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Data Article

Biomonitoring of pesticide exposure and its health implications in agricultural areas of Telangana, India: A brief data report

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A B S T R A C T

The dataset represent the results of a cross-sectional study conducted in Telangana, India, to investigate the effects of pesticide exposure in agricultural regions. This study includes 341 pesticides exposed participants and 152 controls in three districts of Telangana including 15 farming villages. Blood and urine samples were analysed to determine various pesticide concentrations present in blood including organophosphates, carbamates and pyrethroids group of pesticides, and six dialkyl phosphate (DAP) metabolites, including dimethyl phosphate (DMP), diethyl phosphate (DEP), dimethyl thiophosphate (DMTP), dimethyldithiophosphate (DMDTP), diethylthiophosphate (DETP) and diethyldithiophosphate (DEDTP) were analysed in urine samples.In addition the enzyme acetylcholinesterase (AChE) activity were measured using advanced analytical methods. The data provide information on pesticide profiles, exposure biomarkers and the relationship between exposure duration and AChE activity. These study results emphasise the importance and

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addressing pesticide-related health problems in farmers for proactive measures to mitigate the harmful effects of pesticide exposure in agriculture.

Specifications Table

Subject Area	Health, Toxicology and Mutagenesis
More Specific Subject Area	Quantifying multiresidual pesticide residues in blood, identifying pesticides exposure biomarkers, measuring acetylcholinesterase activity, and urinary metabolites.
Type of Data	Tables, Figures, raw files
Data Collection	A study in Telangana, India analysed multiresidue pesticide levels in 493 participants from three districts including 15 villages in Telangana by using questionnaires survey Including socio-demographic, pesticide awareness, and symptom related pesticides data and entered into Excel. 341 exposed and 152 control participants were randomly selected, the sample size determined by epi info stat calc (95 % confidence, ±5 % error, assuming 50 % population proportion).
Data Source Location	The cross-sectional study was carried out in fifteen farming villages across the Yadadri-Bhuvanagiri (17.65°N, 79.05°E), Vikarabad (17°N, 77°54°E), and Sangareddy (17.6075°N, 78.0798°E) districts of Telangana, India. Sample collection was conducted, and the specimens were subsequently transferred to the National Institute of Nutrition for in-depth analysis of pesticides, DAP metabolites, and the activity of the enzyme AChE activity.
Data accessibility	Repository name: "Data for publication", Mendeley Data, V2 Data identification number: doi: 10.17632/z526ncz8y3.2 https://data.mendeley.com/datasets/z526ncz8y3/2
Related research article	The manuscript supports a related research article by Kumar D, Sinha SN. Chronic exposures to cholinesterase-inhibiting pesticides adversely affects the health of agricultural workers in India. Environ Res. (2024) Apr 18;252(Pt 2):118961. doi: 10.1016/j.envres.2024.118961 [1].

1. Value of the Data

- Identification of multiresidue Pesticides: The data distinguish different pesticides found in blood samples of exposed and control groups, providing insights into pesticide used and exposure pattern.
- Biomarkers of organophosphate pesticides exposure: Six DAP metabolites are identified as biomarkers associated with organophosphate pesticides, and health effects.
- Novel Approach to Symptom Documentation: The study documents self-reported symptoms before pesticide use, facilitating research into the relationship between chemical exposure and acute symptoms.
- AChE Activity as a Biomarker: The data shows the duration of pesticide exposure influences AChE activity, highlighting its potential as a biomarker for early detection of neurological diseases.

