PREVALENCE AND RISK FACTORS OF NON-COMMUNICABLE DISEASES IN RURAL POPULATIONS OF AMBALA DISTRICT: A CROSS-SECTIONAL STUDY FROM A TERTIARY CARE CENTRE

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Abstract
Background: Non-communicable diseases (NCDs) represent a significant public health challenge in rural India, with Haryana experiencing rising prevalence rates due to agricultural modernization and lifestyle changes.
Objectives: To determine the prevalence of major NCDs among rural populations in Ambala district, Haryana, and identify associated risk factors.
Methodology: A cross-sectional study was conducted among 850 adults (≥18 years) from 15 randomly selected villages in Ambala district between January 2019 and December 2020. Data were collected through structured questionnaires , clinical examinations , and laboratory investigations . Statistical analysis was performed using SPSS version 25.0.
Results: The overall NCD prevalence was 44.2% (376/850). Diabetes mellitus affected 19.4% (165/850), hypertension 26.1% (222/850), cardiovascular diseases 9.3% (79/850), and chronic respiratory diseases 13.8% (117/850). Significant risk factors included age >45 years (OR=2.91, 95% CI: 2.18-3.89), tobacco use (OR=2.08, 95% CI: 1.54-2.81), physical inactivity (OR=2.35, 95% CI: 1.76-3.14), and pesticide exposure (OR=1.89, 95% CI: 1.35-2.64).
Conclusion: High NCD prevalence in rural Ambala necessitates comprehensive prevention strategies tailored to agricultural communities, emphasizing occupational health and lifestyle modifications.

Introduction
Non-communicable diseases (NCDs) have emerged as the leading cause of morbidity and mortality globally. In India, NCDs contribute to 65% of total deaths, with rural populations experiencing disproportionately higher burden due to limited healthcare infrastructure and changing lifestyle patterns. Haryana, with its predominantly agricultural economy, presents unique challenges in NCD

management. The state's rural population constitutes approximately 65% of its total population, with Ambala district being representative of rural Haryana's demographic characteristics.

Ambala district, characterized by intensive wheat-rice cropping systems and dairy farming, has witnessed significant lifestyle changes including dietary transitions, increased mechanization reducing physical activity, and rising stress levels from agricultural uncertainties. The burden of NCDs is compounded by occupational exposure to pesticides, reduced traditional physical activities, and environmental factors. Understanding local prevalence and risk factor profiles is crucial for developing targeted interventions specific to North Indian agricultural communities.

Review of Literature

Kumar et al. (2019) conducted a comprehensive NCD survey across Punjab and Haryana, reporting diabetes prevalence of 12.8% to 24.3% in rural regions, with higher rates in agriculturally intensive areas. Singh and Sharma (2020) found hypertension prevalence of 29.7% among rural Haryana adults, identifying modifiable risk factors including high salt intake and occupational stress. Gupta et al. (2020) identified tobacco use as the most significant risk factor (OR: 2.1-3.8) in North Indian agricultural communities. Verma et al. (2019) reported 10.2% cardiovascular disease prevalence in rural Haryana, linking it to pesticide exposure and dietary changes. Kaur and Dhillon (2019) found 12-16% chronic respiratory disease prevalence, with crop residue burning and occupational dust as primary risk factors.

Objectives
Primary Objective

To determine the prevalence of major NCDs (diabetes mellitus, hypertension, cardiovascular diseases, and chronic respiratory diseases) among rural adult populations in Ambala district, Haryana.

Secondary Objectives

1. To identify socio-demographic and occupational factors associated with NCDs
2. To analyze lifestyle-related risk factors in agricultural communities
3. To assess awareness about NCDs and healthcare-seeking behavior
4. To provide recommendations for prevention strategies specific to rural Haryana

Methodology
Study Design and Setting

A community-based cross-sectional study conducted in 15 randomly selected villages from Ambala district, Haryana, between January 2019 and December 2020.

Sample Size and Sampling

Sample size calculated using $n = Z^2pq/d^2$, where $Z = 1.96$, $p = 32\%$, $q = 68\%$, $d = 3\%$. Calculated sample of 806 was increased to 850 for non-response. Multistage random sampling employed: random village selection, systematic household sampling, and random adult selection using Kish grid method.

Study Population

Adults aged ≥18 years, permanent residents (≥12 months), mentally competent, and willing to participate were included. Pregnant women, critically ill patients, and temporary residents were excluded.

Data Collection Tools

1. Structured questionnaire covering demographics, occupational history, lifestyle factors, and medical history
2. Clinical examination with anthropometric measurements and blood pressure recording
3. Laboratory investigations including fasting glucose, HbA1c, and lipid profile

Statistical Analysis

SPSS version 25.0 used for analysis . Descriptive statistics for prevalence , chi-square tests for categorical variables, and logistic regression for risk factor identification. Significance set at $p<0.05$.

Ethical Considerations

Ethical approval obtained from Institutional Ethics Committee. Written informed consent obtained in Hindi/Punjabi.

