knowledge, attitudes, and practices of second-year MBBS students regarding pesticides, food adulterants, pollutants, and insect repellents. Although baseline awareness was already high for certain parameters, the overall improvement across most domains highlights the

effectiveness of structured teaching in bridging knowledge gaps. As future healthcare providers, enhanced awareness among medical students is essential for promoting safe practices and disseminating accurate information to patients and the community, thereby contributing to better public health outcomes.

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