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Risk Factors of Non-communicable Diseases among Undergraduate Students: Evidence from Pokhara Metropolitan City, Nepal

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Abstract

Non-communicable diseases (NCDs) are the leading cause of morbidity and mortality globally, accounting for 41 million deaths annually, or about 74% of all deaths. Various behavioural and metabolic risk factors contribute to the development of NCDs. This study aimed to determine the prevalence of NCD-related risk factors among undergraduate students. A cross-sectional study was conducted among students studying in community colleges of Pokhara Metropolitan City. A probability multistage sampling technique was used to select 172 participants. Data were collected by the researcher using a structured self-reporting tool based on the WHO STEPS Survey (version 3.2). The data were entered into EpiData version 3.1 and exported to SPSS version 16 for analysis. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to determine the prevalence of risk factors, while the Chi-square test assessed associations. The mean age of respondents was 20.97±1.42 years, with females forming the majority and most respondents being unmarried. Behavioural risk factors included tobacco use (2.3%), alcohol consumption (9.3%), inadequate fruit and vegetable intake (91.9%), and physical inactivity (9.9%). Biological risk factors showed that 5.2% were hypertensive and 19.8% were overweight or obese. Alcohol consumption and hypertension were significantly higher among males ($p=0.001$), while overweight and obesity were more common among Janajati, Dalit, and Madheshi ethnic groups ($p=0.014$). The study concludes that NCD risk factors are prevalent among undergraduate students.

Keywords

Non-communicable diseases, Risk factors, Undergraduate students.

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1. Background of the Study

Non-communicable diseases (NCDs) are the group of condition that are not spread through infection or through person to person which is caused by combination of genetic, physiological and behavioural factors (World Health Organization, 2022; Pan American Health organization, 2023). The essential NCDs are cardiovascular diseases (CVDs), cancer, chronic respiratory diseases and diabetes (WHO, 2022). NCDs are significant and growing burden of health globally. Every year 41 million death occurs from NCDs which accounts for 74% all death, in which 80% death occurs prematurely. CVDs are the most common leading cause of death around 17.9 million people are die from CVDs in a year followed by cancers (9.3 million), chronic respiratory diseases (4.1 million), and diabetes (2.0 million including kidney disease deaths caused by diabetes) (WHO, 2022).

NCDS are first leading cause of mortality and morbidity developed as well as developing countries. In American region 5.8 million death occurs from NCDs which accounts for 81% of total death (Pan American Health organization, 2021). The mortality from NCDs are increasing in low and middle income countries, in south east Asian region 9.2 million people death from NCDs which is equivalent of 27.5% of all death among them 41.3% of death occurs prematurely (WHO. South East Asia, 2020). In the context of Nepal 71.1% death results from NCDs and it is responsible for 1.2% of total disability adjusted life years (DALYs) (Nepal Health Research Council *et al.*, 2021).

Traditionally, NCDs are called disease of rich, but now burden is increasing in condition in developing countries and it's became a serious threat to national economic development (Budreviciute *et al.*, 2020). NCDs contributes number of health related expenditures, global health expenditures for NCDs is US\$47 trillion in output loss within the next two decades (Chand *et al.*, 2020). Similarly around \$500 billion per year health expenditure due to NCD in Low- and middle-income.

Common preventable risk factors are responsible for causing NCDs which include behavioural risk factors and metabolic risk

factors. The major behavioural risk factors includes tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol and the leading metabolic risk factors was raised blood pressure followed by overweight/obesity, hyperglycemia and hyperlipidemia (Khatib, 2004). About 8 million deaths result from Tobacco intake, 1.8 million death from excess sodium intake, more than 3 million death result from harmful alcohol use and 83000 death due to insufficient physical Activity (WHO, 2022).

