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ALCOHOLS AND ALCOHOLIC BEVERAGES

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Abstract
Chemically known as Ethanol, Alcohol is one of the most abused drug with both recreational and psychoactive properties. It is of great forensic importance as the number of cases confronted is very high. The word alcohol is derived from the Arabic word "alkohl" which refers to a fine metallic powder used to stain the face and eyelids in the East. Later, the term was expanded to include any powder obtained through titration and sublimation, as well as a fluid derived through distillation. ROH is the general formula for alcohols with R being any alkyl group and OH being the functional group for alcohols. All alcoholic beverages contain ethanol in varying amounts. There is no national policy for alcohols in India due to which the problems relating to alcoholism are increasing day by day in the country.
Keywords: Alcohol, Ethanol, Beverages, Illicit, Licit

1. Introduction

Chemically known as Ethanol, Alcohol is one of the most abused drug with both recreational and psychoactive properties. It is of great forensic importance as the number of cases confronted is very high [1-3]. The word alcohol is derived from the Arabic word "alkohl," which refers to a fine metallic powder used to stain the face and eyelids in the East. Later, the term was expanded to include any powder obtained through titration and sublimation, as well as a fluid derived through distillation. ROH is the general formula for alcohols with R being any alkyl group and OH being the functional group for alcohols. The beverages that contain ethanol in them are known as alcoholic beverages. The amount of ethanol in any alcoholic beverage various depending upon the type of alcoholic beverage [3-7].

India is one of the world's largest producers of alcoholic beverages, accounting for 65% of manufacturing and roughly 7% of imports into the country. Sugarcane molasses is used to make the majority of India's bulk liquor. Around 52% of the liquor produced in India is consumed domestically. The type of alcoholic drinks produced in India include IMFL (Indian-made foreign liquor), IMIL (Indian-made Indian liquor), imported alcohol, wines and beers. Due to the high taxes levied on imported liquor, its share in the Indian market as less as 0.8%. Having said that, alcohol does not fall under the GST taxation scheme. CML and IMFL account for roughly 60 to 70% of total beverage liquor consumption. Traditional home-prepared beverages account for a large amount of unrecorded consumption. In India, the sale, production, and distribution of liquor is mostly a state subject. Due to a few flaws in present excise rules, a significant number of Indian states manufacture significantly more liquor than that is required. The manufacture, sale, and distribution follow a complex duty structure that vary with each state. Imported liquor is subjected to taxes that range from 100-500% [8-10]. India holds ninth position among the largest alcohol consuming countries. In India, an estimated 160 million individuals (14.6 %) use alcohol, with 29 million (2.7 %) relying on it . Apart from this, nearly 29 million people (5%) are engaged in risky drinking. More than 60% of the alcohol drank was in the form of "spirits". These spirits are gin, whisky, rum, vodka, tequila as well as liqueurs. India has the greatest annual per capita alcohol consumption (5.7 litres) of the South-East Asia Region (SEAR) countries. India also ranks second among the spirit consuming countries with China being at the first place. The consumption of spirits has grown by 11% in India since 2017 with an annual consumption of almost 663 million liters. Whisky consumption in India is highest in the world. The whisky consumption in India is thrice the whisky consumption of the United States which finds itself at second place as far as whisky consumption is concerned. In India, nearly one out of every two bottles of whiskey imported is being sold [1,8,10]. Although the alcohol consumption noticed a downfall across the globe in 2018, India still managed a 7% surge in the whisky market. In the last two decades, the percentage of young drinkers has increased from 2% to 14%, with the average age of beginning dropping from 19 to 13 years [1,8,11]. By 2022, it is predicted that the Indian alcohol market will be of 16.8 billion litres, rising at an annual rate of 8.8%. Wine and vodka have a CAGR of 21.8% and 22.8%, respectively, in terms of popularity. The per capita alcohol consumption per week consumption is also predicted to increase from 147.3ml inn2017 to 227.1 ml in 2022 with a CAGR of 7.5% [1,8,11].

1.1 What is Alcohol?

The word alcohol is derived from the Arabic word "al kohl," which refers to a fine metallic powder used to stain the cheeks and eyelids in the east. Later, the term was expanded to include any powder obtained through titration and sublimation, as well as a fluid derived through distillation. Alcohol is a compound of organic nature. ROH is the general formula for alcohols with R being any alkyl group and OH being the functional group for alcohols. However, the term alcohol usually refers to a specific chemical, ethanol, the active element in alcoholic beverages [15].

