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Association between tobacco consumption and alcohol, vegetable and fruit intake across urban and rural areas in Mozambique

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Word count: 3269

What this research adds to the literature?

- It was already known that in industrialized countries, smokers tended to have a higher consumption of alcoholic beverages and a lower intake of vegetables and fruit. Evidence from developing countries, at the early phases of the tobacco epidemics and with markedly different cultures, lifestyles and forms of tobacco use, was scarce.
- This manuscript is the first that addresses this topic in an African country, adding knowledge on the discrimination of different types of tobacco use when evaluating the association between those forms of tobacco exposure and the consumption of alcoholic beverages (according to type), fruit and vegetable. Our results show that the use of distinct types of tobacco is associated with different dietary choices. Positive associations were found between tobacco use and alcohol drinking, regardless of type of tobacco consumed, but differences were observed according to the main type of alcoholic beverage consumed, with the smoking of hand rolled cigarettes and the consumption of smokeless tobacco being negatively associated with beer drinking. Manufactured cigarette smokers exhibited a less frequent intake of fruit, but a consistently negative association between smoking of manufactured cigarettes and vegetable intake was observed only in women. Conversely, smokeless tobacco consumption and hand-rolled cigarette smoking were not inversely related to fruit and vegetables intake.

ABSTRACT

Background

Smoking, alcohol consumption and unhealthy diet are known to cluster, but evidence from developing countries, at the early phases of the tobacco epidemics and with markedly different cultures, lifestyles and forms of tobacco use, is scarce. The objective of this study was to quantify the association between tobacco consumption (manufactured cigarettes, hand-rolled cigarettes and smokeless tobacco) and alcohol, fruit and vegetable intake, in Mozambique, according to place of residence (urban/rural).

Methods

A representative sample of 12 902 Mozambicans aged 25-64 years was evaluated in a national household survey conducted in 2003, using a structured questionnaire. Age- and education-adjusted odds ratios were computed to estimate the association between tobacco consumption and alcohol, fruit and vegetable intake.

Results

Tobacco use and overall alcohol drinking were positively associated, regardless of type of tobacco consumed, but smoking of hand-rolled cigarettes and consumption of smokeless tobacco was negatively associated with beer drinking. Manufactured cigarette smokers exhibited a less frequent intake of fruit, but smokeless tobacco consumption and hand-rolled cigarette smoking were not inversely related with fruit or vegetables intake. This pattern was relatively consistent across genders and urban/rural areas, with the observed differences likely to be explained either by random variation or heterogeneity in tobacco consumption patterns across genders or places of residence.

Conclusion

Strong associations between tobacco consumption and the intake of alcoholic beverages, vegetable and fruit intake, were found, but not consistently for all forms of tobacco use.

BACKGROUND

The leading causes of death in Sub-Saharan African countries at the earliest stage of the epidemiologic transition,[1] are HIV/AIDS, malaria and diarrhoeal diseases.[2] Nevertheless, morbidity and mortality from cardiovascular disease, cancer and chronic respiratory disease, all associated with smoking, are now responsible for a "double burden" on low income countries.[3] Cardiovascular disease accounts for 10% of all deaths,[4] and cancer for 4%.[5]

The patterns of tobacco consumption are shaped by demographic, economic, and cultural determinants,[6] as well as by other specific factors operating at different phases of the smoking epidemic, such as the tobacco industry pressure and politics for controlling tobacco exposure.[7-10] In the African setting, oppositely to most high income societies, hand-rolled cigarettes and smokeless tobacco are commonly consumed, in addition to manufactured cigarettes. However, with urbanization those traditional forms of tobacco use are shifting to manufactured cigarettes' smoking and the prevalence of smoking is also expected to increase,[11] Urbanization is also associated with an increase in the consumption of energy rich foods and a reduction in physical activity. Global influences (via advertising or increased availability of processed and animal-source food) contribute to changes in the types of food consumed in both urban and rural areas.[1, 12, 13]

Smoking, alcohol consumption and unhealthy diet tend to cluster and are all major modifiable contributors to the burden of chronic disease.[14] Tobacco consumers have a higher consumption of alcoholic beverages,[15-22] and a lower intake of vegetable and fruit.[20-35] However, most studies evaluating the association between smoking and diet come from Western societies in an advanced phase of the smoking epidemic and where manufactured cigarettes are the main type of tobacco consumed. Evidence from developing countries with markedly different cultures and lifestyles and where several types of tobacco exposure co-exist is scarce.[36]

We aimed to quantify the association between tobacco consumption and alcohol, fruit and vegetable intake, according to place of residence (urban/rural), in a representative sample of the Mozambican general population.

METHODS

In a community-based cross-sectional study 12 902 subjects aged 25 to 64 years were evaluated, between September and December 2003. The homeless and the population living in collective residential institutions (*e.g.* hotels, hospitals, military facilities) were not eligible, and only the population living in households was selected. The sampling procedure was designed to yield samples representative at the country and province levels and, at a national level, according to place of residence (urban-rural). Using the sampling frame of the 1997 census,[37] 604 geographical clusters were selected and within each area 24 households were randomly selected and visited. All eligible subjects in the same household were invited for the study, according to the sampling protocol. **In the Demographic and Health Survey the proportion of participating women was 93.5% in rural and 87.7% in urban areas and among men the participation was 85.6% and 75.2% respectively in rural and urban settings.**

Trained interviewers conducted face-to-face interviews in each household. Given the ethnic and linguistic diversity in Mozambique, all the interviewers were from the provinces in which they were going to do the interviews and were able to speak correctly the predominant languages from each region. A questionnaire-based assessment of sociodemographic and behavioral factors was conducted using standardized methods.

Regarding tobacco consumption participants were asked about the use of any tobacco product, including manufactured cigarettes, hand-rolled cigarettes and smokeless tobacco, anytime in their lives and currently. Current users were asked about the type of tobacco most usually consumed. Manufactured cigarette smokers were asked about the number of cigarettes smoked in the previous 24 hours. Subjects reporting current consumption of any tobacco product were classified as consumers and grouped according type of tobacco most usually consumed (hand rolled cigarettes, smokeless tobacco or manufactured cigarettes). Manufactured cigarettes smokers were further grouped according to the frequency of consumption (<5 and ≥ 5 cigarettes/day). The relatively low cutoff used to distinguish smokers in two groups reflects the low frequency of consumption in this population (table 1).

