EPIDEMIOLOGY
Not All Drinks Are Created Equal: Implications for Alcohol Assessment in India

Madhabika B. Nayak1,* , William Kerr1 , Thomas K. Greenfield1 and Aravind Pillai2

1Alcohol Research Group, Emeryville, CA, USA; and 2Sangath, Porvorim, Goa, India
*Corresponding author: Alcohol Research Group, 6475 Christie Avenue, Suite 400, Emeryville, CA 94608, USA.
Tel: +1-510-597-3440; Fax: +1-510-985-6459; E-mail: mnayak@arg.org

(Received 18 October 2007; first review notified 27 March 2008; in revised form 1 August 2008; accepted 25 August 2008; advance access publication 1 October 2008)
that vary by state and area, are consumed, significantly limiting consumption estimates (Gauneker et al., 2004; World Health Organization, 2004).

A few reports have provided ethanol concentrations of country liquor in different parts of India, including illicit and licit non-commercial region-specific beverages (Gupta et al., 2003; Gauneker et al., 2004) but none have documented methods by which %ABV estimates were ascertained. Similarly, standard measures are sometimes included in measures of consumption or appendices either as equivalent grams or volume of pure ethanol (Mohan et al., 2000; Silva et al., 2003), but the variability in drinking vessel and container sizes has not been documented. Studies in India have also combined information on possibly different beverages in assessing problematic alcohol use, defined as exceeding a given threshold of volume without providing critical information on how consumption of different beverages (in varying drink sizes) was combined to estimate problematic alcohol use. For instance, studies use the Alcohol Use Disorder Identification Test (AUDIT) (Babor et al., 1992) that assesses the frequency of consumption of six or more 10-gram ‘drinks’ to identify hazardous use (Silva et al., 2003; Gauneker et al., 2004). Importantly, the term ‘standard drink’ presents an additional challenge as it does not translate semantically or literally into any Indian language. De Silva (unpublished manuscript, 2007) noted that a major limitation of using the AUDIT in South Asia is that the ‘standard drink’ is an unfamiliar concept to Sri Lankan alcohol consumers and demonstrated the utility of using visual aids to assess consumption in terms of beverage-specific containers.

To the best of our knowledge, detailed information on beverage-specific drink sizes in India has not yet been documented. We begin to fill this gap by providing documentation of variability in ethanol content, container and pour sizes of beverages consumed in three different parts of India. Beverage-specific drink size information is particularly important given the diversity in beverages across different regions in India, the large proportion of undocumented consumption of locally produced illicit and licit alcoholic beverages (Benegal et al., 2003; Gauneker et al., 2004) and the important agenda of identifying excessive alcohol use (Benegal, 2005; Gaunekar et al., 2005).

METHODS

Samples

Data reported here are from the formative phases of three separate studies on alcohol use patterns conducted in north and west India. While not fully representing the extremely diverse Indian population, the study sites, Delhi, Goa and Rajasthan, included urban and rural areas and reflected different cultures as regards alcohol use, socio-economic development and historical traditions. Two studies involved 11-month-pilot research conducted in late 2003, completing structured interviews with 172 men attending gastroenterology clinics in a large Delhi hospital and 172 married men, age 18–50 years, from Churu, a rural district of Rajasthan. The third was a large, epidemiological survey conducted in North Goa from 2005 to 2007 that ultimately screened over 4000 adult men and women and conducted in-depth interviews with roughly half of these respondents. Only data focused on site-specific beverages and associated drink sizes from formative phases of each study are reported here and related procedures for each study are described next.

Procedures

The formative phase of each study included gathering information to adapt alcohol measurement questions developed in the United States for use in the local cultures. Methods employed to determine alcohol beverage-specific drink-size information varied slightly across all three studies (see Table 1) and included:

Participant observation. Research staff interviewed staff and customers at alcohol outlets to gather information on beverage types and typical beverage-specific drink sizes. Outlets visited included licensed liquor shops, bars and an urban beach shack (Goa). In Rajasthan and Goa, participant observation was conducted on the preparation of home and small-scale distillery-brewed local liquors, respectively. Staff in these two studies also observed the measuring out of typical drinks of different liquors by staff at 16 rural and urban bars and by designated ‘pourers’ at five social events (weddings, local festivals, informal gatherings).