1.2 Classification of Alcohols

The classification of alcohols is based either on the number of alkyl groups linked to the hydroxyl group or based on the number of hydroxyl groups present in it.

1.2.1 According to the number of alkyl groups linked to the hydroxyl group:

Primary Alcohols

In primary alcohols, there is only a single alkyl group attached to the carbon atom of the hydroxyl (OH) group. Some examples are Methanol, Propanol, Ethanol. The presence of only one linkage between a hydroxyl group and an alkyl group is the major qualifying requirement for such alcohols.[4]

Secondary Alcohols

The carbon atom of the hydroxyl group is connected to two alkyl groups on either side of the hydroxyl group in secondary alcohols. There can be significant structural similarities and differences between the two alkyl groups. Secondary alcohols include propan-2-ol and butan-2-ol etc.[4]

Tertiary Alcohols

The hydroxyl group of tertiary alcohols is attached to a saturated carbon atom which is further connected to three alkyl groups. The physical properties of such alcohols depend on their structure. The presence of -OH group results in establishment of hydrogen bonds between the adjacent carbon atoms of these alcohols. 2-methlypropan-2-ol and 2-methlybutan-2-ol fall in the category of tertiary alcohols.[4,5]

1.2.2 Based on number of Hydroxyl groups:

Monohydroxy alcohols

This category of alcohols contains only one hydroxyl (-OH) functional group. Examples of Monohydric Alcohols contain Methanol (Methyl Alcohol), Ethyl Alcohol (Ethanol), Isopropanol (Iso propyl alcohol) etc.[8]

Dihydroxy alcohols

The presence of two hydroxyl groups in a alcohol makes it dihydroxy alcohol. They are also known as glycols. Examples are ethylene glycol, propylene glycol, etc.[9]

Trihydroxy alcohols

Trihydroxy alcohols are derivatives of alcohols and not true alcohols. but only derivatives. Example: Glycerine.[8-10]

1.3 Properties of Alcohols

1.3.1 Physical properties

- They are colorless.
- They smell sweet barring glycerol and some low alcohols.
- They catch fire easily and burn with a characteristic blue flame without producing smoke.
- They exist in liquid state at room temperature barring glycerol which exists as a viscous liquid.
- The presence of hydrogen bonds results in higher boiling points of alcohol than halo-alkanes with equal number of carbon atoms.
- The boiling point tends to increase with increase in the number of carbon atoms and decreases with any increase in branching.
- They are water soluble compounds. As the molecular mass of the alcohol increases, the amount of hydrogen bonding between the molecules decreases which results in decreased solubility of such alcohols in water.
- They are less acidic than water as the polarity of -OH bond in alcohols is low.

- They are excellent solvents for a number of organic compounds.[10,11]

1.3.2 Chemical properties: Due to the tendency of the carbon-oxygen bonds and hydrogen-oxygen bonds to break easily, alcohols show a number of chemical reactions like:

- ***Oxidation of Alcohol:*** Under the effect of oxidizing agents, alcohols form aldehydes and ketones, further oxidation of which gives carboxylic acids.

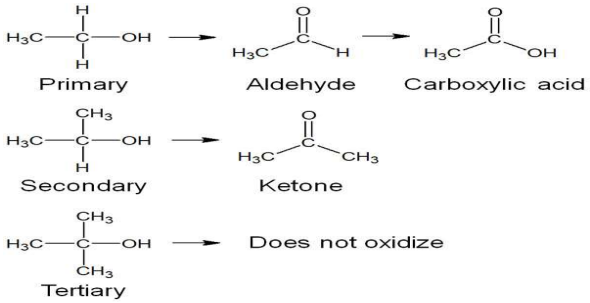

Fig 1. Oxidation of Alcohol [11]

- ***Dehydration of Alcohol****:* Alcohols are easily dehydrated in the presence of concentrated H_2SO_4. The products of the reaction vary with the temperature variation. Tertiary alcohols dehydrate faster than secondary and primary alcohols.

