RESEARCH | Article in Press

Alcohol use and its association with dementia among older persons in northern and southwestern Uganda: a case-control study

Deo Benyumiza · Nathan Kakongi · Evas Nimusiima · Timothy Mwanje Kintu · Edith K Wakida · Celestino Obua · Samuel Maling

Received: 1 August 2025 / Accepted: 15 September 2026
© The Author(s) 2026

Abstract

Background Alcohol use is a major modifiable risk factor for dementia. However, there is a paucity of literature on alcohol use and the development of dementia in sub-Saharan Africa, especially in Uganda. This study investigated alcohol use and the development of dementia among older persons in rural Uganda.

Methods A community-based case-control study among 588 older persons aged 60 years and above in Northern and Southwestern Uganda. Using the IDEA cognitive screening tool (294 Cases and 294 controls) older persons were enrolled. Interview data were collected using a questionnaire. Data were entered in EpiData version 3.0, cleaned, and transferred to SPSS version 26.0 for statistical analysis. Logistic regression was used to determine the risk of development of dementia at a 95% confidence interval.

Results In this study, the proportion of participants reporting alcohol use was at 82.0% (482/588) among older persons aged 60 years and above in rural Uganda. Specifically, alcohol exposure was higher among cases at 85.7% (252/294), compared to 78.2% (230/294) among controls. Alcohol exposure was significantly associated with 1.67-fold increase in the odds of possible dementia among older persons in rural Uganda [cOR:1.67, CI:1.08–2.56, $p=0.018$]. Furthermore, alcohol use for more than 10 years [cOR:2.15, CI:1.27,3.64, $p=0.005$], no formal education [aOR:2.03, CI:1.37,3.01, $p<0.001$], and physical inactivity [aOR:1.84, CI:1.30,2.61, $p=0.001$] were significantly associated with increased odds of being a case among older persons 60 years and above.

Conclusion and recommendation In this study, alcohol exposure between cases and controls is substantially high and is significantly associated with increased odds for being a case among older persons in rural Uganda. Furthermore, alcohol use for more than ten years, lack of formal education, and physical inactivity were significantly associated with increased odds for being a case among older persons. These findings highlight the need for community-based interventions that reduce harmful alcohol use, promote lifelong learning, and encourage physical activity among older adults.

Keywords Alcohol Use · Development of Dementia · Older Persons · Uganda

This Article in Press is shared early to give you faster access to new research. It is citable and carries a permanent DOI. The final edited version will replace it automatically.

Introduction

Globally, more than 55 million people live with dementia, and nearly 10 million new dementia cases are reported every year, with 60% of people with dementia living in low- and middle-income countries [1]. It's estimated that the number of people living with dementia will increase to 152.8 million by 2050 [2]. In Sub-Saharan Africa, it is estimated that over 2.13 million people are living with dementia, and this number is projected to double every 20 years, increasing to 3.48 million by 2030 and 7.62 million by 2050 [3]. In Uganda, community-based studies have shown varying prevalence of dementia between 20% and 23% [4, 5].

Although dementia is an age-related, multifactorial disorder, growing evidence in high-income settings shows that chronic and heavy alcohol use is a well-established risk factor for its development [6, 7]. Previous literature highlights that ethanol and its metabolite acetaldehyde have neurotoxic effects, resulting in permanent structural and functional brain damage [8]. Chronic alcohol use often leads to thiamine deficiency, impairing neuronal function crucial for energy metabolism and neurotransmitter synthesis [9–11]. In addition, heavy alcohol consumption is a risk factor for other brain-damaging conditions, including hepatic encephalopathy in liver disease patients, epilepsy, and head injuries [2]. These mechanisms collectively suggest that alcohol use can contribute to the development of dementia in older individuals.

In Uganda, the northern and southwestern regions have the highest levels of alcohol consumption in the country, at 23.2% and 21.4%, respectively [12]. Socio-cultural and religious practices shape the unique alcohol consumption patterns in these communities, including the use of traditional brews alongside commercially produced alcohol, which warrants further investigation to understand their potential link to dementia. Despite the high burden of alcohol use and the projected rise in dementia prevalence, there is a paucity of data linking alcohol use to the development of dementia in sub-Saharan Africa [7, 8]. This study aimed to explore the association between alcohol use and dementia, as well as provide preliminary prevalence of dementia in people over the age of 60. Using the Identification of Dementia in Elderly Africans (IDEA), a low literacy screening tool specifically for older persons in sub-Sahara Africa with a view to identifying modifiable risk factors for dementia among older adults in northern and southwestern Uganda.

Our study is one of the few case-control studies in Uganda to empirically examine the link between alcohol use and dementia, thus it addresses a critical knowledge gap on the understanding of the link between alcohol use and the development of dementia among older persons in Uganda and the sub-Saharan region.

Methods and materials

Study design

We employed a community-based case-control design to investigate alcohol use association with dementia. Cases were defined as "possible dementia" and controls were defined as "no dementia" on IDEA screening tool [13].

Study setting

The study was conducted in Lira District in northern Uganda and Kabale District in Southwestern Uganda between January 2025 and March 2025. Lira District is located approximately 337 km north, and Kabale District about 399 km southwest, of Kampala, the capital city of Uganda. Lira and Kabale Districts were selected from the two leading regions of Uganda in alcohol consumption rates, with the northern region at 23.2%, and the western region at 21.4%, respectively [12].

