Evidence on Alcohol and Cancer Risk and Recommendations for the Uganda Alcohol Control Act

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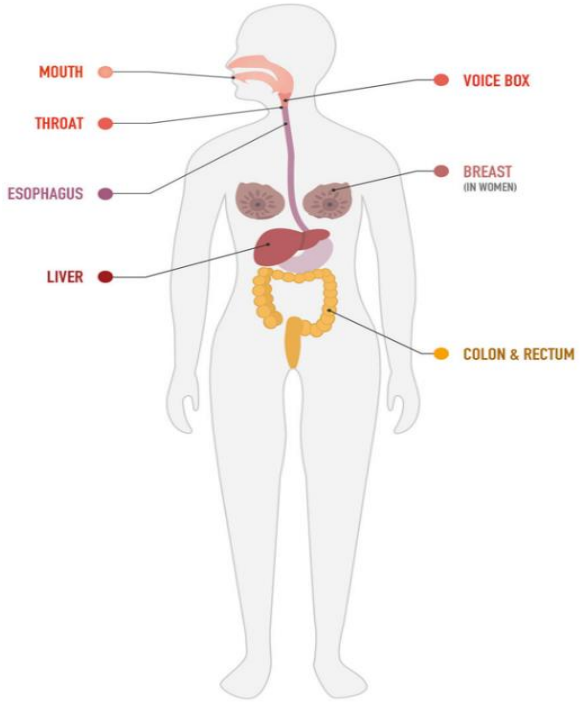
Introduction

Worldwide consumption of alcoholic drinks in 2016 was equal to 6.4 litres of pure alcohol (ethanol) per person aged 15 years or older, which is equivalent to about one alcoholic drink per person per day. Alcohol consumption varies widely, by country, and overall, is expected to continue to rise in half of the World Health Organization (WHO) regions unless effective policy reverses the trend. In 2019, Uganda ranked the eight-leading country in the world, with 12.48 liters of pure alcohol per capita.

What is the evidence that alcohol drinking can cause cancer?

Alcohol consumption has been linked to more than 200 diseases and injury conditions, including, infectious diseases, cirrhosis, cancer, cardiovascular disease, early dementia and mental disorders. Alcohol consumption causes cancers of the oral cavity, pharynx, larynx, oesophagus, colorectum, liver and female breast (IARC, 2012) and possibly cancer of the stomach, pancreas, lung, and gallbladder (Cao at al. 2015). Even light alcohol drinking increases the risk of these cancers (Bagnardi et al. 2012) and with a clear dose-response relationship (Bagnardi et al. 2015)



Alcohol is classified as a group 1 carcinogen. Group 1 carcinogen, means there is enough evidence to conclude that it can cause cancer in humans.
Alcohol consumption accounts for about 3% and 10% of total cancers diagnosed in women and men, respectively.
In both genders, the alcohol-attributable fraction is high for upper aero-digestive tract; lips, mouth, tongue, nose, throat, esophagus and trachea (25–44%), liver (18–33%), and colorectal (4–17%) cancers, and in women for breast cancer (about 5%) (Scoccianti et al. 2015).
In liver cancer, for example, alcohol increases HCC risk at least twofold; some studies suggest at least a fivefold increase (Lafaro, Demirjian & Pawlik 2015)

Figure 1. Types of cancers associated with alcohol consumption. cancer.gov/alcohol-fact-sheet

Alcohol vs Breast Cancer Risk
Light drinkers have a slightly increased (1.04-fold higher) risk of breast cancer, compared with non-drinkers. The risk increase is greater in moderate drinkers (1.23-fold higher) and heavy drinkers (1.6-fold higher) (LoConte et al. 2018). An analysis of prospective data involving women found that for women who have never smoked, light to moderate drinking was associated with a 1.13-fold increased risk of alcohol-related cancers (mostly breast cancer) (Cao et al. 2015).

Alcohol vs Esophageal Cancer Risk
Alcohol consumption at any level is associated with an increased risk of a type of esophageal cancer called esophageal squamous cell carcinoma. The risks, compared with no alcohol consumption, range from 1.3-fold higher for light drinking to nearly 5-fold higher for heavy drinking (LoConte et al. 2018, Bagnardi et al. 2015). In addition, people who inherit a deficiency in an enzyme that metabolizes alcohol have been found to have substantially increased risks of esophageal squamous cell carcinoma if they consume alcohol (Wu et al. 2018).

