Profile of Biochemical Risk Factors for Non Communicable Diseases in Urban, Rural and Periurban Haryana, India


Abstract
Background: Globalisation and increasing urbanisation in most developing countries including India raises concerns of possibility of a major increase in NCDs in these countries. WHO has recommended a STEPwise approach for NCD risk factor surveillance since risk factors of today are diseases of tomorrow. This paper presents the estimation of biochemical risk factors for NCDs undertaken as a part of the ICMR six centre study.

Objective: To estimate the prevalence and levels of bio-chemical risk factors (fasting blood glucose, total cholesterol, HDL and triglyceride levels) in urban, rural and periurban locations in Ballabgarh, Haryana.

Methodology: A community based cross-sectional study was carried out in urban, rural and periurban areas. A total of 1513 subjects were enrolled (501 in urban, 504 in periurban and 508 in rural areas) with equal distribution by area of residence, sex and age group. Fasting blood glucose and lipids were estimated using enzymatic kits.

Results: The mean levels of fasting blood glucose, cholesterol, TGL and low HDL were the highest in the urban area, though there was not much difference in the rural and periurban areas. There was also an increasing trend of all the parameters as age increased in both men and women. 11.4% of men in urban areas had fasting blood glucose above the cut off levels and 44.3% of urban men and women had high cholesterol levels.

Conclusion: This study documents a high burden of biochemical risk factors not only in urban areas but also in the periurban and rural population. It has also brought out some technical and operational issues for carrying out biochemical risk factors surveillance in the community. There is a need to scale up from surveys to surveillance mode using appropriate tools and application of this information for policy planning and programme implementation. ©

INTRODUCTION
There is a global concern on the rising premature morbidity and mortality due to non-communicable diseases (cardiovascular diseases, diabetes, obesity, cancers, chronic lung diseases etc). This disturbing trend is also being increasingly seen in developing countries, including India. The WHO chronic diseases report that in India chronic diseases accounted for more than 53% of all deaths in adults in 2005 and is projected that deaths will increase by 18% in the next ten years, and most markedly, deaths from diabetes will increase by 35%. Besides, currently, the countries with the largest number of people with diabetes are in India (40.9 million) and China (39.8 million) and the greatest increase is expected to occur in India by the year 2025 (69.9 million). However, there is no systematic data on NCDs and their risk factors so far in India. Sporadic studies have been conducted using different population groups and methodologies. WHO has recommended a STEPwise approach for NCD risk factor surveillance. This approach is a sequential process, starting with gathering information on key risk factors by the use of questionnaires (Step 1), then moving to simple, physical...
measurements (Step 2), and only then recommending the collection of blood samples for biochemical assessment (Step 3).

As we go up the steps the complexity of measurement, technical expertise and the resource needs increase. This increase is very steep between Step 2 & Step 3. WHO in general discourages biochemical risk factor surveillance for countries with limited resources and technical capacity. Notwithstanding this, most programme managers want to have data on diseases burden as that is seen as a more concrete piece of information to plan programmes. However, NCD surveillance is very difficult to undertake and countries are aware of this. They see biochemical risk factors as the next best alternative as they are more proximal to diseases rather than the behavioural risk factors.

In order to assess the needs and plan for a national level NCD risk factors survey, ICMR the focal agency for NCD surveillance in the country decided to undertake a pilot project for collection of biochemical risk factors. This utilized the 2003-2004 a multi-site study (Step 1&2) carried out using the WHO Stepwise approach for NCD risk factor surveillance in 6 centers spread across the country (Ballabgarh, Chennai, Delhi, Dibrugarh, Nagpur and Trivandrum). This paper presents the results of the biochemical risk factor surveillance (Step 3) which was conducted in Ballabgarh, Haryana.

**Objective**

The objective of this survey was to estimate the prevalence and levels of biochemical risk factors (fasting blood glucose, total cholesterol, HDL and triglyceride levels) of major non-communicable diseases in urban, rural and periurban locations in Ballabgarh block of Faridabad district in Haryana.

