

PATTERNS OF ALCOHOL CONSUMPTION IN THE SEYCHELLES ISLANDS (INDIAN OCEAN)

JEAN PERDRIX¹, PASCAL BOVET^{1,2,*}, DANIELLA LARUE², BERTRAND YERSIN³,
BERNARD BURNAND¹ and FRED PACCAUD¹

¹University Institute of Social and Preventive Medicine, Bugnon 17, 1005 Lausanne, Switzerland, ²Ministry of Health, Victoria, Seychelles and ³Department of Internal Medicine, University Hospital, 1011 Lausanne, Switzerland

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Abstract — Self-reported drinking habits were examined in a random sample of 1067 persons aged 25–64 years in the Seychelles, a country in epidemiological transition where consumption of home-brewed, mostly unregistered beverages has been traditionally high. Alcohol consumption was calculated from respondents reporting at least one drink per week ('regular drinkers'). Among men, 51.1% were regular drinkers and had average intake of 112.1 ml alcohol a day. Among women, 5.9% were regular drinkers and had 49.7 ml alcohol a day. Frequency of drinking, but not amount per drinker, was slightly less in the 25–34-year than older-age categories. Home-brews (mostly palm toddy and fermented sugar cane juice) were consumed by 52% of regular drinkers and accounted for 54% of the total alcohol intake reported by all regular drinkers. Based on the reported consumption by regular drinkers only, the average annual alcohol consumption amounted respectively to 20.7 litres and 1.2 litres per man and woman aged 25–64 years, or, using extrapolation, 13.2 litres and 0.8 litres per man and woman respectively of the total population. These values may underestimate the true figures by half, since reported beer consumption accounted for 53% of beer sales. Socio-economic status was associated strongly and inversely with home-brew consumption, but slightly and positively with consumption of commercially marketed beverages. Alcohol intake was associated with smoking, high-density lipoprotein cholesterol, carbohydrate-deficient transferrin and blood pressure, but not with age and body mass index. In conclusion, these data show high alcohol consumption in the Seychelles with an important gender difference, a large proportion of alcohol derived from home-brews, and opposite tendencies for the relationships between socio-economic status and home-made or commercially marketed beverages.

INTRODUCTION

Although few data on alcohol consumption and drinking patterns are available from the developing world (Ialomiteanu, 1998), increasing alcohol consumption is observed in developing countries, which may relate, among other factors, to economic growth, stress, conflict, availability (Acuda, 1982) and aggressive advertising (Aitken, 1989). A threefold increase in *per capita* alcohol consumption based on national sales has been observed in several of these countries over the last two decades, whereas trends were stable or decreasing in several Western countries (*World Drink Trends*, 1995).

Alcohol's impact in developing countries is of particular concern, because the production and consumption of wine, spirits and beer is growing in virtually every part of the developing world; beer consumption is growing faster in developing countries than in most developed countries, particularly as alcohol industries can develop quickly in nations with no industrial tradition as access to brewing, distilling, and wine production is relatively easy (Curry, 1988).

However, sales data do not generally account for the consumption of indigenous alcoholic drinks or alcohol produced illegally, which may be the major source of alcohol consumed in several developing countries (Kortteinen, 1988). Quantifying home-brew drinking therefore necessitates investigations relying on self-reported data. Such information may also help to answer questions on home-brew consumption patterns. This includes the extent to which populations of drinkers shift

*Author to whom correspondence should be addressed at: University Institute of Social and Preventive Medicine, Bugnon 17, 1005 Lausanne, Switzerland.

from home-brewed to factory-made beverages or vice-versa, the effect of cost on choice of beverage, the individual and country's socio-economic level and the changing attitudes regarding the status of particular beverages (Colson and Scudder, 1988; Ambler, 1990; Mukolo, 1992).

High alcohol consumption has been reported since the early history of the Seychelles. In 1852, 'the manufacture and consumption at almost every cottage of deleterious fermented drinks made from the sugar cane, pineapple and cocoa-nut' was noted (Seychelles Archives B-31:280). In 1903, the Governor reported 'high numbers of police prosecutions for drunkenness' and believed that 'the great increase in drinking was due to the increasing amount of wages in circulation' and that 'more education was needed' (Seychelles Archives C/AM/8). Based on the number of licensed palm trees producing toddy, locally produced beer and imported other drinks, excluding baka and other home-brews, men over the age of 15 were reported to drink 3 litres of alcoholic beverages per day in 1972 (Benedict and Benedict, 1982). In the 1970s, alcohol consumption *per capita* (excluding home-brews) was higher in the Seychelles than in Britain for example (Finnish Foundation for Alcohol Studies, 1977). Although drinking has been a long-standing problem in the Seychelles, little is known about alcohol consumption patterns, particularly as regards the consumption of indigenous, mostly unregistered home-brews, and the factors associated with drinking. This paper therefore aims at quantifying alcohol consumption from both marketed beverages and indigenous drinks and at identifying correlates of alcohol consumption in the Seychelles islands (Indian Ocean) using self-reported data from a fairly large population-based health survey. Before proceeding, however, it may be useful to give here some relevant background information on the Seychelles.

