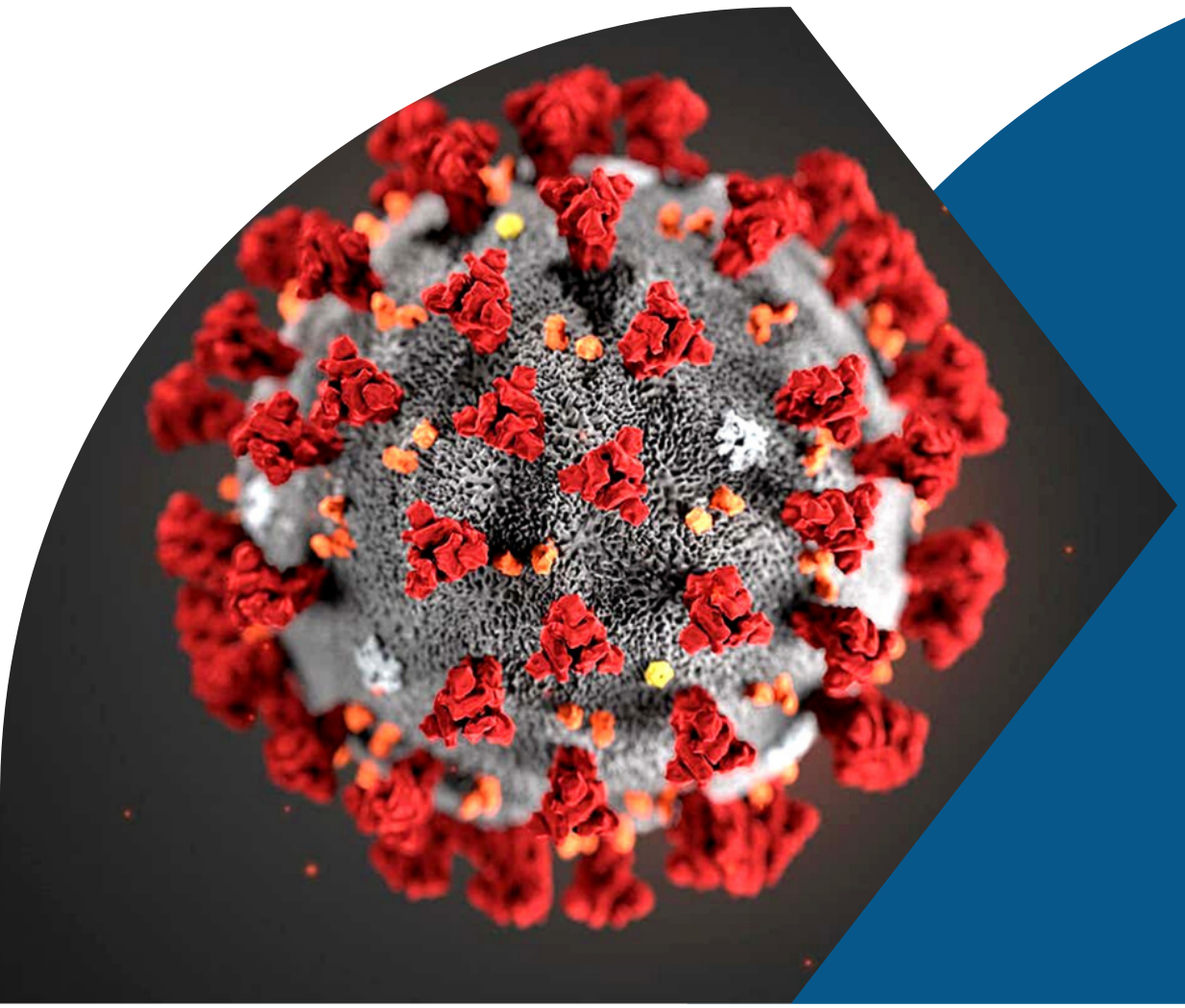
NIPoRe
Nepal Institute for Policy Research

February 2022



COVID-19 and its association with Smoking and Alcohol consumption

A Case of Nepal

Presented to

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COVID-19 and its association with Smoking and Alcohol consumption: A Case of Nepal

Executive Summary

The pandemic caused by COVID-19 has engulfed the whole world and has affected every facet of human life. Researchers have scrambled to figure out the association of the virus with various lifestyle choices so as to limit the spread and mitigate its impact and develop a vaccine. Given that the COVID-19 virus is a new virus to infect human beings, many aspects of the virus remain unstudied. This is reflected in the changing guidelines issued by the WHO and health agencies such as CDC, who update those based on the new information to emerge from the research. The association of COVID-19 with smoking has been studied in some parts of the world, and the results have differed. The WHO stated that smokers were 'more likely to develop severe disease with COVID-19, compared to a non-smoker. Meanwhile, other research found that smoking was not a factor related to the patients who had the diseases. This research aims to assess COVID-19 and its association with smoking and alcohol. Specifically, the research tested whether the prevalence and severity (if contacted) of COVID-19 among those who smoke and consume alcohol. It also analyzed the association of COVID-19 with socio-demographic factors and the health habits of people. Hence, this study adds value by researching the case in the context of Nepal.

The research design was a case-control study based on the COVID-19 infection. The ratio of case-control was 1:1, with a total sample size of 540. The sample included data from Province 2, Bagmati Province, Lumbini Province, and Karnali province to reflect the ecological and geographical coverage of Nepal. Strategic random sampling was applied to ensure socio-demographic representation. The number of participants from each province was selected based on the proportion of COVID-19 cases in each province. Those participants who tested COVID-19 negative through PCR test were the control group and those who tested COVID-19 positive were the case group. A structured questionnaire was administered for the data collection through a phone interview to avoid the contact and risk of transmission of COVID-19.

Among the study population, the percentage of smokers in the control group was lower (by 7%) than in the case group. Two thirds of the smoking population had some form of health complications while a higher proportion of the population i.e., three quartiles of the nonsmoker population had health complications. The statistical analysis demonstrated no significant relationship between health complications and smoking behavior [Odds ratio: 0.626, 95% CI: 0.35 – 1.1, P.Value: 0.0834] although the symptoms were higher among the non-smokers compared to smokers. 77% of non-smokers experienced fever against 72% of smokers, 49% of non-smokers experienced the loss of taste or smell compared to 35% of smokers and 56% of non-smokers experienced muscle pain or body ache compared to 47% of smokers. However, there is no significant relationship between COVID-19 and the non/smoking behavior of the population [Odds Ratio: 1.3, P.Value: 0.102, 95% CI: 0.931 – 1.886]. Furthermore, it was found that there is no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, occupation, income, and smoking behaviors when the demographic variables are combined with smoking behavior. However, there was a significant relationship between the prevalence of COVID-19 and education status as the odds ratio among the uneducated population was 8.25 times compared to 1.14 times among the educated population at P.Value 0.0283 (95% CI, 0.7927915 - 1.653494).

In relation to alcohol behaviors of the population, no statistical significance between alcohol consumption and prevalence of COVID-19 [Odds ratio: 1.2, P.Value: 0.386, 95% CI: 0.8153696 - 1.656787] was found. In addition, there was no significance between the prevalence of COVID-19 and when demographic variables ethnicity, gender, age groups, and occupation were combined with alcohol intake behaviors. Two thirds of the population in the case group who consumed alcohol had health complications and only one third did not have health complications, though the case-control statistical test showed no significant difference.

1. Introduction

1.1. Background

Since the first case was identified in late 2019 in Wuhan, China, COVID-19 has spread around the world. It was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. By September 10, 2020, the global number of cases had exceeded 28 million with more than 900,000 fatalities. The first confirmed positive case of COVID-19 was reported in Nepal on January 23, 2020. Since then, the number of positive cases has surged to 267,322 with a death toll reaching 1,959 as of January 18, 2020. Although Kathmandu valley (Kathmandu, Lalitpur, Bhaktapur) is the hot spot for COVID-19 with over 46% of total cases, other districts are also at risk and vulnerable to COVID-19 especially districts connected to neighboring country India.