2. Background

Agriculture is the primary income source for 70 % of rural households in India [2]. Unfortunately, the excessive use of pesticides poses a significant health problem as many farmers due to lack adequate knowledge about safe application practices. Overuse of pesticides by commercial farmers, driven by the desire to maximize profits, has led to insufficient awareness of risks,

unsafe handling practices, and the use of banned chemicals. Indian farmers are encountering severe health issues such as respiratory diseases, skin problems, headaches, and asthma. In response to these challenges, India has prohibited several highly toxic pesticide compounds and actively promotes sustainable agricultural practices. The government is advocating for Integrated Pest Management (IPM), which has shown promise: trained IPM farmers use 36 % less pesticides. These farmers utilize improved seed varieties, biopesticides, non-toxic chemicals, and efficient irrigation and fertilization practices. Embracing IPM and sustainable techniques can strengthen India's agricultural sector, ensuring food security and safeguarding the environment for future generations.

India is the fourth-largest producer and ninth-largest consumer of chemical pesticides. Despite all modernisation efforts, the country's heavy reliance on chemical pesticides in conventional agriculture poses a major challenge to crop protection, environmental sustainability and public health . Government data shows that around 75,000 tonnes of pesticides have been used annually since 1990, with the average over the last ten years being 61,000 tonnes [3]. This consumption, which is increasing by 10-20 % annually, equates to an average of 396g of an active ingredient per hectare. The escalating use of pesticides requires immediate and strategic action to reduce the negative impact on ecosystems, human health and the resilience of agriculture. Epidemiological studies show that exposure to pesticides can cause wilde range of health problems, from acute gastrointestinal problems neurological symptoms and respiratory diseases [4]. In addition, chronic health problems such as [5] and Alzheimer's disease [6] and other non-communicable diseases [7], endocrine disorders and certain cancers have also been linked to pesticide exposure [8]. Recent research suggests that prenatal exposure to pesticides can lead to lower IQ and neurological problems in children, increasing the risk of neurological and developmental disorders [9]. Pesticides enter the body through inhalation, ingestion and skin contact, accumulate in fatty tissue and inhibit AChE activity. Metabolites such as DAP interfere with cellular and enzymatic processes, leading to health complications. Therefore, DAP metabolites and AChE enzymes are biomarkers in studies to assess pesticide exposure and its health effects.

In this study, the impact of pesticide exposure on farmers in Telangana, India, is investigated with a focus on the health effects of chronic organophosphate exposure. By using biomarkers such as acetylcholinesterase (AChE) and dialkyl phosphate (DAP) concentrations. This study aims to provide a comprehensive assessment of the neurological and general health effects due to pesticide use. The unique approach of this study used advanced statistical methods, the complex interactions between pesticide exposure and health outcomes are analysed to gain a detailed understanding of the pesticides associated risks. In addition, the study emphasises the need for improved safety practises and regulatory measures in Indian agriculture by focusing on population groups without protective equipment. With its findings, the study aims to influence policy changes and promote the adoption of sustainable agricultural practises to ultimately protect public health and strengthen the Indian agricultural sector.

3. Data Description

The study analyse socio-demographic factors as well as participants' attitudes towards pesticides, and pesticide-related symptoms. The study included 493 participants, 341 in the exposure group and 152 in the control group. Table 1 shows the demographic information, which indicates that the average age of the farmers was 48.39 years, with a standard deviation of 12.40 years. The gender breakdown shows that overall 89 % of participants were male and 11 % female, while the control group had an average age of 42.76 years, with 86 % male and 14 % female. Both groups had a similar average weight and height. Detailed information on the participants can be found in the supplementary file-1, which you can access via this link: https://data.mendeley.com/datasets/z526ncz8y3/2.

Most participants in both groups were non-vegetarians, with 33 % of the exposed group and 30 % of the control group reporting tobacco or cigarette use. Educational level was categorised into five groups, with 37 % of participants in both groups requiring improvement in

Table 1
Demographic data comparison between the exposed and control groups.