Alcohol vs Liver Cancer Risk
Heavy alcohol consumption is associated with approximately 2-fold increased risks of two types of liver cancer; Hepatocellular carcinoma and Intrahepatic cholangiocarcinoma) (Petrick et al. 2018, Grewal et 2012).
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Alcohol vs Colorectal Cancer Risk
Moderate to heavy alcohol consumption is associated with 1.2- to 1.5-fold increased risks of cancers of the colon and rectum compared with no alcohol consumption (Fedirko et al, 2011).

Alcohol vs Head and Neck Cancer Risk
Moderate drinkers have 1.8-fold higher risks of oral cavity (excluding the lips) and pharynx (throat) cancers and 1.4-fold higher risks of larynx (voice box) cancers than non-drinkers, and
Heavy drinkers have 5-fold higher risks of oral cavity and pharynx cancers and 2.6-fold higher risks of larynx cancers (LoConte et al. 2018, Bagnardi et al. 2015). Moreover, the risks of these cancers are substantially higher among persons who consume this amount of alcohol and also use tobacco (Hashibe et al. 2009).

How does alcohol (ethanol) cause cancer?

i. **Effect of Acetaldehyde** – When we drink alcohol (ethanol in an alcoholic beverage), it is turned in to a chemical called acetaldehyde. Acetaldehyde is a genotoxic, that is, can damage the DNA/ genetic information within a cell. Therefore, Acetaldehyde can cause cancer by damaging DNA and stopping our cells from repairing this damage. The carcinogenicity (ability to cause cancer) of alcoholic beverages does NOT seem to vary with the type of beverage; the effect appears to be caused by ethanol itself (Scoccianti et al. 2015)
ii. **Hormonal imbalance** – Hormones act as messengers in the body, giving our cells instructions - including when to grow and divide. Alcohol can increase the blood levels of some hormones such as oestrogen and insulin. Oestrogen, a sex hormone, is linked to the risk of breast cancer.

iii. **Impairing absorption of a variety of nutrients** – Alcohol impairs the body's ability to break down and absorb a variety of nutrients that may be associated with cancer risk. Notably, vitamin A; nutrients in the vitamin B complex, such as folate; vitamin C; vitamin D; vitamin E; and carotenoids. For example, low level of folate in certain condition increases breast cancer risk ((Scoccianti et al. 2015, Platek et al. 2009, Supic et al. 2011).

iv. **Mitochondrial injury –** Ethanol injures the mitochondria (part of the cell that generate most of the energy needed to power the cell) by increasing the reactive oxygen species (ROS) production and enhancing oxidation such as the hepatic glutathione oxidation. ROS are chemically reactive molecules that contain oxygen. ROS can damage DNA, proteins, and lipids (fats) in the body through a process called oxidation. Thus, resulting in increased apoptosis and cell injury (Singal & Anand 2007)

v. **Increased absorption of other carcinogens –** Alcohol can affect the cells between the mouth and throat, which may make it easier for other carcinogens to be absorbed.

vi. **Carcinogenic contaminants –** Alcoholic beverages may also contain a variety of carcinogenic contaminants that are introduced during fermentation and production, such as: Nitrosamines, Asbestos fibers, Phenols, and Hydrocarbons. This is more likely to occur when quality assurance is lacking, especially in illicit and informal production.

vii. **Synergy -** Research shows that people who use both alcohol and tobacco have higher risks of developing cancers of the oral cavity, pharynx (throat), larynx, and esophagus than people who use either alcohol or tobacco alone. For oral and pharyngeal cancers, the risks associated with using both alcohol and tobacco are multiplicative; that is, they are greater than would be expected from adding the individual risks associated with alcohol and tobacco together (Turati et al. 2013, Hashibe et al. 2009). Synergistic mechanism has also been observed with Hepatitis B virus (HBV) and Hepatitis C virus (HCV) infections. For example, greater HCV replication in the presence of alcohol, increased oxidative stress & inhibition of hepatic expression of family of proteins that regulate apoptosis (normally programmed cell death) known as the Bcl-2 genes (Singal & Anand 2007).

viii. **Alcohol consumption may increase the risk of sexually transmitted cancer-causing infections** – Alcohol consumption is linked to infectious diseases such as HIV in Uganda (Kim et al. 2016, Zablotska et al. 2006). Alcohol impairs judgment and may influence the risk of sexually transmitted oncogenic infections such as HPV (risk factor for cervical, anal, penile and head and neck cancers), HBV and HCV (risk factor for liver cancer), HIV (risk factor and co-factor for several cancers such cervical cancer, KS, and certain types of lymphoma), and HHV-8 (risk factor of KS). The infection-associated cancers such as cervical, KS, liver, lymphoma, and penile cancers are among the top 10 cancers in Uganda (Figure 2).