The Government of Nepal (GoN) has followed the WHO's directive regarding the methods to slow down the transmission of the virus. Use of masks, use of hand soaps, and hand sanitizers, and social distancing in public places were the mitigating measures implemented by the GoN. Awareness campaigns have been conducted to encourage the public to practice social distancing measures and to encourage the use of masks and hand sanitizers. However, an assessment done by the Nepal Health Research Council (NHRC) regarding the compliance with SMS (Social distancing, mask, and sanitizer) measures found that the public was not following the guidelines set by the government appropriately (NHRC, 2020). The study was a cross-sectional study that investigated the level of compliance at an individual and institutional level. A nonprobability sampling method was used to collect the required data. During the study, a total of 4502 individuals in places such as vegetable markets, malls, hospitals, public buses, banks, temples, and restaurants were observed. The study found that 27.9% of the participants were not wearing masks and out of the people wearing masks 27.34% of the people were not correctly using masks. Only 37.5 % of the institutions (temples, banks, vegetable markets, restaurants, and malls) had set the markings for social distancing, and hand soaps or sanitizers were only available at 50 % of the institutions. Among the hospitals, 80 % had hand sanitizer or soap available, 80 percent had set marking for social distance in front of OPD, 40 percent in front of pharmacies, 20 percent in front of ticket counters, and 100 % of the staff and clients were wearing masks. On a public bus, only 43.3 % of vehicles had arranged seats for one person and only 46.6 % of buses provided sanitizer while entering the vehicle. 96.6 % of drivers and co-drivers were using masks and 86.6 % of passengers used masks.

A study conducted by Hamal et al. which investigated the preparedness of government hospitals in dealing with the pandemic from the perspective of the doctors working there found that the preparations done by these institutions were not adequate (Hamal et al, 2020). The study carried out an online survey among doctors working in government hospitals and health centers at the central, provincial, and local levels. The data shows that the availability of adequate face masks was 84.6 % in central hospitals, 66.7 % in provincial hospitals, and 78.9 % in local hospitals. Among the central hospitals, 84.6 % had mechanical ventilators and oxygen supply, 53.8 % had trained critical care providers and trained critical care nurses, 38.5 % had provisions for airborne isolation, and 46.2 % had separate donning and doffing areas for PPE. In comparison, only 29.2 % of the provincial hospitals had mechanical ventilators, 33.9 % had oxygen supply, 29.2 % had trained critical care providers, 25 % had trained critical care nurses, 8.3 % had provision for airborne isolation, and 29.2 % had separate donning and doffing areas for PPE. Only two central hospitals had provisions for negative pressure rooms with air exchanges and no hospitals at the provincial level had this provision. 61.5 % of healthcare workers in central hospitals had received training regarding PPE use. In comparison, 58.3 % of healthcare workers at the provincial level and 42.1 % of healthcare workers at the local level had received training regarding PPE use. The lax compliance measures and lack of adequate resources for healthcare workers pose another challenge for a country that is already dealing with a poor healthcare infrastructure.

The pandemic has been primarily a public health issue. Global health infrastructure in most parts of the world has been stretched to its limit. Many governments and research institutes have accelerated their attempts to develop vaccines that are at various stages of development, with some already rolling out the vaccines. As the vaccines are being rolled out globally, it is believed that it will require logistical arrangements at a scale never seen before particularly in countries from the Global South. Therefore, it is important that the general population be classified based on their vulnerability to the pandemic. It will allow governments around the world to prioritize the groups in the early phases of vaccination. Hence, this study aims to understand the vulnerable population groups in Nepal

based on the selected indicators of WHO Quality of Life, health related indicators in SDGs, and additional COVID specific indicators. Some of the indicators would include age, gender, region, prevalence (and level) of smoking, prevalence (and level) of alcohol consumption, pre-existing conditions, travel history, contact with COVID patients, recovery days, hospitalization days, use of ICU or ventilator, expenses on COVID treatment, and perceived stress among others.

1.2. Justification of the Study

As the COVID-19 is a novel disease, the research regarding the disease has been happening as the pandemic has been going on. The WHO guidelines and research materials have been continuously updated to reflect the change as new information about the disease has come out. The consensus from various research suggests that older people and people who have underlying medical conditions are at an increased risk of being ill due to the virus. The guidelines provided by WHO and CDC (Centers for Disease Control and Prevention) state that older people and people who may have certain medical conditions such as respiratory diseases, heart conditions, diabetes, and people who smoke are at an increased risk.

On May 11, 2020, WHO published a statement regarding tobacco use and COVID-19 which states that based on the studies conducted by public health experts, smokers were 'more likely to develop severe disease with COVID-19, compared to non-smoker' (WHO, 2020). A study conducted by Zheng et. al. suggested that "males, older than 65, and smoking were risk factors for disease progression" among patients who had COVID-19. The study also found a prevalence of diseases such as hypertension, diabetes, cardiovascular disease, and respiratory disease among the patients who were in critical condition (Zheng et al., 2020). One of the largest studies conducted in China by the China Center for Disease Control and Prevention reported that older age, cardiovascular disease, diabetes, chronic respiratory disease, hypertension, and cancer were all associated with an increased risk of death from COVID-19 (Wu, 2020). Most of the above risk factors are directly or indirectly related to smoking. A study conducted in the US found that obesity was also a major risk factor for patients below 60 years (Lighter et al., 2020). Some studies have found that the link between COVID-19 infection and smoking might be minimal. Rossato et. al found that there is no association between current smoking and COVID-19 (Rossato et al., 2020).

While there has been significant research globally on the potential risk factors of COVID-19, and the association between smoking and COVID-19, it is still at a nascent stage in Nepal. One of the early cross-sectional surveys conducted by the NHRC showed that 10 % of smokers who had contracted COVID-19 had given up smoking. The survey was conducted via telephone with a total of 577 participants over the age of 18 from all seven provinces. 552 participants took the quantitative survey, and 22 participants took the qualitative survey. The survey was conducted to get a better understanding of the physical, mental, and social health of the people who have recovered from COVID-19. Furthermore, 12 % of the survey respondents stated that they had given up drinking alcohol. 70 respondents were found to have underlying health conditions.

The infection in the South Asian region has been increasing exponentially, with India leading the chart with the highest number of daily cases of infections. Also, because of the large population of South Asia (1.8 billion), strategies have to be developed to ensure that the most vulnerable groups receive the vaccination in the first stages as the vaccines start being rolled out. Identifying vulnerable groups is important to focus resources (health officials, medications, etc.) to serve the vulnerable groups. Currently, there has been some attempt at identifying the sub-regions vulnerable to the spread of pandemic; however, there has been no national categorization of the population based on the factors affecting the quality of life. This research will involve coordination with health directorates at federal and provincial governments, national, regional, and local hospitals (including private ones), and close coordination with local governments. It will benefit all three levels of government in Nepal (local, provincial, and federal) in terms of planning, preparation, and allocation of resources.

1.3. Research Objective

The overall objective of the study was to assess the association between COVID-19 and smoking and alcohol consumption among the study population in Nepal. The specific objectives of the research were:

i. Assess association between COVID-19 and smoking and alcohol consumption
ii. Assess the relationship between COVID-19 and socio-demographic factors particularly age, gender, and income
iii. Find out the relationship between the severity of COVID-19 with factors such as physical activity and preexisting conditions.