Open-ended, structured, key informant interviews. In Rajasthan and Goa, key informants included hotel bartenders and managers, bar owners, a faculty member at a hotel management college and a male adult member of a rural household that brewed illicit country liquor. Key informants provided information on beverage types and drink sizes consumed by drinkers in the local population. In Delhi alone, research staff recorded, in detail, individual key informant interviews that included heavy and light drinkers of varying income.
backgrounds. Eleven individuals, age 36–63, were interviewed including physicians, clinic attendees and hospital clerical staff. Questions on types of alcoholic beverages, containers, estimated volume in millilitres (ml) of typical drinks and on respondent-specific pour sizes (i.e. how high they filled their own drinking vessels with the alcoholic beverage) were included.

**Testing ethanol concentration.** Samples of region-specific ‘country liquors’ were collected to test for ethanol concentration (%ABV). These included the home-brewed ‘Daaru’ in Rajasthan, Cashew-based ‘Urack’ (first distillate of Cashew liquor that precedes the distillation of Feni) and Cashew and Coconut ‘Feni’ in Goa. Ethanol concentration of ‘Desi sharaab’ in Delhi and Rajasthan was not assessed since the 200 ml plastic sachets of this liquor report a 40% ABV as previously reported (Mohan et al., 2000).

Two methods were used to assess the ethanol concentration for samples of Daaru. The Gay Lussac Alcoholmeter (http://www.widdernet.de/alcoholmeter.html, accessed 29 July 2008) was used in the day immediately following collection of the samples. Test instructions, including cleaning and drying the alcoholmeter, ensuring temperature equivalence of samples, test jar and alcoholometer, and taking readings at eye level, were carefully followed. Separate samples of Daaru were collected for chemical analyses from homes and social gatherings in Churu, sealed and analysed within 2 weeks of collection at a nationally recognized chemical laboratory in New Delhi.

A total of 18 samples of Urrak and of Cashew and Coconut Feni were collected from rural and peri-urban bars as well as from local small-scale distilleries in Goa. Chemical analyses of the sealed samples were completed within 60 days of collection at the Goa Directorate of Food and Drugs Administration, following specifications of the Bureau of Indian Standards. Separate analyses of additional sealed samples of Urrak and Feni from Goa were also conducted by the staff at our centre, the Alcohol Research Group, with the Analox Analyser AM3, a single channel analyser of ethanol (Analox Instruments, 2003). The AM3 measures the reaction between alcohol oxygen oxidoreductase (AOD) and samples of alcohol-containing fluids using a Clark-type amperometric oxygen electrode. Three samples of each beverage were run on the Analox using the manufacturer-provided 30% standard.

**Estimating the pour size.** In Delhi alone, actual containers were used to estimate poured volume of beverages during structured, closed-ended interviews in the study’s post-formative phase. Three different types of glasses commonly used for drinking alcohol in Northern India were used to help respondents report the amount of alcohol consumed per occasion. The glasses had a series of graduated volume measurements established with the aid of fluid (e.g. water) measured in a measuring jar. Drink sizes for the standard measure of liquor, ‘peg’, similar to a ‘shot’ in western countries were assessed for the following reasons. Key informants reported that distilled spirits were the most commonly consumed beverage, 90% of current drinkers who completed structured interviews in Delhi reported drinking spirits and spirits are typically not consumed in the standard package or bottle (unlike beer).

Prior to interviews, the interviewer marked the level of different standard drink sizes for distilled spirits in millilitres (e.g. 40, 60, 80 ml) on the three glass sizes. During the interview, respondents were asked to point to the level to which they filled a peg on the glass judged most similar to that they typically drank from. Markings on the glass were visible to both interviewer and respondent but the associated volume (ml) was visible to the interviewer alone. Similar methodologies for estimating pour size have been used to determine respondent-defined drink sizes in prior studies in the USA (Russell et al., 1997; Kaskutas and Graves, 2000).

### RESULTS

#### Types of beverages

Table 2 presents information on beverage types documented. Pre-mixed drinks with the ethanol concentration of 4.6% ABV (e.g. Bacardi Breezer) were recently introduced in India and included only in beverages assessed in Goa. All key informants across study sites reported distilled spirits to be the most commonly consumed beverages. Whiskey, Rum, Brandy, Vodka and Gin constitute ‘foreign liquors’ consumed in India and are available as either imported liquor or more often as Indian manufactured foreign liquor (IMFL) across India.

Licit country liquor, essentially by-products of authorized IMFL distilleries, is sold in Delhi and Rajasthan as ‘Desi Madira’ or ‘Desi Sharaab’ (40% ABV). Urack and Feni, the first and second distillate of fermented Cashew apples, and Feni distilled from the Coconut palm are consumed in Goa where locally produced liquor is legal. In Rajasthan’s Churu district, a commonly consumed country liquor included the illicit home-brewed, ‘Jhaad ki Ranj ki Daaru’ distilled from a mixture of raw sugar and the bark and roots of a berry-like (‘Ber’) bush.