**Materials and Method**

A community based cross-sectional study was carried out between February to October 2005 in Ballabgarh, Haryana, India. The study was carried out in three areas- urban, rural and periurban areas. Men and women of 15-64 years of age in the selected areas of Ballabgarh block were included in the study. In earlier survey for Step 1&2 from February 2003 to June 2004, a total of 7989 individuals were interviewed (2593 in urban, 2830 in rural and 2566 in slum areas). As per protocol, for Step 3, a random sample of 50 individuals for each ten-year age group strata was generated from the database by ICMR. Thus, the aim was to cover a sample size of 1500, by selecting 250 men and 250 women from each location (urban, rural, periurban). Out of that list, required number of subjects in each location was contacted for the STEP 3 data collection. Once the original list was exhausted and still the target was not achieved, a new list was generated.

A structured interview schedule was used based on STEPs approach of WHO included parameters regarding socio-demographic characteristics, weight, and blood pressure, any significant illness in the past and any history of current medication for hypertension / diabetes.

Each field worker visited 30-40 houses in a day. After interviewing the subject about history of hypertension and diabetes, they were informed about the venue and time for blood collection with instructions to come fasting overnight. The individuals were additionally given paper slips (Identification Slips) with their name, age and unique ID number and address, which they were required to bring along with at the camp for easy and correct identification. Camps were held in a school, chaupal, subcentre or even in a temple in some places. One doctor, one lab technician, one field worker and one nurse attended the camp. Once the subject arrived at the campsite, his/her details were crosschecked with the identification slip provided to him/her at home. After making sure that the subject was overnight fasting, 5 ml of blood sample was taken and sent to the laboratory for analysis.

**Laboratory procedures and Quality Control**

A training workshop organized by the Department of Cardiac Biochemistry, AIIMS, for the technicians and SRFs from the centers based on a detailed protocol. For quality assurance three levels of quality checks were exercised- internal quality control, external quality control and 10% repeat analysis.

Three samples of internal quality control were run with every batch of samples analyzed. An unknown sample was sent for external quality assurance by the coordinating lab every month. Ten percent of the samples collected from the center were re-analyzed for glucose, total cholesterol, HDL cholesterol and triglycerides in the coordinating lab. Coordinating lab itself is part of external quality assessment scheme, UKNEQAS accredited to BIRMINGHAM, UK. Glucose was estimated by GOD-PAP method using enzymatic kits from RANDOX. Cholesterol was estimated by CHOD-PAP method and triglycerides by GPO-PAP method using enzymatic kits from RANDOX. HDL was estimated by precipitation with phosphotungstate/MgCl₂ followed by estimation of cholesterol in supernatant by the enzymatic kit method.

**Ethical issues**

Ethical clearance for carrying out the study was taken from the Ethical Committee, AIIMS. Written consent was taken from the study subjects. The results of the blood samples were recorded and subjects were given the results of their blood tests. In case of any abnormal results, they were advised to attend any health facility or CRHSP Ballabgarh and medical treatment as necessary was arranged for the study subjects.
Data Analysis

Double data entry of the step 3 questionnaire and the lab results was done in Epi Info 2002. The data was analyzed using SPSS version 10. Age & sex specific mean levels and proportion of “abnormals” was calculated. The cut-off points used for defining abnormality are as recommended by STEPs approach. Age standardization to the population age structure of Faridabad population according to census 2001 population was done. One-way ANOVA with multiple range test was used to test the statistical significance of means, and Chi square for proportions and trends.

RESULTS

A list of 2836 eligible subjects (932 urban, 857 periurban and 943 rural) was provided by ICMR. Out of these about 30% could not be contacted (312 urban, 257 periurban and 330 rural) because of change of residence, migration, locked houses, marriage etc. Out of those who were contacted, around 10% refused to participate (68/620 in urban, 56/600 in periurban, and 59/613 in rural). Hence, the final sample size was 1513 i.e., 501 in urban, 504 in periurban and 508 in rural areas, with equal distribution by area of residence, sex and age group.