1.4. Research Hypothesis

The research hypotheses of the research study are:

- Is the prevalence of COVID-19 higher in smokers than non-smokers?
- Is the severity of COVID-19 higher among smokers than non-smokers?
- Is the prevalence of COVID-19 higher in people who consume alcohol than those who don't?
- Is the severity of COVID-19 higher among people who consume alcohol than those who don't?

2. Methodology

2.1. Research design

The study applied a case-control research design where the sampled population was categorized into a study group and a control group. The basis of classification was the status of COVID-19; COVID-19 positive cases were categorized into the case group and COVID-19 negative cases were categorized as the control group. The sample ratio from case to control group was 1:1, however, matching was not applied for sample selection. The study compared the results between two groups.

2.2. Study site and Population

The research was conducted in four provinces of Nepal: Province 2, Bagmati, Lumbini, and Karnali. Those provinces were selected applying a strategic sampling so that the data represents the diverse geography and ecology of the country. Moreover, these provinces were also proposed considering the higher proportion of COVID-19 cases. The individuals who visited laboratories in Province 2, Bagmati, Lumbini and Karnali provinces for the COVID-19 test were considered as the study population. In addition, only the laboratories prescribed for the COVID-19 test by the Ministry of Health and Population (MoHP) were considered. The COVID-19 positive cases from the PCR tests were the sampling frame for the case group and COVID-19 negative cases were the sampling frames for the control group. As per MOHP, there were a total of 199,247 COVID-19 positive cases in four study provinces as of January 18, 2021.

2.3. Sample size and Selection of Sample

The sample size of the study was 540, which was calculated at 0.05 significance level, 0.8 power, and effect size of 0.6 for the control group and 0.8 for the case group. A STATA command with the syntax “power twomeans 0.6 0.8, m1(0.6) m2(.8)” was used for the calculation of sample size. The list of individuals obtained from the laboratories from the four above-mentioned provinces was the source of data. As per the standard practice for a case and control research design, 1:1 ratio of case and control was considered to measure the effect, better compare the results, and minimize the cost of the research (Hennessy et al., 1999; Sutton-Tyrrell, 1991; Hodge, Subaran, Weissman, & Fyer, 2012). For this study, a list of participants was developed at first based on the data from the labs of four provinces. After the list of individuals was obtained from different labs, a strata sampling was applied to create strata based on provincial proximity. In the third step, the mobile number of the study population was assigned a unique id (number), and then individuals were randomly selected for the interview. Also, samples were distributed proportionately at the provincial level, to accommodate and represent the study population. Moreover, age and gender were accounted for during sample selection to represent diversity and inclusion.

2.4. Data Collection Tools and Technique

The research employed a structured questionnaire (built-in in Kobo Toolbox) as the tool and phone interview as the technique for the data collection. The phone interview and virtual means (Kobo) were considered due to the travel restrictions and to abide by the social distancing protocol of the GoN amid the COVID-19 pandemic. The telephone interview enabled research assistants to avoid physical contact and minimize the transmission of COVID-19. The researchers who had sound previous experience in conducting interviews and research studies plus at least Bachelor's level education were involved in the data collection. In addition, the researchers were trained on the questionnaire, ethical considerations, and other nuances that were accounted for during the research.

2.5. Data management and analysis

In the data collection phase, trained researchers were mobilized, and an online platform "Kobo Toolbox" was used where the researchers directly entered data; this enabled us to minimize errors and increase the coherence and

consistency. Furthermore, STATA version 16 was used for data cleaning and analysis, and all the syntaxes were recorded for reference. A case and control statistical test have been used to assess the effect of different independent variables (smoking and alcohol including socio-economic variables such as age, gender, and income) on dependent variables (prevalence and severity of COVID-19).

2.6. Validity and Reliability

Pretesting: The structured questionnaire that was administered to collect quantitative information was first pretested (14 cases; seven COVID-19 positive and 7 COVID-19 negative cases) and then rolled out. The pretesting was done during the training session, where the researchers involved in the data collection pre-tested the tool.

Validity: The tool was developed taking reference of standard questionnaires such as WHO's guidelines of the list of pre-condition diseases, smoking and alcohol behaviors, etc. Also, the tool was pre-tested, and only after making necessary changes in the questionnaire, it was administered in the study population. Similarly, the data collection instrument was administered by mobilizing trained individuals to collect data.

Reliability: In this study, the data quality was ensured through reliable data sources. The lab was the primary data source, and an appropriate data collection tool was designed taking reference of WHO standard guidelines. Moreover, the secondary literature review was conducted to triangulate the study results for other similar research and wider knowledge in the subject.

Potential Biases: The sample was identified and selected randomly from the strata developed from the list obtained from the labs enlisted by the MoHP. Four provinces (Province 2, Bagmati, Lumbini and Karnali) were strategically selected to have provincial (geographical) and ecological representation. The sample size for this case and control design study was calculated in such a way that it meets the standards of scientific research. Thus, there were fewer chances of biases in the sample selection and design. In addition, the researchers were trained on ethical considerations and ways to minimize biases during the interview.

2.7. Limitation of the study

This research covers the population from four provinces mentioned in the above sections. The provinces were identified and selected in such a way that it represents various geographical distributions of the country. Furthermore, age group and gender were also considered for determining the sample, and hence the results should be representative of different age groups and gender. However, there are some methodological limitations of the study. Since the data was collected through phone calls, personal nuances of individual interviewees which otherwise are accounted for during the interview process will not be captured.

2.8. Ethical Consideration

The study received verbal consent from the research participants before proceeding with the interview. The participants were provided with a detailed explanation of the study and were informed of the full authority to accept or reject before participation in the study. The participants were allowed to withdraw at any point of time during the interview. The study maintained the confidentiality of personal information and only aggregate results have been considered. To ensure the quality of data, the participants were requested to provide true and accurate data about their smoking and alcohol consumption habits, and pre-existing health conditions. When talking about COVID-19 with participants, there was a likelihood of reminders of past incidents which could lead to traumatic memories, thus the research team was aware of such situations and was careful when asking questions. Also, data collection was undertaken remotely to avoid physical contact and the risk of contraction.

3. Findings

3.1. Demographic Information

The study population was from all the seven provinces of Nepal (as per origin). Over fifty percent of them in both study groups (case and control) were from Bagmati province (61% in Case and 57% in Control, and 59% in overall), while the least proportion of the study population was from Sudurpaschim province (1% in both study group). Similarly, 87% of the Case group, 90% of the Control group. and 88 % overall were from the active age group of 18 to 59 years. Overall, nearly two thirds of the study population (64%) were male and one third (36%) were female. In addition, 8% of the study population had no education while a majority of them (92%) were educated. The levels of education were diverse from informal education to master's level.

In terms of the ethnic distribution, half of the study population were from Brahmin, Chhetri, Tharuki, or Sanyasi in both the case and control groups followed by the Janajati and then Madhesi. Moreover, among the study population, a similar percentage of the study population (39% in case and 38% in control) were employed in the private sector and 20% in the case, and 16% in the control group were government employees. The demographic characteristics of the study population and their distribution are presented in Table 1.

