Original Article

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# Prevalence of Cardiovascular Risk Factors in Apparently Healthy Urban Adult Population of Kathmandu

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## ABSTRACT

**Background:** Cardiovascular diseases account for most deaths and major proportion of disabilities worldwide. Major cardiovascular risk factors are implicated in almost 75% of cardiovascular diseases. There has been a rapid increase in prevalence of such risk factors in apparently healthy young adults of urban population. This study aimed to find prevalence of such risk factors in order to implement preventive strategies against cardiovascular diseases in our setting.

**Methods:** A free heart camp was organized following wide dissemination of information through print, online, TV, radio and social media. Pretested data collection tool was used by trained enumerators using standard guidelines and calibrated devices. Demographic, anthropometric, physical examination and blood investigation data were obtained. Standard guidelines were followed to define and categorize the obtained information. Data was analyzed using SPSS V20.

**Results:** A total of 5530 participants were enrolled after carefully applying inclusion and exclusion criteria. Mean age of study population was 38.14±13.03 years. There were 3298 (59.6%) males with mean age of 37.67±12.99 years and 2232 (40.4%) females with mean age of 38.84±13.05 years. Majority of study population (29.6%) belonged to 30-39 years age group. Prevalence of tobacco and alcohol consumption was 29.3%(95%CI:28.1-30.5) and 32.7%(95%CI:31.5-34.) respectively. Prevalence of inadequate fruits and vegetables intake, low physical activity and overweight or obesity was 75.4%(95%CI:74.3-76.6), 61.1%(95%CI:59.8-62.4) and 41.3%(95%CI:40.0-42.6) respectively. Prevalence of hypertension, diabetes and dyslipidemia was 26.4%(95%CI:25.3-27.6), 5.3%(95%CI:4.7-5.9) and 86.9%(95%CI:85.9-87.7) respectively. These results were statistically significant in both age and sex based distribution.

**Conclusions:** Prevalence of major cardiovascular risk factors in apparently healthy adult population of Kathmandu Valley was high. Dyslipidemia, unhealthy diet, physical inactivity and overweight or obesity were most prevalent cardiovascular risk factors.

**Keywords:** Cardiovascular risk factors; healthy adults; prevalence; urban population.

## INTRODUCTION

Cardiovascular Diseases (CVD) are the most common causes of deaths and disabilities across the world.[1] According to the World Health Organization (WHO), in 2012, about 17.5 million annual deaths have been attributed to CVD, of which 80% occurred in low and middle-income countries (LMICs).[2] CVD also account for 62.6 million of disability-adjusted life years (DALYs) globally each year.[3] Smoking, alcohol consumption, low fruits and vegetable intake, physical inactivity, obesity, high blood pressure, high blood sugar and abnormal blood lipids are major Cardiovascular Risk Factors (CVRF).[4] WHO estimates common CVRF contribute to almost 75% of CVD.[5] The most relevant study on the prevalence of CVRF in Nepal was STEPS survey.[6] In recent times, the prevalence of CVRF is rapidly increasing even in young and apparently healthy individuals of the urban population.[7] Therefore, in this study, we aimed to measure the prevalence of CVRF in the apparently healthy adult population of Kathmandu valley.

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## METHODS

A free heart disease risk factors screening and awareness camp was organized in the year 2014 over a period of 12 days in Kathmandu, the capital city of Nepal. Information regarding nature and purpose of the camp was circulated through major prints and electronic media, two weeks prior to the camp and throughout its conduction. People were informed that they would be evaluated for the presence of risk factors for cardiovascular diseases through interview, physical examination and blood investigations free of cost.

Consenting individuals attending the health camp, who were at least 18 years of age and had been residing in Kathmandu, Bhaktapur or Lalitpur at least for past one year were included in the study. Individuals with acute systemic illness, previously diagnosed chronic condition(s) (hypertension, diabetes mellitus, dyslipidemia, chronic liver disease or chronic kidney disease, established CVD) and pregnant ladies were excluded.

Data regarding demographic characteristics and behavioral risk factors (tobacco use, alcohol consumption, low level of physical activity, adverse dietary practice) were collected during interviews using structured questionnaires. The questionnaire had been pre-tested on 25 patients visiting heart clinic, Maharajgunj and was found to be optimal for the study so no changes had to be made.