Comparison of mean values in urban, rural and periurban areas.

a. Fasting blood glucose level (Table 1, Figs. 1A, 2A)

The distribution for the urban population shows high values as indicated by a shift to the right, followed by the periurban area. The mean fasting blood glucose level is highest in urban areas (100.8 mg/dl), but the mode or the most commonly occurring value was slightly lower at 93.6 mg/dl. The fasting blood glucose levels in urban men and women were significantly higher. There was also an increasing trend in the mean blood glucose levels as the age group increased at all the three sites e.g. from 99 mg/dl in 15-24 years age group in urban areas to 120.6 mg/dl in the 55-64 age group.

b. Total Cholesterol level (Table 1, Figs. 1B, 2B)

The distribution of blood cholesterol levels indicated higher values for the urban population whereas the pattern for rural and periurban areas were similar. The mean cholesterol was highest in urban areas (187.2 mg/dl) but the mode is lower than the mean value (159.9 mg/dl). There was an increasing trend in the cholesterol level in all the three sites as age increased; no statistically significant difference was seen between men and women.

c. HDL Cholesterol (Table 1, Figs. 1C, 2C)

The distribution of HDL cholesterol levels showed a different pattern, where the curve to the extreme left was that of the periurban area. The mean HDL cholesterol was highest in urban areas (46.8 mg/dl), but there was no significant difference between men and women. The increasing trend in the HDL levels with age was seen only in the urban and rural areas but in periurban subjects the mean HDL was the same throughout all the age groups.

Table 1: Distribution of mean blood levels by area and sex

<table>
<thead>
<tr>
<th></th>
<th>Area</th>
<th>Men Mean (95%CI)</th>
<th>Women Mean (95%CI)</th>
<th>Total Mean (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting Blood Glucose (mg/dl)</td>
<td>Urban</td>
<td>102.6 (100.8,113.4) † (n= 246)</td>
<td>100.8 (99.0,108.0) † (n= 255)</td>
<td>100.8 (97.2,104.4) (n= 501)</td>
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<tr>
<td></td>
<td>Periurban</td>
<td>100.8 (99.0,106.2) (n= 249)</td>
<td>99.0 (97.2,109.8) (n= 235)</td>
<td>99.0 (95.4,100.8) (n= 504)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>90.0 (88.2,97.2) ¶ (n= 256)</td>
<td>90.0 (88.2,95.4) ¶ (n= 250)</td>
<td>90.0 (88.2,91.8) (n= 506)</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>Urban</td>
<td>183.3 (179.4,198.9) † (n= 246)</td>
<td>187.2 (183.3,202.8) † (n= 255)</td>
<td>187.2 (183.3,191.1) (n= 501)</td>
</tr>
<tr>
<td></td>
<td>Periurban</td>
<td>163.8 (159.9,171.6) § (n= 249)</td>
<td>171.6 (167.7,187.2) § (n= 255)</td>
<td>167.7 (163.8,171.6) (n= 504)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>163.8 (159.9,183.3) (n= 257)</td>
<td>171.6 (167.7,183.3) (n= 249)</td>
<td>167.7 (163.8,171.6) (n= 506)</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>Urban</td>
<td>42.9 (39.0,42.9)* (n= 246)</td>
<td>50.7 (46.8,50.7) † (n= 255)</td>
<td>46.8 (46.0,47.6) (n= 501)</td>
</tr>
<tr>
<td></td>
<td>Periurban</td>
<td>35.1 (31.2,35.1) (n= 249)</td>
<td>42.9 (39.0,42.9) § (n= 255)</td>
<td>39.0 (38.2,39.8) (n= 504)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>39.0 (35.1,39.0) (n= 255)</td>
<td>42.9 (39.0,55.6) (n= 251)</td>
<td>42.9 (42.1,43.7) (n= 506)</td>
</tr>
<tr>
<td>TGL (mg/dl)</td>
<td>Urban</td>
<td>151.3 (142.4,169.1) † (n= 246)</td>
<td>115.7 (106.8,124.6) (n= 255)</td>
<td>133.5 (128.2,138.8) (n= 501)</td>
</tr>
<tr>
<td></td>
<td>Periurban</td>
<td>133.5 (124.6,151.3) § (n= 249)</td>
<td>124.6 (115.7,133.5) (n= 255)</td>
<td>133.5 (128.2,138.8) (n= 504)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>133.5 (124.6,151.3) (n= 257)</td>
<td>106.8 (97.9,133.5) (n= 249)</td>
<td>115.7 (110.4,121.0) (n= 506)</td>
</tr>
</tbody>
</table>