What happens to cancer risk after a person stops drinking alcohol?

Stopping alcohol consumption is not associated with immediate reductions in cancer risk.

However, the cancer risks eventually decline, although it may take years for the risks of cancer to return to those of never drinkers. This was demonstrated in study on head and neck cancers and on esophageal cancer. For example, ex-drinkers still had higher risks of oral cavity and pharyngeal cancers than never drinkers even 16 years after they stopped drinking alcohol, although it was lower than before they stopped drinking (Rehm et al. 2007). One study estimated that it would take more than 35 years for the higher risks of laryngeal and pharyngeal cancers associated with alcohol consumption to decrease to the level of never drinkers (Ahmad Kiadaliri et al. 2013).

What is the Burden of Cancers Linked to Alcohol and their associated evidence in Uganda?

In the figure 2 below, breast, esophageal, liver, and colorectal cancers are alcohol associated cancers. In 2020, by both new cases and deaths, these cancers were the third, fourth, fifth, and eight leading cancers in Uganda. The most common cancer, cervical cancer, the fifth, Kaposi sarcoma, the seventh, non-Hodgkin lymphoma, and the tenth, Penile cancer, are associated with infections- alcohol may also influence the risk of acquiring these infections. Also, the trends in age-standardized incidence rates per 100,000 (3-year moving averages) of most of these cancers continue to rise as shown in Figure 3 (Bukirwa et al 2020).

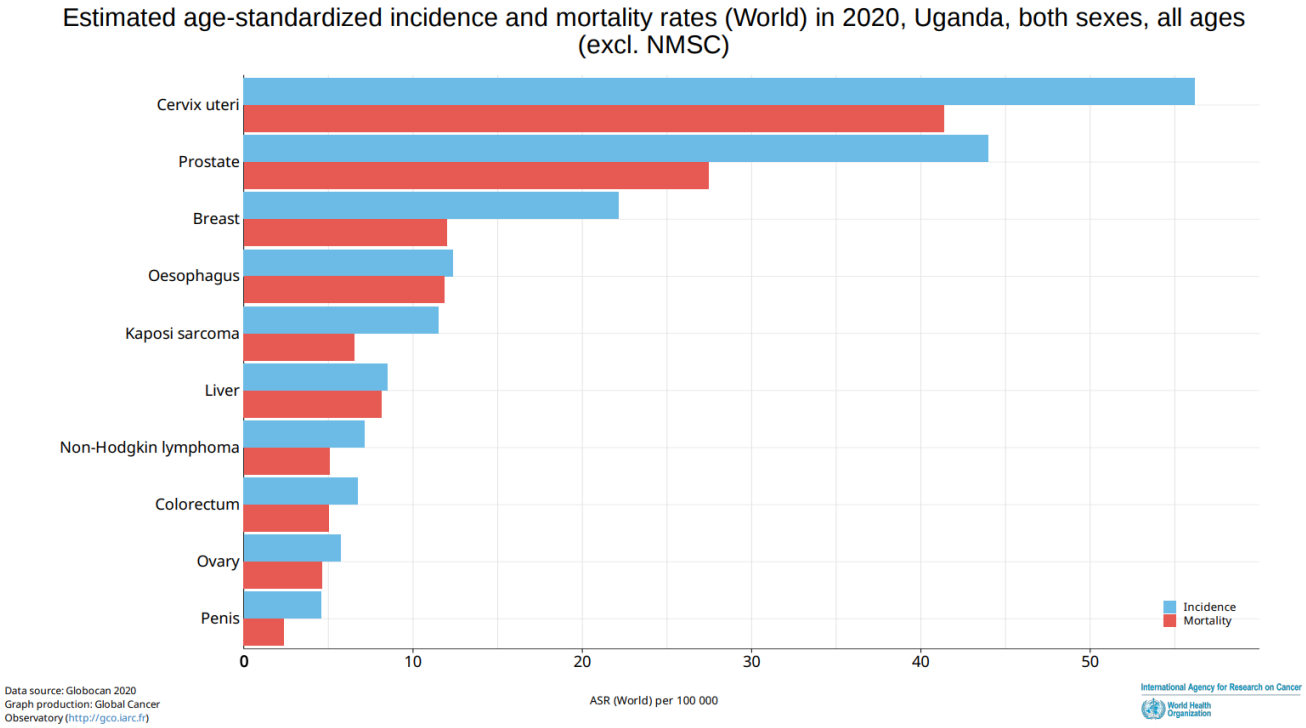

Figure 2. The ten most common cancers in Uganda in 2020 (Globocan 2020)

