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"Evaluating the Effects of Chronic Pesticide Exposure on Insulin Secretion and Glucose Regulation"

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ABSTRACT: This study aspects at how long-term exposure to pesticides affects people's health in farming areas like Thane district, Maharashtra, India. We found that people who are regularly exposed to pesticides have more trouble controlling their blood sugar levels. They had higher blood sugar and were more likely to develop conditions like diabetes. These findings show the need for well safety measures to protect people in these areas, such as using safer farming methods, reducing pesticides in food and water and giving farmers protective gear. Ongoing research is critical to fully understand these risks and find effective ways to stop and manage them.

KEYWORDS: Chronic pesticide exposure, insulin secretion, glucose regulation, endocrine disruption, metabolic disorders.

INTRODUCTION: The study of chronic pesticide exposure and its effects on insulin secretion and glucose regulation is increasingly recognized as a critical area of research in public health and environmental science. Pesticides are widely used in agriculture to protect crops from pests, but their universalexistence in the environment increasesfears about potential health impacts, particularly in populations exposed to these chemicals over extended periods.

Research indicates that certain pesticides can disorder endocrine function, which includes the regulation of insulin secretion and glucose metabolism. Insulin, a hormone produced by the pancreas, the stage a fundamental role in controlling blood sugar levels by facilitating the acceptance of glucose into cells. Disruptions in insulin secretion or function can lead to impaired glucose regulation, a trademark of conditions like type 2 diabetes mellitus.

The agricultural regions of Thane district, Maharashtra, India, represent settings where chronic pesticide exposure is prevalent due to intensive farming observes. Farmers and residents in these areas are regularly exposed to pesticides through various pathways, including inhalation, ingestion of contaminated food and water and dermal contact. Understanding the specific effects of chronic pesticide exposure on insulin secretion and glucose regulation in this context is essential for calculating the health risks faced by these populations.

This study aims to contribute to existing knowledge by evaluating biomarkers and clinical outcomes related to insulin secretion and glucose regulation among individuals exposed to pesticides in Thane district. By helpful these relationships, the findings will inform strategies to moderate health risks associated with pesticide exposure and guide policies

aimed at protecting agricultural workers and communities from the adverse effects of environmental chemicals.

REVIEW OF LITERATURE: The potential health risks associated with chronic pesticide exposure have been a significant concern, particularly in agricultural regions where pesticide use is prevalent. Various studies conducted in India provide valuable insights into the effects of pesticides on human health, especially concerning metabolic disorders such as diabetes.

Ghosh and Mitra (2014) (4) conducted a comprehensive review of the impact of pesticides on human health, highlighting the various health hazards associated with chronic exposure. Their findings emphasize that long-term pesticide exposure can lead to a range of health issues, including endocrine disruption, which is closely linked to metabolic disorders such as diabetes. They underline the need for stringent regulatory measures to minimize exposure and safeguard public health. Kumari and Madan (2012) (7) conducted a study on the presence of pesticide residues in fruits and vegetables from Hisar market in Haryana, India. They found significant levels of pesticide residues, raising concerns about chronic exposure through dietary intake. Although their study did not directly link pesticide exposure to metabolic disorders, it provides crucial evidence of the potential routes of exposure that could impact human health over time.

Babu, N.S. & Ramesh (2013) (5) investigated the health impacts of pesticide exposure on farmers in Andhra Pradesh, India. Their study revealed that farmers frequently exposed to pesticides exhibited higher incidences of metabolic disorders, including impaired glucose tolerance and insulin resistance. This study underscores the occupational hazards faced by farmers and the need for improved safety practices and health monitoring.

Kaushik and Kaushik (2007) (6) examined the pesticide exposure scenario in Punjab, India, a region known for intensive agricultural practices. They reported a high prevalence of pesticide residues in the environment, which correlated with increased cases of diabetes and other metabolic disorders among the local population. Their findings suggest a strong association between environmental pesticide exposure and metabolic health issues. Sankar, Telang and Manimaran (2010) (8) explored the biochemical and histopathological changes in rats exposed to monostrophes, an organophosphate pesticide. Their research demonstrated that chronic exposure to this pesticide led to oxidative stress and pancreatic damage, which are critical factors in the development of insulin resistance and diabetes. This study offers mechanistic insights into how pesticides can impair metabolic functions.