Participants were asked about the intake of any type of alcoholic beverage, including beer, wine, spirits, traditional (including sura, chicaju, tontonto, mal-coado, chicanhu) or other beverages, anytime in their lives and currently. Current drinkers were asked about the beverage most usually consumed and the frequency of consumption (number of days per week in which alcoholic beverages were consumed). Subjects having consumed alcoholic beverages before, but not currently, were classified as ex-drinkers and those reporting current consumption were grouped according to the frequency of weekly consumption of any type of beverage (<1 day, 1-2 days, 3-7 days), to allow the distinction between those drinking less than daily and almost every day, and according to the beverage most usually consumed (beer, traditional beverages, other beverages).

Fruit and vegetable consumption was assessed separately by asking the number of days per week in which these foods were consumed. Participants were grouped according to the weekly consumption of fruit (<1 day, 1 day, 2 days, 3-7 days) and vegetable (<3 days, 3-4 days, 5-6 days, 7 days). The cutoffs were chosen to allow the distribution of participants by groups of similar size, and are different for fruit and vegetable, reflecting distinct patterns of consumption.

Education was registered as the highest education level attained and participants grouped in four categories (<1 year, 1-5 years, 6-7 years, ≥ 8 years).

The classification of the place of residence as urban (in any of the 23 cities and 68 towns) or rural (outside cities or towns), and the definition of categories for the highest level of education attained were done in accordance with the 1997 census.[37]

Information on the consumption of tobacco and socio-demographic variables were available for 12 614 subjects, used in the present analysis. Multinomial logistic regression models were fitted separately for men and women, and for urban and rural areas, to compute age- and education-adjusted odds ratios (OR) and respective 95% confidence intervals (95%CI) for the association between tobacco consumption (independent variable, with non consumers as reference) and frequency of alcohol drinking (baseline outcome: non-drinkers), main type of alcoholic beverage consumed (baseline outcome: non-drinkers), fruit consumption (baseline outcome: <1 day/week) and vegetable consumption (baseline outcome: <3 days/week).

Since the sample was stratified, including a similar number of participants across provinces with unequal population size, each participant contributed to the analyses with a weight inversely proportional to the number of inhabitants per province in order to produce estimates representative of the Mozambican population. All the analyses were conducted considering the sampling weights and adjusting for strata and clustering at primary sampling unit level using STATA, version 9.2.

The study protocol was approved by the National Mozambican Ethics Committee and written informed consent was obtained from all participants.

RESULTS

The population under study is predominantly rural (three quarters), most subjects are aged less than 45 years (two thirds) and less than 15% have more than 54 years, and about half of women and one quarter of men have less than one year of formal education. Nearly 20% of women and 40% of men were tobacco consumers, and current alcohol drinking, mostly traditional beverages, was reported by about 25% of women and 50% of men. Approximately one third of the participants consumed fruit at least every two days and vegetable daily (Table 1).

Table 1. Socio-demographic characteristics, tobacco consumption (main type of tobacco product consumed), alcohol main type of alcoholic beverage consumed, fruit (weekly frequency) and vegetable (weekly frequency) intake of the participants.

| | | Women (n=7691) | | | Men (n=4923) | | |
|---|--|-----------------------|-------------------|-----------------|---------------------|-------------------|-----------------|
| | | n | Unweighted | Weighted | n | Unweighted | Weighted |
| | | | % * | % * | | % * | % * |
| Place of residence | Urban | 2805 | 36.5 | 29.2 | 1651 | 33.5 | 25.9 |
| | Rural | 4886 | 63.5 | 70.8 | 3272 | 66.5 | 74.1 |
| Age (years) | 25-34 | 3093 | 40.2 | 40.9 | 1770 | 36.0 | 36.5 |
| | 35-44 | 2071 | 26.9 | 26.2 | 1357 | 27.6 | 27.4 |
| | 45-54 | 1567 | 20.4 | 20.5 | 1066 | 21.6 | 21.1 |
| | 55-64 | 960 | 12.5 | 12.4 | 730 | 14.8 | 14.9 |
| Education (years) | <1 | 3857 | 50.2 | 54.4 | 1101 | 22.4 | 26.2 |
| | 1-5 | 3079 | 40.0 | 37.8 | 2743 | 55.7 | 55.1 |
| | 6-7 | 488 | 6.4 | 5.0 | 643 | 13.1 | 11.7 |
| | ≥8 | 267 | 3.5 | 2.8 | 436 | 8.9 | 7.0 |
| Tobacco consumption | Non-consumers (currently) | 6547 | 85.1 | 82.0 | 3029 | 61.5 | 60.5 |
| | Hand rolled cigarettes | 319 | 4.2 | 2.4 | 898 | 18.2 | 18.6 |
| | Smokeless tobacco | 664 | 8.6 | 0.3 | 135 | 2.7 | 3.8 |
| | Manufactured cigarettes (<5/day) | 130 | 1.7 | 5.0 | 497 | 10.1 | 11.1 |
| | Manufactured cigarettes (≥5/day) | 31 | 0.4 | 10.2 | 364 | 7.4 | 6.0 |
| Alcohol intake | Non-drinkers (currently) | 5226 | 68.0 | 69.2 | 1888 | 38.4 | 41.6 |
| | Ex-drinkers | 530 | 6.9 | 5.8 | 498 | 10.1 | 9.4 |
| | < 1 day/week | 442 | 5.8 | 5.4 | 316 | 6.4 | 5.5 |
| | 1-2 days/week | 1146 | 14.9 | 15.0 | 1566 | 31.8 | 30.7 |
| | 3-7 days/week | 347 | 4.5 | 4.5 | 655 | 13.3 | 12.8 |
| Alcoholic beverages (most frequently consumed) | Non-drinkers (currently) | 5226 | 68.0 | 69.2 | 1888 | 38.4 | 41.6 |
| | Ex-drinkers | 530 | 6.9 | 5.8 | 498 | 10.1 | 9.4 |
| | Beer | 404 | 5.2 | 4.3 | 573 | 11.6 | 9.0 |
| | Traditional beverages | 1366 | 17.8 | 18.9 | 1796 | 36.5 | 37.4 |
| | Other alcoholic beverages | 165 | 2.2 | 1.7 | 168 | 3.4 | 2.6 |
| Fruit intake | < 1 day/week | 2295 | 29.8 | 30.4 | 1299 | 26.4 | 26.2 |
| | 1 day/week | 1249 | 16.2 | 18.6 | 845 | 17.2 | 20.0 |
| | 2 days/week | 1464 | 19.0 | 19.7 | 981 | 19.9 | 21.0 |
| | 3-7 days/week | 2683 | 34.9 | 31.3 | 1798 | 36.5 | 32.7 |
| Vegetable intake | < 3 days/week | 1446 | 18.8 | 22.3 | 1149 | 23.3 | 27.2 |
| | 3-4 days/week | 2251 | 29.3 | 30.6 | 1571 | 31.9 | 33.1 |
| | 5-6 days/week | 1067 | 13.9 | 14.1 | 695 | 14.1 | 14.4 |
| | 7 days/week | 2927 | 38.1 | 33.0 | 1508 | 30.6 | 25.2 |

* within each variable the sum of the proportions may not be 100% due to rounding.