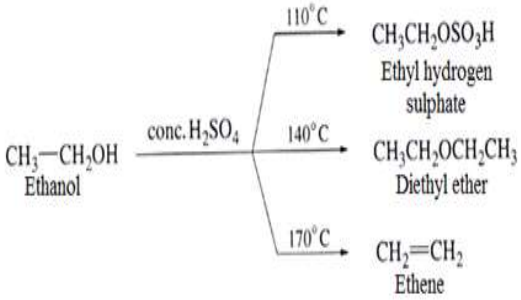

Fig 2. Dehydration of Alcohols [12]

- ***Combustion of alcohols:*** Alcohols give carbon dioxide and water when they are burnt in the company of oxygen. Under insufficient supply of oxygen, the combustion is incomplete and the products are water along with CO gas or soot.

$$C_nH_{(2n+1)}OH + (2n+1)O_2 \rightarrow nCO_2 + (n+1)H_2O$$

Fig 3. Combustion of Alcohols [9]

- ***Reaction with metals:*** Due to their acidic nature, alcohols react with metals to form alkoxides.

$$RO-H \xrightarrow{Na} RO^{-}Na^{+} + \frac{1}{2}H_2$$

$$3RO-H + A1 \rightarrow (RO)_3\ A1 + \frac{3}{2}H_2$$

Fig 4. Alcohols reaction with metals [10]

- ***Formation of halides:*** Alcohols react with Hydrochloric Acid (HCL) to form alkyl halides by removal of hydroxyl groups.

$$ROH + Zn + HCL \rightarrow R\text{-}Cl$$

Fig 5. Formation of halides [7]

- ***Formation of esters:*** Alcohols and carboxylic acids accompanied by a catalyst give esters. This reaction is known as 'Fischer Reaction.'

$$RO + H + R'COOH \xrightarrow{H_2SO_4} R'COOR + H_2O$$

Fig 6. Formation of halides [8]

1.4 Important terms related to Alcohols

A variety of compounds can be prepared by varying the amount of alcohol in a given mixture.
Absolute alcohol*:* Absolute alcohol (Alcohol Dehydratum) contains 99.95% of alcohol.
Rectified spirit: Rectified spirit contains 95% by volume of alcohol.
Denatured alcohol: Denatured alcohol or industrial methylated spirit is a mixture of 95% alcohol and 5% wood naptha.
Rubbing alcohol: It is either 70% isopropyl alcohol or an ethanolic liquid with antibacterial properties and also used for massage purposes.
Power alcohol: A mixture of 80% petrol, 20% ethanol along with some benzene makes power alcohol. It is generally used in automobiles.
Alcoholic beverages: Any drinkable liquid containing 0.5 percent to 75.5 percent ethyl alcohol by volume is considered an alcoholic beverage.
Proof spirit: The measure of absolute alcohol in any given distilled liquor is called Proof. Distilled liquors are a made by addition of water to alcohols. Proof is generally twice the ABV% in any liquor. For example, any liquor having 42% ABV will be 84 degree proof. [4-10]

1.5 Alcoholic Beverages

Any drinkable liquid containing 0.5 percent to 75.5 percent ethyl alcohol by volume is considered

an alcoholic beverage. Ethanol, often known as ethyl alcohol, is by far the most commonly abused narcotic in society. An alcoholic beverage is created when ethanol is combined with water in the proper proportions. The most frequent alcoholic beverages are whisky, brandy, rum, and beer. These beverages are made in India according to Bureau of Indian Standards requirements (BIS). Aside from alcohol, alcoholic beverages contain up to 800 compounds that give them their distinct flavour and aroma. Congener alcohols like methanol (Wood alcohol) and some higher aliphatic alcohols are of the most significant compounds. [4-7]

1.6 Classification of Alcoholic Beverages

Alcoholic beverages can be classified in the following ways:
Classification on the basis of production method
Classification on the basis of country of origin
Classification as per the legal status

1.6.1 Classification of alcoholic beverages on the basis of production method

On the basis of production method, alcohols can be classified as follows:

Fermented beverages

Fermented drinks are made by the process of fermentation. All fruits contain sugar which is utilised to make alcohol. Only in the presence of yeast, which acts as a catalyst, is this chemical reaction feasible. Saccharomyces cerevisiae is the most common yeast found in wine and beer. In addition, suitable conditions, such as a lack of oxygen, must be present. Fermentation now takes place in stainless steel vessels. Fermentation that occurs spontaneously or in a stormy manner is known as spontaneous or tumultuous fermentation. The most common fermented beverages are wine, champagne, cava, and beer.[8,9]

Distilled beverages or Spirits

The distillation of a previously fermented beverage yields distilled beverages or spirits, popularly called Eau de vie. In this process, ethanol is separated from the mixture by heating it to its boiling point. Distillation is accomplished by heating the liquid to the boiling point and then separating the alcohol from the rest of the liquid. When the drink is chilled, the alcohol condenses again, resulting in a drink with a higher alcohol level. This thousand-year-old technology may be used to make a wide variety of beverages. Whisky, vodka, tequila, rum, gin, brandy are the most common types of spirits.[10,11]