#### Standard drink sizes

The standard drink unit for all distilled spirits was reported to be a ‘peg’. However, volumetric and pure alcohol gram

| Table 2. Beverage types available in Delhi, Churu (Rajasthan) and north Goa |
|-----------------------------|-----------------------------|-----------------------------|
| **Beverage**                | **Pure ethanol concentration** | **Available measures**     |
| Beer                        | 5%                          | Bottles—650 ml, 330 ml     |
| Strong beer                 | 8%                          | Bottles—650 ml             |
| Wine                        | 12–15%                      | Bottles—750 ml, Glass—90 ml, Bottles—750 ml |
| Indian-manufactured foreign liquor (IMFL) | 42.8%                    | Glasses (half ‘peg’)—30 ml, Peg—40–60 ml, Patiala or Burra peg—80 ml |
| Country liquor              |                             | Sachets—44 ml, 200 ml      |
| Desi sharaab (Delhi, Rajasthan) | 40–70%                    | Bottles—11, 750 ml, Glasses ‘peg’—40–60 ml, Patiala or Burra peg—80 ml, ‘Quarter’—180 ml, Glass (half ‘peg’)—30 ml |
| Daaru (Rajasthan)           |                             | Patiala or Burra peg—80 ml, ‘Quarter’—180 ml, Glass (half ‘peg’)—30 ml |
| Urack, Feni (Goa)           | 40–70%                      | ‘Pint’ or half bottle poured into a glass—375 ml, ‘Quarter’—180 ml, Glass (half ‘peg’)—30 ml |
| Pre-mixed drinks            | 4.6%                        | Bottle—275 ml             |

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ethanol concentration of region-specific beverages (see Table 3)

Alcoholmeter results indicated ethanol concentrations for Daaru as ranging from 43% (first distillate) to 87% (40 ml peg with 100 ml of water tested as 24.78% ethanol). Chemical analyses in Goa suggested ethanol concentrations of 14.3–26.5%, 25–45.1% and 17.1–38% for Urrak, Cashew Feni and Coconut Feni, respectively. The Analox Analyser AM3 analyses suggested similar averaged ethanol concentrations within the higher end of these ranges (Urrack: 26.5%, Cashew Feni: 36.8%).

Self-reported poured drink sizes

As described previously, ‘peg’ pour sizes were observed and measured at alcohol outlets and social gatherings in Goa and Rajasthan (see Table 1). In the Delhi study, respondent-specific pour sizes were investigated in detail for drinkers in the structured interviews in the post-formative phase. The volume that most respondents stated they typically poured for a ‘peg’ differed from the volume level they pointed to on the glasses. Specifically, the majority of respondents (85% or 85 of 101 drinkers) pointed to the 60 ml level as opposed to 40 ml for standard peg volume in Delhi. In contrast, for the Patiala (large) peg, volume indicated by respondents was consistent with typical standard volume for this peg measure (80 ml).

Key informants in Delhi also reported variable pour sizes for a peg of liquor. Respondents of lower socio-economic backgrounds reported that poured volumes for country liquor ranged from 30 to 250 ml and that at outlets, locally called ‘thekas’, a peg was measured as ‘3 capfuls’ (of a 750-ml bottle). The volume of a 750 ml liquor bottle cap was measured as 14 ml, which suggested that this reported pour size was indeed standard (40 ml). Variability in a peg of IMFL was also found in verbal responses of high and middle class key informants. Heavy drinkers reported higher volume ranges for a standard peg, specifically from 50 to 150 ml compared to those describing themselves as occasional drinkers who reported a standard peg to be 30 to 50 ml.

DISCUSSION

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 equivalents of pegs varied across sites (see Table 3) as well as within respondents at a given site. In Delhi and Rajasthan, for imported liquor and IMFL, and country liquor, a standard peg was described as 40 ml, a ‘Patiala’ or ‘Burra’ (large or double) peg as 80 ml. Several pours of the peg and the large, measured in rural Rajasthan (Churu) with a calibrated measuring jar, were found to be consistent (38–44 ml and 80 ml, respectively), thus confirming standard peg sizes. In Goa, a peg of any type of distilled spirits was observed to be 60 ml; half or small pegs were 30 ml. A metallic (steel) peg measure with two attached vessels to measure each type of peg was used in bars in Goa.