Globally, the prevalence of insufficient physical activity among adolescent was 80% and the risk of having NCDs was increased by 20-30% who are physically inactive (Bull *et al.*, 2020). Similarly the prevalence of hypertension is higher in young adult in the comparison of older adult(Li *et al.*, 2023) as well as different study reported that more male are hypertensive than female (Moussa *et al.*, 2021; Raddy *et al.*, 2015; Sainju *et al.*, 2015).

The prevalence of NCDs related risk factors are, more than 39% adults are overweight, 13% adults are obese, 18.4% consume alcohol, and 15.2% consumed tobacco around the world (Peacock *et al.*, 2018). In Uganda 8.3% consumed tobacco, 58.4% consumed alcohol 3.4% physically inactive and 22.2% of respondents' are hypertensive (Silver *et al.*, 2023). In India 38.9% consumed tobacco, 18.8% consumed alcohol, 11% physically inactive, 91.3% higher salt intake, 35.2% obese or over weight and 26.2 % are hypertensive (Thakur *et al.*, 2019).

According to the NCD STEPS survey 2019, nearly 28.9% consumed tobacco, 23.9% consumed alcohol, around 97% population consumed unhealthy diet and 24% overweight (Bista *et al.*, 2021). Similarly, in Kathmandu the prevalence of smoking 22%, alcohol consumption 31%, physical inactivity 10.2%, inadequate consumption of fruits and vegetable 93.9% and overweight & obesity 55.2% and 27.8% hypertensive (Dahal *et al.*, 2021). However, in the context of Pokhara, 95.33% consume unhealthy diet, 84.77% physically inactive, 6.4% smoke, 5.29% consume alcohol, and 6.66% are obese (Dhungana *et al.*, 2019).

2. Statement of the Problem

NCDS became an emerging global public health challenge which was increasing day by day, globally the death from NCDs increased from 38million or 68% of total death in 2012 to 40.5million or 71% of total death 2016 (World Health Organization, 2021; Schlabach *et al.*, 2021). and 31.5million out of 40.5 million death occurs in low and middle income country like Nepal (Dhungana *et al.*, 2021). Literature review suggest that there is noticeable variation of risk factors of NCDs, among various region of the world, countries to countries age, sex, education

status, marital status even in ethnic groups in Asian countries there is high prevalence of NCDs risk behaviour, obese (39%), physically inactive (53%), alcohol consumption (10.1%) and tobacco consumption (2.5%) (Peltzer & Pengpid, 2018). Tobacco consumption among adults is higher (28.9%) in Nepal as compared to other SAARC countries with prevalence of current smoker followed by 25% in Bangladesh, 14% in India, 12% Pakistan respectively (Rafique *et al.*, 2018). Another study of Pokhara Nepal, shows that (8.5%) smoking, (11.5%) consume alcohol, (13.6%) consume junk food daily and 53.8% are physically inactive (Shrestha *et al.*, 2022). The proportion of physical inactivity and consumption of unhealthy was high in among school and college students whereas smoking and alcohol consumption rate is higher in adult, married and illiterate people (Shrestha *et al.*, 2022; Rustagi *et al.*, 2011; Subedee & Sharma, 2023).

By these all risk factors are preventable, around 80% NCDs related death can be prevented by eliminating known behavioural risk factors (Khuwaja *et al.*, 2011). WHO established different plan and policies for the prevention and control of non-communicable diseases focus on developing countries, like global action plan 2014-2020, sustainable development goal and pen package. Nepal also adopted the South East Asia NCD targets to be achieved by 2025 through multi sectorial coordination (World Health Organization, 2014). In Nepal, national health policy (policy no 12) also address for the prevention and control of non-communicable diseases (Department of Health Service, 2075).