Fortified drinks or wines

Fortified drinks, often known as liquor wines, are made by fortification of fermented beverages with distilled spirits. This is done to boost the alcohol concentration while maintaining the flavour balance. The main goal of this process is to increase the alcohol content from 15% to 17-25%. Porto, Marsala, Sherry are included in this category of alcoholic beverages.[8-10]

Liqueurs and Creams

Liqueurs or creams are prepared by mixing spirits with aromatic spices, fruits and sugars. The infusion or maceration processes are used to make liqueurs. Liqueurs are alcohols that have been sweetened. In most cases, spirits are sweetened in some fashion. They're normally between 15-30% ABV. Absinthe, Amaretto, Aperol, Averna, Baileys, Campari, Chambord, Chartreuse are some examples of liqueurs.[5-7]

1.6.2 Classification based on the country of origin

Based on the country of origin, alcoholic beverages can be classified as following:

Indian-made foreign liquor (IMFL) Alcoholic drinks which are based on foreign recipes but are produced and compounded in India are called Indian Made Foreign Liquors (IMFLs). Apart from the indigenous alcoholic drinks, all the other types of hard drinks produced in India fall in this category.[1,2]

Country-made liquor (CML)

Also known as Indian made Indian liquor (IMIL), such liquors are made from local raw materials like rice, sugarcane, coconut, palm, cheap grains etc. The alcohol content in such liquors varies between 11.4-45.7% v/v.[4,5]

Imported liquor

Alcoholic beverages that are not manufactured in India but are imported from other countries are called imported liquors. Such liquors are rarely consumed in India due to the high tax duty imposed on such liquors.[4-7]

1.6.3 Classification as per the legal status:

As per the legal status, alcoholic drinks in India are classified as either Licit liquor or Illicit Liquor.

Licit liquor

Liquor that is produced as per the standards set by the Bureau of Indian Standards (BIS) and excise and taxation duties are paid as per the government policies, such liquor is termed as Licit liquor. The amount of ethanol, as well as other additives in such liquor, is as per the standards set by the government.[9,11]

Illicit liquor

Liquor that is not produced as per the standards set by the Bureau of Indian Standards (BIS) and excise and taxation duties not paid, such liquor is termed as Ilicit liquor. The amount of ethanol is variable in such beverages as well as the other additives in such liquor are not as per the standards set by the government. Methanol is the most common compound that is found in such beverages apart from ethanol, consumption of which results blindness and death.[9,11]

1.7 Types of Spirits/Liquors

Following are the common spirits/liquors consumed in India

Vodka

Vodka is a clear spirit that is usually not flavoured. It is made from grains and potatoes. Broadly speaking, vodka should be colourless, odourless, and tasteless but different brands tend to add different flavours to it to give it a flavor different from other brands. It contains 40-50% ABV (80 to 100 proof). Skyy, Smirnoff, Absolut are examples of some vodka brands. [7]

Gin

Gin is a flavored type of vodka although it is not sweet. It is colourless and contains botanicals and various spices-based flavors. Juniper berry is known to be the principal ingredient in gin. The ABV in gin vary from 40-47%. Hendricks, Gordons and Bombay are examples of some gin brands.[4]

Whisky

Whisky is made from fermented grain mash. It contains 40 to 50 percent ABV or higher. Jack

Daniels, Johnnie Walker and Canadian Club are examples of some whisky brands.[5]

Rum

Rum is another highly consumed hard liquor worldwide obtained by distillation of molasses or sugar cane. It's often aged in wooden barrels. Spiced rums are made by adding other spices to the basic raw material used to prepare rum. Typically Rum contains 40 percent ABV. Overproof rums can reach as much as 75 percent ABV (150 proof). Old Monk, MacDonald's, Havana Club are examples of some rum brands.[4-7]

Tequila

Tequila has recently become a highly famous drink in India. The distillation of blue agave uive is done to obtain tequila. It contains typically 40 to 50 percent ABV. Hornitos and Jose Cuervo are examples of some tequila brands.[4-6]

Brandy

Brandy is obtained by distillation of fermented fruit juices. Fermented grapes are used to make brandy although other fermented fruits can also be used. Brandy is often aged for several years in barrels before bottling. Cognac and Calvados are some common brandy brands consumed. Pisco is also considered a type of brandy. Brandy contains typically 40% ABV.[5,6]

1.8 Types of Beer

Beer is a highly popular drink in India and is consumed by both males and females. Fermented grain juices are used to make beers. The ABV in such drinks varies from 3% to 8%. All types of cereal grains can be used to make beer but mostly barley is used. Flavouring agents like different spices like hops are also added to it to enhance its taste. Beer can be categorized as either Ale or Lager. The process used for making an ale and the type of yeast used is different from the process and type of yeast used for making lager. Ales are strong, heavy and more flavoured than lagers.