Study population and inclusion

The study was conducted among older persons aged 60 years and above. Sixty years is lowest age for someone to be referred to as an older person in Uganda [14]. Cases were older persons screened as having possible dementia on the IDEA screening tool. Controls were older persons without possible dementia on the same screening tool. Each case was individually matched to one control in a 1:1 ratio. Matching was performed on three variables: age (within ± 5 years of the case), sex (male/female), and residence (urban/rural). For every case identified, a control who met all three matching criteria was selected from among the screened participants who tested negative for possible dementia on the IDEA screening tool. Age, sex, and residence for both cases and controls were verified against participants' national identity cards to ensure matching accuracy. Matching on these variables was intended to minimize confounding, since dementia risk is known to vary by age, sex, and residence, leaving these factors uncontrolled could have distorted the association between the exposure of interest and dementia status.

Sampling strategy

A sample size of 588 was determined using the Epitools calculator. Assuming an expected odds ratio of 2, an alpha of 0.05, a power of 80%, and an expected proportion in controls of 0.26 (according to a previous study in southwestern Uganda). The study recruited 294 cases and 294 controls, equally divided at two study sites, for a total of 588 participants in the study [15]. In instances where participants with dementia were not able to self-report this information, their caregivers provided additional information.

A multi-stage cluster probability sampling method was employed to select the villages and participants in Lira and Kabale District. In the Lira District, firstly, three sub-counties (Ogur, Barr, and Ngetta) were randomly selected out of the ten sub-counties. Secondly, eight parishes were randomly selected out of the 20 parishes in the selected three sub-counties in stage one above. Thirdly, 40 villages out of the 64 villages in the selected eight parishes. Fourthly, 267 households were recruited using simple random sampling from the list of households with older persons that was made available to the researcher by the village health team. In Kabale District, firstly, three sub-counties (Kyanamira, Bubare, and Buhara) were randomly selected out of the nineteen sub-counties. Secondly, 10 parishes were randomly selected out of the 22 parishes in the selected three sub-counties in stage one above. Thirdly, 50 villages out of the 74 villages in the selected eight parishes. Fourthly, 321 households were recruited using simple random sampling from the list of households with older persons that was made available to the researcher by the village health team as shown in(Fig. 1).

Data collection materials

All participants were screened using the Identification of Dementia in Elderly Africans (IDEA) tool to confirm the absence or presence of dementia (attached as a supplementary file). This low-literacy tool is specifically designed for older people in sub-Saharan Africa. It evaluates key cognitive domains such as abstraction, orientation, long-term memory, categorical verbal fluency, verbal delayed recall, and visuospatial construction. The tool does not require reading, writing, drawing, or calculating skills, and has been previously validated for use in sub-Saharan Africa, providing an effective way to screen for possible dementia [13]. The IDEA cognitive screen has a total score range of 0–15. The scoring cut-offs were as follows: 0–9: Possible dementia (cases), and 10–15: No dementia (controls).

Additional data were collected using an interviewer-administered questionnaire designed by the research team following a review of previous literature [2, 16]. The questionnaire comprised four sections (i) Demographic characteristics (age, sex, marital status, level of education, occupation), (ii) Comprehensive history of alcohol use (covering type, frequency, duration, and age of debut), (iii) Comorbidities (hypertension, diabetes, depression, hearing impairment, visual impairment, respiratory disease, kidney disease, severe malaria, ulcers, and HIV), (iv) Additional modifiable risk factors (physical activity, diet, smoking, sleep pattern, air pollution). The study