Characteristics	Exposed (Mean ± SD)	Control (Mean ± SD)	p-value
Age	48.55 ± 12.12	42.76 ± 12.19	0.475
Sex			0.014
Male	305 (89 %)	130 (86 %)	
Female	36 (11 %)	22 (15 %)	
Height (cm)	162.87 ± 7.89	161.94 ± 7.44	0.487
Weight (kg)	61.52 ± 12.32	61.78 ± 10.71	0.081
BMI			0.3
Underweight	34 (10 %)	13 (9 %)	
Normal	206 (60 %)	85 (56 %)	
Pre-obesity	98 (29 %)	53 (35.3 %)	
Obesity I&II	3 (1 %)	1 (1 %)	
Dietary habit			0.121
Vegetarian	11 (3 %)	3 (2 %)	
Non-veg	330 (97 %)	149 (98 %)	
Tobacco			0.195
Yes	113 (33 %)	46 (30 %)	
No	228 (67 %)	106 (70 %)	
Alcohol habit			0.972
Yes	180 (53 %)	66 (43 %)	
No	102 (30 %)	56 (37 %)	
Occasionally	34 (10 %)	22 (14 %)	
Toddy	25 (7 %)	8 (5 %)	
Education			0.091
Illiterate	127 (37 %)	44 (29 %)	
1–4 Std	31 (9 %)	10 (4 %)	
5–10 Std	121 (35 %)	48 (32 %)	
11–12 Std	32 (9 %)	7 (5 %)	
College Above	30 (9 %)	43 (7 %)	

The table contains a detailed analysis of the demographic characteristics of the study participants, which comprised 341 people in the exposed group and 152 in the control group. Means and their corresponding standard deviations (SD) represent continuous variables, while categorical variables are shown as counts and percentages within each category. Independent t-tests were performed to assess the significance of differences between the two groups, with a threshold of $p < 0.05$ indicating statistical significance.

literacy skills. Statistical analysis revealed no significant differences in various factors such as age, weight, height, alcohol consumption, dietary habits, BMI or educational level. However, a notable difference was found in the gender distribution between the two groups.

Tables 2 and 3 show the participants' knowledge, practises and attitudes towards pesticides and pesticide-related symptoms.

4. Experimental Design, Materials and Methods

The study design is illustrated in Fig. 1, which shows the selection of the study area and the structure of the questionnaire. The questionnaire is divided into different sections, the first section demographic and socio-economic characteristics of the participants. The second section participants' knowledge of safety precautions when using pesticides. Finally, the third section for self-reported symptoms experienced by participants after exposure to pesticide sprays. This comprehensive design ensures a multi-faceted approach to data collection, covering demographic profiles, understanding of safety measures and potential health effects. This structured questionnaire generates a comprehensive data set to understand participants' experiences and perceptions of pesticide use and associated impacts. The Table 4 shown the different study section with their description.

Table 2
Knowledge, practice, and attitude of the participants with pesticides.

Question	Variable	Count	%
Years of Pesticides applied?	Less than 1 year	3	1
	2–5 years	19	6
	6–10 years	28	8
	11–20 years	89	26
	21–30 years	74	22
	>30 years	123	38
Do you read the label before use?	Yes	157	46
	No	184	54
How to mix pesticides?	With a stick	215	63
	With bare hands	126	37
Where do you store pesticides?	In the field or garden	280	67
	House	57	17
	Bus and used imitate	4	16
How to apply pesticides in the field?	With hands	59	17
	Backpack sprayer	100	29
	Machine sprayers	182	54
What do you do with empty pesticide containers?	Burn or bury in soil	123	36
	Left in the field	59	17
	Use for other work	29	9
	Sell container	20	6
	Junk Yard	103	30
When applying pesticides, do pesticides ever spill and get on your skin?	Never	54	16
	Sometimes	227	67
	Always	60	18

The table presents findings from interviews conducted with participants (n=341) concerning their practices and safety measures related to pesticide handling. Responses were categorized, and the table displays the percentage (N) of participants for each question regarding pesticide handling.