The Seychelles

The Republic of Seychelles consists of 115 islands in the Indian Ocean, ~1800 km east of Kenya and 1800 km north of Mauritius. The climate is tropical with abundant vegetation throughout the year. After having been administered by France until 1815, then by the United Kingdom, the Seychelles gained political independence in 1976. According to a national census in 1994, the total population was 73 442 and 30.4% of the population was less than

15 years old, 49.3% less than 25, while only 5.6% aged 65 years or more (thus 45.1% was aged 25–64 years). Around 89% of the total population live on the largest island, Mahé. Approximately 65% of the population is of black African descent, 10% of Caucasian descent, 5% of Indian or Chinese descent, and 20% mixed between these various groups. The standard of living has improved markedly in recent decades, which is concurrent with a dramatic increase in the tourism industry following the opening of an international airport in 1971. The gross domestic product (GDP) *per capita* increased from US\$ 600 in 1976 to US\$ 5850 in 1994 and the World Bank considered the Seychelles to be a middle-income country.

Social background of Seychellois society

The islands had no indigenous population until French colonizers settled in 1770, joined by African slaves or indentured African labourers released from slave ships and, later, by small numbers of Indian and Chinese immigrants (Fauvel, 1909). The African population came from East and Central Africa and Madagascar but was unable to retain any tribal organization after arriving in the Seychelles under conditions of slavery and indenture (Fauvel, 1909). Due to economic reliance on cash crops (e.g. vanilla, cinnamon) rather than food crops, it has been claimed that the Seychellois society has not developed long-standing traditions and has relied much on the exchange of goods, particularly money, to regulate interpersonal relations (Benedict and Benedict, 1982). Consequently, the different earning capacities between genders (men earning wages and women doing housework) have been alleged to provide important clues for understanding the contrasting behaviours, including drinking habits, between men and women. Beginning with culture traits derived from France by way of Mauritius and to a lesser extent from Africa and the East, and later from Britain, the Seychellois people have developed their own way of doing things and they share the same language, customs, religion, and values (Benedict, 1966). This homogeneity and distinctiveness about the culture of the Seychelles contrasts, for example, with the plural society of neighbouring Mauritius where French, English, Indian, and Chinese cultural traditions have been maintained by various sections of the population (Benedict, 1961). The Seychelles has experienced dramatic socio-economic development

over the last two decades, which is likely to have accelerated acculturation phenomena. In many respects, the Seychelles may now resemble more other rapidly developing small tropical island states than continental Africa, to which Seychelles geographically belongs.

Alcohol drinking in the Seychelles

The common alcoholic beverages available in the Seychelles are commercially marketed beer, spirits and wines and indigenous home-brews produced at home or in semi-commercial plants. More than 90% of the beer consumed is produced locally (Lager, Guinness) whereas spirits and wines are imported. Of the home-brews, 'kalou' or palm toddy is made of fermented palm sap, 'baka' of fermented sugar-cane juice, and 'lapire' of fermented juice of various vegetables (e.g. potatoes, lentils) or fruit. Baka and lapire tend to be considered together (consequently referred to as 'baka') and are often enriched with commercial sugar. All home-brews are usually consumed within days of the fermentation being completed. A survey conducted in 1996 by the Seychelles Breweries Ltd indicated that there were 544 outlets (one for 137 inhabitants; all licensed) selling beer, wines and spirits, and 1055 outlets (one for 71 inhabitants; 22 licensed) selling home-brews (personal communication by M. Racombo, sales and distribution manager, Seychelles Breweries Ltd). Availability and price of both commercially marketed and home-brews do not materially vary over time or across regions of the country.

As regards consumption patterns, male labourers would traditionally stop by the yard of a seller of toddy or baka, purchase a bottle, drain it, and go on their way. Men may also meet with neighbours or workmates near a shop, at a home-brew seller's, on the beach or on the roadside and have a few beers or some home-brew while chatting or playing dominoes. Men traditionally do not bring alcoholic beverages (particularly home-brews) to their own houses, as this is apt to engender disputes with their wives, often on the basis that alcohol consumption drains money from the household budget. However, alcoholic beverages are consumed in large amounts, particularly by men, at parties held at home to celebrate important family events (e.g. first communions, confirmations, Christmas, New Year) or in community events (e.g. fancy fairs for the patron saint of a village or a church).

SUBJECTS AND METHODS

Study sample

The Seychelles Heart Study II was conducted from July to December 1994. Details of methods have been described elsewhere (Bovet *et al.*, 1997). Sampling was done using a simple age- and sex-stratified random sample of all residents aged 25–64 years living on the island of Mahé. Using computed population data from a census carried out in 1987, which were thereafter regularly updated by the administrative authorities, 160 subjects were selected randomly within each of the eight sex- and 10-year strata. Among the initial sample of 1280 eligible subjects, 28 men and 26 women were dead or abroad at the time the study was carried out and were consequently excluded, so that 1226 subjects were eligible to participate in the study. Overall, 1067 out of the eligible 1226 individuals attended the study, a response rate of 87.0% (82.4% for men and 91.7% for women). Letters inviting the participants to the study could not be delivered by the postal services and were returned unopened to the study centre for 38 (24%) out of the 159 eligible persons who did not attend the study.