Tobacco consumption was strongly associated with drinking of alcoholic beverages (Table 2). The odds favoring smoking tended to increase with increasing drinking amount categories, regardless of the type of tobacco consumed, gender or place of residence. When comparing consumers of different types of tobacco with non consumers, the ORs for 3-7 days/week drinking, were: 9.19 (95%CI: 5.70–14.8) in men, for manufactured cigarette smokers (≥ 5 cigarettes/day), and 2.13 (95%CI: 1.01–4.50) in women, for manufactured cigarette smokers; 5.17 (95%CI: 3.82–6.98) in men and 1.94 (95%CI: 1.02–3.69) in women, for hand-rolled cigarette smokers; 2.30 (95%CI: 1.15–4.58) in men and 3.69 (95%CI: 2.56–5.33) in women, for smokeless tobacco consumers. In the analysis stratified by place of residence the results remained similar, with the largest differences being observed for the association between 3-7 days/week drinking and manufactured cigarette smoking in women, which was positive only in urban women (urban: OR=5.69, 95%CI: 2.65–12.19; rural: OR=0.44, 95%CI: 0.08–2.40).

Tobacco exposure was associated with traditional beverages drinking, regardless of the type of tobacco consumed. When comparing hand-rolled cigarette smokers with non-tobacco consumers, the ORs for traditional beverages drinking was 6.44 (95%CI: 4.97–8.35) in men and 4.05 (95%CI: 2.86–5.75) in women. Associations of a similar magnitude were observed for smoking manufactured cigarettes (men, ≥ 5 cigarettes/day: OR=4.19, 95%CI: 2.67–6.56; women: OR=2.25, 95%CI: 1.27–4.01) or consumption of smokeless tobacco (men: OR=2.77, 95%CI: 1.70–4.51; women: OR=3.68, 95%CI: 2.92–4.64). In general those associations were stronger in urban than in rural areas, in both genders (Table 3).

Beer drinking was positively associated with manufactured cigarette smoking in men regardless of place of residence and in urban women, but inversely related with hand-rolled cigarette smoking in men and with smokeless tobacco consumption in women, especially urban. When comparing manufactured-cigarette smokers with non-tobacco consumers, the OR for beer drinking were 7.32 (95%CI: 4.76–11.3) in men (≥ 5 cigarettes/day) and 2.45 (95%CI: 1.44–4.18) in women. Comparing hand-rolled cigarette smokers with non-tobacco consumers, the OR for beer drinking was 0.21 (95%CI: 0.03–1.62) in urban and 0.13 (95%CI: 0.02–0.90) in rural men. In women the OR for beer drinking (smokeless tobacco consumers vs. non-tobacco consumers) was 0.94 (95%CI: 0.40–2.20) in urban and 0.14 (95%CI: 0.02–1.03) in rural areas (Table 3).

Table 2. Odds ratios for alcoholic beverages intake, according to tobacco consumption status, adjusted for age and education.

| | Non-drinkers | | Ex-drinkers | | Frequency of consumption | | | | | | | | |
|--------------------------------------|--------------|------|-------------|-------------|--------------------------|-------------|------------------|---------------|-------------|-------------|---------------|--------------|-------------|
| | % | % | OR | 95% CI | <1 day/week | | | 1-2 days/week | | | 3-7 days/week | | |
| | | | | | % | OR | 95% CI | % | OR | 95% CI | % | OR | 95% CI |
| Men (urban and rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 75.1 | 64.6 | 1 | [reference] | 58.0 | 1 | [reference] | 47.8 | 1 | [reference] | 41.4 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 9.2 | 18.4 | 2.77 | 1.88-4.09 | 20.6 | 4.00 | 2.49-6.39 | 28.1 | 5.49 | 4.13-7.31 | 25.9 | 5.17 | 3.82-6.98 |