Although different plan and policies are being run to prevent the non-communicable disease. On the basis review literatures, the NCDs related risk behaviour still high in the context of Nepal, so taking in concept prevention is better than cure early identification and prevention of NCDs risk factors is important. College students are highly engaged in social media and peer group influence so college students are more prone to engaged in those behaviour related to NCDs risk, this inappropriate behaviour established during this period can continue to the later life and can affect long term health (Shrestha *et al.*, 2022). In the context of Nepal, previous studies merely attempt to assess the NCDs risk factors among younger population, so the researcher is interested to assess risk factors related to NCDs among undergraduate students.

The study aims to assess the prevalence and associations of risk factors related to non-communicable diseases (NCDs) among undergraduate students. Specifically, the study seeks to address the three research questions:

1. What is the prevalence of behavioural risk factors (such as smoking, alcohol consumption, physical activity, inadequate fruit and vegetable intake) and biological risk factors (such as hypertension and Body Mass Index – BMI) among undergraduate students?
2. Is there any association between behavioural and biological risk factors and selected background variables (such as sex and ethnicity)?
3. Is there any association between behavioural risk factors and biological risk factors among undergraduate students?

3. Review of Previous Study

3.1 Introduction

This paper deals with the abstract of the reviewed literature from primary and secondary sources, using electronic and non-electronic method. Search engines and data base like Google Scholar, PubMed, Research Gate and Research4Life are main web sites searched using keywords Non-communicable disease, Risk factors and undergraduate Students. Book journals, articles and thesis are searched from the library. Related literature reviewed are based on the risk factors of NCDs like as Alcohol consumption, smoking, physical inactivity, dietary practice, obesity and hypertension.

3.2 Overview of Studies on Non-communicable Diseases

Non-communicable disease are group of chronic diseases which are not transmitted to one person to another person, slowly progressive and presenting as significant burden on individual community and economic resources (Calcaterra & Zuccotti, 2022). Among them most common NCDs are cardiovascular diseases, chronic respiratory diseases, cancer and diabetes (WHO, 2022). In the context of Nepal 2019, 71.1% death results from non-communicable diseases among them 38.1% death due to behavioural risk factors and 22.9% death due to metabolic risk factors (National Burden of Disease, 2019).

Risk factors covered in these studies are as follows:

- 1. Smoking:** Around one-third of the adult population in the world smoke daily and tobacco consumption responsible for 2nd leading cause of death and disability, accounting for 11.5% of death globally (GBD 2015; Tobacco Collaborators, 2017) and nearly 80% of death occurs in low and middle income country (Shrestha *et al.*, 2019). Annually around 27,100 death occurs from tobacco related

diseases, which accounts 14.9% of all death (Khanal & Khatri, 2021).

- 2. Alcohol consumption:** Alcohol consumption has been identified as one of the major risk factor death globally, accounting for 1.7 million death and 5% global burden of disease every year among them 75% death occurs in men (WHO, 2018). Alcohol consumption was responsible for 8th highest risk factor of death (5th in middle income countries and 9th in high income countries) in terms of NCDs alcohol caused CVDs, cancer, liver disease, diabetes mellitus, hypertension (Parry *et al.*, 2011).

A study of New Delhi, India among college students reveals that 28.8% of students consumed alcohol in past 30 days. Alcohol consumption significantly more number of boys than girls (boys, 33.5%; girls, 21.2%; OR = 0.60; 0.36-0.98) (Rustagi *et al.*, 2011). Region wise study of India shows that there is high prevalence of alcohol consumption 23.3% North India, highest proportion of male (35.2%) consumed alcohol, aged between 18-69 years (Ramamoorthy *et al.*, 2022).

According National demographic health survey 2022, 42% of men consumed alcohol in the past month, as compared with 11% of women. Among those who consumed alcohol in the past month, 20% of men and 13% of women consumed alcohol every day or almost every day. 11% of women and 21% of men consumed three or more drinks on days when alcohol was consumed.