QUESTIONNAIRE AND ALCOHOL CONSUMPTION

A questionnaire was designed in the local Creole language and administered by three experienced Seychellois nurses in a face-to-face interview lasting ~30 min. The questionnaire included 207 questions pertaining to socio-demographic context, educational level, occupation, cardiovascular risk factors and dietary habits, as well as to knowledge and attitudes on health, cardiovascular risk factors and related behaviours, including drinking. The recorded consumption of fruits, vegetables, and non-alcoholic drinks was based on consumption reported for the previous day and consumption of alcohol, fish, and meat on average weekly consumption. A description of the current or last job was requested, and occupation was categorized in five groups. Body mass index (BMI) was calculated as body weight (kg) divided by height squared (m²). Blood pressure was determined on the basis of the average of the last two out of three readings,

taken with a mercury sphygmomanometer after subjects had been sitting in a quiet environment for at least 30 min.

Questions on alcohol drinking followed the questions on dietary habits. A frequency question was first used to filter regular drinkers. Thus, all participants were first asked the closed-end question 'how frequently, on average, do you usually drink any alcoholic beverage' (referred to hereafter as 'a drink'). The possible answers were 'never', 'only on some occasions but less than once a week on average', 'once or twice a week on average', 'every other day on average', 'almost every day or every day'. Persons reporting having a drink less often than 'once or twice a week' and not 'never' were categorized as 'occasional drinkers' and were not further questioned about their drinking habits. Persons reporting to have a drink at least as frequently as 'once or twice a week on average' were considered as 'regular drinkers' and were further systematically questioned, using five separate questions, about their weekly average consumption of bottles of beer, bottles of kalou, bottles of baka or lapire, glasses of wine, and measures of spirits (e.g. 'On average, how many bottles of beer do you drink in a week, including the week-end?'). Noticeably, alcoholic beverages including home-brews are generally available only in limited measures in the Seychelles.

The average daily intake of alcohol (ethanol) in regular drinkers was calculated from the reported number of units of alcoholic beverages and content of alcohol of each type of beverage. The following values were used for volume per unit of alcohol beverage and alcohol content: beer (0.3 litre bottle; 5.45 vol%), spirits (0.05 litre measure; 43 vol%), wine (0.2 litre glass; 12 vol%), kalou (0.75 litre bottle; 8 vol%), baka and lapire (0.75 litre bottle; 9 vol%). The average alcohol content of beer was weighted for the contribution of 'Guinness' and 'Lager', which amount, respectively, to about 20% and 80% of sales, and contain, respectively, 7.5 vol% and 4.9 vol% alcohol. In this study, heavy drinkers were defined as having a calculated average alcohol intake of ≥ 100 ml alcohol a day.

The alcohol content of home-brews was determined from eight samples of each of the three local brews, which were collected in 1996 at several semi-commercial plants throughout the country. Their alcohol content was analysed at the

Laboratory of Analytic Toxicology, Institute of Legal Medicine, University of Lausanne, Switzerland, less than 2 weeks after they were purchased. Analysis was performed by gas chromatography with flame ionization detection, introduction by head-space and direct injection, and separation on either Carbowax 20 (partition chromatography) or Chromosorb 102 (adsorption chromatography). The analyses did not reveal significant amounts of formaldehyde, which indicated that no lactic acidosis had occurred in the samples before analysis. No significant amount of methanol was detected. Analyses of home-brews conducted in 1989 in a UK laboratory on fewer samples showed similar alcohol contents (Pinn and Bovet, 1991).

The estimated daily and annual consumption *per capita* of the total population aged 25–64 was based on the age-adjusted alcohol consumption reported by regular drinkers only (drinking by occasional drinkers was assumed to be zero). For the estimates *per capita* extrapolated to the entire population, it was assumed that subjects aged up to 17 years did not drink alcohol and that consumption in the population aged 18–24 and above 64 years was equal to that of the age-adjusted consumption in the population aged 25–64. The age cut-off value for drinking was set at 17 years, as nearly all Seychellois adolescents aged 16–17 attend a boarding school (National Health Service) where alcohol is unavailable. The validity of the study estimates was assessed by comparing reported beer consumption, extrapolated to the entire population, with sales data in the country (6.23 million litres in 1994) adjusted for the estimated consumption by tourists (0.67 million litres).

Blood analyses

Total cholesterol and high-density lipoprotein (HDL)-cholesterol were analysed at the Laboratory of Lipids, University Medical Polyclinic, Lausanne, Switzerland, using the enzymatic CHOD/PAP method (Roche, Basel, Switzerland). Low-density-lipoprotein (LDL) cholesterol was determined by the Friedewald formula. Carbohydrate-deficient transferin (CDT) was measured using a radioimmunoassay (CDTect, Kabi Pharmacia Diagnostics, Upsala, Sweden). Detailed methods and results of these and other biochemical investigations, in relation to alcohol consumption, have been published elsewhere (Fontana *et al.*, 1999).

Statistical analysis

Statistical differences for continuous or categorical variables were tested with the *t*-test and the Fisher's exact test, respectively. Trend across ordered groups was tested with Cuzik non-parametric trend test (an extension of the Wilcoxon rank-sum test). Multivariate logistic regression was carried out to estimate the independent association between heavy drinking and selected variables. Education, economic and occupational variables were examined in two different models, as over-control or unstable estimates due to co-linearity could result if these two groups of variables, several of which strongly correlate, were considered simultaneously. Estimates for the actual population aged 25–64 years were obtained by adjusting sex- and age-stratified estimates with weights equal to the inverse probability that an observation was sampled from the actual population in 1994.