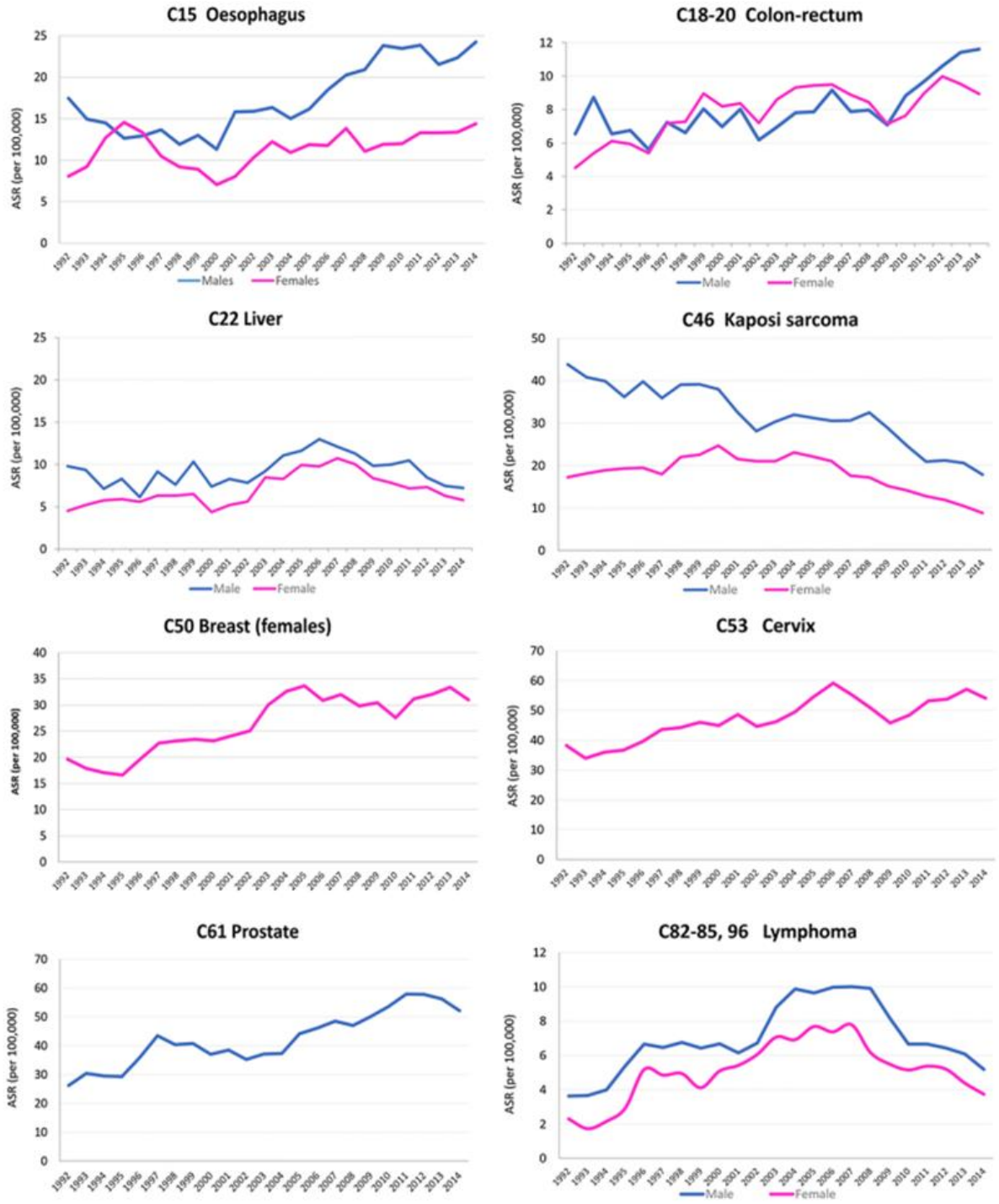

Figure3. Trends in age-standardized incidence rates per 100,000 (3-year moving averages): Data from Kampala population based cancer registry (Bukirwa et al 2020)