Drinking vessels or containers

Two types of glasses (110 ml and 140 ml) were used in Churu to consume home-brewed Daaru. Respondents in qualitative interviews independently described filling these glasses up to slightly over and under one-third high, respectively, translating to 37 and 45 ml pour sizes. These pour sizes were consistent with the standard 40 ml peg, verified independently with samples collected, and observed to be used at social gatherings by a ‘pourer’ keeping track of individual and group consumption. Daaru is also stored and sold in any available bottle, including IMFL (180, 750 ml), mineral water (1 litre) or soft drink (300, 500 ml) bottles. Thus, it is vital to assess the specific size to which the respondent is referring to when assessing Daaru consumption.
sizes may not be time or cost efficient (Greenfield and Kerr, 2008).

Consistent with prior work in developed countries (Martin and Nirenberg, 1991), we found differences in alcohol content in spirits, previously documented as the preferred beverage of drinkers in India (Benegal, 2005; Gaunekar et al., 2005). Unrecorded or illicit consumption comprises at least half of the total recorded alcohol consumption in India (Mohan et al., 2000; Benegal et al., 2003) and is reported to be higher than that of commercial alcohol in hazardous drinkers (Gauneker et al., 2004). Our study adds to the existing literature by providing detailed information on locally produced and consumed illicit high-strength spirits, such as Daaru in rural Rajasthan, and on the variability in alcohol content of spirits in India. Our findings also demonstrate the importance of assessing beverage type, %ABV, vessel and pour sizes, even of ‘standard’ measures in India. While the peg is a standard measure of liquor across India, the amount of pure ethanol consumed via the peg varies by region-specific beverage and the poured volume of the peg (13–28 g pure ethanol).

Like drinkers in developed countries (White et al., 2003; Kerr et al., 2005), those in our Delhi sample identified larger volumes for poured drinks than would be indicated by verbal self-report only. Stockwell and colleagues (2004) reported obtaining higher consumption estimates when detailed drink-size information, as opposed to standard drinks, were used. Similarly, we used respondent-defined peg pour sizes in our Delhi study to correct overall volume of consumption assessed in subsequently conducted structured interviews. For those respondents who reported drinking a regular peg of IMFL and pointed to the 60 ml level on the glass placed before them, the number of pegs was recorded as 1.5 and computed as equivalent to 20 g as opposed to almost 14 g for a regular 40-ml peg (see Table 3 for gram conversions).

A second important application of drink-size data is the improved identification of problematic alcohol use, defined typically as exceeding a threshold amount in standard drinks or grams of pure ethanol. For instance, the AUDIT (Babor et al., 1992; Saunders et al., 1993) assesses for the consumption of more than six (10 gm) drinks and necessitates combining information on different types of alcoholic beverages. For developing countries, like India, that have a wide variety of alcoholic beverages, including licit and illicit alcohol, beverage-specific information that integrates alcohol content, container and pour sizes is vital for better estimates of total volume of alcohol consumption and of problematic drinking.

Research from developed countries suggests that assessing and adjusting for larger pour sizes may be particularly critical for assessing consumption by heavy drinkers (Dawson, 1998; Kaskutas, 2000; Kerr and Greenfield, 2007). We did not have enough respondents to statistically analyse differences by drinker type. However, it is noteworthy that heavy drinkers reported higher volumes than ‘occasional’ drinkers for the drink unit (peg) of liquor. Research from developed countries also indicates larger discrepancies between pour and standard drink sizes for spirits than for other alcoholic beverages (Gual et al., 1999; Gill and Donaghy, 2004; Kerr et al., 2005) and that drinking at home is likely to involve larger pour sizes than that at alcohol outlets (Banwell, 1999). Most drinking reported for hazardous drinkers in India involved spirits and in northern India occurred in the home (Gauneker et al., 2004), suggesting 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 (Gill and O’May, 2007) 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 (Benegal, 2005; Benegal et al., 2005) and poverty-related health risks of poverty, presents a significant public health crisis (Neufeld et al., 2005) 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 (Saxena, 1997). 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 key areas. Future studies on factors that influence alcohol drink sizes and thereby estimates of consumption are needed.

Acknowledgements — This work was supported by the P50 AA05595 (Pilot studies component), P30 AA05595 (Method component) and R21 AA014773-02 grants from the National Institute on Alcohol Abuse and Alcoholism to the Alcohol Research Group. We thank the staff at the Indian Institute of Health Management Research, Sir Ganga Ram Hospital and Sangath for help with data collection.

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