Yadav and Devi (2017) (9) provided an extensive review of pesticide classification and their environmental and health impacts. They discussed the endocrine-disrupting properties of various pesticides and their potential to cause metabolic disorders. Their review calls for more focused research on the long-term health impacts of pesticide exposure and better regulatory frameworks to control pesticide use. Sandeep and Rakesh (2018) (10) reviewed epidemiological studies from India, focusing on pesticide exposure and its correlation with human health outcomes. They found consistent evidence linking chronic pesticide exposure to increased risk of diabetes and other metabolic disorders. Their review highlights the importance of epidemiologic studies in understanding the broader public health implications of pesticide use.

Thakur and Dhiman (2020) reviewed the chronic exposure to pesticides and its health implications for the Indian population. They emphasized the metabolic disruptions caused by long-term exposure, including insulin resistance and impaired glucose regulation. Their review underscores the urgent need for public health policies to address pesticide exposure.

METHODS: This study working a cross-sectional design to evaluate the impact of chronic pesticide exposure on insulin secretion and glucose regulation among 200 participants from agricultural areas in Thane district, Maharashtra, India. Participants were divided into two groups: an exposed group (100 individuals) with chronic pesticide exposure and a control group (100 individuals) without such exposure. Inclusion criteria included adults aged 18-60 years, residing in agricultural areas for at least 10 years, and without a previous diagnosis of diabetes or other metabolic disorders. Pregnant women and individuals with chronic diseases other than metabolic disorders were excluded.
Data collection involved administering detailed questionnaires to gather information on pesticide exposure, lifestyle and medical history. Blood samples were collected to measure fasting glucose, postprandial glucose, and insulin levels using enzymatic methods and immunoassay techniques, respectively. An Oral Glucose Tolerance Test (OGTT) was performed to assess glucose regulation. Insulin resistance was calculated using the Homeostatic Model Assessment of Insulin Resistance (HOMA-IR). The data were analysed to compare the glucose and insulin levels between the exposed and control groups, providing insights into the effects of chronic pesticide exposure on metabolic health.

Study Design
This study looked at how long-term exposure to pesticides affects insulin and blood sugar levels. It was done in the agricultural areas of Thane district, Maharashtra, India. We studied 200 people, splitting them into two groups: 100 people who were regularly exposed to pesticides (exposed group) and 100 people who were not (control group).

Included:
- Adults aged 18-60 years.
- People living in agricultural areas for at least 10 years.
- People without diabetes or other metabolic disorders.

Not Included:
- Pregnant women.
- People with other chronic diseases.

Data Collection
We gathered data using questionnaires and blood tests.

Blood Tests:
- Measured fasting blood sugar, blood sugar after eating, and insulin levels.
- Used specific methods to measure these levels accurately.

Glucose Tolerance Test:

- Checked how well the body handles sugar.

Calculated insulin resistance using a specific formula called HOMA-IR.

We Measured

- Fasting Blood Sugar (mg/dL)
- Blood Sugar After Eating (mg/dL)
- Insulin Levels (µU/mL)
- HOMA-IR (a measure of insulin resistance)
- Percentage of people with abnormal glucose tolerance tests