1.8.1 Types of Ales

- ***Pale Ale*** – It is made from pale malt and is the most commonly consumed ale and contains 5-6% ABV. It is lighter than the rest of the ales.[5]
- ***India Pale Ale*** – It is a type of pale ale which contains higher amounts of alcohol ranging from 6%-8% due to the heavy hopping process.[6]
- ***Stouts & Porters*** – stouts are also a type of ales but are darker in colour and contain almost 4.2% ABV.[4]
- ***English Bitter Ale*** – A Type of ale with ABV ranging from 3-4.2%. They are slightly bitter in taste.[5,6]
- ***Amber Ales*** – It is named after its golden to amber color. Such ales can be either toffee flavoured or caramel flavoured. General ABV% ranges from 4.5-6.2%.[4,7]
- ***Wheat Beers*** – While most beers are made using barley, rice, rye, corn etc., wheat beer contains at least 50% wheat which is much higher than beer types. General ABV% ranges from 3.5-5.6%.[7]

1.8.2 Types of Lagers

- ***Pale Lager*** – Pale lager is a clean, crispy and light beer and thus is the most consumed beer worldwide. The normal alcohol content is typically 5%. Typical brands include Heineken, Budweiser etc.[8]
- ***Pilsner*** – Light-toned pilsner malt is used to make a classic pilsner. It is hopped with Saaz and Hallertau hops along with pilsner yeast which fermentates at the bottom. Hop gives it more flavor & bitterness. General ABV% ranges from 4.2-5.8%.[11]
- ***Dark Lager*** – They are dark coloured lagers and are less consumed type of lagers. General ABV% ranges from 4.5-6%.[10]

1.9 Types of Wine

Wine is prepared by fermenting the juice of grapes. fermented grape juice. The ABV% varies with the type of wine and can vary from 12-15% in table wines and from 20-30% in fortified wines. Wines are basically classified as red, white, rose, sparkling, and fortified wines based on the type of grapes which are used to make them.

Red Wines

As the name suggests, red wines are red in color. They are made by crushing and fermenting dark-colored whole grapes. It is the grape skin that decides the wine colour. While preparing red wines, the skin of the grapes is not removed from them. The alcohol content in red wines generally ranges from 12-15%. Pinot noir, Cabernet Sauvignon, Merlot, Syrah/Shiraz, Grenache are the examples of the most common red grape varieties used for preparing red wine.[4]

White Wines

They are either white or yellow coloured as the skin of the grapes used to make such wines is removed at the time of fermentation. The average ABV in such wines is 10% but can vary anywhere between 5%-14%. As less ripe grapes are used to make such wines, the conversion rate of sugar present in grapes to ethanol is less and that is why such wines are sweeter in taste. Moscato, Sauvignon Blanc, Riesling are some common grape varieties used to make white wines.[5,6]

Rose Wine

Typically pinkish in colour, rose wines are made from red wine grapes but their skin is removed during the fermentation process whenever the winemaker decides to do so based on the type of colour he wants to give to the wine. Thus, such wines are lighter than the red ones. The alcohol content in rose wine is nearly 12% ABV. Pinot noir is a grape variety used to make rose wines.[6,7]

Sparkling Wine

Just like rose wines, three is no specific grape variety used to make sparkling wines. Rather, the process and the winemaker decides its style. Fermenting wines and/or 'Must' is used to make such wines. Moreover, they are carbonated and lighter in colour. The alcohol content in sparkling wine is nearly 12% ABV. Champagne and Prosecco are examples of sparkling wines.[5,7]

Fortified Wines

Fortified wines are the odd ones as both fermented and distilled drinks are used to make such wines. Distilled spirit is added to a fermented drink with the purpose to increase its ABV percentage. Generally, the alcohol content in fortified wines varies from 15% to 20% ABV. Also, to give such

wines a certain type of flavor, herbs and spices are also added. Vermouth, sherry, port, and muscat are some common types of fortified wines.[6,7]