Analyses were performed using Stata for Windows 5.0 (Stata Corporation, College Station, Texas, USA). Two-sided *P* values ≤ 0.05 were regarded as significant.

RESULTS

Alcohol consumption

Among men aged 25–64 years, 14.2% reported never drinking alcohol, 34.7% drinking any alcoholic beverage less often than once a week ('occasional drinkers'), and 51.1% drinking at least one alcoholic beverage a week ('regular drinkers'). Further quantification of alcohol patterns was limited to regular drinkers (as drinking by occasional drinkers was not quantified in this study). Table 1 shows the proportions of regular drinkers by type

Table 1. Proportion of male regular drinkers and corresponding average daily alcohol intake, by age category and type of beverage

	Age category (years)				
	25–34 (<i>n</i> = 119)	35–44 (<i>n</i> = 124)	45–54 (<i>n</i> = 132)	55–64 (<i>n</i> = 129)	25–64* —
Beer					
Drinkers (%)	38.4	56.5	43.2	44.9	45.3
Alcohol (ml/day)	36.5	42.4	38.7	35.2	38.8
Spirits					
Drinkers (%)	14.2	16.1	12.9	20.2	15.3
Alcohol (ml/day)	57.8	30.1	42.3	37.3	44.0
Wine					
Drinkers (%)	5.8	8.1	5.3	4.6	6.2
Alcohol (ml/day)	24.0	19.5	25.5	14.3	21.6
Kalou					
Drinkers (%)	5.0	10.5	10.6	7.7	7.8
Alcohol (ml/day)	65.7	50.8	81.4	36.0	59.6
Baka					
Drinkers (%)	14.2	27.4	27.3	28.7	22.2
Alcohol (ml/day)	114.0	125.4	119.5	112.8	119.0
Any home-brew (kalou, baka, lapire)					
Drinkers (%)	15.0	31.4	29.6	31.0	24.4
Alcohol (ml/day)	129.6	126.2	139.5	113.4	127.6
Any commercially marketed alcoholic beverage (beer, spirits, wine)					
Drinkers (%)	40.0	56.5	45.5	47.3	46.7
Alcohol (ml/day)	56.6	51.9	45.0	46.8	51.6
Any alcohol drink					
Drinkers (%)	41.7	58.9	52.3	51.2	51.1
Alcohol (ml/day)	99.3	119.3	122.0	113.8	112.1

Percentages refer to regular drinkers of specified beverage(s) in relation to the total number of men in the corresponding age group.

*Estimates are adjusted for the actual age distribution of the population.

n = no. of subjects.

Table 2. Age-adjusted average self-reported alcohol intake *per capita* aged 25–64 years

Beverage	Men aged 25–64		Women aged 25–64		Total	
	ml/day	(%)	ml/day	(%)	ml/day	(%)
Beer	17.6	(31.0)	1.1	(32.4)	9.5	(31.0)
Spirits	6.7	(11.8)	0.7	(20.6)	3.8	(12.4)
Wine	1.3	(2.3)	0.1	(2.9)	0.7	(2.3)
Kalou	4.7	(8.3)	0.2	(5.9)	2.5	(8.2)
Baka	26.4	(46.6)	1.3	(38.2)	14.1	(46.1)
Total (ml/day)	56.7	(100)	3.4	(100)	34.3	(100)
Total (litres/year)	20.7	—	1.2	—	12.5	—

of beverage and the corresponding mean daily self-reported intake for each of the considered beverages among men (medians were approximately equal to two-thirds of most of the means). Among men aged 25–64 years, 45.3% reported drinking beer, 15.3% spirits, 6.2% wine, and 24.4% any type of home-brews. Fewer men drank home-brews than registered beverages (24.4% vs 46.7%; $P < 0.001$) but drinkers of home-brews had higher alcohol intake from home-brews than drinkers of registered beverages from registered beverages (127.6 vs 51.6 ml/day; $P < 0.001$). Few drinkers of home-brews (14%) did not consume registered beverages as well. Drinkers of home-brews had daily alcohol intake from commercial beverages similar to that of drinkers who did not drink home-brews (respectively 51.3 vs 48.2 ml per day; $P = 0.8$) and this amount was not different in drinkers who drank home-brews in high (>100 ml) or moderate (1–100 ml) daily amounts (respectively 51.7 vs 51.0 ml; $P = 0.9$). Drinkers had a daily average intake of 112.1 ml (SD = 120) of alcohol. There were fewer drinkers among men aged 25–34 than 35–64 (41.7% vs 55.2%; $P = 0.012$), but intake was not statistically different in these categories (respectively 99.3 vs 113.1 ml a day; $P = 0.2$).