Weight was measured to the nearest kilogram using a standard weighing machine (Microlife BR-9201) weighing machine and height using a calibrated stadiometer (Prestige Portable Stadiometer, PRESTIGE-HM007) to the nearest 0.5 cm. Body Mass Index (BMI) was calculated by dividing weight by height squared (kg/m$^2$).[8] Blood pressure was measured using auscultatory method with a standardized calibrated mercury column type sphygmomanometer (Life line Mercury Sphygmomanometer B01AT7ACII) to the nearest mmHg. Two measurements were taken in each arm of each participant after a gap of at least five minutes with standard techniques. Mean of all four readings was recorded.[9]

Fasting blood sugar (FBS) and lipid profile were measured from 12hr overnight fasting Blood sample, which was kept in gel vials. The samples were transported to the laboratory in ice pack carriers. Glucose was measured using GOD-POD (Glucose oxidase- Peroxidase) method. The lipid profile consisted of total cholesterol (TC), Triglyceride (TG), High-density lipoprotein (HDL) cholesterol and Low-density lipoprotein (LDL) cholesterol. TC, TG and HDL were measured using CHOD-PAP (cholesteroloxidase/peroxidase), enzymatic end point method and precipitation method respectively. LDL cholesterol was calculated by the Friedewald equation.

Participants were classified into different categories for risk factors. Harmful intake of alcohol meant daily intake of greater than 60 gm and 40 gm of pure alcohol for male and female respectively.[10] 'Inadequate' intake of fruits and vegetables was defined as consumption of fewer than 5 servings of fruits and vegetables on an average each day.[10] Based on the level and duration of activity performed by the participants, physical activity was classified as low, moderate or high based on STEPS Manual.[10] 'Overweight' meant BMI in the range 25-29.9 kg/m$^2$ and 'obesity' meant BMI 30 kg/m$^2$ or more.[8] 'Normal BP' meant systolic BP less than 120 mmHg and diastolic less than 80mmHg. 'Prehypertension' meant systolic BP 120-139 mmHg and/or diastolic BP 80-89 mmHg. Hypertension meant systolic BP 140 mmHg and/or diastolic BP 90 mmHg or more.[9]

'Normal FBS' meant an FBS of less than 110 mg/dL. 'Pre-diabetes' meant FBS in the range of 110-125 mg/dL, and diabetes meant FBS of 126 mg/dL or more.[11] Serum level of total cholesterol more than 200 mg/dL, LDL more than 130 mg/dL, TG more than 150 mg/dL and HDL less than 40 mg/dL in male and less than 50 mg/dL in female were considered abnormal.[12]

Data were entered into the computer using EpiData 3.1. Data analysis was then carried out using SPSS version 20. Mean and standard deviation were calculated for continuous variables and proportion for categorical variables. Chi-square test was used to test the association between demographic factors (age groups and sex) and presence of CVRF. A P-value of less than 0.05 was taken as test of significance.

Ethical Approval for the study was taken from the Nepal Health Research Council. Permission to conduct the heath camp was granted by the District Public Health Office, Kathmandu. Informed written consent was taken from each participant. Blood samples were safely destroyed following the biochemical analysis. Participants were counseled regarding the results of their clinical examination and laboratory reports and were given education about prevention and management of cardiovascular diseases. Counseling that could be provided based on the interview and the physical measurement was provided on the same day. Participants were asked to visit the reporting desk serially two weeks after the blood collection to inform them about the biochemical findings and final impression and they were advised accordingly.

## RESULTS

Altogether, 6859 individuals attended the health camp. Participants, who did not meet inclusion criteria, had missing data or those who denied consent were excluded. Data from 5530 individuals was used for analysis.

Age of participants ranged from 18 to 79 years with mean age of 38.14±13.03 years. There were 3298 (59.6%) males with mean age of 37.67±12.99 and 2232 (40.4%) females with mean age of 38.84±13.05 years. The majority of participants belonged to 30-39 years and was male (figure 1).

