ORIGINAL RESEARCH

Co-occurrence of Behavioral Risk Factors of Non-communicable Diseases and Social Determinants among Adults in Urban Centers of Southwestern Ethiopia in 2020: A Community-Based Cross-Sectional Study

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Background: Non-communicable diseases are priority global health problems. Smoking, harmful alcohol consumption, physical inactivity, and an unhealthy diet are four behavioral risk factors of these diseases. Studies in Ethiopia have focused on establishing associations between these factors and incommunicable diseases.

Objective: To assess the prevalence, co-occurrence, and social determinants of behavioral risk factors of non-communicable diseases among adults in urban centers of southwestern Ethiopia.

Methods: This study employed a cross-sectional design. Multistage sampling and the Kish method were used. The WHO's STEPS instrument was used for data collection. Proportions and other descriptive measures are used to describe the data. Bivariate and multivariate logistic regression was run to assess associations. Associations between dependent and independent variables were determined using AORs, 95% CIs, and significance level of P=0.05.

Results: A total of 1,191 adults participated in the study for a 93.3% response rate. In sum, 4.8% of participants were smokers and 15.6% indulge in harmful drinking. Prevalence of physical inactivity was 60.45%, and 94.8% consumed insufficient fruit and vegetables. Regarding co-occurrence of these factors, 65.5% of participants had two or more behavioral risk factors. Female sex (AOR 3.1, 95% CI 1.8–5.5), no formal employment (AOR 1.9, 95% CI 1.02–3.7), greater wealth (AOR 2.44, 95% CI 1.1–5.1), not having a friend who does physical exercise (AOR 2.7, 95% CI 1.5–4.7), having friends who do not drink (AOR 0.20, 95% CI 0.09–0.44), and participating in community activities (AOR 2.95, 95% CI 1.4–6.0) were associated with co-occurrence of behavioral risk factors of non-communicable diseases.

Conclusion: The prevalence and co-occurrence of behavioral risk factors of non-communicable diseases in the study area are alarming. Several factors were associated with co-occurrence of these factors. Community-based interventions have to be implemented considering family settings. Special focus has to be given to physical inactivity and fruit and vegetable consumption.

Keywords: behavioral risk factors, non-communicable diseases, southwestern Ethiopia

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Background

Non-communicable diseases (NCDs) are significant global health and development challenges. On top of their social and economic impact, they are leading causes of

morbidity and mortality, resulting in 41.1 million deaths in 2019. Of special concern is global NCD-related premature death. Almost 75% of all ICD deaths and 82% of the 16 million people who died prematurely or before reaching 70 years of age occur in low- and middle-income countries (LMICs). Between 1990 and 2019, disability adjusted life years for NCDs increased by 13.1%.[1–4]

The major NCDs responsible for these deaths include cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes.[5] The World Health Organization (WHO) has identified four behavioral risk factors associated with NCDs: harmful alcohol use, tobacco use, physical inactivity, and unhealthy diet. In addition, it has made action against these four risk factors one of the global objectives in the fight against NCDS.[6]

According to the global status report on alcohol and health in 2018, it is estimated that harmful alcohol use was the cause of some 3 million deaths worldwide and 132.6 million disability-adjusted life years. Mortality resulting from alcohol consumption is higher than that caused by such diseases as tuberculosis, HIV/AIDS, and diabetes.[7]

Tobacco use is one of the leading global risk factors of illness and death from NCD. In 2019, tobacco use resulted in 8.7 million deaths globally. Tobacco smoking accounted for 6.57 million deaths among men, accounting for >21.4% of all deaths among men. The prevalence of current tobacco use is 8.1% among men, 1.8% among women, 3.8% in urban areas, and 5.3% in rural areas. The overall prevalence of adult daily smoking is 3.2% (2.2 million).[8]