4.1. Analytical techniques

Various analytical methods were used to measure different analytes, such as iquid chromatography-tandem mass spectrometery (LC-MS/MS) for pesticide residues in blood samples, and DAP metabolites in urine samples, reversed-phase hight-performance liquid chromatography (RP-HPLC) foracetylcholinesterase activity in blood. Detailed descriptions, including specifications and optimised conditions for each method, for its high sensitivity and specificity, ensuring the accuracy of our results. Each method was carefully selected for its ability to detect and quantify specific analytes to ensure the reliability of data collection and analysis for the study.

4.1.1. Analysis of pesticides from blood samples

The pesticides in blood were effectively analysed by liquid chromatography-tandem mass spectrometry (LC-MS/MS) according to the protocol of Kumar et al. [10]. The mass spectrometer operated with positive electrospray ionisation (ESI) and multiple reaction monitoring (MRM). A binary gradient solvent system of 10 mM ammonium formate and acetonitrile, a C18 column (1.8 µm particle size, 4.6 × 150 mm) was used for chromatography. A 20-µl sample was injected via an autosampler, allowing rapid detection of 33 pesticides within 20 minutes.

The procedure involved analysing 100 µl of blood for 33 pesticides and included a simple liquid extraction. First, 100 µl of blood was collected in a clear glass tube and mixed with 900 µl of chilled acetonitrile (ACN). The mixture was shaken for 1 minute, cooled on ice for 10–20 minutes and filtered through a 0.2 µl syringe filter prior to LC-MS/MS analysis.

Validation and performance were performed according to SANTE guidelines for pesticide analysis. The method showed a linearity of >0.9921 and a recovery range of 78.01–104.36 %. Precision and accuracy were maintained with an RSD of <15 %. The lower limit of detection (LOD) and lower limit of quantification (LOQ) were between 0.023–0.161 ng/mL and 0.072–0.487

Table 3
Observed symptoms.

Symptoms	Always	Sometime	Never
Dizziness or headache	7.92	21.11	70.97
Tense, anxious	6.16	14.96	78.89
Vomiting	1.47	6.45	92.08
Tired or sleepy	12.61	13.49	73.90
Confusion	1.47	11.73	86.80
Loss of appetite	2.93	8.50	88.56
Fast heart rate	3.52	7.04	89.44
Difficulty with balance	0.88	4.99	94.13
Blurred or double vision	9.09	18.48	72.43
Difficulty concentrating	1.76	4.11	94.13
Numbness of hands and feet	10.56	18.77	70.67
Consciousness	0.88	3.81	95.31
Irritable or angry	0.88	14.66	84.46
Changes in sense, smell or taste	2.64	2.64	94.72
Depressed, indifferent or quiet	1.17	3.81	95.01
Twitches of arms or legs	10.56	14.96	74.49
Excessive salivation	5.57	11.14	83.28
Ringing ears	1.17	3.81	95.01

The table shows the frequency of self-reported symptoms observed after pesticide spraying, with multiple responses recorded for various symptoms.