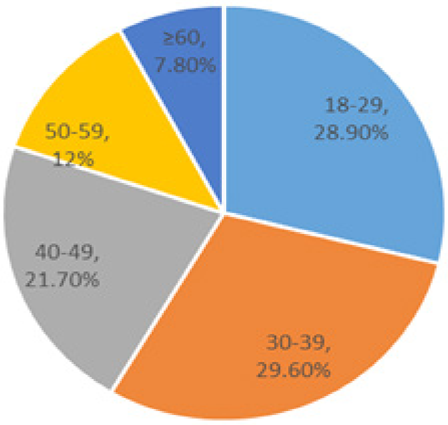


Figure 1. Age based distribution.

Prevalence of smoking was 18.9%(95%CI:17.9-19.9) with male predominance (28.7%,95%CI:27.1-30.2). Prevalence of smoking increased with age (table 1). Smokeless tobacco was consumed by 16.5%(95%CI:15.6-17.5) of the participants. Prevalence of smokeless tobacco consumption increased with age till age group 50-59 years then decreased slightly (table 1). Among all participants, 29.3%(95%CI:28.1-30.5) consumed either form of tobacco (smoking or smokeless), whereas 6.1%(95%CI:5.5-6.8) of the participants consumed both forms of tobacco. Prevalence of consumption of either and both form of tobacco was higher in males (table 2). Tobacco consumption as smoking ($p<0.001$), smokeless ($p<0.001$), either ($p<0.001$) and both forms ($p=0.001$) were statistically significant across age groups (table 1). These forms of tobacco consumption were statistically significant in sex ($p<0.001$) based distribution (table 2).

Among all participants, 32.7%(95%CI:31.5-34.0) had consumed alcohol at some point in their life. Prevalence of harmful consumption was highest in age group 50-59 years (table 1). Harmful use of alcohol consumption was more prevalent among males 14.1% (95%CI:13.0-15.4) than females 3.2 %(95%CI:2.5-4.0) (table 2). Different amount of alcohol consumption was not statistically significant in age based distribution ($p=0.056$) but statistically significant in sex based distribution ($p<0.001$).

Table 1. Age based distribution of tobacco consumption, alcohol consumption, dietary habits and physical activity.

| Risk Factors | | 18-29(%) | 30-39 (%) | 40-49(%) | 50-59(%) | >=60 (%) | p-value | Total(%) |
|---|---|---|---|---|---|---|---|---|
| | Pop (n) | 1600 | 1637 | 1201 | 663 | 429 | | 5530 |
| Tobacco consumption | Smoking | 17.1 | 17.9 | 17.5 | 21.9 | 28.4 | <0.001 | 18.9 |
| | Smokeless | 12.3 | 16.5 | 19.5 | 19.9 | 18.9 | <0.001 | 16.5 |
| | Either | 24.8 | 28.3 | 31.1 | 33.9 | 37.5 | <0.001 | 29.3 |
| | Both | 4.7 | 6.0 | 5.8 | 7.8 | 9.8 | 0.001 | 6.1 |
| Alcohol consumption | Harmful use | 8.6 | 10.9 | 8.4 | 11.3 | 10.5 | 0.056 | 9.7 |
| Diet | Veg | 9.5 | 9.5 | 10.8 | 13.7 | 25.9 | <0.001 | 11.6 |
| | Mixed | 90.5 | 90.5 | 89.2 | 86.3 | 74.1 | | 88.4 |
| Fruits/ Vegetables intake | Adequate | 24.0 | 23.6 | 25.7 | 25.8 | 24.9 | 0.65 | 24.6 |
| | Inadequate | 76.0 | 76.4 | 74.3 | 74.2 | 75.1 | | 75.4 |
| Physical activity | Low | 62.6 | 64.0 | 58.5 | 56.0 | 59.7 | 0.001 | 61.1 |
| | Moderate | 19.9 | 19.7 | 24.3 | 26.7 | 22.1 | | 21.8 |
| | High | 17.6 | 16.2 | 17.2 | 17.3 | 18.2 | | 17.1 |

Table 2. Sex based distribution of tobacco consumption, alcohol consumption, dietary habits and physical activity.