- 3. Physical Activity:** "Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure" (Caspersen *et al.*, 1985). Physical activity helps to preventing and managing the non-communicable disease like CVDs, cancer and diabetes. Physical inactivity of person defined as less than 150 minutes moderate intensity of activity per week or equivalents. Inadequate physical activity 4th foremost risk factor of mortality (WHO, 2022). 80% of world adolescent's population have insufficient physical activity. People who are physically inactive have 20-30% risk of death in the comparison of people who are physically active (Physical Inactivity, 2015).

The findings of the study conducted in Jordan among college students concludes that (52.8%) of students are physically inactive. The rate of physical activity was significantly associated with gender, male students are physically active in comparison to female students (Al Ali & Khazaaleh, 2023).

4. Inadequate Fruit and Vegetable Intake: Adequate consumption of fruit and vegetables reduces the risk of cardiovascular diseases, stomach cancer, and colorectal cancer. In many countries worldwide, the majority of the population consumes less than the recommended amount of five servings of fruits and vegetables per day (Wang *et al.*, 2014). A study conducted in South Africa shows that a higher proportion of women consumed salty processed foods (35.6%) compared to men (32.0%) and fewer women than men consumed at least three servings of vegetables per day (74.5% vs 78.5%) (Gbadamosi & Tlou, 2020).

According to the NCD STEPS survey 2019, the prevalence of insufficient intake of fruits and vegetables was 96.7% among them, 96.3% (men) and 97% (female). 5.6% always add salt in their food before or while eating, and 19.5% of adults consumed processed food. A cross-sectional study was conducted in Kathmandu to assess cardiovascular health practices among 236 adults. Findings of the study conclude that only (22%) consumed WHO-recommended fruits and vegetables. This study also concludes that there is a significant association between cardiovascular health practice and marital status (Subedee & Sharma, 2023).

5. Hypertension: Hypertension means raised blood pressure which is equal to or greater than 140 mm of Hg systolic and 90 mm of Hg diastolic. Around 1.28 billion people have hypertension across the world (WHO, 2023). In Nepal, 18% of women and 23% of men are hypertensive (age 15 years and above), and the proportion of hypertension is increased in females from 17% (2016) to 18% in 2022, but the proportion of hypertension remains stable in males (Ministry of Health and Population *et al.*, 2022).

A study conducted in France among university students (n=2030) found that the mean age of the students is 20 years, and the prevalence of hypertension is 6%, which was higher in males (6.8%) compared to females (2.7%). This study also concludes that there is a significant association between age (>25 years), sex (being female), and tobacco use with hypertension (Zobo *et al.*, 2023). The findings of a study conducted in Egypt among university students show that the mean age of students is (20.4 ± 1.15), the prevalence of hypertension was 26.5%, and there is a statistically significant relation between hypertension and age, sex, smoking, and exercise among university students (Moussa *et al.*, 2016).

6. Obesity/Body Mass Index: According to WHO, obesity and overweight defined as, if BMI is more than or equal to 25 is overweight and BMI is more than or equal to 30 is Obesity. Globally 1.9 billion (39%) adults are overweight and 650 million (13%) adults are obese (WHO, 2021). In Saudi Arabia 32.8% are overweight and 23% adults are obese (Alsulami *et al.*, 2023).

A study conducted in Switzerland shows that the prevalence of abdominal (central) obesity was 5.0% (1.3% in males and 8.4% in females) based on waist circumference and 20% (12.3% in males and 26.5% in females) based on the waist-to-hip ratio (WHR). Prevalence of abdominal obesity was significantly higher among females compared to males ($p < 0.001$) (Olatona *et al.*, 2018). Another study conducted in Bangladesh among college students shows that prevalence of overweight is 23.5% in male and 10% in female, similarly prevalence of obesity in female 3.3% and 2.9% in male (Awasthi *et al.*, 2023).