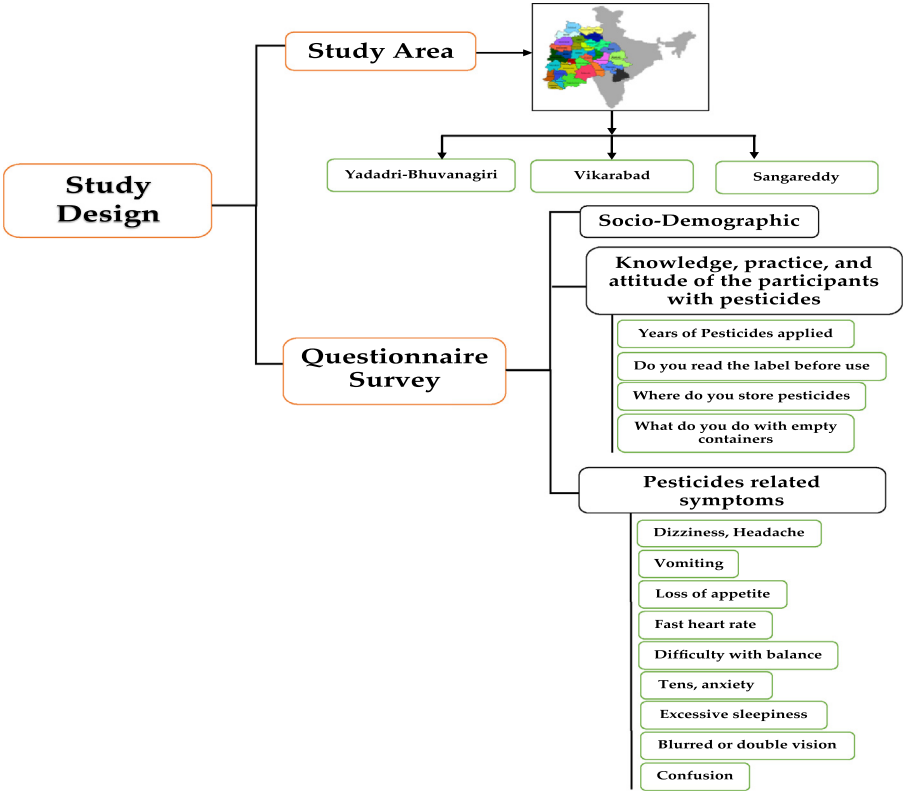

Fig. 1. Flow chart of study design.

Table 4
Study Section and description.

Section	Description
Study Design	This study was conducted between October 2021 to April 2023 in fifteen agricultural villages in the districts of Yadadri-Bhuvanagiri (17.65°N, 79.05°E), Vikarabad (17°N, 77°54°E) and Sangareddy (17.6075°N, 78.0798°E) in Telangana, India. To ensure a comprehensive analysis, five villages representing diverse agricultural practices were selected from each district. The selection was randomised, taking into account geographical, climatic and socio-economic factors to ensure that the villages are typical of the agricultural context of the region. The study involved 493 participants of different genders and ages, provided by the local authorities were selected. The participants were divided into two groups: the exposed group, consisting of 341 participants, and the control group, consisting of 152 participants. The sample size was determined using epi info stat calc version 7.2.5.0, aiming for a confidence level of 95 with a margin of error of ± 5 % and assuming a population proportion of 50 %.
Selection of Participants	Participants were randomly selected from a list of households provided by the local authorities to ensure a fair and impartial selection process. The sample comprised individuals in the age group of 18–70 years living in five agricultural villages in Yadadri-Bhuvanagiri, Vikarabad and Sangareddy districts of Telangana, India. The selected villages grown rice, cotton or other crops and had at least one year of experience in spraying pesticides. The control group consisted of people aged 18–70 who were not farmers and lived in similar areas to the exposed group, and participants who had been diagnosed with cancer, diabetes or neurological disorders, who were pregnant or who had conflicts with the study were excluded from both groups. Eligible exposed and control subjects were recruited to participate in the study and provided written informed consent.
Data Collection	Data collection was performed on a pre-validated questionnaire with over 25 questions in different sections, which was tailored to our study with minor adaptations. The interviews, which lasted 15–20 minutes, were conducted by native speakers of southern Telugu and Hindi. The questionnaire included sections on personal information, pesticide use and exposure, occupational knowledge before, during and after spraying, and recall of health symptoms. Prior to data collection, the reliability and validity of the questionnaire were thoroughly checked. Topics covered included demographic information such as age, gender, height, weight, BMI, blood glucose level, education level and main occupation. Participants also provided information on farming practises, pesticide use, acreage, expenses, labour tasks, sources of information, reasons for pesticide use, and disposal methods for used pesticide containers. In addition, participants reported health symptoms related to pesticide exposure, such as shortness of breath, chest pain, rapid heartbeat, vomiting, blurred vision, anger, difficulty concentrating, numbness, muscle weakness, headaches, dizziness, balance problems and eye irritation. Standardised scales were used for data collection to ensure consistency and reliability.
Sample Collection	The blood and urine samples were collected with the permission of the Ministry of Health and Family Welfare. To ensure the integrity of these samples, we strictly followed the guidelines of the Indian Council of Medical Research (ICMR) in the collection procedures. The blood samples were collected from the cubital median vein and immediately transferred to sodium ethylenediaminetetraacetic acid (EDTA) vacutainer tubes to prevent clotting. The urine samples were collected in sterilised containers and stored at -20°C to ensure the stability of the analytes. To ensure reliable and accurate analysis of pesticides, dialkyl phosphate metabolites (DAP) and acetylcholinesterase (AChE) enzymes, samples were transported to the ICMR-National Institute of Nutrition following standardised protocols to prevent deterioration or contamination during transport.