Table 1: Demographic characteristics of the study population

Demographic Category	**Case**		**Control**		**Total**	
	Number	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
Provincial distribution						
Province 1	5	1.85	7	2.59	12	2.22
Province 2	34	12.59	37	13.7	71	13.15
Bagmati	165	61.11	154	57.04	319	59.07
Gandaki	1	0.37	5	1.85	6	1.11
Lumbini	47	17.41	47	17.41	94	17.41
Karnali	14	5.19	16	5.93	30	5.56
Sudurpaschim	4	1.48	4	1.48	8	1.48
Age Distribution						
Less than 18 years	1	0.37	15	5.56	16	2.96
Between 18 and 59 years	236	87.41	243	90	479	88.7
Above 60 years	33	12.22	12	4.44	45	8.33
Gender						
Female	86	15.93	108	20	194	35.93
Male	184	34.07	162	30	346	64.07
Education						
Educated	252	93.33	245	90.74	497	92.04
Uneducated	18	6.67	25	9.26	43	7.96
Ethnicity						
Brahmin, Chhetri,Thakuri, Sanyasi	134	49.63	132	51.97	266	50.76
Janajati	74	27.41	69	27.17	143	27.29
Dalit	6	2.22	6	2.36	12	2.29
Madhesi	47	17.41	44	17.32	91	17.37
Others-Muslim, etc.	9	3.33	3	1.18	12	2.29
Occupation						
Student	5	1.85	35	12.96	40	7.41
Government Employee	54	20	44	16.3	98	18.15

Demographic Category	Case		Control		Total	
	Number	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
Employee in Private Sector	106	39.26	103	38.15	209	38.7
NGO/INGO sector	8	2.96	3	1.11	11	2.04
Business	42	15.56	38	14.07	80	14.81
Daily Wage	8	2.96	7	2.59	15	2.78
Unemployed	19	7.04	30	11.11	49	9.07
Others	28	10.37	10	3.7	38	7.04

3.2. COVID-19 and its relationship with non/smoking behaviors

The population was classified into two groups: smoker and non-smoker and the relationship were assessed with the prevalence of COVID-19 and severity of COVID-19. Those who are current smokers and those who had smoked in the past were combined in the smoker category and the population who had never smoked were in the nonsmoker category. The cross-tabulation of the study population showed that 54% of the study population were smokers compared to 46% of nonsmokers and the male population of smokers was higher (43%) compared to the female smokers (11%) in the case group. However, the percentage of smokers in the control group was lower by 7% in comparison to the smokers in the case group. The smoking population was the highest in the age group between 18 to 59 years, i.e., 48% in the case and 43% in the control.

With regards to education, a significant percentage (50% among the total case) were educated smokers in contrast to 44% educated nonsmokers. However, the proportion of educated smokers and nonsmokers in the study population was equal (45%) in the control group. The majority of the study population belonged to Brahmin, Chhetri, Thakuri, or Sanyasi ethnic group, and one fourth (26% in case and 25% in control) of the study population were smokers, however, the percentage of nonsmokers were lower by 2% in the case group. Janajati smokers were in the second position and Madhesi smokers were in the third position in terms of distribution of the study population. The proportion of smokers was higher among the employees of the private sector in the case group (22%) compared to the control group (17%). A similar percentage (10%) in the case and control group were smokers who were involved in the business (Table 2).

Table 2: Cross-tabulation of smoking behaviors with demographic characteristics among the Case and Control group

	Case			Control			Combined Total		
	Smoker	*Nonsmoker*	*Total*	*Smoker*	*Nonsmoker*	*Total*	*Smoker*	*Nonsmoker*	*Total*
Gender									
Female	11.11	20.74	31.85	13.33	26.67	40	12.22	23.7	35.93
Male	42.59	25.56	68.15	33.33	26.67	60	37.96	26.11	64.07
Total	53.7	46.3	100	46.67	53.33	100	50.19	49.81	100
n			270			270			540
Age Group									
< 18 years	0	0.37	0.37	0.74	4.81	5.56	0.37	2.59	2.96
Between 18 and 59 years	48.15	39.26	87.41	42.96	47.04	90	45.56	43.15	88.7
> 60 years	5.56	6.67	12.22	2.96	1.48	4.44	4.26	4.07	8.33
n			270			270			540
Education									
Educated	49.6	43.7	93.33	45.2	45.56	90.74	47.41	44.63	92.04
Uneducated	4.07	2.59	6.67	1.48	7.78	9.26	2.78	5.19	7.96

	Case			Control			Combined Total		
	Smoker	*Nonsmoker*	*Total*	*Smoker*	*Nonsmoker*	*Total*	*Smoker*	*Nonsmoker*	*Total*
n			270			270			540
Ethnicity									
Brahmin, Chhetri, Thakuri, Sanyasi	26.3	23.33	49.63	24.8	27.17	51.97	25.57	25.19	50.76
Janajati	14.07	13.33	27.41	12.99	14.17	27.17	13.55	13.74	27.29
Dalit	1.48	0.74	2.22	1.57	0.79	2.36	1.53	0.76	2.29
Madhesi	8.89	8.52	17.41	7.87	9.45	17.32	8.4	8.97	17.37
Others-Muslim, etc.	2.96	0.37	3.33	0.79	0.39	1.18	1.91	0.38	2.29
Total	53.7	46.3	100	48.03	51.97	100	50.95	49.05	100
n			270			254			524
Occupation									
Student	1.11	0.74	1.85	4.81	8.15	12.96	2.96	4.44	7.41
Government Employee	9.26	10.74	20	6.3	10	16.3	7.78	10.37	18.15
Employee in Private Sector	22.22	17.04	39.26	17.04	21.11	38.15	19.63	19.07	38.7
NGO/INGO sector	2.59	0.37	2.96	0.74	0.37	1.11	1.67	0.37	2.04
Business	10.37	5.19	15.56	9.63	4.44	14.07	10	4.81	14.81
Daily Wage	1.85	1.11	2.96	1.48	1.11	2.59	1.67	1.11	2.78
Unemployed	0.74	6.3	7.04	4.07	7.04	11.11	2.41	6.67	9.07
Others	5.56	4.81	10.37	2.59	1.11	3.7	4.07	2.96	7.04
Total	53.7	46.3	100	46.67	53.33	100	50.19	49.81	100
n			270			270			540

3.3. Relationship between COVID-19 prevalence and non/smoking behavior

Based on the statistical data analysis, there is no statistically significant relationship between COVID1-19 and non/smoking behavior of the population as the Odds Ratio was calculated to be 1.3 at P.Value 0.102 at 95% confidence interval (0.931 – 1.886). The result is illustrated in Table 3.

Table 3: Odds ratio and statistical test analysis among case and control due to smoking behavior

Group	Exposure	
	Smoking	*Non-Smoking*
Case (COVID-19 Positive)	145	126
Control (COVID-19 Negative)	125	144
Total	270	270
Odds Ratio	1.33 [95%CI: 0.931 – 1.886]	
P. Value	0.102	

Furthermore, there was no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, occupation, income, and smoking behaviors when the demographic variables were combined with smoking behavior. However, there was a significant relationship between the prevalence of COVID-19 and education status as the odds ratio among the uneducated population was 8.25 times compared to 1.14 times among the educated population at P.Value 0.0283 (95% CI, 0.7927915 - 1.653494). In addition, although the relationship of the

prevalence of COVID-19 and occupation combined with smoking behavior was not significant (P.Value 0.3032), the odds ratio for employees of INGO/NGO and who also smoked was 3.5, which indicated a 3.5 times higher likelihood of getting COVID-19. The results of the odds ratio between different demographic variables combined with smoking and the prevalence of COVID-19 are presented in Table 4.