| Smokeless | 3.1 | 1.7 | 0.66 | 0.25-1.79 | 2.5 | 1.15 | 0.42-3.14 | 5.0 | 2.49 | 1.44-4.28 | 4.9 | 2.30 | 1.15-4.58 |
| Manufactured cigarettes | | | | | | | | | | | | | |
| <5 cig/day | 9.9 | 9.0 | 1.21 | 0.78-1.87 | 10.8 | 1.73 | 1.02-2.94 | 11.8 | 2.09 | 1.53-2.87 | 14.9 | 3.21 | 2.10-4.89 |
| ≥5 cig/day | 2.7 | 6.2 | 2.58 | 1.42-4.70 | 8.2 | 3.86 | 2.09-7.14 | 7.4 | 4.24 | 2.81-6.41 | 12.9 | 9.19 | 5.70-14.8 |
| Men (urban areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 84.6 | 80.9 | 1 | [reference] | 73.6 | 1 | [reference] | 61.8 | 1 | [reference] | 40.3 | 1 | [reference] |
| Tobacco consumers * | | | | | | | | | | | | | |
| Hand rolled cigarettes | 1.6 | 2.6 | 1.85 | 0.52-6.58 | 1.8 | 1.81 | 0.22-15.10 | 6.6 | 6.66 | 2.69-16.48 | 8.4 | 10.6 | 3.95-28.47 |
| Manufactured cigarettes | | | | | | | | | | | | | |
| <5 cig/day | 10.0 | 6.0 | 0.62 | 0.21-1.83 | 13.3 | 1.91 | 0.85-4.31 | 15.1 | 2.30 | 1.28-4.13 | 23.1 | 5.74 | 2.53-13.04 |
| ≥5 cig/day | 3.7 | 10.5 | 2.84 | 1.13-7.14 | 11.3 | 4.18 | 1.80-9.72 | 16.5 | 6.67 | 3.17-14.01 | 28.2 | 17.64 | 7.46-41.69 |
| Men (rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 72.9 | 55.5 | 1 | [reference] | 47.9 | 1 | [reference] | 43.4 | 1 | [reference] | 41.9 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 11.4 | 27.3 | 3.27 | 2.15-4.97 | 33.2 | 4.88 | 2.90-8.23 | 35.3 | 5.38 | 4.00-7.23 | 32.2 | 4.82 | 3.54-6.57 |
| Smokeless | 3.5 | 2.7 | 0.87 | 0.31-2.46 | 3.5 | 1.42 | 0.46-4.41 | 6.0 | 2.66 | 1.47-4.82 | 6.6 | 2.67 | 1.31-5.46 |
| Manufactured cigarettes | | | | | | | | | | | | | |
| <5 cig/day | 9.8 | 10.8 | 1.68 | 1.03-2.72 | 9.2 | 1.64 | 0.81-3.31 | 10.8 | 1.99 | 1.36-2.90 | 12.0 | 2.46 | 1.50-4.03 |
| ≥5 cig/day | 2.4 | 3.8 | 2.12 | 0.91-4.90 | 6.1 | 3.70 | 1.30-10.52 | 4.4 | 3.03 | 1.82-5.05 | 7.4 | 5.62 | 3.07-10.27 |
| Women (urban and rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 87.1 | 84.3 | 1 | [reference] | 79.6 | 1 | [reference] | 65.0 | 1 | [reference] | 61.2 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 3.4 | 4.9 | 1.49 | 0.84-2.62 | 8.0 | 2.90 | 1.48-5.67 | 11.1 | 3.96 | 2.75-5.70 | 7.0 | 1.94 | 1.02-3.69 |
| Smokeless | 7.3 | 8.5 | 1.18 | 0.71-1.93 | 9.1 | 1.49 | 0.88-2.51 | 19.6 | 3.26 | 2.55-4.18 | 27.8 | 3.69 | 2.56-5.33 |
| Manufactured cigarettes † | 2.2 | 2.2 | 0.90 | 0.40-2.06 | 3.3 | 1.50 | 0.75-3.00 | 4.3 | 2.42 | 1.35-4.36 | 4.0 | 2.13 | 1.01-4.50 |
| Women (urban areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 92.5 | 93.1 | 1 | [reference] | 89.9 | 1 | [reference] | 79.0 | 1 | [reference] | 68.5 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 0.4 | 0.8 | 2.44 | 0.59-10.19 | 2.2 | 7.58 | 2.28-25.21 | 3.1 | 11.67 | 4.86-28.04 | 1.4 | 3.64 | 0.59-22.36 |
| Smokeless | 4.6 | 3.7 | 0.98 | 0.42-2.24 | 3.5 | 1.21 | 0.40-3.65 | 11.7 | 4.46 | 2.62-7.59 | 19.3 | 4.14 | 1.62-10.60 |
| Manufactured cigarettes † | 2.5 | 2.3 | 0.99 | 0.31-3.23 | 4.4 | 2.14 | 0.79-5.81 | 6.3 | 3.31 | 1.30-8.43 | 10.8 | 5.69 | 2.65-12.19 |
| Women (rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 85.0 | 76.7 | 1 | [reference] | 70.4 | 1 | [reference] | 60.4 | 1 | [reference] | 57.7 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 4.5 | 8.4 | 1.65 | 0.89-3.07 | 13.2 | 2.96 | 1.36-6.44 | 13.7 | 3.40 | 2.29-5.07 | 9.6 | 1.92 | 0.94-3.88 |
| Smokeless | 8.3 | 12.7 | 1.37 | 0.75-2.50 | 14.2 | 1.74 | 0.95-3.19 | 22.2 | 3.07 | 2.33-4.03 | 31.8 | 3.68 | 2.45-5.53 |
| Manufactured cigarettes † | 2.1 | 2.2 | 0.97 | 0.30-3.10 | 2.2 | 1.16 | 0.37-3.67 | 3.7 | 2.18 | 1.00-4.72 | 0.8 | 0.44 | 0.08-2.40 |