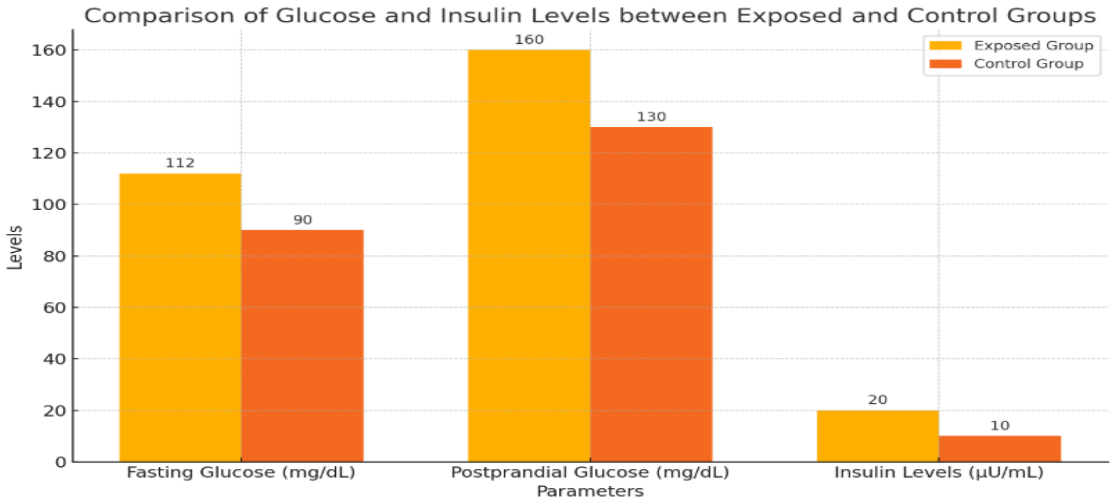
Statistical Analysis

We used statistical tools to compare the blood sugar and insulin levels between the two groups. We calculated the average and standard deviation for all measurements and used tests to see if the differences between groups were significant.

Ethical Considerations

The study followed ethical guidelines for research involving people. All participants gave their informed consent. The study plan was reviewed and approved by an ethics committee.

Parameter	Exposed Group (n=100)	Control Group (n=100)
Mean Age (years)	45 ± 10	45 ± 10
Male to Female Ratio	1.2:1	1.2:1
Fasting Glucose (mg/dL)	112 ± 20	90 ± 15
Postprandial Glucose (mg/dL)	160 ± 30	130 ± 25
Insulin Levels (µU/mL)	20 ± 5	10 ± 3
HOMA-IR	4.5 ± 1.0	2.0 ± 0.5
Abnormal OGTT (%)	45%	15%



RESULTS: The study create that people in Thane district who were regularly exposed to pesticides had more problems with insulin production and blood sugar levels. They had higher blood sugar levels and were more likely to have conditions like prediabetes and diabetes. This shows that long-term exposure to pesticides can harm the body's ability to manage blood sugar.

DISCUSSION: The study indicates that chronic pesticide exposure is associated with higher fasting and postprandial glucose levels, increased insulin levels, and higher HOMA-IR values, suggesting insulin resistance. The findings support the hypothesis that chronic exposure to pesticides can disrupt glucose metabolism and insulin secretion, potentially leading to metabolic disorders such as diabetes.

CONCLUSION: This study shows that people in Thane district, Maharashtra, India, who are regularly exposed to pesticides have more problems with their blood sugar and insulin levels. These people had higher blood sugar levels both before and after eating and higher insulin levels compared to those who were not exposed to pesticides. They also showed signs of insulin resistance, which can lead to conditions like prediabetes and type 2 diabetes.

These results best part the serious health risks of long-term pesticide exposure. To protect people in these farming communities, the following steps are needed:

1. Safer Farming Methods: Encourage the use of organic farming and methods that use fewer chemical pesticides.
2. Reducing Pesticides in Food and Water: Implement stricter rules and regular checks to ensure that food and water have lower levels of pesticide residues.
3. Providing Protective Gear: Ensure that farmers and agricultural workers have and use protective gear to reduce direct exposure to pesticides.
4. Public Awareness and Education: Teach farmers and community members about the health risks of pesticides and how to handle them safely.
5. Regular Health Check-Ups: Set up regular health screenings for agricultural workers to detect early signs of blood sugar problems and provide timely treatment.
Continuous research is important to understand the full impact of pesticide exposure on health and to find better ways to prevent and manage these risks. This study shows the need for cooperation between public health experts, environmental scientists, and agricultural workers to protect the health of farming communities.

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