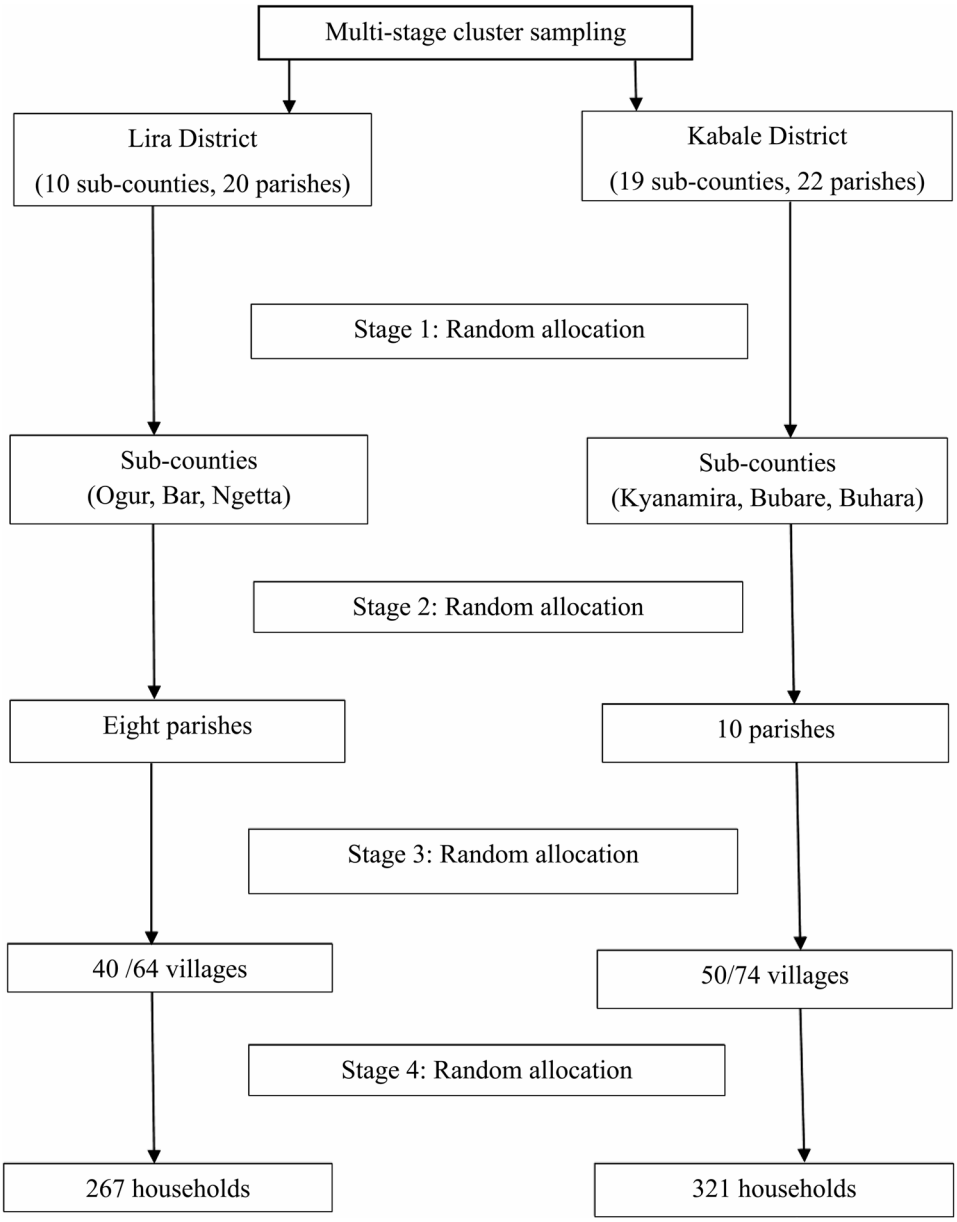


Fig. 1 A graphical flow of multi-stage cluster sampling

questionnaire was pretested by the research assistants among the non-participating older persons before actual data collection.

Data collection procedure

The data were collected by eight research Assistants (RAs) with a Bachelor of Science in Nursing, and training in responsible conduct of research. Before field data collection, the research assistants were trained on the study protocol and data collection tools. While in the field, the research assistants worked with the Village Health Teams (VHTs) to establish the list of households with older persons aged≥60 years who reside in the selected villages. The VHTs also provided a field guide for the RAs to visit the selected households. The objectives of the study and the need for older persons to participate were explained to the potential participants and their caregivers. Older persons together with their adult caregivers for participants who had significant cognitive impairment or were unable to provide reliable responses independently who agreed to participate in the study were taken

through the consent process, and written informed consent was obtained from the participant. After consenting, the aforementioned data collection tools were administered to collect the data from the participants along with their caregivers. The data collection process took about 25 to 40 min per participant.

Data management

Data collection tools were checked for completeness before departing the field. A data entry screen was created in EpiData version 3.0. Double data entry validation and corrections of entry errors were conducted before exporting the data to Statistical Package for Social Sciences (SPSS) version 26.0 for data cleaning and analysis.

Data analysis

Continuous variables were summarized using means and standard deviations (SD), while categorical variables were presented as frequencies and percentages. For ordered categorical variables, such as age at first alcohol use, a chi-square test for linear trend (Linear-by-Linear Association) was additionally used to assess whether the odds of dementia changed systematically across ordered categories. Bivariable analysis was conducted using conditional logistic regression to evaluate unadjusted associations between potential risk factors and dementia status, reporting unadjusted odds ratios (cOR) with 95% confidence intervals (CI). Independent variables displaying a bivariable p-value ≤ 0.20 were considered for inclusion in the multivariable model. Multivariable analysis was executed using conditional logistic regression to determine factors independently associated with dementia while explicitly accounting for the 1:1 matched case-control design and intra-pair dependency. Goodness-of-fit for the final model was assessed using the Hosmer-Lemeshow test, with a p-value > 0.05 indicating acceptable model fit. All statistical tests were two-tailed, and statistical significance was established at alpha $= 0.05$.

Results

Participant characteristics

A total of 588 participants were recruited. The overall mean age of the participants was 70.07 ± 7.43years. The mean ages were 70.57 ± 7.54years and 69.56 ± 7.29 years across cases and controls, respectively. Majority of the participants were females at 59.2% (174/294) and 56.5% (166/294) among cases and controls respectively, aged between 60 and 69 years at 49.3% (145/294) and 57.5% (169/294) among cases and controls respectively, Married at 53.1% (156/294) and 64.6% (190/294) among cases and controls respectively, no formal education 63.9% (188/294) and 41.5% (122/294) among cases and controls respectively, farmer 74.1% (218/294), and 71.4% (210/294) among cases and controls respectively. The p-values reported are from chi-square test. as shown in Table 1 below.