4. Methodology

This cross-sectional descriptive study examined risk factors related to non-communicable diseases (NCDs) among undergraduate students in Pokhara Metropolitan City. A multistage sampling technique was used to select participants. Three community colleges—Gupteshwor Multiple Campus, Shivashakti Campus, and Bhadrakali Campus—were randomly selected from the twelve community colleges in the city. The sample size of 172 students was determined using the Cochran formula ($n = z^2pq/d^2$), based on a previously reported prevalence of 11.5% and including a 10% allowance for non-response. One academic stream from each selected college was chosen randomly. Participants were then selected using probability proportionate to size (PPS) followed by systematic random sampling. Data were collected using the WHO STEPS instrument (Version 3.2, Steps I and II), which was translated into Nepali and pre-tested among 18 students to ensure clarity and reliability.

Ethical approval was obtained from the Institutional Review Committee of Tribhuvan University, Institute of Medicine (T.U. IOM). Written informed consent was obtained from all participants, and confidentiality, anonymity, and voluntary participation were ensured throughout the study.

5. Data Analysis and Presentation

This paper deals with the presentation and description of the findings obtained from the analysis of the data collected from 172

respondents of three community colleges, with objectives to find out the status of risk factors related to non-communicable diseases among undergraduate students. In order to facilitate interpretation, the analyzed data were organized and presented in tables according to the objectives of the study.

Table-1: Respondents Socio-demographic Information (n =172)

Variables	Number	Percent
Age in Completed Years		
18-20	71	41.3
21-23	91	52.9
24-26	10	5.80
Mean ± SD=20.97±1.42 years		
Sex		
Male	52	30.2
Female	120	69.8
Ethnicity		
Brahmin/Chhetri	112	65.2
Janajati	46	26.7
Dalit	14	8.1
Marital Status		
Unmarried	147	85.5
Married	24	14.0
Divorced	1	0.60
Education Stream		
Humanities	44	25.6
Education	42	24.4
Management	86	50.0
Diagnosed NCDS in Family		
DM only	14	8.1
HTN only	30	17.4
Dyslipidemia only	8	4.7

The above table depicts the socio-demographic information of respondents. The average age of the respondents was 20.97 ± 1.42 years. Highest proportion (69.8%) of the respondents were female. Regarding ethnicity, 65.2% of respondents belongs to Brahmin/

Chhetri. Majority (85.5%) of the respondents were unmarried. Similarly, 50% of respondents were studying in management stream.

Table-2: Prevalence of Behavioural Risk Factors among Respondents

(n=172)

Risk Factor	Yes n (%)	No n (%)
Current tobacco use	4 (2.3)	168 (97.7)
Current alcohol consumption	16 (9.3)	156 (90.7)
Inadequate fruit & vegetable intake	158 (91.9)	12 (8.1)
Physical inactivity	17 (9.9)	155 (90.1)

Behavioural risk factors are summarized in the above table. The most prevalent risk factor was inadequate fruit and vegetable consumption (91.9%). Current alcohol consumption was reported by 9.3% of respondents, current tobacco use by 2.3%, and physical inactivity by 9.9%. These figures indicate that although tobacco and alcohol use were relatively low, unhealthy diet and insufficient physical activity remain widespread.

Table-3: Prevalence of Biological Risk Factors

(n=172)

Risk factor	Yes n (%)	No n (%)
Overweight/obese	34 (19.8)	138 (80.2)
Hypertension	9 (5.2)	163 (94.8)
Abdominal obesity	3 (1.7)	169 (98.3)

Biological risk factors are shown in the above table. It is evident that the overweight/obesity was observed in 19.8% of students, hypertension in 5.2%, and abdominal obesity in 1.7%. These results demonstrate that even in a young population, measurable biological risk factors are already present.