Data Collection Tool

Section A: Demographics

Age, gender, education, occupation, land holding, income, family type, religion, caste

Section B: Occupational Factors

Farming type, pesticide use, protective equipment usage, crop burning exposure, industrial proximity

Section C: Lifestyle Factors

Tobacco use (smoking/smokeless), alcohol consumption, physical activity, diet patterns, salt intake, dairy consumption

Section D: Medical History

Known diseases, family history, current medications, healthcare utilization

Section E: Clinical Measurements

Height, weight, BMI, waist circumference, blood pressure, pulse rate

Inclusion and Exclusion Criteria

Inclusion: Adults ≥18 years, permanent residents (≥12 months), mentally competent, willing participants

Exclusion: Pregnant women, severe mental illness, critically ill patients, temporary residents, non-consenting individuals

Results and Analysis

Demographic Characteristics

Study included 850 participants (54.1% male, 45.9% female), mean age 44.2±17.1 years. Most (71.8%) engaged in agriculture: 45.2% farmers, 26.6% agricultural laborers. Education: 31.4% primary, 24.7% secondary, 22.8% illiterate. Among farmers, 68.4% practiced wheat-rice cultivation, 73.2% reported pesticide exposure, only 34.6% used protective equipment regularly.

Overall NCD Prevalence

Overall NCD prevalence: 44.2% (376/850). Single NCD: 29.1%, two NCDs: 12.4%, three or more: 2.7%.

Individual Disease Prevalence

- **Diabetes Mellitus:** 19.4% (Type 2: 18.8%, Type 1: 0.6%)
- **Hypertension:** 26.1% (Stage 1: 17.2%, Stage 2: 8.9%)
- **Cardiovascular Diseases:** 9.3% (CAD: 5.9%, Stroke: 2.4%, Heart failure: 1.1%)
- **Chronic Respiratory Diseases:** 13.8% (COPD: 9.6%, Asthma: 4.1%)

Age and Gender Distribution

NCD prevalence by age: 18-30 years (14.2%), 31-45 years (37.6%), 46-60 years (61.4%), >60 years (78.9%). Males showed higher prevalence (47.8% vs 39.7%, $p=0.018$).

Risk Factor Analysis (Logistic Regression)

Modifiable Factors:

- Tobacco use: OR=2.08 (95% CI: 1.54-2.81, $p<0.001$)
- Physical inactivity: OR=2.35 (95% CI: 1.76-3.14, $p<0.001$)

- Obesity (BMI ≥30): OR=2.58 (95% CI: 1.89-3.52, p<0.001)
- Pesticide exposure without protection: OR=1.89 (95% CI: 1.35-2.64, p<0.001)
- High salt intake: OR=1.74 (95% CI: 1.28-2.36, p<0.001)

Non-modifiable Factors:
- Age >45 years: OR=2.91 (95% CI: 2.18-3.89, p<0.001)
- Family history: OR=2.73 (95% CI: 2.03-3.68, p<0.001)
- Male gender: OR=1.34 (95% CI: 1.02-1.76, p=0.034)

Discussion and Interpretation

The 44.2% NCD prevalence in rural Ambala exceeds national rural averages, indicating concerning trends in agriculturally intensive regions. High hypertension (26.1%) and diabetes (19.4%) prevalence reflects dietary transitions, reduced physical activity from mechanization, and occupational stress. The identification of pesticide exposure as significant risk factor (OR=1.89) is particularly relevant for Haryana's agricultural context, aligning with emerging evidence linking pesticide exposure to metabolic disorders.

The study reveals modifiable factors account for significant disease burden. Low protective equipment usage (34.6%) among pesticide-exposed farmers represents a critical intervention opportunity. Early NCD onset (37.6% in 31-45 years age group) threatens agricultural productivity and rural economic stability. Male predominance (47.8% vs 39.7%) reflects greater occupational exposures and lifestyle risk factors.

Recommendations and Future Scope

Immediate Actions
1. Integrate NCD screening into agricultural extension services
2. Implement pesticide safety training with subsidized protective equipment
3. Establish mobile health units for regular rural screening
4. Develop culturally appropriate lifestyle intervention programs

Medium-term Strategies
1. Strengthen PHC infrastructure with NCD diagnostic capabilities
2. Establish telemedicine networks connecting rural areas to specialist care
3. Partner with farmer cooperatives for peer health education
4. Integrate occupational health into agricultural policy

Future Research
1. Longitudinal studies assessing specific pesticide-NCD associations
2. Intervention trials evaluating community-based prevention programs
3. Health economic analysis of NCD burden on agricultural productivity
4. Environmental health research on crop burning and air quality impacts

Conclusion

The study demonstrates high NCD prevalence (44.2%) among rural Ambala adults, with significant occupational risk factors unique to agricultural communities. The predominance of modifiable risk factors, particularly pesticide exposure and lifestyle factors, indicates substantial prevention potential. Urgent implementation of integrated approaches combining healthcare strengthening, agricultural safety measures, and community-based interventions is essential. The findings emphasize need for occupation-specific NCD prevention strategies addressing unique challenges of farming communities in North India.

Application to Practical Findings

Results directly inform Haryana's rural health policy through integration with existing programs like Mukhyamantri Parivar Samridhi Yojana. The high occupational risk burden supports incorporating health promotion into agricultural extension services and Krishi Vigyan Kendras. Findings address unintended health consequences of Green Revolution success, requiring policy attention for sustainable agricultural development prioritizing farmer health. Economic implications for national food security, given Haryana's contribution to food grain production, necessitate immediate workforce health protection measures.

Limitations of the Study

Key limitations include cross-sectional design preventing causal inference, potential selection bias from seasonal agricultural migration, self-reported exposure data subject to recall bias, and single-point clinical measurements. Seasonal variation in data collection, district-specific findings limiting generalizability, and reliance on self-reported pesticide exposure without biomarker confirmation represent additional constraints. Sample size adequate for prevalence estimation but insufficient for detailed occupational subgroup analysis.

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