Alcohol use and development of dementia

In this study, the proportion of participants reporting alcohol use was at 82.0% (482/588) among older persons aged 60 years and above in rural Uganda. Specifically, alcohol exposure was higher among cases at 85.7% (252/294), compared to 78.2% (230/294) among controls. Furthermore, alcohol exposure is significantly associated with 1.67fold increase in the odds of dementia among older persons in rural Uganda [cOR:1.67, CI:1.08–2.56, p-0.018]. Confounding variables such as traumatic head injury [Cases 11.9% (35/294) vs. Controls 12.9% (38/294), $p = 0.708$], history of mental illness [Cases 4.1% (12/294) vs. Controls 2.7% (8/294), $p = 0.363$], history of severe malaria [Cases 12.9% (38/294 vs. Controls 13.3% (39/294), $p = 0.903$], and hypertension [Cases 36.4% (107/294) vs. Controls 35.4% (104/294), $p = 0.796$], hearing impairment [cases 18.4% (54/294) vs. Control 21.4%

Table 1 Participant Characteristics ($N=588$)

Characteristics	Description	Overall population	Cases	Controls	*p*-value
Mean age	Years	70.07 ± 7.43	70.57 ± 7.54	69.56 ± 7.29	
Age (years)	60–69	314(53.4)	145(49.3)	169(57.5)	0.129
	70–79	194(33.0)	104(35.4)	90(30.6)	
	≥80	80(13.6)	45(15.3)	35(11.9)	
Gender	Female	340(58.8)	174(59.2)	166(56.6)	0.504
	Male	248(42.2)	120(40.8)	128(43.5)	
Marital status	Single	10(1.7)	5(1.7)	5(1.7)	0.039*
	Married	346(58.8)	156(53.1)	190(64.6)	
	Widow	187(31.8)	108(36.7)	79(26.9)	
	Divorced	45(7.7)	25(8.5)	20(6.8)	
Level of education	Primary	181(30.8)	76(25.9)	105(35.7)	< 0.001*
	Secondary	46(7.8)	14(4.8)	32(10.9)	
	Tertiary	51(8.7)	16(5.4)	35(11.9)	
	No formal	310(52.7)	188(63.9)	122(41.5)	
Occupation	Farmer	428(72.8)	218(74.1)	210(71.4)	0.183
	Business	39(6.6)	19(6.5)	20(6.8)	
	Unemployed	58(9.9)	33(11.2)	25(8.5)	
	Retired	63(10.7)	24(8.2)	39(13.3)	

Table 2 Comparison of Alcohol Use Patterns Among Cases and Controls

Alcohol use Patterns	Description	Cases	Controls	Odds Ratio, 95%CI	*p*-values
Age at first alcohol use (years)	0–10	48(19.0)	33(14.3)	1	0.133
	11–20	89(35.3)	90(39.1)	0.67(0.39–1.13)	0.206
	≥21	114(45.6)	107(46.6)	0.72(0.43–1.02)	
				p-value for trend	0.344
Duration of alcohol use (years)	0–10	25(9.9)	44(19.1)	1	0.005*
	> 10years	227(90.1)	186(80.9)	2.15(1.27–3.64)	
Binge alcohol use	No	165(65.5)	154(66.9)	1	0.389
	Yes	87(34.5)	76(33.1)	1.15(0.84–1.56)	
Types of alcohol brews	Mixed brew	74(29.4)	75(32.6)	1	0.208
	Local brew	178(70.6)	155(67.4)	1.15(0.93–1.42)	

*Significant at $p<0.05$, *c0R* crude odds ratio, 0.344 is *p*-value for trend

(63/294). $P=0.353$) were statistically not significant to contribute to the development of dementia among study participants in rural Uganda.

Alcohol use patterns among cases vs. controls

Alcohol use for more than 10 years [cOR:2.15, CI:1.27–3.64, $p=0.005$] was significantly associated with a two-fold increase in the odds of cases compared to the controls. A p-value of 0.344 indicates no evidence of a linear trend across the ordered categories as shown in Table 2 below.

Multivariable analysis of other modifiable risk factors associated with possible dementia

The analysis of collinearity between potential variables, namely age, marital status, level of education, occupation, and alcohol use, yielded no multicollinearity. These variables were entered into the conditional logistic regression model. The model fitness was checked using the Hosmer-Lemeshow test at $p>0.05$. The findings from conditional multivariable logistic regression indicate that no formal education [aOR:2.03, CI:1.37,3.01, $p<0.001$], physical inactivity [aOR:1.84, CI:1.30,2.61, $p=0.001$], and alcohol use [aOR:1.67, CI:1.04,2.67, $p=0.032$] were independently associated with possible dementia among older persons, as shown in Table 3 below.