Discussion

For ages, alcohol has been used in the Indian subcontinent. India's alcohol culture has grown as a result of colonization. Age, religion, education, type of drink, and other socio-demographic factors all influence the trends of alcohol use. Consumption patterns range significantly between cultures and societies, and considerable shifts have happened in the last two decades. An 1878 rule consolidated the law addressing the collection and control of excise money, as well as the regulation of the production, possession, sale, and transportation of liquor. India has one of the most thriving liquor markets on the subcontinent; therefore alcohol is a big source of revenue. In India, there are several different liquor regulations, and none of them are consistent. Liquor is mentioned in the seventh schedule (article 246) and Article 47 of the constitution. "Alcohol for Human Consumption" is a subject matter for states according to State List entry 51. This gives states the authority to enact laws for human consumption and levy taxes on alcoholic beverages. Thus, the laws and regulations vary from state to state. Article 47 of the Directive's Principles urges states to take steps to improve their health as well as standards of living. India is one of the world's largest producers of alcoholic beverages, accounting for 65% of manufacturing and roughly 7% of imports into the country. Sugarcane molasses is used to make the majority of India's bulk liquor. Around 52% of the liquor produced in India is consumed domestically. The type of alcoholic drinks produced in India include IMFL (Indian-made foreign liquor), IMIL (Indian-made Indian liquor), imported alcohol, wines and beers. Due to the high taxes levied on imported liquor, its share in the Indian market as less as 0.8%. Having said that, alcohol does not fall under the GST taxation scheme. CML and IMFL account for roughly 60 to 70% of total beverage liquor consumption. Traditional home-prepared beverages account for a large amount of unrecorded consumption. In India, the sale, production, and distribution of liquor is mostly a state subject. Due to a few flaws in present excise rules, a significant number of Indian states manufacture significantly more liquor than that is required. The manufacture, sale, and distribution follow a complex duty structure that vary with each state. Imported liquor is subjected to taxes that range from 100-500%.

Conclusion

Our study documented the diversity of beverage types and related ethanol content of alcoholic drinks in India and described processes for determining the ethanol content of drinks for different beverage types. Such information from diverse geographic areas and cultural groups is of considerable value to alcohol research and can be used to adjust consumption data in larger studies where collecting details on individual’s pour that pour size information is particularly relevant for the study of hazardous drinking in India. Drink size information has direct implications for health messages regarding alcohol use. Gill and colleagues reported that most randomly selected adults reported poured drinks twice as large as the standard UK drink unit for wine or spirits. Hazardous drinking by the small portion of drinkers in India, when compounded with a preference for high-strength beverages and poverty-related health risks of poverty, presents a significant public health crisis and underscores the need for alcohol-related health messages. Relative lack of detailed scientific

information on alcohol use has impeded development of suitable health messages in India. Our data provides some of the information needed. Specifically, drinkers in India can better monitor their own consumption to be within prescribed limits with pertinent information on beverage- and drink-size-specific ethanol intake. The present findings suggest specific recommendations for future research in alcohol use in developing countries. First, it is critical to assess for region-specific beverages, including legal and illegal drinks. Chemical and/or other analyses of samples of such beverages should be conducted to establish ethanol concentration where feasible. Variations in beverage-specific drink sizes, including volume (vessel and pour size) information, should also be assessed. Finally, the use of respondent-defined drink sizes will help better estimate each individual's volume of consumption and identify problematic drinking. This appears particularly important for those beverages that are poured into glasses and not consumed directly from standard containers (unlike a 330-ml bottle of beer). Needless to say, the present study has several limitations. Most data presented are based on small sample sizes and rigorous quantitative methodologies were not used. While both rural and urban areas of diverse parts of India were included, three sites in a large and extremely diverse country like India cannot yield data that can be generalized to the entire country. Further, the assessment of poured drink sizes was conducted only in the clinic attending sample of men in Delhi, noted observationally, and did not include the examination of possible differences due to religion, social class, age, drinker type and drinking context. Finally, although home-brewed Daaru in rural Rajasthan was studied in detail, adulterated illicit liquors were not included in the range of beverages assessed. This was primarily due to the low reporting of such liquors in our study areas, particularly Goa and Delhi, where alcohol is freely available. Despite these limitations, our study represents an effort to improve alcohol assessment in three parts of India. Future studies on factors that influence alcohol drink sizes and thereby estimates of consumption are needed.

form of liquor. But, there should be a process of acceptance in our society. Even if we don't consume alcohol, we need to respect other people's choices to some extent. There is a need for

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