| Risk Factors | | Male (n=3298) | | Female (n=2232) | | p-value | Total (n=5530) | |
|---|---|---|---|---|---|---|---|---|
| | | % | 95%CI | % | 95%CI | | % | 95%CI |
| Tobacco consumption | Smoking | 28.7 | 27.1-30.2 | 4.4 | 3.7-5.4 | <0.001 | 18.9 | 17.9-19.9 |
| | Smokeless | 22.5 | 21.1-24.0 | 7.7 | 6.7-8.9 | <0.001 | 16.5 | 15.6-17.5 |
| | Either | 41.4 | 39.8-43.1 | 11.3 | 10.1-12.7 | <0.001 | 29.3 | 28.1-30.5 |
| | Both | 9.7 | 8.7-10.7 | 0.8 | 0.5-1.3 | <0.001 | 6.1 | 5.5-6.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alcohol consumption | Harmful use | 14.1 | 13.0-15.4 | 3.2 | 2.5-4.0 | <0.001 | 9.7 | 9.0-10.3 |
| Diet | Veg | 9.0 | 8.1-10.0 | 15.4 | 13.9-16.9 | <0.001 | 11.6 | 10.8-12.4 |
| | Mixed | 91.0 | 90.0-91.9 | 84.6 | 83.1-86.1 | | 88.4 | 87.6-89.2 |
| Fruits/ Vegetables intake | Adequate | 23.9 | 22.5-25.4 | 25.5 | 23.8-27.4 | 0.16 | 24.6 | 23.4-25.7 |
| | Inadequate | 76.1 | 74.6-77.5 | 74.5 | 72.6-76.2 | | 75.4 | 74.3-76.6 |
| Physical activity | Low | 55.2 | 53.5-56.8 | 69.9 | 68.0-71.8 | <0.001 | 61.1 | 59.8-62.4 |
| | Moderate | 23.5 | 22.1-25.0 | 19.2 | 17.6-20.9 | | 21.8 | 20.7-22.9 |
| | High | 21.3 | 20.0-22.7 | 10.9 | 9.7-12.2 | | 17.1 | 16.1-18.1 |

Table 3. Age based distribution of body mass index, blood pressure, fasting blood sugar and dyslipidemia.

| Risk Factors | | 18-29 (%) | 30-39 (%) | 40-49 (%) | 50-59 (%) | >=60 (%) | p-value | Total (%) |
|---|---|---|---|---|---|---|---|---|
| | Pop (n) | 1600 | 1637 | 1201 | 663 | 429 | | 5530 |
| Body Mass Index (BMI) | Underweight | 11.6 | 2.2 | 1.7 | 1.8 | 3.0 | <0.001 | 4.8 |
| | Normal | 67.5 | 50.4 | 47.6 | 43.0 | 50.3 | | 53.9 |
| | Over weight | 17.9 | 38.7 | 41.5 | 44.6 | 38.5 | | 34.0 |
| | Obesity | 2.9 | 8.7 | 9.2 | 10.6 | 8.2 | | 7.3 |
| Blood Pressure | Normal | 40.1 | 26.3 | 20.2 | 14.5 | 12.6 | <0.001 | 26.5 |
| | PreHTN | 47.5 | 51.3 | 46.0 | 42.5 | 39.6 | | 47.1 |
| | HTN | 12.4 | 22.4 | 33.7 | 43.0 | 47.8 | | 26.4 |
| Fasting Blood Sugar | Normal | 98.7 | 93.8 | 85.1 | 80.2 | 69.7 | <0.001 | 89.8 |
| | PreDM | 0.9 | 3.1 | 7.6 | 8.4 | 13.5 | | 4.9 |
| | DM | 0.4 | 3.1 | 7.3 | 11.3 | 16.8 | | 5.3 |
| Dyslipidemia | TC >200 | 14.6 | 29.3 | 35.3 | 39.2 | 30.5 | <0.001 | 27.6 |
| | TG >150 | 21.4 | 39.3 | 43.5 | 44.3 | 35.2 | <0.001 | 35.3 |
| | LDL >130 | 14.8 | 25.4 | 30.4 | 35.0 | 25.9 | <0.001 | 24.6 |
| | HDL (M<40;F<50) | 73.2 | 72.8 | 70.2 | 62.4 | 62.7 | <0.001 | 70.3 |
| | Either | 82.4 | 89.6 | 89.3 | 89.0 | 82.5 | <0.001 | 86.9 |
| | All | 3.1 | 6.1 | 7.8 | 6.9 | 6.8 | <0.001 | 5.8 |

PreHTN=Prehypertension; HTN=Hypertension; PreDM=Prediabetes Mellitus; DM=Diabetes Mellitus; TC=Total Cholesterol; TG=Triglyceride; LDL=Low Density Lipoprotein; HDL=High Density Lipoprotein

Inadequate intake of fruits and vegetables was found in 75.4%(95%CI:74.3-76.6) of the participants. Similar dietary patterns were noted across all ages (p=0.65) (table 1) with slight male predominance (table 2). Mixed diet consumption was found in 88.4% of study participants which was statistically significant in age (p<0.001) and sex (p<0.001) based distribution.