Among women aged 25–64 years, 45.9% reported never drinking alcohol, 48.3% drinking less than one drink a week on average ('occasional drinkers') and only 5.8% drinking at least one drink a week on average ('regular drinkers'). Female regular drinkers reported a fairly high average intake (57 ml a day, SD = 56). Among female regular drinkers, 72% drank beer, 43% spirits, 10% wine, 14% kalou, and 23% baka (25% drank any type of home-brews). Women drinking home-brews had higher daily intake of alcohol (105 ml derived from

home-brews and 131 ml from any source) than women who did not drink home-brews (47 ml). Other patterns were not analysed in detail for women, because of the small numbers of female regular drinkers.

Table 2 shows *per capita* alcohol consumption in the entire population aged 25–64 years, based on drinking by regular drinkers. Average alcohol consumption was much higher in men than in women. As regards the source of alcohol consumed, 54% came from home-brews and 31% from beer. Annual *per capita* consumption was 20.7 litres per man and 1.2 litres per woman aged 25–64 years, or, after extrapolation to the entire population, 13.2 litres per man, 0.8 litres per woman (7.9 litres per inhabitant). Beer consumption in the entire population estimated from the study amounted to 3.00 million litres, i.e., 53% of the 5.56 million litres sold to inhabitants in 1994.

Alcohol consumption in men in relation to other variables

Socio-economic status (SES). The relationship between alcohol intake and occupation is shown in Table 3. There were sharply contrasted drinking patterns between unskilled manual workers (e.g. labourers) and skilled non-manuals (e.g. teachers, nurses, higher professionals, executives), with intermediate consumption patterns being observed in the categories of skilled manuals (e.g. carpenters, mechanics) and unskilled non-manuals (e.g. clerks, unqualified sales persons). Compared to unskilled manuals, skilled non-manuals drank smaller amounts of alcohol (61.3 vs 132.6 ml a day; $P < 0.001$) and less often (37.7% vs 59.7%, $P < 0.001$). The difference resulted mostly from a drastically smaller consumption of home-brews by skilled

Table 3. Proportion of male regular drinkers and corresponding average daily alcohol intake, by occupational category and type of beverage

	Occupational category				
	Fishermen and farmers (<i>n</i> = 37)	Unskilled manuals (<i>n</i> = 221)	Skilled manuals (<i>n</i> = 107)	Unskilled non-manuals (<i>n</i> = 56)	Skilled non-manuals (<i>n</i> = 77)
Any commercially marketed alcoholic beverage (beer, spirits, wine)					
Drinkers (%)	43.2	52.0	49.5	46.4	37.7
Alcohol (ml/day)	55.1	48.3	66.1	40.7	62.7
Any home-brew (kalou, baka, lapire)					
Drinkers (%)	18.9	41.6	23.4	19.6	1.3
Alcohol (ml/day)	146.9	132.7	96.7	141.0	19.3
Any alcohol drink					
Drinkers (%)	46.0	59.7	49.5	48.2	37.7
Alcohol (ml/day)	112.3	132.6	111.7	93.2	61.3

Percentages refer to regular drinkers of specified beverage(s) in relation to the total number of men in the corresponding job category group.
n = no. of subjects.

non-manuals than unskilled non-manuals, both in frequency (1.3% vs 41.6%; $P < 0.001$) and amount (19.3 vs 132.7 ml a day; $P < 0.001$). In contrast, the consumption of commercial alcoholic beverages was higher in skilled workers, both white and blue collar, compared to unskilled workers, both white and blue collar. High educational attainment (as assessed by having attended secondary school or mastering English or French) and high economic status (as assessed by car ownership or having travelled abroad) were both associated with low alcohol intake (Table 4). However, a J-shaped relation was observed between several SES variables and alcohol intake, with highest SES being associated with light drinking (1–29 ml a day). There was a non-significant trend of fewer heavy drinkers being married or currently employed. Alcohol intake did not relate to the number of persons per household.

Diet, smoking and physiological variables. There was a strong inverse relationship between alcohol intake and fruit or vegetable consumption, while no significant trend was found for fish (consumed every day by most persons) and meat (rarely consumed by most persons). Smoking was strongly associated with alcohol intake. Alcohol intake related directly with physiological variables, such as CDT, HDL-cholesterol and blood pressure. Age and body mass index showed no substantial

relationship to alcohol intake and therefore could not account for the observed associations (Table 4).

Knowledge, attitude and practice on health and alcohol. Compared to non-drinkers or light drinkers, heavy drinkers tended to consider themselves less healthy, and had visited a doctor over the last 12 months more often. The proportion of persons reporting being unfit to work over the last 4 weeks was similar among non-drinkers and heavy drinkers, but lower among light or moderate drinkers. A similarly large proportion of individuals in all alcohol intake categories reported doing their best to keep healthy. Almost all drinkers and non-drinkers were aware of the harmful effects of alcohol on health. Heavy drinkers did not perceive less than non-drinkers that they were doing their best to keep healthy. Heavy drinkers expressed more often than light drinkers the wish to cut down drinking, but there was a non-significant inverse trend for heavy drinkers to have done so (Table 4).