†Statistically significant difference between urban vs rural (p<0.05); §Statistically significant difference between urban vs periurban (p<0.05); ¶ Statistically significant difference between rural vs periurban (p<0.05); * Statistically significant difference between urban vs. periurban vs rural (p<0.05)
d. Triglycerides (Table 1, Figs. 1D, 2D)

The distribution of TGL levels was almost similar in all three areas. The mean TGL level was highest in urban men (151.3 mg/dl) and least among rural women (106.8 mg/dl). Similarly, there was an increasing trend in the TGL level in the urban area with age from 106.8 mg/dl to 169.1 mg/dl. However, in rural and periurban areas, the increase in trend was not seen beyond 55 years. Men were seen to have significantly higher values than women in all the three sites.

Proportion of subjects with abnormal cut off values and urban, rural and periurban comparison (Table 2).

Fasting blood glucose

It was seen that in men, the highest proportion of raised blood glucose (≥ 126 mg/dl) was seen in the urban area (11.4%) followed by periurban (10.8%), and sharply decreased in rural area (3.9%). The proportion of women with high blood sugar was seen to be highest in periurban area (14.1%) followed by urban (9.4%). The rural areas had least women with high blood glucose (1.6%). There was a statistically significant increase in proportion of men and women with raised fasting blood glucose levels with increasing age group in all sites except among rural men.

Blood Cholesterol

The largest proportion of men with high cholesterol was seen in the urban area (44.3%) followed by periurban (25.3%) and least in the rural area (24.5%). A similar trend was seen in women. The increase in proportion of men and women with raised cholesterol levels as age group increased was seen in all sites and was statistically significant.

HDL cholesterol

In men, low HDL cholesterol was seen in 23.2% in the urban. This was followed by the rural area (31.0%) and periurban area (40.6%). In women, low HDL cholesterol was seen to be least in the urban area (12.2%) and similar in rural and periurban i.e, 22.4%. The increasing trend above cut off value was found to be statistically significant among men and women in all the three areas except in rural women and periurban men.

Triglycerides (TGL)

About 44.7% of urban men had high TGL in urban area followed by periurban (35.7%) and rural area (34.6%). However, amongst women, TGL was seen to be highest in rural area (30.5%) as compared to urban (28.2%) and periurban (20.4%) areas. The increase in proportion of men and women with increasing age group in all sites was statistically significant.

Discussion

This paper documents the process and results of survey of biochemical risk factors for NCDs in one of the centres of an ICMR coordinated study. In India, very few published studies could be found which have assessed the biochemical risk factors according to the WHO Steps approach. A study was conducted amongst industrial workers from 10 companies across India to establish a surveillance network for cardiovascular diseases (CVD) risk factors in industrial settings and estimate the risk factor burden. It was seen that the prevalence of diabetes was reported to be 10.1%, which similar to this study. The mean cholesterol levels increased with age in both men and women, and HDL levels was higher in women that men. A study from rural Rajasthan reported about 22% of adults more than 20 years of age with high cholesterol level (above 200 mg/dl) which is similar to this study. Another study from urban Rajasthan, the prevalence of diabetes was 17.7% in men and 14.2% in women. Hypercholesterolemia (total cholesterol ≥ 200 mg/dl) was seen in 33.2% men and 28.9% women, women. Hypercholesterolemia (total cholesterol ≥ 200 mg/dl) was seen in 33.2% men and 28.9% women, high triglycerides 24.3% in men and 14.7% in women. Low high-density lipoprotein cholesterol was seen in 33.2% men and 28.9% women, high triglycerides 24.3% in men and 14.7% in women.