Physical inactivity has been identified as the fourth-leading cause of global mortality, causing 6% of global deaths. It is estimated to be the principal cause of approximately 21%–25% of breast and colon cancer, 27% of diabetes, and 30% of ischemic heart disease. Physical inactivity is also responsible for a great share of the rise in NCD morbidity and mortality. The WHO has put forth global recommendations for physical activity for health and urged its member states to prepare national physical activity action plans and draft policies to increase physical activity levels in their populations, with special emphasis on creating suitable and healthy transportation and suitable environments that promote physical activity.[9]

Fruit and vegetables are important components of a healthy diet, and sufficient daily consumption could help to prevent cardiovascular diseases and certain cancers. According to the WHO, low fruit-and-vegetable intake is estimated to cause about 31% of ischemic heart disease and 11% of strokes worldwide. It is estimated that up to 2.7 million lives could potentially be saved each year if fruit-and-vegetable consumption were sufficiently increased. Unhealthy diets and more importantly poor consumption of fruit and vegetables are also one of the main behavioral risk factors of NCDs. Despite this, the level of consumption of these food items is still far below that recommended.[10]

It is believed that these four behavioral risk factors of NCDs are preventable. In line with this, multiple efforts have been made both internationally and locally. Regarding tobacco, the World Health Assembly in 2003 adopted the World Health Organization Framework Convention on Tobacco Control, which entered into force in 2005. Ethiopia ratified the convention on January 21, 2014. Despite several shortcomings, Ethiopia has made progress in laying the groundwork to prevent the public-health impacts of smoking and excessive alcohol consumption.[7]

Several studies conducted over the last few decades concerning factors associated with NCDs have brought these factors to the level of established facts. It is a wastage of resource and time to conduct studies to assess the association of the four behavioral risk factors of NCDs. Rather than re-exploring the already-established facts, steps must be taken to assess prevalence and social determinants associated with these four behavioral factors. In addition, individuals with more risk factors are more likely to develop diseases and suffer the consequences, and no study has been done to assess the co-occurrence of these factors among individuals in Ethiopia. This study accordingly aimed to conduct a comprehensive assessment of the co-occurrence of behavioral risk factors of ICDs and their social determinants in the study area.

Methods
Study Area, Design, and Period
The study was conducted in urban centers of southwestern Ethiopia. These urban centers — Bedelle, Mettu, and Gambella — are administrative capitals of the zones and regions in Southwest Ethiopia. Despite their organizational differences, the developmental status of the three cities is comparable. This community-based cross-sectional study was conducted from January 15 to 30, 2020.

Sample-Size Determination and Sampling Procedure
Sample size was calculated for all objectives and the largest is used. This sample size was found using

a single population–proportion formula with proportion of 41%,[11] 95% confidence level (ie, Z=1.96), design effect of 2, marginal error of 0.04 and nonresponse rate of 10%. The final sample size was 1,277.

The sampling approaches used in this study were a combination of multistage sampling, simple random sampling, the and Kish grid method.[12] From the three urban centers, kebeles (lowest administrative units in Ethiopia) were randomly selected by lottery. Sample size was proportionally distributed to each kebele based on household numbers. At the household level, one individual among the eligible household members was selected using the Kish method.

Data-Collection Tools and Procedures

Data were collected using an interviewer-administered questionnaire adopted from the WHO's STEPS instrument. This instrument included questions to assess tobacco smoking, harmful alcohol consumption, physical activity, and fruit-and-vegetable consumption. The wealth index was measured by using 27 locally validated questions to measure household assets. Social capital and social cohesion were assessed with an integrated questionnaire for the measurement of social capital validated for use in developing countries.[13] Additional social determinants of health variables were measured by developing appropriate questions. Data were collected by trained public-health officers and nurses. Supervisors were senior public-health officers of the towns.