ng/mL, respectively. The detection parameters were determined according to the protocol of Kumar et al. (2022). This method enables efficient, accurate and sensitive detection of pesticides in blood, fulfils strict analytical standards and ensures reliable results in pesticide analysis.

4.1.2. Analysis of organophosphate pesticides metabolites in urine samples

The six DAP metabolites of organophosphate pesticide metabolites were analysed by LC-MS/MS as reported by Kumar et al. [11]; this analytical approach targets six specific DAP metabo-

lites: Dimethyl phosphate (DMP), diethyl phosphate (DEP), dimethyl thiophosphate (DMTP), dimethyldithiophosphate (DMDTP), diethyl thiophosphate (DETP) and diethyl dithiophosphate (DEDTP). In the MRM mode of the spectrometer with negative ionisation, chromatographic separation is performed with a binary gradient solvent consisting of 10 mM ammonium formate and acetonitrile on a C18 column (1.8 µm, 4.6 × 150 mm) at 40°C. A 20-µl sample of the extracted urine is injected into the system so that the DAP metabolites can be separated within six minutes.

The sample is prepared as follows: 200 µl of urine is mixed with 800 µl of cold ethyl acetate in a 2 mL Eppendorf tube. This mixture is then shaken vigorously for one minute. The mixture is then cooled in an ice bath for ten minutes to cause precipitation. After ten minutes of centrifugation at 10,000 rpm, the supernatant is separated and transferred to a 10 mL tube. It is then dried under nitrogen and reconstituted with 500 µl acetonitrile. The finished solution is transferred to a vial for analysis.

Validation of this method according to the SANTE guidelines for pesticide analysis showed a linearity of over 0.99 and recovery rates between 93 and 102 %. Precision and accuracy were both below 15 % RSD, with detection and quantification limits between 0.0201–0.0697 ng/mL and 0.0609–0.2112 ng/mL, respectively. The detection parameters were determined according to the method described by Kumar et al. (2023).

4.1.3. Estimation of AChE in blood samples

The enzyme activity of AChE in blood was measured by reverse-phase high-performance liquid chromatography (RP-HPLC), which was developed by Sinha et al. [12]. A Shimadzu 20AD dual pump system with autoinjector, photodiode array detector and a C18 column (4.6 mm diameter, 150 mm length, 4.5 µm particle size) was used for the analysis. The mobile phase was a 55:45 (v/v) mixture of water and acetonitrile with a flow rate of 0.600 mL/min.

To determine the AChE level, 10 µL blood was mixed with 280 µL phosphate-buffered saline (PBS) and 10 µL 50 µM 1-naphthol acetate. After a 20-minute incubation at room temperature, the reaction was stopped by adding 700 µL acetonitrile. The mixture was filtered through a 0.2-µm syringe filter and the filtrate was analysed for AChE content. The conversion of 1-naphthol acetate to 1-naphthol was used to quantify the AChE activity.