Low level of physical activity was seen in 61.1%(95%CI:59.8-62.4) of the participants. Prevalence of low physical activity fluctuated across age groups with high prevalence in younger age (table 1). Females were found to be more inactive compared to male (table 2). Different levels of physical activity were statistically significant in age (p=0.001) and sex based distribution (p<0.001).

Among all respondents, 41.3%(95%CI:40.0-42.6) were overweight or obese. Prevalence of overweight/obesity increased with age upto age group 50-59 then dropped (table 3). Overweight/obesity was more prevalent in females (47.3%,95%CI:45.2-49.4) than males (37.3%,95%CI:35.6-38.9) (table 4).Participants in different BMI categories were statistically significant in age (p<0.001) and sex (p<0.001) based distribution.

Normal blood pressure, hypertension and prehypertension was seen in 26.5%(95%CI:25.3-27.7), 26.4%(95%CI:25.3-27.6) and 47.1%(95%CI:45.8-48.4) respectively. Prevalence of hypertension increased with age (table 3). Both pre-hypertension and hypertension were more prevalent in male population (table 4). Participants in different BP categories were statistically significant in age (p<0.001) and sex (p<0.001) based distribution.

Table 4. Sex based distribution of body mass index, blood pressure, fasting blood sugar and dyslipidemia.

| Risk Factors | | Male (n=3298) | | Female (n=2232) | | p-value | Total (n=5530) | |
|---|---|---|---|---|---|---|---|---|
| | | % | 95%CI | % | 95%CI | | % | 95%CI |
| Body Mass Index (BMI) | Underweight | 4.6 | 4.0-5.4 | 5.1 | 4.3-6.1 | <0.001 | 4.8 | 4.3-5.2 |
| | Normal | 58.1 | 56.4-59.8 | 47.6 | 45.5-49.7 | | 53.9 | 52.5-55.1 |
| | Over weight | 32.6 | 31.0-34.2 | 36.1 | 34.1-38.1 | | 34.0 | 32.8-35.3 |
| | Obesity | 4.7 | 4.0-5.4 | 11.2 | 10.0-12.6 | | 7.3 | 6.6-8.0 |
| Blood Pressure | Normal | 19.7 | 18.4-21.1 | 36.4 | 34.5-38.4 | <0.001 | 26.5 | 25.3-27.7 |
| | PreHTN | 51.3 | 49.6-53.0 | 40.9 | 38.9-43.0 | | 47.1 | 45.8-48.4 |
| | HTN | 29.0 | 27.5-30.6 | 22.6 | 20.9-24.4 | | 26.4 | 25.3-27.6 |
| Fasting Blood Sugar | Normal | 89.9 | 88.8-90.9 | 89.8 | 88.5-91.0 | 0.69 | 89.8 | 89.0-90.6 |
| | PreDM | 5.0 | 4.3-5.8 | 4.7 | 3.8-5.7 | | 4.9 | 4.4-5.5 |
| | DM | 5.1 | 4.4-5.9 | 5.5 | 4.6-6.5 | | 5.3 | 4.7-5.9 |
| Dyslipidemia | TC >200 | 28.4 | 26.9-30.0 | 26.4 | 24.6-28.3 | 0.09 | 27.6 | 26.5-28.8 |
| | TG >150 | 42.6 | 40.9-44.3 | 24.6 | 22.9-26.5 | <0.001 | 35.3 | 34.1-36.6 |
| | LDL >130 | 24.5 | 23.1-26.0 | 24.8 | 23.0-26.6 | 0.82 | 24.6 | 23.5-25.7 |
| | HDL (M<40;F<50) | 61.9 | 60.2-63.6 | 82.7 | 81.1-84.2 | 0.09 | 70.3 | 69.1-71.5 |
| | Either | 83.9 | 82.6-85.1 | 91.2 | 90.0-92.3 | <0.001 | 86.9 | 85.9-87.7 |
| | All | 4.9 | 4.2-5.6 | 7.1 | 6.1-8.2 | <0.001 | 5.8 | 5.2-6.4 |