Data Processing and Analysis

Raw data were edited and coded on a daily basis. Edited and coded data were entered into EpiData 3.1 and exported to SPSS 20 for analysis. Presence or absence of the four behavioral risk factors was assessed for all participants. Participants who were current users of any tobacco product at the time of the study were classified as smokers. Harmful alcohol use was defined by assessing current use and comparing it with sex-specific threshold levels. Individuals who performed <150 minutes of moderate or <75 minutes of vigorous physical activity or an equivalent combination of the two in a week were categorized as physically inactive. Finally, participants who consumed fewer than five servings of fruit and vegetables per day in the week prior to the study were classified as poor consumers of fruits and vegetables. The occurrence and absence of each behavioral risk factor was coded as 0 if the risk factor is absent and one if present.

Co-occurrence of behavioral risk factors was computed by summing the results of the four risk factors. Participants with two or more behavioral risk factors at the time of the study were declared to have co-occurrence of behavioral risk factors of NCDs. Participants who had co-occurrence of two or more behavioral risk factors were coded as 1 and those with one or no risk factors coded as 0 in the software.

Proportions and other descriptive statistical analysis are used to describe the data. Bivariate logistic regression was run to screen variables for multivariate regression. Variables with P<0.25 on bivariate regression progressed to multivariate logistic regression to assess associations using backward stepwise logistic regression. On multivariate logistic regression, associations between co-occurrence of behavioral risk factors and independent variables were determined using AORs, 95% CIs, and significance level of P=0.05.

Data-Quality Management

Pretesting of the study instrument was conducted in Hurumu town on 5% of the total sample. The data-collection tool was translated into local languages and back-translated to English. Data collectors were trained on the objectives and general procedures of data collection prior to initiation of the study. Onsite supervision of data-collection procedures was done, and the data collected were carefully handled by assigned personnel.

Ethical Considerations

The research was conducted in full compliance with the ethical principles of the Declaration of Helsinki. The protocol of the research was reviewed and approved by the Research Ethics Review Committee of Mettu University College of Health Sciences. Participants were provided complete information concerning the nature, objectives, procedures, risks, and benefits of the study. The right of the study participants to refuse to participate or to stop at any time in the process was clearly communicated and assured. After the provision of comprehensive information, participants provided written informed consent. All information provided by the participants was kept confidential and not transferred to any third party. In addition, any information that may have led to identification of study participants was not included in the data-collection tool.

Results

Sociodemographic Characteristics of Participants

A total of 1,191 participants participated in the study, yielding a 93.3% response rate. Of original sample, 54 participants (4.2%) refused to participate, despite repeated attempts to convince them. The remaining 32 (2.5%) were absent after three home visits on workdays and at weekends. Median age of participants was 36 years, with an IQR of 82(22–100). Well over half (654, 54.9%) were female. The Oromo were the predominant ethnic group (857, 71.9%), 693 (58.8%) participants had achieved secondary education and beyond, and 150 were Orthodox (37.8%), 126 Protestant (31.7%), and 114 Muslim (28.7%). Married participants comprised around four in ten participants (152, 38.3%), while cohabiting participants numbered 120 (30.2%). Concerning occupation the biggest group was self-employed (106, 26.7%) (Table 1).

Prevalence of Behavioral Risk Factors

A total of 57 (4.8%, 95% CI 2.8%–6.8%) of participants were smokers and 186 (15.6%, 95% CI 12.3%–19.4%) were harmful alcohol consumers. In addition, 720 (60.45%, 95% CI 56.4%–66.0%) were physically inactive, while 1,119 (94.8%, 95% CI 92.7%–96.9%) were currently consuming fewer than five servings of fruit and vegetables a day (Figure 1).

Co-occurrence of Behavioral Risk Factors

In sum, 780 (65.5%, 95% CI 60.7%–70.0%) of participants had co-occurrence of at least two of the four behavioral risk factors of NCDs: 663 (56.7%) had two, 105 (8.8%) had three factors, and 12 (1%) had all four. The median number of risk factors per participant was two, with an IQR of 2 (1–3).

Almost half the males (273, 50.8%) and 507 (77.5%) females had co-occurrence of at least two behavioral risk factors (Table 2).

Of those aged 18–29 years, 231 (59.2%) had at least two behavioral risk factors, This was 77.6% for those aged 45–59 years, 61.1% for those aged 30–44 years, 70% for those aged 60–69 years, and 90.5% for those aged >70 years (Figure 2).