The method showed not only high reproducibility, sensitivity and accuracy, but also the ability to determine the enzyme activity within a remarkably short time of 20 minutes. It showed linearity with an $R^2 > 0.9842$, precision within 15 % relative standard deviation (RSD) and accuracy between 85.2 % and 99.6 %. The robustness of the method was rigorously validated according to the guidelines of the International Conference on Harmonisation (ICH), ensuring the reliability of the results. The detection parameters were consistent with those described by Sinha et al. (2022).

4.2. Pesticides, DAP metabolites and enzyme AChE activity

Table 5 shows the mean concentrations of various pesticides detected in the blood samples of 494 participants, including 341 individuals from the exposed group and 152 from the control group. A total of 28 different pesticides were identified, categorised into 19 insecticides, 6 herbicides and 3 fungicides. The pesticide concentrations ranged from 0.42 to 45.77 ng/mL. The toxicity levels of these pesticides were assessed according to World Health Organization (WHO) guidelines 2019 [13] 11 were categorised as highly hazardous (Class Ib), eight as moderately hazardous (Class II) and six as slightly hazardous (Class III). One pesticide was categorised as likely non- acutely hazardous and two pesticides were not classified. The supplementary file 2 and 3 contains a statistical analysis of various pesticides, DAP metabolites, and AChE activity in both exposed and control participants. You can access the data at this link: https://data.mendeley.com/datasets/z526ncz8y3/2. The dataset compared the levels of six DAP metabolites between an exposed and a control group, with significance set at 0.05. All metabolite levels were significantly higher in the exposed group: DEP at 23.87±1.67, DETP at 2.05±0.33,

Table 5
Observed pesticides in exposed and control blood samples.

Type	Pesticides	WHO	Exposed (341)		Control (152)		P value
			n	Mean ±SD ng/mL	n	Mean ±SD ng/mL	
Insecticide	Acephate	III	11	12.29± 4.20	3	2.92±1.18	0.153
	Allethrins	III	8	3.10±1.86	5	0.58±0.17	0.074
	Chlorpyrifos	II	48	2.52±1.62	19	1.86±1.58	0.601
	Chlorpyrvinophos	II	25	0.42±0.18	7	0.46±0.27	0.006
	Coumaphos	Ib	91	2.90± 1.12	28	1.95±0.63	0.002
	Diazinon	II	54	1.73±1.70	22	0.12±0.04	<0.001
	Dichlorvos	Ib	58	1.99± 2.05	12	0.77±0.42	<0.001
	Ethion	II	22	3.24±4.46	12	1.89±0.077	0.007
	Fenamiphos	Ib	35	3.55±0.035	7	3.54±0.01	0.298
	Imidacloprid	II	43	1.75± 0.57	11	1.27±0.50	0.859
	Malathion	III	7	1.18±0.039	4	0.32±0.24	0.009
	Methamidophos	Ib	65	3.90±2.46	29	2.26±0.80	<0.001
	Monocrotophos	Ib	93	11.21± 4.84	23	6.96±2.57	0.016
	Omethoate	Ib	18		6		0.981
				45.77±36.94		33.76±40.57	
	Phosalone	II	20	6.93±3.77	5	4.46±0.08	<0.001
	Profenofos	II	20	1.81±0.99	12	1.23±0.45	0.013
	Quinalphos	II	61	12.14±8.17	22	0.709±0.97	<0.001
	Temephos	III	61	1.79±1.33	22	0.709±0.97	0.036
	Triazophos	Ib	168	1.51±1.33	68	0.66±0.68	<0.001
Herbicide	Acetochlor	III	136	3.55± 4.14	57	2.82±1.33	0.055
	Alachlor	II	18		6	0.74±0.48	0.148
				0.708±0.539			
	Atrazine	III	85	3.83±2.38	30	2.72±0.156	0.445
	Butachlor	III	116	5.57± 2.49	60	5.78±3.39	0.042
	Isopropalin	O	12	1.33±0.57	0	ND	0.280
	Propanil	II	21	6.53± 5.02	15	2.68±2.77	<0.001
Fungicide	Carbendazim	U	42	0.44±0.27	21	0.38±0.273	0.464
	Difenoconazole	II	8	1.40±0.57	2	0.25±0.70	0.280
	Mepronil	O	105	0.88±1.08	50	1.06±1.18	0.165