Data from the National Urban Diabetes Survey reports a prevalence of 12.1%, with no gender difference. A cross-sectional survey carried out in two villages in rural Andhra Pradesh among 345 adults aged 20 to 90 to find out the cardiovascular risk factors among rural population reported the mean cholesterol to be 4.6 (4.5-4.7) mmol/L, HDL-cholesterol 0.8 (0.8-0.9) mmol/L and triglyceride 1.3 (1.2-1.4) mmol/L.

NCDRisk Factor (NCDRF) surveillance aims to capture limited pieces of information with good quality data for programme planning purposes and needs to be differentiated from data collected on a research paradigm. This study was done primarily through research institutions only because they have the technical capacity to undertake such surveys. Our results are comparable to other disease surveys done by other researchers quoted above.

Lessons learnt

This experience has taught some lessons that would be useful for undertaking future biochemical risk factors surveillance in our country.

1. Need for quality control: Strict quality control measures will need to be followed as it involves laboratory investigations and highly trained personnel.

2. Choice of method: Other issues like using other methods that are more convenient and gives rapid results like glucometer for blood glucose, dry chemistry (strip method) for cholesterol can help to simplify the procedures. It will also reduce the time until results are available to the subjects as well as for decision making for control measures. However, their variability and quality control procedures to be adopted need to be addressed.

3. Operational issues: Motivating and obtaining consent from apparently healthy subjects to participate in the study which involves invasive procedures is challenging.

CONCLUSION

This study has demonstrated the feasibility of conducting a population based biochemical risk factor survey in India. The high prevalence of biochemical risk factors even among the rural and periurban (slums) shows that they are also at risk for NCDs. This has far reaching implications in terms of provision of health services in our country which has so far been oriented only to infectious disease and maternal and child issues. The need of the hour is the understanding of the concept of surveillance for NCD risk factors and not only understanding of the diseases. This is crucial in order to translate research to action. The introduction of the NCD surveillance in the Integrated Diseases Surveillance Project (IDSP) is the first step in this direction, but the concept still has to gain popularity and understanding from the medical fraternity as well as the policy makers. “There is a need to provide an effective public health response to the growing challenge of chronic diseases in India. A comprehensive strategy must integrate actions to minimize exposure to risk factors at the population level and reduce risk in individuals at high risk, to provide early, medium and long term effects”.

REFERENCES


community: Jaipur Heart Watch-3. *Indian Heart J* 2004;56:646-52.


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**Announcement**

**Eligibility Criteria for the Award of Fellowship of Indian College of Physicians**

Full Format available on API and JAPI Website - www.apiindia.org and www.japi.org

**Dr. Sandhya Kamath**
Hon General Secretary, API & ICP

**Dr. Falguni Parikh**
Jt Secretary, API & ICP

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**Announcement**

**Dr J C Patel Birth Centenary Celebrations**

International conference on Iron Deficiency will be held on 4-8 Dec, 2008 at Gyan Sarovar, Prajapita Brahmakumaris’ Ishwariya Vishwa Vidyalaya, Mt Abu, Rajasthan, India.

This will be a unique event combining Scientific Deliberation with Spiritual Wisdom. Scientific programme will include Plenary Sessions, Penal Discussions, Symposia and Guest lectures. Free papers in Poster format are accepted; last date for submission of poster abstract is 31 July, 2008. Registration is restricted because of limited accommodation; early registration closes on 1 October, 2008.

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