Table 4: Statistical analysis (Odds ratio) between different demographic variables and smoking behaviors in the study population

	Odds Ratio	[95% Conf. Interval	P.Value (Test of Homogeneity)
Gender			
Female	1.071429	0.5634596 - 2.030777	0.5604
Male	1.333333	0.8474041 - 2.097762	
Age Group			
Less than 18 years	0	0 - 0	0.2379
Between 18 and 59 years	1.342713	0.9224486 - 1.954801	
Above 60 years	0.4166667	0.0775597 - 1.975593	
Education level			
Educated	1.14	0.7927915 - 1.653494	0.0283
Uneducated	8.25	1.652237 - 45.47613	
Ethnicity			
Brahmin, Chhetri, Thakuri, Sanyasi	1.234316	0.7413754 - 2.055643	0.9632
Janajati	1.151515	0.567179 - 2.339362	
Dalit	1	0.0480318 - 20.82052	
Madhesi	1.252174	0.5072785 - 3.097709	
Others-Muslim, etc.	4	0.0340591 - 352.2657	
Occupation			
Student	2.538462	0.2491429 - 33.35732	0.3032
Employed in Government offices	1.369168	0.5657998 - 3.334489	
Employee in private sector	1.616257	0.9029041- 2.896171	
Employee in NGO/INGO	3.5	0.0298035 - 313.104	
Business	0.9230769	0.3242201 - 2.608835	
Daily wage	1.25	0.1008825 - 15.37805	
Unemployed	0.2032086	0.0198226 - 1.168305	
Others	0.4945055	0.0695782 - 2.800802	

3.4. Relationship between severity of COVID-19 and non/smoking behavior

As per the WHO's disease category and its prevalence among the study population grouped according to the smoking habits, major diseases prevalent in the study population included high blood pressure (48% among the smoking population and 44% among the non-smoking population), diabetes (21% among smoking population and 19% among non-smoking population) and heart disease (5% among smoking and non-smoking population) (Table 5).

Table 5: Prevalence of pre-condition health complications among the study population

	Smoker	Non-Smoker	Combined overall

Disease List	Case	Control	Total	Case	Control	Total	Case	Control	Total
Cancer	0	0	0	1.69	0	1.69	0.65	0	0.65
Kidney related diseases	1.06	1.06	2.13	0	1.69	1.69	0.65	1.31	1.96
Heart disease	3.19	2.13	5.32	1.69	3.39	5.08	2.61	2.61	5.23
Obesity	1.06	0	1.06	1.69	1.69	3.39	1.31	0.65	1.96
Lung disease	1.06	0	1.06				0.65	0	0.65
Diabetes	11.7	9.57	21.28	8.47	10.17	18.64	10.46	9.8	20.26
Asthma	0	2.13	2.13	3.39	0	3.39	1.31	1.31	2.61
High Blood Pressure	21.28	26.6	47.87	32.2	11.86	44.07	25.49	20.92	46.41
Neuron related (dementia)	1.06	0	1.06	3.39	0	3.39	1.96	0	1.96
Liver				0	1.69	1.69	0	0.65	0.65
Other	25.53	21.28	46.81	18.64	25.42	44.07	22.88	22.88	45.75
Total	65.96	62.77	128.72	71.19	55.93	127.12	67.97	60.13	128.1
n	48	46	94	35	24	59	83	70	153

Among COVID-19 positive cases (case group), 54% out of 270 study population had smoking habits (current smoker plus past smoker). Among those who smoked, 66% of the population mentioned having health complications while among the population who did not smoke, 75% of them found complications. However, the statistical test showed no significant relationship between health complications and smoking behavior [Odds ratio: 0.626, 95% CI: 0.35 – 1.1, P.Value: 0.0834]. The symptoms were relatively higher among the non-smokers compared to smokers such as 77% non-smokers experienced fever against 72% of smokers, 49% of non-smokers experienced a loss of taste or smell compared to 35% of the smokers and 56% of non-smokers experienced muscle pain or body ache against 47% of smokers (Table 6).

Table 6: Health Complications among the study group population

	Smoker	**Non-Smoker**	**Total**
Fever	72.12	77.23	74.63
Coughing	44.23	35.64	40.00
Difficulty in breathing	31.73	23.76	27.80
Fatigue/tired	23.08	31.68	27.32
Muscle Pain or body ache	47.12	56.44	51.71
Headache	30.77	22.77	26.83
Loss of taste or smell	34.62	48.51	41.46
Sore throat	14.42	16.83	15.61
Vomiting	0.96	3.96	2.44
Diarrhea	7.69	5.94	6.83

With regards to recovery, the nonsmoker study population was found to have taken more days as 57% of the non-smoker population said to have recovered between 10 to 20 days against 49% of the smoker population in the same number of days. Similarly, 27% of the nonsmoker population recovered in more than 20 days compared to 23% of the smoker population. This indicated a statistically significant relationship between recovery days and smoking behaviors as the P.value was found to be less than 0.05 [Coefficient: -1.027998, P.value: 0.014, 95% CI: -.184772 to -.0208272]. Only 17 respondents (6%) out of 270 study population were hospitalized for critical care and treatment, and among those, 65% were non-smokers.

3.5. COVID-19 and its relationship with alcohol intake behavior

The cross tabulation of the study population showed that 46% of the study population consumed alcohol compared to 54% of alcohol non-consumers in the case group and the male population of drinkers was higher, 49 % compared to 6% in the total case population. However, the percentage of the population who drank alcohol in the control group was lower by just 3% in comparison to the drinkers in the case group. The alcohol was consumed the highest in the age group between 18 to 59 years, i.e., 43% in the case and 40% in the control. The percentage of the educated population who drank alcohol was higher (7% more) in the case than the control group as nearly half of the study population (44% among the total case) were educated who drank alcohol compared to 37% educated who drank alcohol in the control group. The proportion of drinking alcohol was distributed across different ethnic groups as 20% of Brahmin, Chhetri, Thakuri, or Sanyasi ethnicity in the case group was drinking alcohol against 17% in the control group of same ethnicities. Likewise, a nearly similar proportion of 15% of Janajati ethnicity and 8% of Madhesi ethnicity were drinking alcohol in both study groups. Among total 46% alcohol consuming population, a majority of them were employed in the private sector (23% in case and 39% in control) followed by involvement in business (9% in both case and control) and then in the government offices (7% in case and 6% in control) (Table 7).

Table 7: Cross-tabulation of the prevalence of COVID-19 among the population who consumed alcohol and who do not in the different demographic category

	Case			**Control**			**Combined Total**		
	Alcohol-Yes	Alcohol-No	Total	Alcohol-Yes	Alcohol-No	Total	Alcohol-Yes	Alcohol-No	Total
Gender									
Female	6.3	25.56	31.85	8.89	31.11	40	7.59	28.33	35.93
Male	39.63	28.52	68.15	33.33	26.67	60	36.48	27.59	64.07
Total	45.93	54.07	100	42.22	57.78	100	44.07	55.93	100
n			270			270			540
Age Group									
<18 years	0	0.37	0.37	0.37	5.19	5.56	0.19	2.78	2.96
Between 18 and 59 years	42.59	44.81	87.41	40.37	49.63	90	41.48	47.22	88.7
> 60 years	3.33	8.89	12.22	1.48	2.96	4.44	2.41	5.93	8.33
Total	45.93	54.07	100	42.22	57.78	100	44.07	55.93	100
n			270			270			540
Education									
Educated	44.44	48.89	6.67	36.67	54.07	9.26	40.56	51.48	92.04
Uneducated	1.48	5.19	93.33	5.56	3.7	90.74	3.52	4.44	7.96
Total	45.93	54.07	100	42.22	57.78	100	44.07	55.93	100
n			270			270			540
Ethnicity									
BCTS*	20.37	29.26	49.63	16.93	35.04	51.97	18.7	32.06	50.76
Janajati	15.19	12.22	27.41	14.57	12.6	27.17	14.89	12.4	27.29
Dalit	1.48	0.74	2.22	1.97	0.39	2.36	1.72	0.57	2.29
Madhesi	7.78	9.63	17.41	7.87	9.45	17.32	7.82	9.54	17.37
Others-Muslim, etc.	1.11	2.22	3.33	0.39	0.79	1.18	0.76	1.53	2.29
Total	45.93	54.07	100	41.73	58.27	100	43.89	56.11	100
n			270			254			524
Occupation									
Student	0.74	1.11	1.85	2.22	10.74	12.96	1.48	5.93	7.41
Government	7.04	12.96	20	5.93	10.37	16.3	6.48	11.67	18.15