Table 1 Sociodemographic characteristics of participants

Variable	Categories	n	Proportion
Age, years	18–29	390	32.7%
	30–44	447	37.5%
	45–59	201	16.9%
	60–69	90	7.6%
	≥70	63	5.3%
	Total	1191	100%
Sex	Male	537	45.1%
	Female	654	54.9%
	Total	1191	100%
Ethnicity	Oromo	857	71.9%
	Amhara	111	9.3%
	Gurage	9	0.8%
	Nuer	101	8.5%
	Agnua	98	8.2%
	Other	15	1.3%
	Total	1191	100
Religion	Orthodox	450	37.8%
	Protestant	378	31.7%
	Muslim	342	28.7%
	Catholic	19	1.8%
Wealth index	First quartile	294	24.7%
	Second quartile	300	25.2%
	Third quartile	300	25.2%
	Fourth quartile	297	24.9%
	Total	1191	100%

Social Factors Associated with Co-Occurrence of Behavioral Risk Factors

On the final model, female sex, no formal employment, greater wealth, having a friend who drinks alcohol, not having a friend who do physical activities, and participating in community activities were significantly associated with co-occurrence of at least two behavioral risk factors of NCDs at a time (Table 3).

Female participants were three times as likely to have co-occurrence of behavioral risk factors as male participants (AOR 3.1, 95% CI 1.8–5.5). Occupation was also associated with co-occurrence of behavioral risk factors. Those with no formal employment were nearly twice as likely to have co-occurrence of behavioral risk factors as employed participants (AOR 1.9, 95% CI 1.02–3.65).
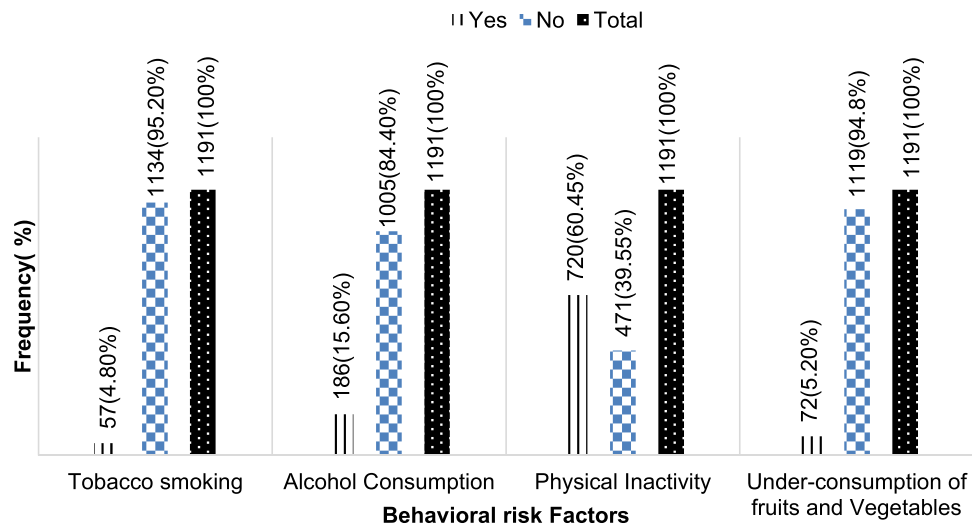
Figure I Prevalence of behavioral risk factors of ICDs in three urban centers of south western Ethiopia.

Wealth was another variable significantly associated with co-occurrence of behavioral risk factors of . Accordingly, individual participants in the second quartile were more than twice as likely to have co-occurrence as participants in the lowest quartile (AOR 2.44, 95% CI 1.15–5.15). Similarly, individuals whose wealth fell in the third quartile were also more than twice as likely to have co-occurrence of behavioral risk factors as those in the lowest quartile (AOR 2.3 CI, 95% 1.09–4.89).