Factors associated with heavy drinking. Table 5 shows multivariate analysis results carried out to examine which variables were independently associated with high alcohol intake (admittedly the cross-sectional design of the study precludes the distinction between cause and consequence). Blue-collar workers were 10–16 times more likely

Table 4. Distribution of various characteristics within categories of alcohol intake in men

Parameter	Alcohol intake (ml/day)				P for trend
	0* (n = 247)	1-29 (n = 48)	30-99 (n = 112)	≥100 (n = 98)	
Alcohol intake					
Total alcohol (ml/day)	0*	17.4	57.3	232.6	—
Commercially marketed beverages (ml/day)	0*	16.5	41.7	75.1	—
Home-brews (ml/day)	0*	1.0	15.6	157.5	—
Demographic variables					
Age (years)	44.3	41.3	46.5	45.3	ns
Selected socio-economic variables					
Married (%)	41.3	39.6	47.3	28.6	ns
Number of persons living at home	4.8	5.0	4.9	5.0	ns
Has current paid job (%)	80.2	85.4	88.4	75.5	ns
Heavy occupation (%)	8.9	14.6	20.5	26.5	0.000
Has completed secondary education (%)	23.8	41.7	19.6	8.2	0.002
Understands well English or French (%)	69.2	80.5	65.2	44.4	0.001
Has been abroad (%)	42.1	47.9	37.5	17.3	0.001
Owens a car (%)	24.3	27.0	31.3	8.2	0.003
Health					
Feels in good or excellent health (%)	49.0	45.8	45.5	37.7	0.082
Says he does his best to keep healthy (%)	89.9	77.1	92.8	89.8	ns
Thinks he should do more for his health (%)	17.8	29.1	22.3	24.5	ns
Visited a doctor ≥1 time during last 12 months (%)	72.9	75.0	76.7	81.6	0.091
Unable to work ≥1 day during last 4 weeks due to illness (%)	15.0	10.4	11.6	15.3	ns
Alcohol consumption					
Knows that much alcohol harms health (%)	98.8	97.9	99.1	95.9	ns
Would like to reduce intake (%)	NA	62.5	70.5	89.8	0.000
Has tried to reduce intake during last 12 months (%)	NA	54.1	70.5	60.0	ns
Reports decreased intake in last 12 months (%)	NA	62.6	65.2	53.1	ns
Diet variables					
Fish ≥once daily (%)	83.4	85.4	84.8	88.7	ns
Meat ≥once weekly (%)	35.6	31.2	41.9	30.6	ns
Fruit ≥1 on previous day (%)	44.5	37.5	34.8	20.4	0.000
Vegetables ≥1 serving on previous day (%)	42.5	43.7	38.4	15.3	0.002
Tea (cups a day on average)	2.62	2.56	2.31	1.69	0.000
Clinical variables and smoking					
Body mass index (kg/m ²)	24.1	23.9	24.5	23.6	ns
Blood pressure (mm Hg)†	103.7	103.5	109.8	110.6	0.001
HDL-cholesterol (mmol/l)	1.42	1.54	1.51	1.82	0.000
LDL-cholesterol (mmol/l)	3.33	3.15	3.24	2.67	0.000
Carbohydrate-deficient transferrin (U/l)‡	22.5	29.3	27.7	41.0	0.000
Cigarette smoking (%)	25.5	45.8	41.9	67.3	0.000

*This category also includes occasional drinkers (less than one alcoholic beverage a week on average).

†Calculated as: (systolic BP + 2*diastolic BP)/3.

‡Only for African men (n = 333).

n = no. of subjects; HDL = high-density lipoprotein; LDL = low-density lipoprotein; ns = not significant; BP = blood pressure.

to be heavy drinkers than skilled non-manuals. Similarly, subjects with lower educational attainment and lower economic status tended to be more likely to be heavy drinkers. Smoking was also strongly related to heavy drinking.

DISCUSSION

Based on the consumption by persons reporting drinking at least once per week, this study shows high annual alcohol consumption in the Seychelles,

Table 5. Association between selected variables and heavy drinking (≥ 100 ml alcohol a day) in men

	Univariate analysis		Multivariate analysis (1)*		Multivariate analysis (2)*	
	OR	95% CI	OR	95% CI	OR	95% CI
Age (vs 25–64)						
35–44	1.61	0.88–2.95	1.39	0.68–2.83	1.55	0.74–3.24
45–54	1.07	0.53–2.16	2.17	1.14–4.16†	2.05	1.07–3.92†
55–64	0.73	0.36–1.50	1.49	0.79–2.80	1.40	0.74–2.62
Job (vs skilled non manual)						
Unskilled non manual	3.03	0.62–14.7	3.95	0.78–19.8	—	—
Skilled manual	12.71	2.88–56.0†	11.85	2.58–54.2†	—	—
Farmer or fisherman	19.68	4.02–96.3†	16.88	2.61–53.9†	—	—
Unskilled manual	16.44	4.00–67.7†	16.64	3.19–86.4†	—	—
Social						
Currently employed (vs not)	1.02	0.65–1.62	0.94	0.54–1.60	1.02	0.60–1.72
Married (vs not)	0.52	0.33–0.81†	0.60	0.36–0.98†	0.63	0.38–1.05
Education						
Secondary school (vs not)	0.68	0.51–0.89†	—	—	0.60	0.25–1.43
Masters well English or French (vs not)	0.33	0.22–0.50†	—	—	0.55	0.33–0.91†
Economic level						
Owns a car (vs not)	0.40	0.19–0.83†	—	—	0.93	0.42–2.25
Has been abroad (vs not)	0.31	0.19–0.52†	—	—	0.55	0.30–0.99†
Smoking						
Yes (vs not)	9.68	6.22–15.1†	8.65	5.42–13.8†	8.77	5.52–13.9†

*Multivariate analysis in model 1 and model 2 included all listed variables.