	Case			Control			Combined Total		
	Alcohol-Yes	Alcohol-No	Total	Alcohol-Yes	Alcohol-No	Total	Alcohol-Yes	Alcohol-No	Total
Employee									
Employee in Private Sector	22.96	16.3	39.26	19.63	18.52	38.15	21.3	17.41	38.7
NGO/INGO sector	1.48	1.48	2.96	0.37	0.74	1.11	0.93	1.11	2.04
Business	8.89	6.67	15.56	8.89	5.19	14.07	8.89	5.93	14.81
Daily Wage	1.48	1.48	2.96	0.74	1.85	2.59	1.11	1.67	2.78
Unemployed	1.48	5.56	7.04	3.7	7.41	11.11	2.59	6.48	9.07
Others	1.85	8.52	10.37	0.74	2.96	3.7	1.3	5.74	7.04
Total	45.93	54.07	100	57.78	42.22	100	44.07	55.93	100
n			270			270			540

*Brahmin, Chhetri, Thakuri, Sanyasi

3.6. Relationship between COVID-19 prevalence and alcohol consumption behavior

Based on the statistical tests, the odds ratio of 1.2 between alcohol consumption behavior and prevalence of COVID-19 among the study population suggested no statistical significance between these two variables [95% CI: 0.8153696 - 1.656787, P.Value: 0.386], as illustrated in Table 8.

Table 8: Odds ratio and statistical test analysis among case and control due to alcohol drinking behavior

Group	Exposure: Alcohol Consumption	
	Yes	No
Cases (COVID-19 positive)	124	114
Controls (COVID-19 Negative)	146	156
Total	270	270
Odds Ratio	1.2 [95% CI: 0.8153696 - 1.656787]	
P.Value	0.386	

With regards to the effect of demographic variables on the prevalence of COVID-19 when the demographic variables are combined with the alcohol consumption behavior of the population, the results suggested that there was no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, and occupation, and alcohol intake behaviors when the demographic variable are combined with alcohol intake behaviors. However, there was a significant relationship between the prevalence of COVID-19 and education status as the odds ratio among the uneducated population was 0.19 compared to the odds ratio of 1.3 among the educated population at P.Value 0.0068. In addition, although the relationship of the prevalence of COVID-19 and occupation combined with alcohol intake behavior was not significant (P.Value 0.756), the odds ratio population who were students and also drank alcohol was 3.2, which suggested a 3.2 times higher likelihood of getting COVID-19. The results of the odds ratio between different demographic variables combined with smoking and the prevalence of COVID-19 are presented in Table 9.

Table 9: Statistical analysis (Odds ratio) between different demographic variables and alcohol intake in the study population

Gender	Odds Ratio	[95% Conf. Interval	P.Value (Test of Homogeneity)
Female	0.862319	0.4002871 - 1.829086	0.5428
Male	1.111688	0.7094694 - 1.741441	
Age Group			
Less than 18 years	0	0	0.8052
Between 18 and 59 years	1.168398	0.802755 - 1.700695	
Above 60 years	0.75	0.150966 - 4.290965	
Education level			
Educated	1.34068	0.9251982 - 1.943295	0.0068
Uneducated	0.1904762	0.0364382 - 0.8759066	
Ethnicity			
Brahmin, Chhetri, Thakuri, Sanyasi	1.440977	0.8471909 - 2.454914	0.8244
Janajati	1.074529	0.5276406 - 2.188172	
Dalit	0.4	0.0056659 - 11.31491	
Madhesi	0.969231	0.3912999 - 2.4022	
Others-Muslim, etc.	1	0.0358731 - 78.42344	
Occupation			
Student	3.222222	0.2158656 - 33.89186	0.7569
Employed in Government offices	0.95	0.3824471 - 2.372603	
Employed in private sector	1.329331	0.7423316 - 2.381971	
Employed in NGO/INGO	2	0.0688811 - 147.0436	
Business	0.777778	0.2868059 - 2.095949	
Daily	2.5	0.1989479 - 39.54428	
Unemployed	0.533333	0.1030168 - 2.355593	
Others	0.869565	0.1118424 - 10.89119	

3.7. Relationship between severity of COVID-19 and Alcohol Consumption

As per the WHO's disease category and its prevalence among the study population grouped according to the alcohol intake behaviors, major diseases prevalent in the study population included high blood pressure 47% among alcohol consuming population and 46% among non-alcohol consuming population), diabetes (19% among alcohol consuming population and 21% among non-alcohol consuming population) and heart disease (5% among the alcohol consuming alcohol and 6% among the non-alcohol consuming alcohol population).

Table 10: Prevalence of pre-condition health complications among the study population

	Case			Control			Combined total		
	Alcohol Consumption			Alcohol Consumption			Alcohol Consumption		
Diseases	Yes	No	Total	Yes	No	Total	Yes	No	Total
Cancer	1.2	0	1.2				0.65	0	0.65
Kidney related diseases	1.2	0	1.2	0	2.86	2.86	0.65	1.31	1.96
Heart disease	2.41	2.41	4.82	2.86	2.86	5.71	2.61	2.61	5.23
Obesity	0	2.41	2.41	0	1.43	1.43	0	1.96	1.96
Lung	1.2	0	1.2				0.65	0	0.65
Diabetes	8.43	10.84	19.28	10	11.43	21.43	9.15	11.11	20.26

	Case			Control			Combined total		
	Alcohol Consumption			Alcohol Consumption			Alcohol Consumption		
Diseases	Yes	No	Total	Yes	No	Total	Yes	No	Total
Asthma	0	2.41	2.41	1.43	1.43	2.86	0.65	1.96	2.61
High Blood Pressure	14.46	32.53	46.99	17.14	28.57	45.71	15.69	30.72	46.41
Neuron related (dementia)	2.41	1.2	3.61				1.31	0.65	1.96
Liver	0	0	0	1.43	0	1.43	0.65	0	0.65
Other	19.28	22.89	42.17	15.71	34.29	50	17.65	28.1	45.75
Total	50.6	74.7	125.3	48.57	82.86	131.43	49.67	78.43	128.1
Neuron	33	50	83	28	42	70	61	92	153

In the total study population combining both case and control groups, 44% out of 540 were found to have consumed alcohol (current or past). In the case group, 46% had consumed alcohol compared to 42% in the control group population that indicated a lesser percentage of the population in the control who consumed alcohol compared to the case group. Among the case group population and those who consumed alcohol, two thirds of them had health complications and only one third (35% out of 124) did not have health complications. However, the case-control statistical test did not show a significant difference [odd ratio: 0.6627, 95% CI: 0.3796 – 1.156, P.Value: 0.122].

The symptoms of complications due to COVID-19 were present in a higher percentage of the population in the population who did not consume alcohol in comparison to the population who consumed alcohol. For example, 54% of the population who did not drink had muscle pain or body ache compared to 48% of the population who drank alcohol. Likewise, 44% of the population who did not drink had a loss of taste or smell compared to 38% of the population who consumed alcohol (Table 11).

Table 11: Health Complications among case group combined with alcohol intake behaviors

	Alcohol consumption		
Symptoms	**Yes**	**No**	**Total**
Fever	75	74.36	74.63
Coughing	38.64	41.03	40
Difficulty in breathing	20.45	33.33	27.8
Fatigue/tired	20.45	32.48	27.32
Muscle Pain or body ache	47.73	54.7	51.71
Headache	22.73	29.91	26.83
Loss of taste or smell	37.5	44.44	41.46
Sore throat	17.05	14.53	15.61
Vomiting	2.27	2.56	2.44
Diarrhea	7.95	5.98	6.83

The recovery of COVID-19 positive cases combined with alcohol consumption habit; percentage of the population who did not drink alcohol took two times (more than 20 days) to recover compared to those who drank alcohol. However, there was no statistically significant relationship between recovery days and consumption behavior of alcohol [Coef: -0.171, P.Value: 0.055, 95% CI: -0.345 – 0.00366]. In addition, 17 respondents (6%) out of 270 were hospitalized for critical care and treatment, and among those, 71% were alcohol non-consumer.