Table 3 Multivariable analysis of other modifiable risk factors associated with possible dementia ($n=588$)

Variable	Description	cOR,95%	*p*-value	aOR,95%	*p*-value
Age (years)	60–69	1	0.104	1	0.841
	70–79	1.35(0.94–1.93)	0.109	1.04(0.70–1.54)	0.627
	80years Above	1.49(0.91–2.46)		1.14(0.67–1.94)	
Marital status	Single	1	0.759	1	0.944
	Married	0.82(0.23–2.89)	0.630	1.05(0.29–3.94)	0.579
	Widow	1.37(0.38–4.88)	0.750	1.46(0.24–5.54)	0.818
	Divorced	1.25(0.32–4.93)		1.18(0.28–5.01)	
Level of education	Primary	1	0.155	1	0.153
	Secondary	0.60(0.30–1.21)	0.173	0.59(0.29–1.22)	0.258
	Tertiary	0.63(0.33–1.22)	<0.001	0.59(0.24–1.47)	<0.001*
	No formal	2.13(1.47–3.09)		2.03(1.37–3.01)	
Occupation	Farmer	1	0.791	1	0.330
	Business	0.92(0.47–1.76)	0.395	1.42(0.70–2.89)	0.586
	Unemployed	1.27(0.73–2.21)	0.059	1.18(0.65–2.17)	0.730
	Retired	0.59(0.35–1.02)		1.15(0.52–2.55)	
Physical inactivity	Yes	1	<0.001	1	0.001*
	No	1.88(1.36–2.61)		1.84(1.30–2.61)	
Alcohol use	No	1	0.018	1	0.032*
	Yes	1.67(1.08–2.56)		1.67(1.04–2.67)	

*Significant at $p<0.05$, *c0R* crude odds ratio, *aOR* adjusted odds ratio

Discussion

In this study, the proportion of participants reporting alcohol use was high among older persons aged 60 years and above in rural Uganda. Specifically, alcohol exposure was higher among cases compared to controls. This differential exposure translated into a significant association, where older persons with a history of alcohol exposure had approximately 67% increased odds of being a case compared to those without a history of alcohol exposure. This can be attributed to the fact that chronic and heavy alcohol consumption increases neurotoxicity and nutritional deficit, especially among older adults [2]. Our finding is consistent with results from a previous randomized controlled trial in the UK, where alcohol use was associated with an 89% likelihood of the development of dementia among study participants [17]. However, the discrepancy in the findings could be due to the differences in the study design, sample sizes, and participants characteristics. The findings of this study highlight the need for the Ugandan government, through the Ministry of Health, to strengthen community sensitization on the mental health risks associated with harmful alcohol use and enforce effective alcohol control measures. Local governments, Village Health Teams, civil society and community-based organizations, faith-based institutions, and cultural leaders should work collaboratively to raise awareness and promote responsible alcohol use. Such a multisectoral approach is essential for improving community mental health and reducing alcohol-related harm. Our study further found that older persons with a history of alcohol use for more than ten years had twice the odds of being cases compared to their counterparts with alcohol use less than ten years. This finding aligns with evidence from prospective cohort studies in Western populations. For instance, a large cohort study in the USA and UK reported that individuals with alcohol use disorder had a 51% higher risk of developing dementia than light drinkers, suggesting that chronic alcohol exposure contributes to neurodegeneration [18]. Similarly, 23-year follow-up study in UK found that sustained heavy alcohol consumption during midlife was associated with an 41% increased risk of dementia [16]. The observed association may be explained by the cumulative neurotoxic effects of alcohol, including oxidative stress, neuronal loss, and structural brain changes that accelerate cognitive decline. This consistency across different study designs and populations strengthens the evidence base for a link between prolonged alcohol use and dementia. The biological plausibility for this association is well-established. Chronic alcohol consumption can lead to the accumulation of its neurotoxic metabolite, acetaldehyde, causing permanent structural and functional brain damage [2, 8]. Furthermore, chronic alcohol use is strongly associated with thiamine deficiency, which impairs neuronal function crucial for energy metabolism and neurotransmitter synthesis [9–11]. Our finding, therefore, implies a critical need for public health action by the Ministry of Health

of Uganda and related stakeholders. Creating widespread awareness of the long-term dangers of chronic alcohol use among the general population, particularly targeting older adults and those at risk, is essential to mitigate the growing burden of dementia potentially.

The proportion of participants reporting alcohol use in our study sample was at 82.0% considerably higher than the 23.3% and 21.4% reported for northern and western Uganda, respectively, in a Ugandan study comparing alcohol use across regions [12]. This discrepancy may be explained by several factors. First, that study sampled the general population across all age groups, whereas our study specifically recruited older persons (aged 60 years and above) presenting for dementia screening, this age-restricted, targeted sampling approach may have captured a population with different alcohol use patterns than the general population. Even within a single national study, marked regional variation was observed (23.3% vs. 21.4%), underscoring that alcohol use patterns differ considerably across Uganda. Our study population may reflect a distinct regional or demographic profile with correspondingly different consumption patterns. These findings highlight the importance of considering study population, age group, and measurement approach when comparing alcohol prevalence estimates across settings.

The study also found that older persons with no formal education demonstrated two-fold increased odds of being cases compared to their counterparts with formal education in this study. Our finding conforms with results from previous studies in Ethiopia and Norway, where no formal education was associated with increased odds of 1.8 and 5.5 for the development of dementia respectively [19, 20]. In other meta-analysis studies, the odds of no formal education and risk for dementia range between 1.59 and 1.89 among older persons [21, 22]. No formal education has been associated with low baseline cognitive reserve. Cognitive reserve is defined as the ability of the brain to tolerate age-related changes and disease pathology without developing clinical symptoms and signs [21]. The reduced cognitive reserve among persons with no formal education could potentially increase their risk of developing dementia. Our findings imply the need to promote lifelong learning and cognitive engagement findings imply the need to promote lifelong learning and cognitive engagement, which may include activities such as writing and reading, solving puzzles and games, workshops, and discussion groups, fostering social engagement. These can improve the neuronal activity of the brain and lower the risk of the development of dementia.