* the number of smokeless tobacco consumers among men from urban areas was too small (n=13) and no estimates are provided for this group; † the number of women smoking ≥5 manufactured cigarettes per day was

too small in both urban (n=25) and rural (n=6) areas and the estimates are provided for smoking, regardless of the number of cigarettes consumed.

Table 3. Odds ratios for alcoholic beverages intake (type), according to tobacco consumption status, adjusted for age and education.

| | Non-drinkers | | Ex-drinkers | | Type of beverage more frequently consumed | | | | | | | | |
|--------------------------------------|--------------|------|-------------|-------------|---|-------------|-------------|--------------------------------|--------------|-------------|--------------------------|--------------|-------------|
| | % | % | OR | 95% CI | Beer drinkers | | | Traditional beverages drinkers | | | Other beverages drinkers | | |
| | | | | | % | OR | 95% CI | % | OR | 95% CI | % | OR | 95% CI |
| Men (urban and rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 75.1 | 64.6 | 1 | [reference] | 65.4 | 1 | [reference] | 41.9 | 1 | [reference] | 61.8 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 9.2 | 18.4 | 2.67 | 1.81-3.94 | 0.4 | 0.09 | 0.02-0.38 | 34.6 | 6.44 | 4.97-8.35 | 3.7 | 0.74 | 0.30-1.82 |
| Smokeless | 3.1 | 1.7 | 0.65 | 0.24-1.76 | 0.0 | - | - | 6.0 | 2.77 | 1.70-4.51 | 1.4 | 0.63 | 0.07-5.25 |
| Manufactured cigarettes | | | | | | | | | | | | | |
| <5 cig/day | 9.9 | 9.0 | 1.21 | 0.78-1.88 | 16.8 | 2.29 | 1.55-3.37 | 11.5 | 2.33 | 1.67-3.25 | 12.1 | 1.97 | 1.02-3.78 |
| ≥5 cig/day | 2.7 | 6.2 | 2.71 | 1.50-4.90 | 17.3 | 7.32 | 4.76-11.23 | 6.0 | 4.19 | 2.67-6.56 | 21.1 | 11.1 | 5.81-21.4 |
| Men (urban areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 84.6 | 80.9 | 1 | [reference] | 66.8 | 1 | [reference] | 43.5 | 1 | [reference] | 65.3 | 1 | [reference] |
| Tobacco consumers * | | | | | | | | | | | | | |
| Hand rolled cigarettes | 1.6 | 2.6 | 1.71 | 0.48-6.02 | 0.2 | 0.21 | 0.03-1.62 | 16.2 | 15.92 | 6.32-40.06 | 2.5 | 2.63 | 0.57-12.15 |
| Manufactured cigarettes | | | | | | | | | | | | | |
| <5 cig/day | 10.0 | 6.0 | 0.62 | 0.21-1.81 | 15.0 | 2.13 | 1.19-3.83 | 22.5 | 4.84 | 2.29-10.20 | 9.2 | 1.52 | 0.64-3.57 |
| ≥5 cig/day | 3.7 | 10.5 | 2.87 | 1.14-7.21 | 18.0 | 6.82 | 3.37-13.84 | 17.8 | 9.87 | 4.19-23.22 | 22.9 | 10.22 | 3.76-27.76 |
| Men (rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 72.9 | 55.5 | 1 | [reference] | 62.0 | 1 | [reference] | 41.9 | 1 | [reference] | 50.4 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 11.4 | 27.3 | 3.24 | 2.14-4.93 | 0.9 | 0.13 | 0.02-0.90 | 37.4 | 5.68 | 4.35-7.42 | 7.5 | 1.01 | 0.31-3.27 |
| Smokeless | 3.5 | 2.7 | 0.87 | 0.31-2.45 | 0.0 | - | - | 6.4 | 2.75 | 1.62-4.67 | 5.7 | 2.00 | 0.20-19.59 |
| Manufactured cigarettes | | | | | | | | | | | | | |
| <5 cig/day | 9.8 | 10.8 | 1.68 | 1.03-2.72 | 21.3 | 2.68 | 1.47-4.90 | 10.0 | 1.97 | 1.36-2.84 | 21.3 | 3.46 | 1.39-8.61 |
| ≥5 cig/day | 2.4 | 3.8 | 2.13 | 0.92-4.93 | 15.8 | 6.42 | 3.21-12.86 | 4.4 | 3.26 | 1.93-5.48 | 15.1 | 9.55 | 3.18-28.72 |
| Women (urban and rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 87.1 | 84.3 | 1 | [reference] | 92.3 | 1 | [reference] | 59.5 | 1 | [reference] | 92.8 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 3.4 | 4.9 | 1.47 | 0.83-2.59 | 0.0 | - | - | 12.5 | 4.05 | 2.86-5.75 | 2.8 | 1.01 | 0.13-7.90 |
| Smokeless | 7.3 | 8.5 | 1.16 | 0.71-1.91 | 2.0 | 0.41 | 0.20-0.85 | 24.2 | 3.68 | 2.92-4.64 | 2.2 | 0.35 | 0.08-1.50 |
| Manufactured cigarettes † | 2.2 | 2.2 | 0.90 | 0.40-2.03 | 5.7 | 2.45 | 1.44-4.18 | 3.8 | 2.25 | 1.27-4.01 | 2.3 | 0.73 | 0.27-1.94 |
| Women (urban areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 92.5 | 93.1 | 1 | [reference] | 90.6 | 1 | [reference] | 64.1 | 1 | [reference] | 95.3 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 0.4 | 0.8 | 2.30 | 0.55-9.63 | 0.0 | - | - | 6.1 | 19.24 | 7.48-49.51 | 0.0 | - | - |
| Smokeless | 4.6 | 3.7 | 0.94 | 0.41-2.17 | 2.3 | 0.94 | 0.40-2.20 | 22.4 | 6.28 | 3.45-11.44 | 1.7 | 0.46 | 0.05-3.82 |
| Manufactured cigarettes † | 2.5 | 2.3 | 1.00 | 0.31-3.20 | 7.1 | 3.59 | 1.55-8.34 | 7.4 | 4.15 | 1.92-9.00 | 3.0 | 1.33 | 0.38-4.68 |
| Women (rural areas) | | | | | | | | | | | | | |
| Non-tobacco consumers | 85.0 | 76.7 | 1 | [reference] | 97.5 | 1 | [reference] | 58.5 | 1 | [reference] | 85.1 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | | | | |
| Hand rolled cigarettes | 4.5 | 8.4 | 1.65 | 0.89-3.07 | 0.0 | - | - | 13.8 | 3.30 | 2.26-4.81 | 11.3 | 1.98 | 0.23-17.23 |
| Smokeless | 8.3 | 12.7 | 1.36 | 0.74-2.49 | 1.2 | 0.14 | 0.02-1.03 | 24.5 | 3.28 | 2.55-4.22 | 3.5 | 0.34 | 0.05-2.51 |
| Manufactured cigarettes † | 2.1 | 2.2 | 0.97 | 0.30-3.10 | 1.3 | 0.59 | 0.08-4.59 | 3.1 | 1.83 | 0.86-3.92 | 0.0 | - | - |

* the number of smokeless tobacco consumers among men from urban areas was too small (n=13) and no estimates are provided for this group; † the number of women smoking ≥5 manufactured cigarettes per day was

too small in both urban (n=25) and rural (n=6) areas and the estimates are provided for smoking, regardless of the number of cigarettes consumed.

Regarding the association between tobacco and fruit consumption the OR for fruit intake (3-7 times/week) were 0.60 (95%CI: 0.42–0.86) in men (≥ 5 cigarettes/day) and 0.61 (95%CI: 0.35–1.04) in women, for manufactured cigarettes smokers compared to non-consumers, with similar point estimates for urban and rural areas. However, in men, this association only remained statistically significant in rural areas (Table 4). Among women, the manufactured cigarette smoking was positively associated with fruit intake once a week (OR=1.62; 95%CI: 0.92–2.85), though statistically significant only in urban areas (urban: OR=2.26; 95%CI: 1.05–4.87; rural: OR=1.36; 95%CI: 0.63–2.93). Smokeless tobacco consumption was positively associated with fruit intake (once weekly) in both genders (men: OR=2.53, 95%CI: 1.40–4.59; women: OR=1.51, 95%CI: 1.07–2.14), but no estimates could be computed for urban men due to the small number of smokeless tobacco consumers among the males in this setting. No significant associations between hand-rolled cigarettes smoking and fruit intake were observed in either gender (Table 4).

Table 4. Odds ratios for fruit intake according to tobacco consumption status, adjusted for age and education.