Not having a friend who drinks alcohol was also associated with lower probability of co-occurrence of behavioral risk factors. Participants whose friends do not drink alcohol have an 80% reduction in probability of co-occurrence compared to those whose friends drank alcohol (AOR 0.2, 95% CI 0.09–0.44). Participants who do not have physically active friends had nearly triple the likelihood of experiencing co-occurrence of behavioral risk factors of NCDs as those whose friends were physically active (AOR 2.7, 95% CI 1.5–4.7).

Participating in community activities was also significantly associated with lower probability of co-occurrence

of behavioral risk factors. Individuals who did not participate in community activities in the last year preceding the study were almost three times as likely to have co-occurrence as those who engaged in community activities (AOR 2.95, 95% CI 1.42–6.09).

Discussion

Less than 5% of participants were smokers, while 15.6% were alcohol consumers. Concerning physical activity, six in ten fell below WHO recommendations. Inadequate consumption of fruit and vegetables was another important behavioral risk factor of NCDs: 92.7% of participants consumed less than the recommended servings of fruits and vegetables per day.

The prevalence of tobacco smoking and alcohol consumption was low compared to another study outside Ethiopia: up to 69.8% for tobacco and 40.7% for alcohol consumption in West Bengal,India.[14] The level of smoking in the study area was also lower than a report from Nepal, where prevalence was 19%.[15] This difference may be due to socio-cultural difference between the study areas. In Ethiopia, cultural and religious conservatism prevails.[16] Religious banning of alcohol and tobacco smoking among Muslims and Protestants (>60% of the participants) may have played a role in reducing the prevalence of these two risk factors.

The high level of physical inactivity and poor consumption of fruit and vegetables in the study area was comparable with findings from studies conducted in West Bengal, where 96.5%[14] consumed an unhealthy diet, and Nepal, where 95.3% consumed less than the recommended level of fruit and vegetables.[17] It is also similar to

Table 2 Cross tabulation of sex and co-occurrence of behavioral risk factors among study participants

Sex	Risk Factor		Total	P
	One or none	Two or more		
Male	264 (49.2%)	273 (50.8%)	537	<0.001
Female	147 (22.5%)	507 (77.5%)	654	
Total	411	612	1191	
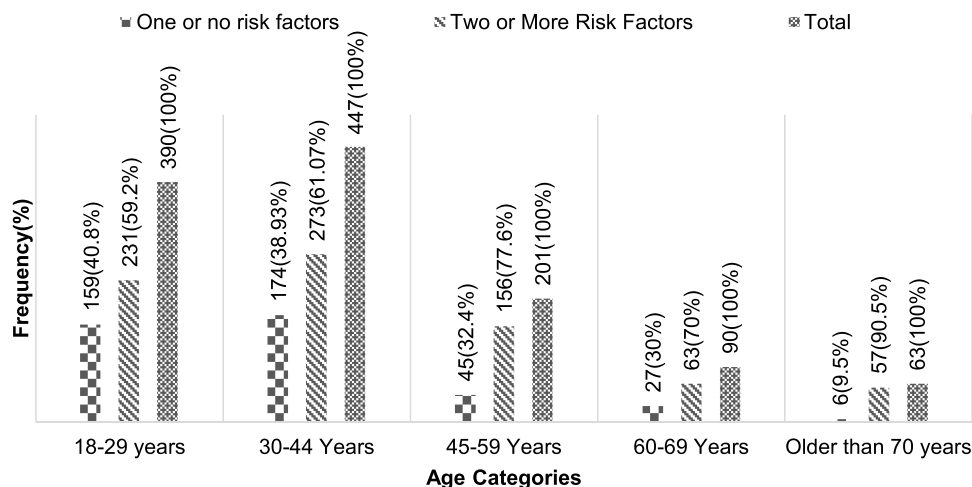
Figure 2 Age distribution of the co-occurrence of behavioral risk factors among study participants. south western

a report from Kenya, where 99.8% of participants did not stick to fruit and vegetable–consumption recommendations.[18] This similarity may be due to similar income status of the countries in which the studies were conducted (all LMICs), which may make it financially difficult to access the required fruit and vegetables.