PreHTN=Prehypertension; HTN=Hypertension; PreDM=Prediabetes Mellitus; DM=Diabetes Mellitus; TC=Total Cholesterol; TG=Triglyceride; LDL=Low Density Lipoprotein; HDL=High Density Lipoprotein

Table 5. Mean of anthropometric measurements, blood pressure and lab investigations.

| | Male | | Female | | Overall | |
|---|---|---|---|---|---|---|
| | Mean±SD | 95% CI | Mean±SD | 95% CI | Mean±SD | 95% CI |
| Weight | 67.29±10.49 | 66.93-67.65 | 59.35±10.44 | 58.91-59.78 | 64.08±11.17 | 63.79-64.38 |
| Height | 167.19±6.46 | 166.97-167.41 | 154.40±6.15 | 154.14-154.65 | 162.03±8.92 | 161.79-162.26 |
| BMI | 24.05±3.41 | 23.94-24.17 | 24.90±4.17 | 24.72-25.07 | 24.39±3.76 | 24.29-24.49 |
| SBP | 121.03±12.94 | 120.59-121.47 | 117.56±15.37 | 116.92-118.20 | 119.63±14.08 | 119.26-12.00 |
| DBP | 83.69±19.25 | 83.04-84.35 | 80.28±17.21 | 79.57-81.00 | 82.32±18.53 | 81.83-82.81 |
| FBS | 96.37±41.79 | 94.94-97.80 | 95.92±45.39 | 94.04-97.81 | 96.19±43.28 | 95.05-97.33 |
| TC | 179.73±43.35 | 178.25-181.21 | 177.73±43.84 | 175.91-179.55 | 178.92±43.56 | 177.77-180.07 |
| TG | 165.14±11.94 | 161.07-169.22 | 127.63±90.14 | 123.88-131.37 | 150.00±11.01 | 147.10-152.90 |
| LDL | 109.94±41.74 | 108.52-111.37 | 110.23±35.78 | 108.74-111.71 | 110.06±39.44 | 109.02-111.10 |
| HDL | 38.03±8.90 | 37.73-38.34 | 42.10±9.19 | 41.72-42.49 | 39.68±9.24 | 39.43-39.92 |

BMI=Body Mass Index; SBP=Systolic Blood Pressure; DBP=Diastolic Blood Pressure; FBS=Fating Blood Sugar; TG=Triglyceride; TC=Total Cholesterol; LDL=Low Density Lipoprotein; HDL=High Density Lipoprotein

Prevalence of diabetes and pre-diabetes was 5.3%(95%CI:4.7-5.9)and4.9%(95%CI:4.4-5.5)respectively. The prevalence of pre-diabetes and diabetes increased with advancing age (table 3). Prevalence of diabetes was higher in female (5.5%,95%CI:4.6-6.5) compared to male (5.1%,95%CI:4.4-5.9) whereas prevalence of pre-diabetes was higher in male (5%,95%CI:4.3-5.8) than female (4.7%,95%CI:3.8-5.7) (table 4). Participants in different FBS categories were statistically significant across age groups (p<0.001) while it was not statistically significant in sex based distribution (p=0.69).

Prevalence of dyslipidemia was 86.9%(95%CI:85.9-87.7). Hypercholesterolemia, hypertriglyceridemia, high LDL and low HDL was found to be present in 27.6%(95%CI: 26.5-28.8), 35.3%(95%CI:34.1-36.6), 24.6%(95%CI:23.5-25.7) and 70.3%(95%CI:69.1-71.5) of the participants respectively. Lipid profile findings were statistically significant across age groups (p<0.001). In sex based distribution, lipid profile findings except LDL (p=0.82) were statistically significant (table 4).

## DISCUSSION

Our study showed high prevalence of major CVRF among apparently healthy urban adults.

The prevalence of smoking was found to be 18.9% in our study, which is similar to the prevalence found by Sreeramareddy et al.[13] but higher than that found in other studies done in Nepal[14-16] and India.[17,18] The prevalence of smoking was noted to rise with age and was higher among males than females, which is consistent with findings from several other studies done in Nepal[13-15] and India.[19] These findings may be explained by difficulty to abstain from smoking once initiated and the relative higher acceptability to tobacco consumption by males than females in Asian societies.