Table-4: Association of Alcohol Consumption with Background Variables

(n=172)

Variables	Alcohol Consumption		²	-value
	Yes n (%)	No n (%)		
Age				
<21 years	6 (8.5)	65 (91.5)	3.049	0.081
>21 years	18 (17.8)	83 (82.2)		
Sex				
Male	14 (26.9)	38 (73.1)	10.422	0.001
Female	10 (8.3)	110 (91.7)		

Ethnicity				
Brahmin/Chhetri	15 (13.4)	97 (86.6)	0.084	0.772
Others	9 (15.0)	51 (85.0)		
Marital Status				
Single	20 (13.6)	127 (86.4)	0.102	0.756
Married	4 (16.0)	21 (84.0)		
Education Stream				
Management	16 (18.6)	70 (81.4)	3.099	0.078
Education/Humanities	8 (9.3)	78 (90.7)		
Diagnosed NCDs in Family				
Yes	6 (11.5)	46 (88.5)	0.362	0.547
No	18 (15.0)	102 (85.0)		

*Fisher’s Exact Test

The above table reveals that association of alcohol consumption with background Variables. The proportion of alcohol consumption was significantly high in male (26.9%) than female (8.3%) so, there is statistically significant association between alcohol consumption and sex (=0.001), otherwise there is no significant association of alcohol consumption and other socio-demographic variables (>0.05).

Table-5: Association of BMI with Background Variables (n=172)

Variables	BMI		χ ²	-value
	>25 n (%)	<25 n (%)		
Age				
<21 years	15 (21.1)	56 (78.9)	0.141	0.707
>21 years	19 (18.8)	82 (81.2)		
Sex				
Male	9 (17.3)	43 (82.7)	0.284	0.594
Female	25 (20.8)	95 (79.2)		
Ethnicity				
Brahmin/Chhetri	16 (14.3)	96 (85.7)	6.083	0.014
Others	18 (30.0)	42 (70.0)		
Marital Status				
Single	27 (18.4)	120 (81.6)	1.250	0.281
Married	7 (28.0)	18 (72.0)		
Diagnosed NCDs in Family				
Yes	12 (23.1)	40 (76.9)	0.515	0.473
No	22 (18.3)	98 (81.7)		

Alcohol Consumption				
Yes	19 (79.2)	5 (20.8)	0.200	0.888
No	119 (80.4)	29 (19.6)		
Fruits and Vegetable Consumption				
Adequate	128 (81.0)	30 (19.0)	–	0.481*
Inadequate	10 (71.4)	4 (28.6)		

*Fisher's Exact Test

Data contained in the above table show that association of overweight and obesity was significantly high (30%) in others ethnicity (janajati, dalit) than Brahmin/Chhetri so there is significant association between body mass index and ethnicity ($p=0.014$). otherwise there is no significant association between body mass index and age, sex, marital status and diagnosed NCDs in family as well as behavioural risk factors ($p > 0.05$).

Table-6: Association of Current BP with Variables (n=172)

Variables	Blood Pressure		χ ²	p-value
	Hypertensive n (%)	Normal n (%)		
Age				
<21 years	3 (4.2)	68 (95.8)	–	0.738*
>21 years	6 (5.9)	95 (94.1)		
Sex				
Male	8 (15.4)	44 (84.6)	–	0.001*
Female	1 (0.8)	119 (99.2)		
Ethnicity				
Brahmin/ Chhetri	5 (4.5)	107 (95.5)	–	0.721*
Others	4 (6.7)	56 (93.3)		
Marital Status				
Single	8 (5.4)	139 (94.6)	–	1.000*
Married	1 (4.0)	24 (96.0)		
Education Stream				
Management	7 (8.1)	79 (91.9)	–	0.168*
Education/Humanities	2 (2.3)	84 (97.7)		
Diagnosed NCDs in Family				
Yes	3 (5.8)	49 (94.2)	–	1.000*
No	6 (5.0)	114 (95.8)		
Alcohol Consumption				
Yes	3 (12.5)	21 (87.5)	–	0.114*
No	6 (4.1)	142 (95.9)		

Physical Activity				
Active	8 (5.2)	147 (94.8)	-	1.000*
Inactive	1 (5.9)	16 (94.1)		

*Fisher’s Exact Test

Data contained in Table-6 reveal that association of hypertension with background and behavioural risk factors, where, the proportion of hypertension among male (15.4%) was significantly higher than female (0.8%). So there is significant association between sex and blood pressure (=0.001).There is no significant association of blood pressure and other variables (>0.05).