Table 12: Recovery pattern of the case group population

	Alcohol Consumption		
Recovery days	Yes	No	Total
Less than 10 days	10.45	11.19	21.64
Between 10 to 20 days	26.49	26.49	52.99
More than 20 days	8.58	16.04	24.63
Death	0	0.75	0.75
Total	45.52	54.48	100

Moreover, among the study population, there was low adherence towards the travel restrictions during lockdown imposed by the GoN. Nearly half of the study population (49%) had traveled to other places despite the lockdown imposed by the GoN. The common purpose of traveling was family gathering (51% total, 49% in case and 53% in control), office meeting or event (52% total, 56% in case, and 47% in control), and other religious and entertainment events. With respect to smoking behaviors and alcohol intake patterns, the study population was evenly spread who traveled during the lockdown in both case and control groups (Table 13). In addition, adherence to the prevention rules and policies such as maintaining social distance and wearing masks was found to be low among the study population. Only a quarter of the study population (27%) were obliged to social distance (1.6 meters) and wear masks. However, the percentage of the population in the case was higher (59%) who adhered to the prevention measures (mask and social distance) compared to the population in the control group (41%).

Table 13: Travel pattern of study population during lockdown imposed by the Government of Nepal

Travel status	Smoking behavior				Alcohol Intake			
	Case		Control		Case		Control	
	Smoker	Nonsmoker	Smoker	Nonsmoker	Yes	No	Yes	No
Yes	53.47	44	54.4	47.92	56.5	42.8	55.26	47.74
No	46.53	56	45.6	52.08	43.6	57.2	44.74	52.26

The study also explored the drop out of smoking during the lockdown as an effect of awareness related to the COVID-19. Out of smoking respondents (126), only a small percentage of the population (20%) have dropped the smoking habit due to various reasons including awareness about risky behaviors for COVID-19 and recommendation of a doctor. Two third (65%) of the smoking dropout population was in the case and only one third population (35%) was in the control group.

4. Discussion

The result of this study showed that there is no statistically significant relationship between COVID-19 and the non/smoking behavior of the population. The cross-tabulation of the study population showed that 54% of the study population were smokers compared to 46% of nonsmokers and the male population of smokers was higher (43%) compared to the female smokers (11%) in the case group. However, the percentage of smokers in the control group was lower by 7% in comparison to the smokers in the case group. The smoking population was the highest in the age group between 18 to 59 years, i.e., 48% in the case and 43% in the control. The Odds Ratio was calculated to be 1.3 at P.Value 0.102 at a 95% confidence interval (0.931 – 1.886). Furthermore, we found no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, occupation, income, and smoking behaviors when the demographic variables were combined with smoking behavior. However, there was a significant relationship between the prevalence of COVID-19 and education status as the odds ratio among the uneducated population was 8.25 times compared to 1.14 times among the educated population at P.Value 0.0283 (95% CI, 0.7927915 - 1.653494). The result of this study also suggested no statistical significance between alcohol consumption and COVID-19 [95% CI: 0.8153696 - 1.656787, P.Value: 0.386]. The cross tabulation of the study population showed that 46% of the study population consumed alcohol compared to 54% of alcohol non-consumers and the male population of drinkers was higher, 37% compared to 6% in the total case population. With regards to the effect of demographic variables on the prevalence of COVID-19 when the demographic variables are combined with the alcohol consumption behavior of the population, the results suggested that there was no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, and occupation, and alcohol intake behaviors when the demographic variable are combined with alcohol intake behaviors.

According to the Multiple Indicator Cluster Survey (MICS) published by the Government of Nepal (GoN), the smoking rate for women aged 15 to 49 was 5.1% and the smoking rate for men aged 15 to 49 years was 16.9% for ever users of cigarette. In comparison, the smoking rate for women was 12.2 % and the smoking rate for men was 38 % in our study. According to age groups, the highest smoking rate was seen in people between 18 to 59 years age i.e., 45.5% of the population were smokers. There is a discrepancy in the smoking rate between the MICS number and the numbers in our study.

While there has not been a study done regarding the relationship between smoking and the prevalence and severity of COVID-19 focusing on Nepal, various studies have been conducted around the world to study this relationship. Other research conducted by looking at the smoking behaviors and alcohol consumption behavior and relationship with COVID-19 has given different results. A meta-analysis study conducted using data from China and the USA found that there was no statistically significant relationship (OR 1.40, 95% CI 0.98-1.98) between smoking and COVID-19 severity (Farsalinos, et al., 2021). Another ecological study that was conducted with data from 38 European countries found a statistically significant negative association between COVID-19 and smoking (Tsigaris, et al., 2020).

In contrast, some studies suggest that there exists a statistically significant relationship between smoking behaviors and COVID-19. A study conducted in Dhaka, Bangladesh among 2022 adults (aged > 18) found that smoking status, duration, and frequency, and the presence of comorbidities were significantly associated with COVID-19 (Mohshin, et al., 2021). The data showed that ever-smokers were 1.35 times (95% CI: 0.74–2.45), 1.30 times (95% CI: 0.58–2.87), and 2.45 times (95% CI: 1.07–5.61) more likely to be mild, severe, and critical cases in comparison to non-smokers. Another study conducted in the UK by using data the UK Biobank found that current smokers had higher risks of hospitalization (OR 1.80, 95% CI 1.26 to 2.29) and mortality (smoking 1–9/day: OR 2.14, 95% CI 0.87 to 5.24; 10–19/day: OR 5.91, 95% CI 3.66 to 9.54; 20+/day: OR 6.11, 95% CI 3.59 to 10.42) in comparison to people who had never smoked (Clift, A.K, et al., 2021).

As different studies show contrasting results with regards to the association between smoking and alcohol consumption and COVID-19, further research needs to be done. Currently, this study was undertaken in a small sample size from four different provinces, thus, further study with data from all provinces can be done to see whether the conclusion for the topic remains the same.

5. Conclusion and Recommendation

5.1. Conclusion

There were higher male smokers in the case group, i.e., 43% male vs 11% female. Also, the percentage of smokers in the control group was lower by 7% than in the case group. Two thirds of the smoking population and three quartiles of the nonsmoker population mentioned that they had health complications. Though, the statistical test showed no significant relationship between health complications and smoking behavior [Odds ratio: 0.626, 95% CI: 0.35 – 1.1, P.Value: 0.0834]. The symptoms were relatively higher among the non-smokers compared to smokers such as 77% non-smokers experienced fever against 72% of smokers, 49% of non-smokers experienced a loss of taste or smell versus 35% of smokers and 56% of non-smokers experienced muscle pain or body ache against 47% of smokers. In addition, there is no statistical significance relationship between COVIDo-19 and non/smoking behavior of the population [Odds Ratio: 1.3, P.Value: 0.102, 95% CI: 0.931 – 1.886].