In this study, older persons with physical inactivity demonstrated two-fold increased odds of being cases as compared to their counterparts who were physically active. This finding agrees with results from the previous meta-analysis of longitudinal studies where physical activity was associated with a 18% reduction in risk of dementia [23]. This agreement across different study designs and measures of association reinforces the protective role of physical activity against cognitive decline. The biological mechanisms underlying this association are robust. Physical inactivity significantly increases dementia risk by harming cardiovascular health, which in turn reduces critical blood flow and nutrient supply to the brain, and promotes conditions like high blood pressure and diabetes [24]. This sedentary lifestyle also negatively impacts brain structure and function, leading to consequences such as reduced brain volume, decreased neuroplasticity, and increased inflammation [25, 26]. To effectively boost physical activity and combat the rising burden of dementia, our findings imply a critical role for the Ministry of Health of Uganda. They should disseminate national guidelines and launch sustained, culturally relevant public awareness campaigns. These campaigns should leverage local media and empower community health workers to provide practical and accessible physical activity advice tailored to the Ugandan context.

Our study controlled for potential confounders such as traumatic head injury, history of mental illness, history of severe malaria, hypertension which showed no statistical significance among cases and controls. However, there could be other potential residual confounders such as undiagnosed or poorly managed health conditions, socio-economic status, and genetic factor related to both alcohol consumption behaviours and dementia. This implies the need for future researches to explore the genetic factors responsible for the alcohol behaviour and development of dementia among older persons in Uganda. Furthermore, the generalizability of these findings to other regions of Uganda may require careful consideration. Our study was conducted in the northern and southern regions of Uganda. While this region may share certain demographic and epidemiological characteristics with other parts of the country, significant variations exist across Uganda's diverse geographical, cultural,

and socio-economic landscapes which could shape the health seeking behaviours. Future studies should aim for broader geographic representation within Uganda to establish the wider applicability of these results.

Study strengths and limitations

This study used the IDEA screening tool, which was validated in a similar local setting like Tanzania, to recruit study participants. The IDEA tool items reduce education bias and cater to cultural appropriateness and local relevance within the Ugandan setting. A limitation in our findings could be subject to recall bias from the respondents who were required to remember aspects of their past years, particularly their history of alcohol consumption. However, this was mitigated by interviewing the older persons alongside their adult caregivers, who provided additional information on the participants' alcohol use history. Although caregivers helped improve the completeness of the information collected, their responses may not have fully reflected the participants' experiences or histories, particularly if they were not closely involved in the participants' daily lives.

Another potential limitation of this study could be temporal ambiguity related to study design. Where it's difficult to tell whether an exposure occurred before an outcome. This ambiguity can critically undermine the ability to establish a causal relationship between alcohol use and development of dementia among older persons. Lastly, population sampling frames across administrative tiers were unavailable to construct inverse probability sampling weights, and village-level cluster codes were not retained in the final dataset. Consequently, complex survey design weights could not be applied. However, conditional logistic regression explicitly accounted for the matched-pair clustering, and the wide dispersion of participants across 90 villages with small cluster sizes minimizes potential design effect bias.

Conclusion and recommendations

This study found a high prevalence of alcohol exposure among both cases and controls, and alcohol use was associated with increased odds of possible dementia among older persons in rural Uganda. In addition, alcohol use for more than ten years, lack of formal education, and physical inactivity were independently associated with higher odds of possible dementia. These findings suggest that potentially modifiable lifestyle and socioeconomic factors may contribute to dementia risk in this setting, although causal inference is limited due to the case–control design. There is a need for integrated community-based interventions in rural Uganda that address harmful alcohol use, promote healthy ageing, and encourage physical activity among older persons. The Ministry of Health, through existing primary healthcare structures such as Village Health Teams, should strengthen community sensitization on the long-term cognitive effects of alcohol use and promote screening for risky alcohol consumption at the community level. In addition, adult education and health literacy programs should be supported to address the protective role of formal education, while local governments and community organizations should incorporate dementia risk reduction messages into ongoing non-communicable disease prevention strategies.

Abbreviations

LMICs Low	Middle-income countries
WHO	World Health Organization
DHO	District Health Officer
SSA	Sub-Saharan Africa
VHT	Village Health Teams

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1186/s12877-026-08336-3.

Acknowledgements We extended our sincere appreciation to our study participants for their participation in this study. We also thank and acknowledge our beloved qualitative trainer Dr. Ocan Moses., for his guidance during data analysis and manuscript writing.

Authors' contributions DB, NK, EN, TKM, SM, contributed in idea conceptualization, protocol development, data coding and data analysis, and manuscript writing.EKW, SM, CO, contributed in protocol development, manuscript drafting, and manuscript reviewing.

Funding Research reported in this publication was supported by the Fogarty International Center of the National Institutes of Health under Award Number 3D43TW011964-03S1. The content is solely the authors' responsibility and does not necessarily represent the official views of the National Institutes of Health.

Data availability The dataset supporting the conclusions of this article is accessible on request from the corresponding author.