The population attributable fraction (PAF) due alcohol intake and a combination of alcohol & smoking were10%, and 13 % respectively (Okello et al. 2016). The PAF of 6.5% in men and 2 % in women collectively for cancers of the oral cavity, pharynx, esophagus, liver, colon, rectum, larynx and female breast was observed in some studies (Boffetta et al. 2006). In rural Uganda, a study found that drinking 3 to 4 alcoholic drinks daily was associated with the increased risk of Esophageal Squamous Cell Carcinoma (AOR 8.00, 95% CI 2.31 - 27.74.) (Okello et al. 2023). Of course, paucity of higher-level evidence on risk assessment, due to lack of or limited local research funding opportunities (Jatho et al. 2021), however, precautionary principles suffice.

In another study, Alcohol drinking was associated with breast cancer risk by twofold (2.1 (1.1-4.1) (Rukundo et al. 2014). Alcohol consumption mediated benign breast disease and breast cancer risk by 3.3 % with total mediation effect of 1.5 times more compared to non-drinkers (1.204–1.889) (Olasubomi et al. 2022). Worst still, The alcoholic beverages in the Ugandan market are heavily contaminated with carcinogens (Table 1) and the lifetime risk of developing cancer due to exposure to these contaminants in alcohol alone is 1 in 102,041 persons (Otim, Juma,and Otunnu. 2019). Overall, the prevalence of Alcohol drinking remains high and this affect both health and socio-economic indicators. The Uganda Stepwise Approach to Surveillance (STEPS) Survey of Non-communicable Disease (NCD) Risk Factors in 2014 involving 3987 adults indicated 40.1% and 17.9% prevalence of alcohol drinking in Uganda among men and women respectively (Table 2)

Table 1. The levels of metals (µg/L) in each brand of alcohol and their associated health indices (HI)

Sachet brand	Metal content[a]	HI metals	Ratio[b]
Ethanol	—	4.1 (1.0)[c]	>1 (1)[c]
TEB	12143[d]	$7.3x10^{-2}$ [e]	1/14
AWE	4342[d]	$2.6x10^{-2}$ [e]	1/38
REX	794.5	$1.3x10^{-2}$	1/83
NSB	1479[d]	$1.1x10^{-2}$ [e]	1/91
BOL	1340[d]	$9.6x10^{-3}$ [e]	1/104
TGL	538.0[d]	$5.7x10^{-3}$ [e]	1/192
B5V	200.8	$1.9x10^{-3}$	1/529
B7W	64.8	$1.5x10^{-3}$	1/714
BEG	148.4	$1.3x10^{-3}$	1/769
GOV	123.3	$1.1x10^{-3}$	1/909
KPW	166.5	$1.1x10^{-3}$	1/1000
BRG	123.3	$8.9x10^{-4}$	1/1136
CW1	43.3	$8.7x10^{-4}$	1/1176
ROV	164.1	$8.3x10^{-4}$	1/1266
CW2	113.6	$7.8x10^{-4}$	1/1300
SAG	138.9	$6.9x10^{-4}$	1/1493
UGW	16.1	$6.3x10^{-4}$	1/1639
V6T	148.5	$5.8x10^{-4}$	1/1818

The 13 Alcoholic brands assessed were: Big 5 Vodka (B5V), Beckham Spirit (BEG), Bond 7 Whisky (B7W), Brigade Spirit (BRG), Chief Waragi Spirit (CW1 and CW2, duplicates sampled one year apart), Goal Vodka (GOV), Kick Spirit Pineapple Waragi (KPW), Relax (REX), Royal Vodka (ROV), Salongo Spirit (SAG), Uganda Waragi (UGW), and V6 Tangawizi Vodka

HI is listed from the most significant (top) to the least (bottom). Otim O, Juma T, Otunnu O (2019) Assessing the health risks of consuming 'sachet' alcohol in Acoli, Uganda. PLoS ONE.