Furthermore, it was found that there is no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, occupation, income, and smoking behaviors when the demographic variables are combined with smoking behavior. However, there was a significant relationship between the prevalence of COVID-19 and education status as the odds ratio among the uneducated population was 8.25 times compared to 1.14 times among the educated population at P.Value 0.0283 (95% CI, 0.7927915 - 1.653494). In addition, although the relationship of the prevalence of COVID-19 and occupation combined with smoking behavior was not significant (P.Value 0.3032), the odds ratio for employees of INGO/NGO and who also smoked was 3.5, which indicated a 3.5 times higher likelihood of getting COVID-19. Nonsmokers recovered slower than smokers. 57% of the nonsmoker population recovered between 10 to 20 days against 49% of the smoker population in the same number of days. This indicated a statistically significant relationship between recovery days and smoking behaviors [Coefficient: -1.027998, P.value: 0.014, 95% CI: -0.184772 to -.0208272].

A total of 46% of the study population consumed alcohol compared to 54% of alcohol non-consumers and the male population of smokers was higher in who consumed alcohol compared to females. In addition, there was no statistical significance between these two variables [Odds ratio: 1.2, P.Value: 0.386, 95% CI: 0.8153696 - 1.656787]. Moreover, there was no significant relationship between the prevalence of COVID-19 and ethnicity, gender, age groups, and occupation, and alcohol intake behaviors when the demographic variables are combined with alcohol intake behaviors. However, there was a significant relationship between the prevalence of COVID-19 and education status [Odds ratio: 0.19, P.Value 0.0068]. Two third of the population in the case group who consumed alcohol had health complications and only one third (35% out of 124) did not have health complications. However, the case-control statistical test did not show a significant difference [odd ratio: 0.6627, 95% CI: 0.3796 – 1.156, P.Value: 0.122]. The symptoms of complications due to COVID-19 were present in a higher percentage of the population who did not consume alcohol than those who consumed alcohol.

With regards to the compliance and adherence to the prevention rules and policies such as maintaining social distance and wearing masks, only a quarter of the study population were found obliged to social distance (1.6 meters) and wearing masks.

5.2. Recommendations

The small sample size of the study population for a case-control study design for such a global pandemic disease was not adequate to generalize the results across different countries of the world. As the disease is still evolving with the mutation of several new variants of COVID-19, it is not possible to predict and generalize the results. Thus, although this research concludes that there is no significant relationship between smoking and alcohol intake behaviors of the study population with a prevalence of COVID-19 as well as the severity of the disease, it is difficult to generalize amidst the evolution of new variants and rapid transmission of the disease globally. Therefore, it is highly recommended to scale up this research design in the new context with larger sample size and higher geographical coverage, within the country as well as the inter-country.

6. References

1. Clift, A.K., von Ende, A.., Tan, P.S., Sallies, H. M., Lindson, N, Coupland, C., Munafo, M.R., Aveyard, P., Hippley-Cox, J., & Hopewell, J.C. (2021). Smoking and COVID-19 outcomes: an observational and Mendelian randomisation study using the UK Biobank cohort. *Thorax.* http://dx.doi.org/10.1136/thoraxjnl-2021-217080
2. Farsalinos, K., Bagos, P.G., Giannouchos, T. *et al.* Smoking prevalence among hospitalized COVID-19 patients and its association with disease severity and mortality: an expanded re-analysis of a recent publication. *Harm Reduct J* 18, 9 (2021). https://doi.org/10.1186/s12954-020-00437-5
3. Government of Nepal, National Planning Commission, central Bureau of Statistics, & UNICEF Nepal. (2019). Multiple Indicator Cluster Survey 2019. https://www.unicef.org/nepal/reports/multiple-indicator-cluster-survey-final-report-2019
4. Hamal, P. K., Pokharel, N., Pandey, D., Malla, P., & Lamsal R. (2020). Perspectives of doctors for COVID-19 pandemic readiness in government hospitals of Nepal. *Journal of Nepal Health Research Council*, *18*(2), 166-171. https://doi.org/10.33314/jnhrc.v18i2.2811
5. Hodge, S. E., Subaran, R. L., Weissman, M. M., & Fyer, A. J. (2012). Designing case-control studies: decisions about the controls. *The American journal of psychiatry*, *169*(8), 785–789. https://doi.org/10.1176/appi.ajp.2012.11111686
6. John Hopkins University. (2020). *Global number of COVID-19 Cases.* https://coronavirus.jhu.edu/map.html
7. Lighter J., Phillips M., Hochman S., Sterling, S., Johnson, D., Francois, F., & Stachel A. (2020). Obesity in Patients Younger Than 60 Years Is a Risk Factor for COVID-19 Hospital Admissions. *Clinical Infectious Diseases.* https://doi.org/10.1093/cid/ciaa415
8. Ministry of Health and Population. (2020). *Number of COVID-19 Cases.* https://covid19.mohp.gov.np/
9. Mohsin, FM., Tonmon, TT., Nahrin, R., Tithy, SA., Ame, FA., Ara, I., Alam, ST., Pervejj, AMA., Shahjalal, M., & Hawaldhar, MDH. (2021). *Journal of Multidisciplinary HealthCare.* https://doi.org/10.2147/JMDH.S317603
10. Nepal Health Research Council. (2020). *Assessment of Compliance with SMS measures against COVID-19 in Kathmandu.* http://nhrc.gov.np/wp-content/uploads/2020/08/SMS_Report.pdf
11. Rossato M., Russo L., Mazzocut S., Vincenzo, A., Fioretto, P., & Vettor R. (2020). Current Smoking is not associated with COVID-19. *European Respiratory Journal.* 10.1183/13993003.01290-2020
12. Sutton-Tyrrell, K. (1991). Assessing bias in case-control studies. Proper selection of cases and controls. *Stroke*, *22*(7), 938-942.
13. Tsigaris, P, Trixeria da Silva, J. A. (2020). Smoking Prevalence and COVID-19 in Europe. *Nicotine & Tobacco Research*, Volume 22, Issue 9, September 2020, Pages 1646–1649, https://doi.org/10.1093/ntr/ntaa121
14. World Health Organization. (2020). *Declaration of COVID-19 as a pandemic.* https://www.who.int/news-room/detail/27-04-2020-who-timeline---covid-19
15. Wu, Z. & McGoogan JM. (2020). Characteristics and important lessons from the Coronavirus Disease 2019 (COVID-19) in China: summary of a report of 72314 cases from the Chinese Center for Disease Control and Prevention. *JAMA Network.* 10.1001/jama.2020.2648 32091533
16. Zheng, Z., Peng, F., Xu, B.,Zhao, J., Liu, H., Peng, J., Li, Q.,Jiang, C., Zhou, Y., Liu, S., Ye, C., Zhang, P., Xing, Y., Guo, H., & Tang, W. (2020). Risk factors of critical and mortal COVID-19 cases: A systematic literature review and meta-analysis. *Journal of Infection*. https://doi.org/10.1016/j.jinf.2020.04.021

7. Annexures

Acknowledgment

We are grateful to Action Nepal for the funding support and thankful to Dr. Tara Singh Bam and Mr. Ananda Dhungana for their technical inputs and guidance.

We acknowledge the support of research assistants namely Mr. Ankit Khanal, Ms. Soni Khanal, Ms. Diskha Pokharel, Ms. Kusum Poudel, and Ms. Manusmriti Baral for their support in gathering the data by conducting the interviews with the respondents. Similarly, we also thank the staff of the Nepal Institute for Policy and Research (NIPoRe); Ms. Anushruti Adhikari, Ms. Samjhana Karki, Mr. Ankur Shrestha, Mr. Rubin Singh Maharjan, and Ms. Sujata Mainali for their support in the data collection process. We are also grateful to Institute for Integrated for Development Studies (IIDS) for providing a venue for the orientation session.

We are grateful to the Co-founder and Director of NIPoRe, Mr. Jaya Jung Mahat, and COO of NIPoRe Mr. Santosh Sharma Poudel for continuous support in terms of technical guidance as well as logistical support during the study. Without their support, we could not have accomplished this study. Last but not the least, we are grateful to all those respondents who provided their time and data that formed the basis of this study.

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