† $P < 0.05$.

OR = odds ratio; 95% CI = 95% confidence interval.

with 20.7 litres per man and 1.2 litres per woman aged 25–64 years. It is known that a large proportion of the total alcohol consumed in a population is consumed by no more than 50% of the heaviest drinkers, so that the contribution of occasional drinkers would be small (Ledermann, 1964). High alcohol consumption in the country is consistent with a large proportion of the household budget being spent on alcohol [20% in the 1960s and 1970s (Benedict and Benedict, 1982) and 22% in 1983 and 1993 (Larue, 1996)] and with high rates of alcohol-related hospital admissions [33% of male admissions to medical wards (Pinn and Bovet, 1991) and 38% of all admissions to psychiatric wards (Jeyakumar, 1999)].

Using the same 25–64-year age group and similar methods, self-reported annual alcohol consumption was 20.4 litres per man and 1.3 litres per woman in the Seychelles compared to 9.4 litres per man and 3.3 litres per woman in Switzerland (Schmid and Gmel, 1996). Given that reported data

underestimate sales data, possibly by a half, the reported annual consumption *per capita* extrapolated to the entire population (7.9 litres) seems high in the Seychelles, compared to sales *per capita* in other countries, e.g. 11.4 litres in France, 9.7 litres in Switzerland, 7.5 litres in the United Kingdom, 3.8 litres in Cuba, or 1.6 litres in Singapore (*World Drink Trends*, 1995). Interestingly, a very high alcohol consumption was reported in Guadeloupe, a Caribbean island sharing with the Seychelles a tropical climate and a Creole culture (Moutet *et al.*, 1989). In contrast, alcohol consumption seemed lower in neighbouring Mauritius than in the Seychelles, with 17.6% of men and 0.7% of women reporting drinking at least three standard drinks per day in Mauritius (Pereira, 1998).

More than half of total alcohol intake in the population was derived from unregistered beverages. Home-brews were consumed only by a minority of the population (~20% of men and a few per cent of women), mostly of low socio-economic status

(e.g. labourers). However, home-brew drinkers consumed a particularly high amount of alcohol derived from these home-brews. Noticeably, drinkers of home-brews drank, in addition to home-brews, as much commercial beverages as drinkers who did not drink home-brews.

Self-reported, rather than sales, data were used in this study to enable an evaluation of the consumption of unregistered beverages in the population to be made. Questionnaires standardized for quantity and frequency for investigating weekly consumption, as used in this study, have been shown to be reliable instruments for measuring alcohol intake (Babor *et al.*, 1987). For example, a food-frequency questionnaire has been shown to measure alcohol intake by regular drinkers as reliably and validly as a reference method consisting of repeated 7-day dietary records (Ferraroni *et al.*, 1996). In addition, our study showed a dose-dependent relation of reported alcohol intake with classical indicators, such as CDT, which is a reliable biological marker of alcohol consumption in clinical populations (Kapur *et al.*, 1989; Stibler, 1991; Yersin *et al.*, 1995), HDL-cholesterol (Robinson *et al.*, 1987; Hartung *et al.*, 1990; Sillanaukee *et al.*, 1993), and blood pressure (Beilin and Puddey, 1992; Klag *et al.*, 1993). However, the total annual consumption of beer, as estimated from our self-reported data and extrapolated to the entire population, amounted to only 53% of the total sales in the country, as officially reported. The magnitude of underestimation between self-reported and sales data in the Seychelles compares with that found in other surveys assessing self-reported consumption, which typically ranged from 40 to 60% (Pernanen, 1974; Midanik, 1982; Gmel, 1996). Moreover, the discrepancy between reported consumption and sales data in the Swiss study was similar across various types of alcoholic beverages (Gmel, 1996), which suggests that the degree of under-reporting of beer consumption in the Seychelles could apply equally to other types of beverages.

There are several possible reasons for the under-reporting of drinking. (1) The design of this study did not permit us to quantify drinking by occasional drinkers (defined as persons drinking less than one alcoholic beverage per week). (2) This study could not account for drinkers denying their drinking. (3) Regular drinkers often deny or overlook binge drinking and its extent is underestimated by

questions on average weekly consumption. (4) Social desirability is likely to occur whereby subjects interviewed by health professionals tend to under-report the amount they consume. It is conceivable that such sources of underestimation may apply more to women than men in this study, given the larger social tolerance for men's than women's drinking in the Seychelles. Overall, it is likely that our data correctly rank the distribution of alcohol consumption, but underestimate the true alcohol consumption, possibly by half.