Declarations

Ethics approval and consent to participate This research was conducted following the Helsinki Declaration. The protocol was reviewed and approved by the Gulu University Research Ethics Committee (GUREC-2024-992) and the Uganda National Council of Science and Technology (UNCST). Administrative clearance was obtained from the District Health Officers, Town clerks, and Principal Medical Officers of the Kabale and Lira Districts before data collection. All study participants provided written informed consent and were interviewed in private locations of their choice. Participants were assured of their anonymity and informed that their participation was entirely voluntary.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit http://creativecommons.org/licenses/by-nc-nd/4.0/.

References

1. WHO. World Health Organization website [Internet]. 2025 [cited 2026 Jun 30]. Word Health Organization, report on Dementia. Available from: https://www.who.int/health-topics/dementia
2. Rehm J, Hasan OSM, Black SE, Shield KD, Schwarzinger M. Alcohol use and dementia: a systematic scoping review. Alzheimers Res Ther. 2019;11(1):1. https://doi.org/10.1186/S13195-018-0453-0 . PubMed PMID: 30611304.
3. International AD, Wimo A, Aboderin I, Guerchet M, Prince M, Amoakoh-Coleman M et al. Dementia in sub-Saharan Africa: Challenges and opportunities [Internet]. 2017 [cited 2025 Apr 9]. Available from: https://www.alzint.org/resource/dementia-in-sub-saharan-africa/
4. Benyumiza D, Kumakech E, Gutu J, Banihani J, Mandap J, Talib ZM, et al. Prevalence of dementia and its association with central nervous system infections among older persons in northern Uganda: cross-sectional community-based study. BMC Geriatr. 2023;23(1):1–11. https://doi.org/10.1186/S12877-023-04174-9/TABLES/4 . PubMed PMID: 37697266.
5. Mubangizi V, Maling S, Obua C, Tsai AC. Prevalence and correlates of Alzheimer's disease and related dementias in rural Uganda: cross-sectional, population-based study. BMC Geriatr. 2020;20(1):48. https://doi.org/10.1186/S12877-020-1461-Z . PubMed PMID: 32041525.
6. Nutt D, Hayes A, Fonville L, Zafar R, Palmer EOC, Paterson L, et al. Alcohol and the Brain. Nutrients. 2021;13(11):3938. 10. 3390/NU13113938 PubMed PMID: 34836193.