This table shows the mean concentrations (ng/mL) and standard deviations of the individual pesticides for the exposed and control groups, with significance determined at $p<0.05$. The 'n' value indicates the number of pesticides observed. According to the World Health Organisation (WHO) classification system, pesticides are classified based on their toxicity as follows: extremely hazardous (class Ia), Highly hazardous (class Ib), moderately hazardous (class II), slightly hazardous (class III), unlikely to present any hazard (class U) and unclassified (class O).

DEDTP at 1.49±0.25, DMP at 6.47±1.46, DMTP at 20.09±1.13, DMDTP at 7.22±0.06, ΣDEP at 33.70±0.75, ΣDMP at 27.41±1.07, and ΣDAP at 61.18±0.91. In contrast, the values in the control group were lower: DEP at 13.56±0.58, DETP at 1.18±0.21, DEDTP at 0.74±0.06, DMP at 3.21±1.07, DMTP at 10.54±1.00, DMDTP at 4.10±0.36, ΣDEP at 17.19±0.29, ΣDMP at 15.12±0.81, and ΣDAP at 23.41±0.55. In addition, AChE enzyme levels were measured in U/mL: the exposed group had an average of 23.12±3.06 U/mL, while the average of the control group was higher at 28.83±4.70 U/mL, with a significance of $p<0.05$.

Statistical Analysis

The qualitative data collected in the study was statistically analysed using a independent t-test to determine mean differences between the exposed and control groups. In addition, pesticide concentrations, DAP metabolites and AChE levels were compared between the two groups. Statistical significance was determined at $p < 0.05$. Data analysis was performed using IBM SPSS version 29 software and results were presented as mean $\pm$ standard deviation (SD).

Limitations

A limitation of using questionnaire surveys have self-report symptoms is the possibility of bias if respondents exaggerate their adherence to safety measures against pesticide exposure. In addition, the health symptoms reported may not be directly related to pesticide exposure. Nevertheless, the data have notable strengths. The sample size is substantial and includes a range of exposure levels in both agricultural and non-agricultural areas in 15 villages. In addition, reliable data were collected on demographic and socioeconomic factors as well as self-reported pesticide exposure.

Ethical Statement

Ethical approval for the collection of human blood and urine samples was obtained from the Institutional Ethics Committee of the ICMR-NIN Ministry of Health and Family Welfare, Government of India (ECR/35/Inst/AP/2013), and the Ethics Committee of the Indian Council of Medical Research (ICMR) approved the study protocol under reference number NIN Protocol 16/II/2019. Informed consent was obtained from all donors who provided blood and urine samples.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

CRediT Author Statement

Dileshwar Kumar: Conceptualization, Methodology, Data curation, Formal analysis, Software, Validation, Investigation, Writing- Reviewing and Editing. **Sukesh Narayan Sinha**: Supervision, Conceptualization, Writing- Reviewing and Editing. **Kasturi Vasudev**: sample collection, Domain Expect, Validation, Writing- Reviewing and Editing. **Rajesh Kumar K**: Reviewing and editing, Sample collection. **Gouda Balaji**: Sample collection. **Sathish Kumar Mungamuri**: Writing- Reviewingand Editing. **Vakdevi Validandi**: Writing- Reviewing and Editing.

Data Availability

Data for publication (Original data) (Mendeley Data).

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Declaration of Competing Interest

The authors declare that there is no conflict of interest on our part.

Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2024.110632.

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