Almost two-thirds of participants in the current study had co-occurrence of two or more behavioral risk factors. This is high, and needs proportional focus to avert future problems.

The current findings on co-occurrence (65.5%, 95% CI 60.7%–70.0%) are line with a report from a study conducted in Nepal among women, which reported prevalence of co-occurrence of two or more behavioral risk factors as 66%.[19]

Prevalence of co-occurrence in the current study was higher than a report from Uganda, where 56.4% of participants had co-occurrence.[20] In addition, it was higher than a report from Florianópolis, where 43% of males and 36% of females had co-occurrence.[21] The relatively lower prevalencein these areas may be due to variations in study settings. Our study was conducted among residents of urban centers, where people tend to adopt Western-style living conditions, while the studies in Uganda and Florianópolis involved a mix of urban and rural residents.

Contrarily, the prevalence in co-occurrence in our study was lower than a report from Nepal, which showed up to 83% co-occurrence. The relatively higher proportion of participants with co-occurrence in the Nepal study may be due to the type of population involved in the study. The study in Nepal involved adolescents, while ours enrolled those aged ≥18 years.[17]

Median risk factors per participant in this study was tw, and 65.5% of participants had two.Median factors per participant in this study was lower than reports from Bhutan (three),[22] 2.5 among Indonesian adolescents,[23] and 3 (three among south African adults.[24] The relatively lower number of risk factors per person in the current study when compared with these may be due to differences in the number of risk factors analyzed. While our studyy focused only on four risk factors (smoking, alcohol, physical inactivity and fruit-and-vegetable consumption), the otherss included physical measurements like BMI and laboratory measures.

Several factors were associated with the likelihood of having two or more risk factors. Female participants were more than three times as likely to have co-occurrence. Other research in Africa has reported a similar finding.[25] This may be due to working types and conditions, income, and educational status of females in in urban centers of LMICs that predispose them to stay home, consume less fruit and vegetables and have multiple behavioral risk factors.[26]

Higher wealth was also positively associated with co-occurrence. In the current study, participants in the second wealth quartile were twice as likely to have co-occurrence. Similarly, participants in the third wealth quartile were more than twice as likely to have co-occurrence asthose in the lowest wealth quartile. This finding is contrary to the trend of NCDs in recent years, where the premature death is more common among poorer nations.[27] Other studies also reported significantly higher prevalence of behavioral risk factors among socioeconomically disadvantaged populations.[28,29] The importance of poor

Table 3 Bivariate and multivariate logistic regression of co-occurrence of behavioral risk factors and social determinants among participants