| | Frequency of consumption | | | | | | | | | |
|--------------------------------------|--------------------------|------|-------------|-------------|-------------|-------------|-------------|---------------|-------------|-------------|
| | <1day/week | | 1 day/week | | 2 days/week | | | 3-7 days/week | | |
| | % | % | OR | 95% CI | % | OR | 95% CI | % | OR | 95% CI |
| Men (urban and rural areas) | | | | | | | | | | |
| Non-tobacco consumers | 58.3 | 57.5 | 1 | [reference] | 61.7 | 1 | [reference] | 63.3 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | |
| Hand rolled cigarettes | 19.0 | 20.0 | 1.15 | 0.84-1.56 | 18.1 | 0.99 | 0.71-1.37 | 17.8 | 1.06 | 0.79-1.43 |
| Smokeless | 2.8 | 5.9 | 2.53 | 1.40-4.59 | 4.2 | 1.72 | 0.97-3.06 | 2.9 | 1.31 | 0.74-2.33 |
| Manufactured cigarettes | | | | | | | | | | |
| <5 cig/day | 11.9 | 11.0 | 0.90 | 0.61-1.32 | 11.8 | 0.87 | 0.60-1.26 | 10.0 | 0.72 | 0.49-1.05 |
| ≥5 cig/day | 8.0 | 5.6 | 0.67 | 0.43-1.06 | 4.2 | 0.47 | 0.31-0.70 | 6.0 | 0.60 | 0.42-0.86 |
| Men (urban areas) | | | | | | | | | | |
| Non-tobacco consumers | 64.8 | 69.8 | 1 | [reference] | 74.8 | 1 | [reference] | 73.6 | 1 | [reference] |
| Tobacco consumers * | | | | | | | | | | |
| Hand rolled cigarettes | 2.8 | 6.6 | 2.56 | 0.86-7.64 | 5.2 | 2.38 | 0.95-5.97 | 3.4 | 1.59 | 0.64-3.95 |
| Manufactured cigarettes | | | | | | | | | | |
| <5 cig/day | 16.8 | 13.3 | 0.74 | 0.34-1.58 | 11.2 | 0.54 | 0.28-1.04 | 10.6 | 0.56 | 0.31-1.00 |
| ≥5 cig/day | 15.6 | 10.3 | 0.63 | 0.35-1.13 | 8.7 | 0.47 | 0.26-0.84 | 12.3 | 0.73 | 0.44-1.20 |
| Men (rural areas) | | | | | | | | | | |
| Non-tobacco consumers | 55.9 | 54.4 | 1 | [reference] | 58.4 | 1 | [reference] | 59.5 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | |
| Hand rolled cigarettes | 25.3 | 24.3 | 1.04 | 0.75-1.44 | 21.6 | 0.86 | 0.62-1.21 | 23.6 | 0.96 | 0.70-1.32 |
| Smokeless | 3.7 | 6.6 | 2.15 | 1.14-4.04 | 5.0 | 1.50 | 0.82-2.71 | 3.7 | 1.16 | 0.63-2.12 |
| Manufactured cigarettes | | | | | | | | | | |
| <5 cig/day | 10.0 | 10.4 | 0.99 | 0.65-1.52 | 12.0 | 1.05 | 0.68-1.62 | 9.7 | 0.81 | 0.51-1.29 |
| ≥5 cig/day | 5.0 | 4.2 | 0.80 | 0.42-1.50 | 3.0 | 0.53 | 0.30-0.96 | 3.5 | 0.57 | 0.33-0.97 |
| Women (urban and rural areas) | | | | | | | | | | |
| Non-tobacco consumers | 81.3 | 77.4 | 1 | [reference] | 81.8 | 1 | [reference] | 85.6 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | |
| Hand rolled cigarettes | 6.1 | 5.8 | 1.11 | 0.72-1.71 | 5.6 | 1.09 | 0.73-1.61 | 3.3 | 0.66 | 0.42-1.05 |
| Smokeless | 9.8 | 12.6 | 1.51 | 1.07-2.14 | 10.3 | 1.25 | 0.92-1.71 | 9.2 | 1.15 | 0.83-1.57 |
| Manufactured cigarettes † | 2.8 | 4.3 | 1.62 | 0.92-2.85 | 2.3 | 0.83 | 0.44-1.58 | 1.8 | 0.61 | 0.35-1.04 |
| Women (urban areas) | | | | | | | | | | |
| Non-tobacco consumers | 87.9 | 82.9 | 1 | [reference] | 92.4 | 1 | [reference] | 92.2 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | |
| Hand rolled cigarettes | 1.5 | 0.9 | 0.69 | 0.16-3.01 | 1.1 | 0.83 | 0.25-2.78 | 0.5 | 0.42 | 0.11-1.63 |
| Smokeless | 7.1 | 8.6 | 1.42 | 0.81-2.49 | 4.4 | 0.77 | 0.42-1.42 | 4.9 | 1.06 | 0.56-2.03 |
| Manufactured cigarettes † | 3.5 | 7.6 | 2.26 | 1.05-4.87 | 2.1 | 0.60 | 0.25-1.46 | 2.4 | 0.71 | 0.34-1.49 |
| Women (rural areas) | | | | | | | | | | |
| Non-tobacco consumers | 78.4 | 75.6 | 1 | [reference] | 78.0 | 1 | [reference] | 82.5 | 1 | [reference] |
| Tobacco consumers | | | | | | | | | | |
| Hand rolled cigarettes | 8.1 | 7.3 | 1.07 | 0.68-1.69 | 7.2 | 1.05 | 0.69-1.61 | 4.6 | 0.65 | 0.39-1.06 |
| Smokeless | 11.0 | 13.8 | 1.48 | 0.98-2.23 | 12.5 | 1.33 | 0.93-1.90 | 11.4 | 1.15 | 0.79-1.66 |
| Manufactured cigarettes † | 2.6 | 3.2 | 1.36 | 0.63-2.93 | 2.3 | 0.99 | 0.44-2.23 | 1.5 | 0.61 | 0.29-1.27 |

* the number of smokeless tobacco consumers among men from urban areas was too small (n=13) and no estimates are provided for this group; † the number of women in smoking ≥5 manufactured cigarettes per day was too small in both urban (n=25) and rural (n=6) areas and the estimates are provided for smoking, regardless of the number of cigarettes consumed.

Hand-rolled cigarette smoking was positively associated with vegetable consumption in men but inversely in women. The OR for daily vegetable intake was 2.24 (95%CI: 1.71–2.94) for men and 0.61 (95%CI: 0.41–0.91) for women. Among women, the inverse association was observed only in rural areas (urban: OR=5.91, 95%CI: 1.10–31.70; rural: OR=0.52, 95%CI: 0.34–0.78). Manufactured cigarette smoking was inversely associated with vegetable intake in both genders. The OR for 3-4 days/week vegetable consumption was 0.58 (95%CI: 0.42–0.81) in men (<5 cigarettes/day) and 0.45 (95%CI: 0.26–0.76) in women. When stratifying by place of residence, the point estimates remained similar, both in men and women. No significant association between smokeless tobacco consumption and vegetable intake was observed in either gender (Table 5).

Table 5. Odds ratios for vegetable intake according to tobacco consumption status, adjusted for age and education.