Table 2. Prevalence of Alcohol Drinking in Uganda in 2014: The Uganda STEPS Survey of Non-communicable Disease (NCD) Risk Factors

Results for adults aged 18-69 years (incl. 95% CI)	Both Sexes	Males	Females
% Currently drink (drank alcohol in the past 30 days)	28.5 (26.2-30.8)	40.1 (36.5-43.6)	17.9 (15.3-20.5)
% Engage in heavy episodic drinking (6 or more drinks on any occasion in the past 30 days)	16.7 (14.9-18.5)	26.2 (23.1-29.4)	7.9 (6.3-9.6)
% past 12-month alcohol abstainers	12.1 (10.8-13.4)	12.5 (10.4-14.5)	11.8 (10.2-13.4)
% lifetime alcohol abstainers	51.8 (49.3-54.3)	40.4 (36.9-43.8)	62.4 (59.2-65.5)

What are the recommended priority areas for global action on alcohol control?

The protection of the health of the population by preventing and reducing the harmful use of alcohol is a public health priority. The WHO 2010 global strategy on harmful use of alcohol recommends four priority areas for global action; Public health advocacy and partnership; Technical support and capacity building; Production and dissemination of knowledge; and Resource mobilization.

What are the recommended public policy strategies for alcohol control at national level?

The WHO 2010 global strategy on harmful use of alcohol supports ten target areas for national actions: Leadership, awareness and commitment; Health services' response; Community action; Drink-driving policies and countermeasures; Availability of alcohol; Marketing of alcoholic beverages; Pricing policies; Reducing the negative consequences of drinking and alcohol intoxication; Reducing the public health impact of illicit alcohol and informally produced alcohol; and Monitoring and surveillance. Of these. WHO recently identified the three best interventions to tackle harmful alcohol use at national level; Restricted access to retailed alcohol; Limitation of alcohol advertising; and Taxes on alcohol. These require an Act of Parliament to ensure effective alcohol control measures.

What are the current challenges on Alcohol Control in Uganda?

There is lack of an Act of Parliament on alcohol control following the repeal of the obsolete Liquor Act 1960 and the Enguli (Manufacture and Licencing Act) 1966. The Liquor Act of 1960 regulated the manufacture and sale of intoxicating liquor and restricts consumption of liquor by children while the Enguli (Manufacture and Licencing Act) 1966 prohibited the consumption and export of enguli (any unrefined spirit). Thus, creating a legal vacuum. In addition, beside the surge in Alcohol associated cancers in Uganda, emerging evidence on high level of carcinogenic contaminants in alcoholic beverages in Uganda is worrisome.

Recommendations

- Enact a law (Act of Parliament) on alcohol control in Uganda with provisions on regulation of production, packaging, distribution, marketing, sale and consumption of all alcoholic beverage. This will strengthen the legal basis of the Uganda National Alcohol Control Policy (2019).
- Set prohibitive fines for the breach of the provisions of the Alcohol Control Act.
- Provide for the registration and licensure of all trade in alcohol right from production. Note that this will not reduce the revenue associated with alcohol trade, but instead will increase revenue directly through registration and licensure fees.
- Provisions for restricted access to retailed alcohol, limitation of alcohol advertising, regulated licensing and taxes on alcohol are recommended. This will provide for more working time for the economically productive age groups and restricting alcohol access in and in proximity of critical institutions such as schools, health facilities, among others
- Provide for a strong enforcement measure including enforcement institution capability in this Act.
- Multi-sectoral consideration and a healthy balance of interest especially among; trade, revenue, health, alcohol use for social function and leisure should be evaluated and taken care of in the provisions.
- Provide for packaging of all alcoholic beverages including locally brewed products such as Kwete, Mulamba, Lacoyi / Maluwa intended for public sale. This will promote value addition and health /safety. This will also tract the provisions on registration and licensure of trade in alcoholic beverages.
- Provide for quality assurance and monitoring the content of alcoholic beverages in Uganda, relative to the permissible level (upper limit) to ensure public health and safety.
- Provie for acholic beverage content substitution with healthier ingredient.

Conclusion

The risk of alcohol associated cancers in Uganda remain high and continue to rise as alcohol intake rises. Also, the alcoholic beverages in Uganda contain harmful level of carcinogenic contaminants such as Arsenic, Lead and Chromium. Alcohol being a social and cultural drinks in Africa, acholic beverage content substitution with healthy ingredient, restricted access to retailed alcohol, limitation of alcohol advertising, regulated licensing and taxes on alcohol are recommended in the Alcohol Control Act.

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