In our study, harmful use of alcohol was present in 14% of participants, which is higher than the finding noted in urban population of nationwide STEP survey done in Nepal.[14] Alcohol consumption was prevalent among males than females which is in line with studies done in Nepal[14,15] and India.[17]

Fruit and vegetable consumption was inadequate in 75.4% participants. This might reflect the preference of urban population towards packed food and fast food. The prevalence noted in our study is lower than found in other studies conducted in Nepal,[14] India[19] and Malaysia.[20] The inadequate consumption of fruits and vegetable was seen across all age groups and both sex. This finding was also seen in other studies done in Nepal[14] and India.[19]

The prevalence of low physical activity noted in our study (61.1%) is greater than that in other studies carried out in Nepal,[14,15,21] India[19] and Malaysia.[20] This prevalence was higher in females than males, which is in line with findings noted by Adhikari et al.[15] and Gupta et al.[18] This might have been seen because urban females have to do household chores in addition to their work or study which might have restricted their physical activity.

Among total participants, 41.3% were overweight or obese. This is higher than the findings from studies done in Nepal,[14,15] India,[19] Malaysia[20] and China.[22] Obesity was found to be more prevalent among females than males. Similar finding was noted in previous studies in Nepal[15] and India.[18]

The prevalence of hypertension noted in our study (26.9%) is lower than that seen in other studies done in Nepal[14-16] and India.[17,18] Our study did not include previously diagnosed cases and majority of participants were of the younger age group, which might have shown the lower prevalence. In our study, the prevalence of prehypertension and hypertension increased with age and higher in males and females, which is consistent with findings noted in studies done in different countries like Nepal,[14,15] India,[19] Malaysia[20] and China.[22]

Our study showed 5.3% of participants to be diabetic which is lower than that noted in previous studies done in Nepal[14,16] and India.[17-19] The prevalence increased with age which is consistent with STEPS survey and several other studies. The prevalence of diabetes was higher in females than males, which is in contrast to findings from nationwide STEPS survey in Nepal,[14] India[19] and a study done in China[22] that have shown diabetes to be more prevalent among males. However, pre-diabetes was slightly more prevalent among males than females. This finding has not been noted in earlier studies and might need further evaluation.

This study showed dyslipidemia to be of common occurrence. Urban lifestyle and dietary pattern might have key roles. The prevalence of hypercholesteremia seen is higher than that noted in other studies done in Nepal[14,16] and India.[18] The prevalence of hypertriglyceridemia and high LDL cholesterol was seen lower than studies done by Sharma et al.[16] and Limbu et al.[23] in Nepal but higher than that noted by Gupta et al.[18] in India. The prevalence of low HDL cholesterol noted in our study is higher than that noted in previous studies done in Nepal[16] and India.[18]

Larger sample size was major strength of our study. We were able to measure fasting glucose and lipid profile for detecting diabetes and dyslipidemia. We have analyzed the data to present the information about stages such as pre-hypertension and pre-diabetes apart from hypertension and diabetes. In addition, looking for the prevalence of CVRF in apparently healthy looking adults may significantly contribute in convincing general people to screen for CVRF.

The limitation of our study is that we have not used random sampling and the study was done in participants of a camp, data of which cannot reflect true prevalence of CVRF in entire community.

There have been some efforts to address the problem of non-communicable diseases in Nepal. The Ministry of Health and Population of Nepal endorsed Package of Essential Non-communicable Diseases (PEN) protocol in July 2016, which is a tool for implementing the PEN for primary care in low-resource settings. However, it is focused on secondary prevention rather than primary prevention.[24]

Although there have been efforts to address the risk factors for cardiovascular diseases in Nepal, these are insufficient. It is necessary to scale up the interventions in order to tackle the high prevalence of risk factors of cardiovascular diseases in Nepal and also take into consideration the apparently healthy population during this process.

## CONCLUSIONS

The prevalence of various CVRF is high in the apparently healthy adult population of Kathmandu. Dyslipidemia, unhealthy diet, physical inactivity and overweight or obesity were the most prevalent CVRF.

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