Variable	Category	Dependent variable category		COR (95% CI)	P	AOR (95% CI)	P
		<2 BRFs coded 0	≥2 BRF coded I				
Sex	Male	264	273	I		I	
	Female	147	507	3.3 (2.16–5.1)	<0.01	3.1 (1.8–5.5)	<0.001*
Education	Primary and Below	144	354	1.5 (1.2–0.2.4)	0.48		
	Secondary and Above	267	426	I		—	—
Getting together for food and drink	Never Get together	147	330	1.3 (08–0.2.0)	0.207	0.6 (0.3–1.2)	0.158
	Get together	264	450	I		I	
Have someone to borrow from	Yes	264	510	I		I	
	Unsure	30	111	1.9 (0.9–4.03)	0.087	1.4 (0.5–3.5	0.45
	No	117	159	0.7 (0.4–1.1)	0.157	0.22 (0.1–0.4)	<0*
Group membership	Not member of group	111	138	0.5 (0.35–0.95)	0.031		
	Member of a group	300	642	I		I	
Housing condition (crowding)	No crowding	387	726	I			
	Over crowding	24	54	1.2 (0.5–2.8)	0.679		
Wealth index	First quartile	153	141	I			
	Second quartile	75	225	3.2 (1.8–5.9)	<0.001	2.4 (1.15–5.15)	0.019*
	Third quartile	78	222	3 (1.7–5.6)	<0.001	2.3 (1.09–4.8)	0.028*
	Fourth quartile	105	192	1.9 (1.1–3.5)	0.019	1.05 (0.48–2.2)	0.89
Friends drink	No	354	570	0.4 (0.25–0.76)	0.004	0.2 (0.09–0.44)	<0*
	Yes	57	210	I		I	I
Family members drink	No	387	651	I			
	Yes	24	129	3.1 (1.5–7.0)	0.004		
Occupation	Employed	123	195	I			
	Unemployed	283	585	1.3 (0.8–2.0)	0.292	1.9 (1.02–3.6)	0.043*
Education	Primary and below	144	354	1.5 (1.05–2.4)	0.048		
	Secondary and above	267	426	I			
Friends smoke	No	354	693	I		I	
	Yes	57	87	0.78 (0.4–1.44)	0.431	2.1 (0.9–5.2)	0.098
Family members smoke	Yes	10	54	1.0 (0.47–2.3)	0.889		
	No	381	726	I			
Family members exercise	No	189	471	1.8 (1.2–2.7)	0.006	1.6 (0.95–2.9)	0.07*
	Yes	222	309	I		I	
Friends do physical activity	No	186	564	3.1 (2.0–4.8)	<0.001	2.7 (1.5–4.7)	<0*
	Yes	225	216	I		I	
Participation in community work	No	48	222	3.0 (1.6–5.4)	<0.001	2.95 (1.4–6.0)	0.003*
	Yes	363	558	I		I	

Note: *Significant association on final backward stepwise logistic regression model.

socioeconomic conditions as predisposing factors for unhealthy behavior is well documented in developed countries. This issue needs further investigation in developing countries like Ethiopia.

Social factors also determine the probability of having behavioral risk factors of NCDs. In this study, participants whose friends did not drink had up to an 80% reduction in likelihood of co-occurrence. In addition, participants whose

friends did not exercise were roughly three times as likely to have co-occurrence of sas their counterparts. This may be due to the social impact and pressure that friends and family members exert on their friends and housemates .[30]

Participating in community activities helps to share health information and adapt to best practices in the community. This truth is supported by our study: participants who did not take part in community activities prior to the study were up to three times as likely to have co-occurrence asthose who did.[31]

Limitations

We used the WHO STEPS instrument to assess the behavioral risk factors, including physical inactivity, rather than usage of objective measures. This may have resulted in variations when compared with objective measurements of these risk factors.

Conclusion

Almost all participants had one or more of the four behavioral risk factors of NCDs studied.The highest prevalence was recorded for level of fruit and vegetable consumption. The next highest was for physical inactivity, alcohol consumption, and smoking. More than six in ten participants had co-occurrence of two or more behavioral risk factors of NCDs. This can be considered high.

Several factors were also associated with co-occurrence of behavioral risk factors. Community-based interventions to lower the prevalence and co-occurrence of these factors has to be implemented to protect the health of the community from the looming danger these risk factors pose.

Interventions to tackle these behavioral risk factors have to target the entire community. Family-based changes have to be fostered to reduce behavioral risk factors, as many family factors are found to be associated with co-occurrence of these risk factors. Strengthening of social capital and social cohesion also helps to tackle the problem by fostering collective action and societal changes.

Abbreviations

BRFs, behavioral risk factors; LMICs, low and middle income countries; NCDS, Non-communicable diseases; WHO, World Health Organization.

Data Sharing Statement

All data for this research article is available and can be accessed from the corresponding author at any time.

Ethics and Consent to Participate

This research was approved by the Mettu University Ethical Review Committee. Informed written consent was obtained from participants ahead of data collection. All information provided by the participants was not transferred to any third party. In addition, any information leading to identification of study participants was not included in the data-collection instrument.

Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data, took part in drafting the article or revising it critically for important intellectual content, agreed to submit to the current journal, gave final approval to the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no conflicts of interest for this work.

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