| | Frequency of consumption | | | | | | | | | | | |
|--------------------------------------|--------------------------|------|-------------|---------------|------|-------------|---------------|------|-------------|-------------|--|--|
| | <3 days/week | | | 3-4 days/week | | | 5-6 days/week | | | 7 days/week | | |
| | % | % | OR | 95% CI | % | OR | 95% CI | % | OR | 95% CI | | |
| Men (urban and rural areas) | | | | | | | | | | | | |
| Non-tobacco consumers | 63.3 | 63.1 | 1 | [reference] | 55.7 | 1 | [reference] | 56.7 | 1 | [reference] | | |
| Tobacco consumers | | | | | | | | | | | | |
| Hand rolled cigarettes | 11.5 | 17.5 | 1.58 | 1.21-2.08 | 24.6 | 2.27 | 1.66-3.10 | 24.3 | 2.24 | 1.71-2.94 | | |
| Smokeless | 3.7 | 4.6 | 1.28 | 0.74-2.21 | 4.1 | 1.15 | 0.64-2.04 | 2.5 | 0.70 | 0.38-1.26 | | |
| Manufactured cigarettes | | | | | | | | | | | | |
| <5 cig/day | 15.0 | 8.6 | 0.58 | 0.42-0.81 | 9.4 | 0.70 | 0.48-1.02 | 11.0 | 0.83 | 0.62-1.10 | | |
| ≥5 cig/day | 6.4 | 6.1 | 0.92 | 0.60-1.41 | 6.2 | 1.13 | 0.68-1.90 | 5.5 | 0.97 | 0.63-1.51 | | |
| Men (urban areas) | | | | | | | | | | | | |
| Non-tobacco consumers | 72.7 | 74.1 | 1 | [reference] | 61.2 | 1 | [reference] | 65.6 | 1 | [reference] | | |
| Tobacco consumers * | | | | | | | | | | | | |
| Hand rolled cigarettes | 2.8 | 4.4 | 1.65 | 0.69-3.92 | 4.2 | 1.99 | 0.68-5.82 | 5.7 | 2.33 | 1.00-5.42 | | |
| Manufactured cigarettes | | | | | | | | | | | | |
| <5 cig/day | 14.3 | 9.8 | 0.69 | 0.40-1.22 | 15.1 | 1.40 | 0.76-2.57 | 15.7 | 1.31 | 0.88-1.95 | | |
| ≥5 cig/day | 10.3 | 11.6 | 1.16 | 0.61-2.19 | 19.4 | 2.29 | 1.09-4.81 | 13.0 | 1.44 | 0.78-2.65 | | |
| Men (rural areas) | | | | | | | | | | | | |
| Non-tobacco consumers | 59.8 | 58.9 | 1 | [reference] | 54.7 | 1 | [reference] | 54.4 | 1 | [reference] | | |
| Tobacco consumers | | | | | | | | | | | | |
| Hand rolled cigarettes | 15.5 | 22.9 | 1.49 | 1.13-1.98 | 29.2 | 2.02 | 1.47-2.79 | 29.2 | 2.03 | 1.52-2.70 | | |
| Smokeless | 4.4 | 6.1 | 1.40 | 0.80-2.45 | 4.5 | 1.13 | 0.63-2.04 | 3.1 | 0.74 | 0.40-1.36 | | |
| Manufactured cigarettes | | | | | | | | | | | | |
| <5 cig/day | 15.5 | 8.2 | 0.54 | 0.35-0.80 | 8.1 | 0.56 | 0.36-0.89 | 9.8 | 0.70 | 0.48-1.01 | | |
| ≥5 cig/day | 4.8 | 3.9 | 0.82 | 0.47-1.46 | 3.4 | 0.80 | 0.42-1.55 | 3.5 | 0.84 | 0.46-1.55 | | |
| Women (urban and rural areas) | | | | | | | | | | | | |
| Non-tobacco consumers | 79.8 | 84.3 | 1 | [reference] | 79.5 | 1 | [reference] | 82.5 | 1 | [reference] | | |
| Tobacco consumers | | | | | | | | | | | | |
| Hand rolled cigarettes | 5.6 | 5.0 | 0.86 | 0.58-1.29 | 5.6 | 0.89 | 0.58-1.37 | 4.5 | 0.61 | 0.41-0.91 | | |
| Smokeless | 9.8 | 8.5 | 0.84 | 0.60-1.17 | 12.6 | 1.15 | 0.80-1.64 | 11.2 | 0.87 | 0.62-1.22 | | |
| Manufactured cigarettes † | 4.8 | 2.3 | 0.45 | 0.26-0.76 | 2.3 | 0.48 | 0.24-0.92 | 1.8 | 0.34 | 0.18-0.62 | | |
| Women (urban areas) | | | | | | | | | | | | |
| Non-tobacco consumers | 85.3 | 93.7 | 1 | [reference] | 87.7 | 1 | [reference] | 88.1 | 1 | [reference] | | |
| Tobacco consumers | | | | | | | | | | | | |
| Hand rolled cigarettes | 0.1 | 1.1 | 7.27 | 1.22-43.33 | 2.3 | 13.37 | 1.96-91.06 | 1.1 | 5.91 | 1.10-31.70 | | |
| Smokeless | 9.2 | 2.3 | 0.23 | 0.11-0.49 | 6.9 | 0.57 | 0.25-1.33 | 8.1 | 0.56 | 0.26-1.22 | | |
| Manufactured cigarettes † | 5.4 | 2.9 | 0.51 | 0.24-1.08 | 3.1 | 0.53 | 0.15-1.86 | 2.6 | 0.44 | 0.14-1.36 | | |
| Women (rural areas) | | | | | | | | | | | | |
| Non-tobacco consumers | 76.9 | 79.1 | 1 | [reference] | 77.0 | 1 | [reference] | 80.9 | 1 | [reference] | | |
| Tobacco consumers | | | | | | | | | | | | |
| Hand rolled cigarettes | 8.5 | 7.1 | 0.82 | 0.54-1.24 | 6.6 | 0.74 | 0.47-1.16 | 5.5 | 0.52 | 0.34-0.78 | | |
| Smokeless | 10.1 | 11.9 | 1.14 | 0.81-1.61 | 14.2 | 1.35 | 0.92-1.96 | 12.1 | 0.96 | 0.66-1.40 | | |
| Manufactured cigarettes † | 4.5 | 1.9 | 0.41 | 0.19-0.88 | 2.1 | 0.45 | 0.21-0.96 | 1.5 | 0.30 | 0.15-0.60 | | |

* the number of smokeless tobacco consumers among men from urban areas was too small (n=13) and no estimates are provided for this group; † the number of women in smoking ≥5 manufactured cigarettes per day was too small in both urban (n=25) and rural (n=6) areas and the estimates are provided for smoking, regardless of the number of cigarettes consumed.

DISCUSSION

Our results from a country under epidemiologic transition, in the earlier phases of the tobacco epidemic, show that the use of distinct types of tobacco is associated with different dietary choices. Positive associations were found between tobacco use and alcohol drinking, regardless of type of tobacco consumed, but differences were observed according to the main type of alcoholic beverage consumed, with the smoking of hand rolled cigarettes and the consumption of smokeless tobacco being negatively associated with beer drinking. Manufactured cigarette smokers exhibited a less frequent intake of fruit, but a consistently negative association between smoking of manufactured cigarettes and vegetable intake was observed only in women. Conversely, smokeless tobacco consumption and hand-rolled cigarette smoking were not inversely related to fruit and vegetable intake. This pattern was relatively consistent across urban and rural areas, with the observed differences being explained either by random variation or heterogeneity in the tobacco consumption patterns across urban and rural areas.