Drinking, mainly by men, is not a recent problem in the Seychelles, and various underlying factors should be mentioned. First, alcohol is widely available throughout the country and home-brews can be purchased at low price at any time of the year. Second, alcohol drinking is an important aspect of male culture in the Seychelles. Benedict and Benedict (1982) emphasized that, while drinking is an integrated part of men's recreational activities and social network, women who drink have been exceptions and are generally regarded as playing an inappropriate male role or considered a kind of social failure, condemned by men and women. In their investigation of the Seychelles society of the 1970s and early 1980s, these authors also described how monetary and social demands from wives, mistresses, children, parents and friends result in pressure upon older men (particularly those likely to earn lower income as they get older, e.g. labourers) and how men can be caught in a system of expectations and demands over which they have little control, with drinking as a response. Third, drinking also results from peer pressure (Kandel, 1986; Morgan and Grube, 1991). Though boys receive some introduction to drinking at home in the Seychelles, the habit becomes ingrained in the company of their peers and drinking becomes part of the camaraderie that helps bring young male peer groups together. For example, men who fish together usually drink together after they have sold their catch. More generally, it has been suggested that men drink alcoholic beverages to attain or regain a feeling of strength and that low male solidarity, the absence of unilineal descent groups, and the lack of ritualization of male activity are correlated with drinking (Boyatzis, 1976). The absence of a strong father-son tie also appears to be correlated with drinking (Schaefer, 1976). All these features characterize low-income Seychellois and have been claimed to

result from a long history of dependency and powerlessness since the eighteenth century (Benedict and Benedict, 1982).

The relationship between the SES and alcohol consumption was found to depend on which type of beverage was considered (however, these analyses were restricted to men due to the small number of female regular drinkers). Men of high SES reported much lower consumption of home-brews than men of low SES, and consequently the former also had substantially lower overall alcohol consumption than the latter. However, men of high SES consumed larger amounts of commercially marketed beverages, which may relate to their larger purchasing power (the cost per alcohol unit being currently at least five times higher for beer or spirits than for any home-brew). Remarkably, marriage and size of household were not substantially associated with alcohol consumption, which is consistent with the common finding in the Seychelles that heavy (male) drinkers are generally not socially deprived, unlike heavy drinkers in Western countries (Room, 1977; Clark and Hilton, 1991), which is further evidence of the high social tolerance for men's drinking in the country. Our finding that heavy drinkers had a poorer diet, particularly that they ate less vegetables and fruits than light drinkers (partly because alcohol intake displaces nutrient-rich foods from the diet), points to their increased risk of developing alcohol-related and nutrient-deficiency diseases, and is consistent with the high prevalence rates of alcohol-related illnesses and possibly thiamine-deficient dilated cardiomyopathy in Seychellois men (Pinn and Bovet, 1991; Bovet *et al.*, 1998).

Almost all drinkers and non-drinkers knew that large amounts of alcohol harm health (analyses restricted to men in this study). Interestingly, heavy drinkers did not report making less effort to keep healthy, compared to moderate or non-drinkers, possibly from their personal experience of disease or from their increased exposure to medical advice (heavy drinkers visited a doctor more often than moderate or non-drinkers). Moreover, heavy drinkers tended to report more often than moderate drinkers their wish to cut down their drinking, though heavy drinkers tended to report smaller actual reduction in alcohol intake over the preceding year than moderate drinkers. This contradiction may relate to addiction or to heavy drinkers tending to use avoidance coping responses to

manage life stressors or challenges (Moos *et al.*, 1990).

The results of this study have several public health implications. Increasing taxation on alcoholic beverages is a powerful means of decreasing both average consumption in the population and the number of alcohol abusers, provided it applies to all alcoholic beverages (Levy and Shelfin, 1983; Baltagi and Goel, 1990). This may, however, not fully apply to the Seychelles, as large-scale, semi-commercial and private production of home-brews in the country easily escapes control and taxation. These limitations of regulatory measures underscore the role of sustained health education as an important tool for curbing consumption and abuse of alcohol (Grant and Room, 1983). However, by showing that the population in general and heavy drinkers in particular are well aware of the harmful effects of alcohol on health, the study findings also suggest that educational programmes designed to impress upon people the harmful effects of alcohol may be unlikely to change attitudes and to deter either the heavy drinkers or the general population from drinking. Instead, measures designed to strengthen social support and mechanisms for coping with alcohol consumption, directed at the public (e.g. incentives to promote non-alcoholic drinking) and at alcohol abusers (e.g. Alcoholics Anonymous, telephone 'hotline', rehabilitation programmes) may be more effective. It would also be particularly relevant to gain more knowledge on the role of alcohol in the Seychellois society, so that healthier norms and specific culturally sound measures can be worked out efficiently.

It may be speculated that a future reduction in home-brew drinking will be an important factor favouring a decrease in the overall per-capita consumption, as the country experiences further socio-economic development. However, factors favouring an increase in alcohol consumption could include the facts that increasing socio-economic development enables a larger number of persons to afford to buy commercial alcoholic beverages and that Seychellois women, who traditionally had little economic purchasing power and very low alcohol consumption, are likely to increase their alcohol consumption as many of them become economically active. When anticipating further trends in alcohol consumption, the role of alcohol in Seychellois society should also be taken into account. If drinking often serves as a means for some Seychellois

men to evade responsibility *vis-à-vis* their significant others or reflects limited opportunities for upward social mobility, as stressed by Benedict and Benedict (1982), rapid socio-economic development and subsequently rising expectations may also impose more pressure, with increased drinking as a result, including home-brew drinking in the lower SES segments of the population.

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