7. Alcohol and the Brain. An Overview | National Institute on Alcohol Abuse and Alcoholism (NIAAA) [Internet]. [cited 2025 Apr 9]. Available from: https://www.niaaa.nih.gov/publications/alcohol-and-brain-overview
8. Pervin Z, Stephen JM. Effect of alcohol on the central nervous system to develop neurological disorder: pathophysiological and lifestyle modulation can be potential therapeutic options for alcohol-induced neurotoxication. AIMS Neurosci. 2021;8(3):390–413. 10. 3934/NEUROSCIENCE.2021021 PubMed PMID: 34183988.
9. Martin PR, Singleton CK, Hiller-Sturmhöfel S. The Role of Thiamine Deficiency in Alcoholic Brain Disease. Alcohol Res Health. 2003;27(2):134. PubMed PMID: 15303623.
10. Subramanya SB, Subramanian VS, Said HM. Chronic alcohol consumption and intestinal thiamin absorption: effects on physiological and molecular parameters of the uptake process. Am J Physiol Gastrointest Liver Physiol. 2010;299(1):G23. 10.1152/. AJPGI.00132.2010 PubMed PMID: 20448146.
11. McLean C, Ivers R, Antony A, Anne-Therese. Malnutrition, nutritional deficiency and alcohol: A guide for general practice. Aust J Gen Pract. 2024;53(4):173–8. https://doi.org/10.31128/AJGP-05-23-6827 . PubMed PMID: 38575531.
12. Kabwama SN, Ndyanabangi S, Mutungi G, Wesonga R, Bahendeka SK, Guwatudde D. Alcohol use among adults in Uganda: findings from the countrywide non-communicable diseases risk factor cross-sectional survey. Glob Health Action. 2016;9(1). 10.3402/. GHA.V9.31302 PubMed PMID: 27491961.
13. Paddick SM, Gray WK, Ogunjimi L, Lwezuala B, Olakehinde O, Kisoli A, et al. Validation of the Identification and Intervention for Dementia in Elderly Africans (IDEA) cognitive screen in Nigeria and Tanzania. BMC Geriatr. 2015;15(1):1–9. https://doi.org/10.1186/S12877-015-0040-1/TABLES/4 . PubMed PMID: 25908439.
14. Maniragaba F, Kwagala B, Bizimungu E, Wandera SO, Ntozi J. Predictors of quality of life of older persons in rural Uganda: A cross-sectional study. AAS Open Res. 2018;1:22. https://doi.org/10.12688/AASOPENRES. .12874.2 PubMed PMID: 32259022.
15. Package. epitools Title Epidemiology Tools Depends R (>=2.10) [Internet]. 2022 [cited 2025 May 27]. Available from: http://www
16. Sabia S, Fayosse A, Dumurgier J, Dugravot A, Akbaraly T, Britton A, et al. Alcohol consumption and risk of dementia: 23 year follow-up of Whitehall II cohort study. BMJ. 2018;362. 10.1136. /BMJ.K2927 PubMed PMID: 30068508.
17. Zheng L, Liao W, Luo S, Li B, Liu D, Yun Q, et al. Association between alcohol consumption and incidence of dementia in current drinkers: linear and non-linear mendelian randomization analysis. E Clin Med. 2024;76. https://doi.org/10.1016/j.eclinm.2024.102810.
18. Topiwala A, Levey DF, Zhou H, Deak JD, Adhikari K, Ebmeier KP, et al. Alcohol use and risk of dementia in diverse populations: evidence from cohort, case-control and Mendelian randomisation approaches. BMJ Evid Based Med. 2026;31(1). 10. 1136/BMJEBM-2025-113913 PubMed PMID: 40987604.
19. Gela YY, Fekadu SA, Belsti Y, Akalu Y, Dagnew B, Getnet M, et al. Cognitive impairment and associated factors among mature and older adults living in the community of Gondar town, Ethiopia, 2020. Sci Rep. 2022;12(1):1–8. https://doi.org/10.1038/S41598-022-11735-2 . SUBJMETA=308,378,443,617,631,692; KWRD=MEDICAL+RESEARCH, NEUROLOGY, NEUROSCIENCE, PHYSIOLOGY PubMed PMID: 35534683.
20. Mekonnen T, Skirbekk V, Håberg AK, Engdahl B, Zotcheva E, Jugessur A, et al. Mediators of educational differences in dementia risk later in life: evidence from the HUNT study. BMC Public Health. 2025;25(1):1–12. https://doi.org/10.1186/S12889-025-22592-9/FIGURES/5.
21. Meng X, D'Arcy C. Education and Dementia in the Context of the Cognitive Reserve Hypothesis: A Systematic Review with Meta-Analyses and Qualitative Analyses. PLoS ONE. 2012;7(6):e38268. 10.1371/. JOURNAL.PONE.0038268 PubMed PMID: 22675535.
22. Xu W, Tan L, Wang HF, Tan MS, Tan L, Li JQ, et al. Education and Risk of Dementia: Dose-Response Meta-Analysis of Prospective Cohort Studies. Mol Neurobiol. 2016;53(5):3113–23. https://doi.org/10.1007/S12035-015-9211-5/. METRICS PubMed PMID: 25983035.
23. Blondell SJ, Hammersley-Mather R, Veerman JL. Does physical activity prevent cognitive decline and dementia? A systematic review and meta-analysis of longitudinal studies. BMC Public Health. 2014;14(1):1–12. https://doi.org/10.1186/1471-2458-14-510/FIGURES/1 . PubMed PMID: 24885250.
24. Kivimäki M, Singh-Manoux A, Pentti J, Sabia S, Nyberg ST, Alfredsson L, et al. Physical inactivity, cardiometabolic disease, and risk of dementia: an individual-participant meta-analysis. BMJ. 2019;365. 10.1136. /BMJ.L1495 PubMed PMID: 30995986.
25. Phillips C. Lifestyle Modulators of Neuroplasticity: How Physical Activity, Mental Engagement, and Diet Promote Cognitive Health during Aging. Neural Plast. 2017;2017:3589271. https://doi.org/10.1155/2017/3589271 . PubMed PMID: 28695017.
26. De Sousa Fernandes MS, Ordônio TF, Santos GCJ, Santos LER, Calazans CT, Gomes DA et al. Effects of Physical Exercise on Neuroplasticity and Brain Function: A Systematic Review in Human and Animal Studies. Neural Plast. 2020; 2020:8856621. https://doi.org/10.1155/2020/8856621 PubMed PMID: 33414823.
27. Zhao B, Cheng B, Li X, Xia J, Gou Y, Kang M, et al. Association of dietary diversity, genetic susceptibility, and the risk of incident dementia: A prospective cohort study. J Prev Alzheimers Dis. 2025;12(4):100078. J.TJPAD.2025.100078 PubMed PMID: 39952880.

28. Licher S, Ahmad S, Karamujić-Čomić H, Voortman T, Leening MJG, Ikram MA, et al. Genetic predisposition, modifiable risk factor profile and long-term dementia risk in the general population. Nat Med. 2019;25(9):1364. https://doi.org/10.1038/S41591-019-0547-7 . PubMed PMID: 31451782.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Authors and Affiliations

Deo Benyumiza[1] · Nathan Kakongi[2] · Evas Nimusiima[3] · Timothy Mwanje Kintu[4] · Edith K Wakida[6] · Celestino Obua[5] · Samuel Maling[7]

✉ Deo Benyumiza
benyumizadeo@gmail.com

1 Department of Pharmacology and Therapeutics, Faculty of Medicine, Mbarara University of Science and Technology, P.O. BOX, Mbarara City 1410, Uganda

2 Department of Biochemistry, Faculty of Medicine, Mbarara University of Science and Technology, P.O. BOX, Mbarara City 1410, Uganda

3 Department of Community Health, Faculty of Medicine, Mbarara University of Science and Technology, P.O. BOX, Mbarara City 1410, Uganda

4 Department of Medicine, Faculty of Medicine, Mbarara University of Science and Technology, P.O. BOX, Mbarara City 1410, Uganda

5 Department of Research and Development, Alpha Center for Research Administration, P.O. Box 379, Mbarara City, Uganda

6 Department of Medical Education, California University of Science and Medicine, Colton, CA, USA

7 Department of Psychiatry, Faculty of Medicine, Mbarara University of Science and Technology, P.O. BOX, Mbarara City 1410, Uganda