6. Discussion

A cross-sectional descriptive study was conducted to assess risk factors related to non-communicable diseases (NCDs) among 172 undergraduate students. Regarding socio-demographic characteristics, the mean age of respondents was 20.97 ± 1.42 years, with the majority (52.9%) belonging to the 21–23 years age group. A higher proportion of respondents were female (69.8%), and most participants (65.2%) belonged to the Brahmin/Chhetri ethnic group. The majority of respondents were unmarried (85.5%), and half of the participants were enrolled in the management stream.

The present study found that 91.9% of respondents consumed inadequate amounts of fruits and vegetables. This finding is consistent with the national NCD STEPS survey, which reported that 96.7% of the population consumed insufficient fruits and vegetables (Dhimal *et al.*, 2019). Similar results have been reported in studies conducted among undergraduate students in Dhaka, where 93.6% consumed fewer than the recommended five servings per day (Mondal *et al.*, 2018). Studies from Nigeria also reported very high levels of inadequate fruit and vegetable intake (98%) (Olatona *et al.*, 2018). However, the prevalence reported in the present study is slightly higher than that found in an Indian study (85%) (Li *et al.*, 2023). The high prevalence may be attributed to changing dietary patterns among young adults, including increased consumption of processed foods and westernized diets.

The study revealed that 8.1% of respondents reported alcohol consumption. This finding is consistent with the national NCD STEPS survey in Nepal, which reported a prevalence of 6.8%. Similar rates have been observed among students in Pokhara, where 11.5% reported current alcohol consumption (Shrestha *et al.*, 2022), and in Tamil Nadu, India, where the prevalence was 7.5% (Anuradha *et al.*, 2021). However, higher prevalence rates have been reported in other studies from India (23.3% and 28.8%) and the United States (49.3%) (Ramamoorthy *et al.*,

2022; Rustagi *et al.*, 2011). These variations may be due to differences in socio-cultural context, geographic settings, and sample characteristics.

In the present study, 2.3% of respondents reported smoking. This finding is comparable with a study conducted in Kathmandu, which reported a smoking prevalence of 1.2% (Panta *et al.*, 2020). Similarly, Anuradha *et al.* (2021) reported that 3% of respondents consumed tobacco, which is close to the present findings. However, higher smoking prevalence has been reported in other studies, including 8.5% in Pokhara (Shrestha *et al.*, 2022), 14% in Pakistan, and 15.4% in Turkey (Khuwaja *et al.*, 2011; Turan *et al.*, 2018). Differences may be attributed to variations in study populations, cultural factors, and sample size. The mean age of smoking initiation was 16.25 years, which aligns with findings from previous studies conducted in Nepal reporting initiation between 14.55 and 18.6 years (Mishra *et al.*, 2015; Gurung, 2018; Panta *et al.*, 2024).

Physical inactivity is recognized as a major risk factor for cardiovascular diseases, diabetes, and obesity (Zobo *et al.*, 2023; Verma *et al.*, 2022). The present study found that 9.9% of respondents were physically inactive. This finding is consistent with studies conducted in India (14.4%) (Verma *et al.*, 2022) and Chitwan Medical College in Nepal (7%) (Adhikari *et al.*, 2021). Similar prevalence was also reported in Haryana, India (11%) (Thakur *et al.*, 2019). However, substantially higher prevalence of physical inactivity has been reported among college students in Jordan (52.8%) and Saudi Arabia (29.9%) (Al Ali & Khazaaleh, 2023; Samarkandi, 2022). Such variations may be influenced by differences in lifestyle patterns, environmental conditions, and cultural practices.

The prevalence of hypertension in the present study was 5.2% among undergraduate students. This finding is consistent with other studies conducted among college students, which reported prevalence rates ranging from 4% to 8.5% (Reddy *et al.*, 2015; Bhaila *et al.*, 2021; Zobo *et al.*, 2023; Sainju *et al.*, 2015). Evidence suggests that hypertension is increasingly being observed among younger populations, indicating the need for early preventive interventions.

Overweight and obesity are growing global public health concerns and major contributors to NCDs. The present study reported that 19.7% of students were overweight or obese. This finding is comparable with a study conducted at Kathmandu Medical College, which reported a prevalence of 19.48% (Rai & Makaju, 2021). Similar results have been reported in other studies in Nepal, with prevalence rates of 15% and

14.8% (Jha *et al.*, 2021; Bhaila *et al.*, 2021). Comparable findings have also been observed among university students in Nigeria (19.6%) and Spain (14.5%) (Olatona *et al.*, 2018; Telleria- Aramburu & Arroyo-Izaga, 2021). However, a much higher prevalence (44%) was reported in Iraq (Moalif *et al.*, 2021), possibly due to differences in lifestyle patterns, dietary habits, and study settings.

The prevalence of abdominal obesity in the present study was 1.7%, which is similar to findings from a study conducted at the National University of Yamoussoukro, where the prevalence was 1.2%. Another study reported a slightly higher prevalence of 5% (Olatona *et al.*, 2018).

The study further observed that a higher proportion of Janajati, Dalit, and Madheshi ethnic groups were overweight or obese compared to Brahmin and Chhetri groups. However, no statistically significant association was found between biological risk factors and socio-demographic variables. Similarly, the study did not find a significant association between behavioural risk factors and biological risk factors. In contrast, other studies have reported significant associations, such as between smoking and hypertension (Turan *et al.*, 2018).

7. Conclusion

The findings of the present study highlight that several behavioural and biological risk factors associated with non-communicable diseases (NCDs) are prevalent among undergraduate students in Pokhara Metropolitan City. Behavioural risk factors such as inadequate consumption of fruits and vegetables, alcohol consumption, smoking, and physical inactivity were observed among the study participants, with inadequate fruit and vegetable intake being particularly widespread. In addition, biological risk factors including hypertension and overweight/obesity were also identified among a notable proportion of students.

The study further revealed gender differences in certain risk factors, with alcohol consumption and hypertension being more prevalent among male students. Although the prevalence of some risk factors was relatively lower compared to findings from other countries, the presence of these behaviours and conditions among young adults indicates a potential future burden of non-communicable diseases if preventive measures are not adopted early.

These findings underscore the importance of early health promotion and preventive strategies targeting university students, including awareness programmes on healthy dietary practices, regular

physical activity, and avoidance of tobacco and alcohol use. Educational institutions can play a crucial role by promoting health education, lifestyle modification programs, and regular health screening to identify risk factors at an early stage. Strengthening such preventive initiatives among young adults may help reduce the long-term risk of NCDs and contribute to improved public health outcomes.

8. Implications

The present study provides important insights into the distribution and prevalence of established risk factors for non-communicable diseases (NCDs) among undergraduate students. The findings highlight the presence of both behavioural and biological risk factors within this young population, indicating the need for early preventive interventions. These results may be useful for health professionals, social workers, and college authorities in planning and implementing health promotion and NCD prevention programmes within educational institutions.

Furthermore, the study underscores the importance of promoting healthy lifestyle practices among students, including balanced dietary habits, regular physical activity, and avoidance of tobacco and alcohol consumption. Educational institutions can play a significant role by integrating health awareness programs, screening initiatives, and counseling services aimed at reducing NCD risk factors among students.

In addition, the findings of this study may serve as baseline information for future researchers interested in examining NCD-related risk factors among young adults and may support the development of more comprehensive research and intervention programs in similar settings.

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