To our knowledge this is the first report addressing this topic in an African country, based on a large representative sample of the Mozambican population, but some limitations need to be pointed. Unfortunately no validation of the method used for assessing fruit and vegetable intake could be accomplished. The recall of the frequency of usual consumption depends on the participants' memory although compared to methods referring to more recent periods, such as a 24-hour recall, it is expected to minimize the effects of the daily or weekly variability [38]. The questionnaire employed the generic terms "vegetable" and "fruit", rather than specific varieties of these food groups which may contribute for inaccurate reporting. Although misclassification is expectedly non-differential, probably driving the associations conservatively towards the null, we cannot dismiss the possibility that it may differ across the urban and rural settings or dependent on the main type of tobacco consumed. The latter, however, could hardly be responsible for a bias responsible for the differences observed across settings or types of tobacco consumed. Either way, it is unlikely the validity of our conclusions is compromised by such misclassification. Also, as for alcoholic beverages intake, only the frequency of consumption was assessed and it was not possible to estimate the quantity consumed.

The frequency of consumption, however, is likely to reflect the quantity consumed and our results clearly show that the magnitude of the association between tobacco consumption and alcoholic beverages increased with increasing drinking frequency. In our study, the frequency of consumption was recorded only for the more usual type of alcoholic beverage consumed, but this option is not expected to compromise our conclusions, given the consistency of the associations for different types of beverages.

The association between manufactured cigarette smoking and dietary intake may be confounded by other factors such as prohibitive costs of vegetable and fruits, recent migration to urban places or loss of livelihood or stress or staying away from family or socio-economic condition. Unfortunately, no data on the family income, specific indicators of socioeconomic position or migration to urban areas were available for the present analysis. These aspects were partially accounted by including education in the multivariate models, and by conducting stratified analyses according to gender and place of residence. The analyses were also conducted for specific types of tobacco consumption, which have different frequencies across urban and rural areas.

Our findings confirm a well-known relationship between smoking and alcohol consumption,[15-22, 39] but also enable further discussions on this subject as they add to the previous studies information on the type of tobacco used and the discrimination of alcoholic beverage consumed. Manufactured cigarette smoking tends to cluster with all different types of alcoholic beverages analysed while the pattern of the association between other types of tobacco use and each type of alcoholic beverage was clearly different. While traditional beverages drinking was associated with all different types of tobacco consumed, beer drinking was inversely related with hand-rolled cigarette smoking in men and with smokeless tobacco consumption in women. This is probably due to the fact that both hand-rolled cigarette smoking and smokeless tobacco are the traditional forms of tobacco use, more frequent in rural regions where the access to manufactured cigarettes and beer drinking, expected to increase with urbanization, is probably more difficult and the determinants of its use may differ in urban and rural areas. Another possible reason is the extreme poverty of the majority of the rural population that could contribute to the pattern of alcohol and tobacco consumption, since manufactured cigarettes and beer are more expensive and less accessible to this population. Although

no such data is available in the dataset made available for our analysis, a recent STEPS survey conducted in Mozambique showed that approximately two thirds of the adult Mozambican population has an annual family income lower than 400 United States dollars (data not shown).

Unfortunately, our study quantifies the association between the most frequent forms of tobacco consumption and alcohol, fruit and vegetable intake, but no conclusions can be drawn regarding the consumption of more than one type of tobacco simultaneously. However, our gender-specific estimates are consistent across urban and rural areas, and we may assume that different forms of tobacco use do not coexist frequently or to a large extent and that there is an association between consumption patterns and gender and place of residence.[11]

Smoking manufactured cigarettes was inversely related with the frequency of fruit and vegetable intake in both genders. Several studies have reported that compared to smokers, non-smokers are more likely to consume fruit and vegetable,[20-35, 40, 41] items rich in fibre, antioxidants, and phytochemicals.[42, 43] These results are also consistent with those obtained when nutrients, instead of food items, were analysed. Several studies have found that non-smokers had higher intakes of vitamins, antioxidants, and fibre,[22, 32, 41, 44, 45] which are found in vegetable and fruit. However, despite the well documented inverse association between manufactured cigarette smoking and fruit and vegetable consumption, in our study smokeless tobacco use was positively associated with fruit intake. This result is consistent with those obtained by Stegmayr *et al* in Sweden, who showed that plasma levels of antioxidant vitamins are not reduced in snuff dippers as they are in smokers, possibly due to the combined result of higher intake and lower expenditure of ascorbate and tocopherols in those who use smokeless tobacco.[46] However, it is not possible to determine the extent to which the higher levels of plasma antioxidants in consumers of smokeless tobacco compared to smokers can be attributed to higher consumption of fruit and vegetable or lower expenditure of nutrients contained in those food items. Inversely, Accort *et al*.[39] and Giraud *et al*,[47] in the United States, showed that smokeless was associated with low fruit and vegetable intake. However, all the previous studies come from high income countries in an advanced phase of smoking epidemic, with high level of urbanization, western culture and where the determinants of the consumption of each type of tobacco are probably distinct from those from low income countries.

In Mozambique, manufactured cigarette smokers have a lower intake of fruit and vegetable and a higher alcohol intake, consistently with the tendency for health behavior to cluster.[48, 49] However this association was not consistent across other types of tobacco consumed. Hand-rolled cigarette smokers and smokeless tobacco consumers showed, in general, a healthier diet, especially in rural areas. We may speculate about the existence of a construct that joins different aspects of a less urban lifestyle such as eating healthier (namely more fruit and vegetable), being physically more active (inherent to a more rural environment), drinking traditional food and beverages (including traditional alcoholic beverages) and using non-manufactured ways of tobacco use (such as hand-rolled and smokeless). The urban construct, on the other hand, may aggregate unhealthier choices. Our results suggest that lifestyles are culturally determined and that the pattern of association of lifestyle behaviours also differs across societies.

Although this epidemiological study was not specifically designed to assess the role of social aspects on the association between smoking and other health-related behaviors, we agree that socio-economic exposures and urban-rural migrations should be accounted in future investigations.

This study adds to previous research on this subject a greater knowledge on the association between different forms of tobacco exposure and the consumption of alcoholic beverages (including traditional beverages), fruit and vegetable. These findings suggest the importance of knowing, in depth, how health behaviors are distributed and how they cluster in Mozambique, namely for etiological research and design of health promotion programs.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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REFERENCES

- 1 Yusuf S, Reddy S, Ounpuu S, *et al.* Global Burden of Cardiovascular Diseases: Part I: General Considerations, the Epidemiologic Transition, Risk Factors, and Impact of Urbanization. *Circulation* 2001;**104**:2746-53.
- 2 World Health Statistics. Country Health System Fact Sheet 2006 Mozambique. Geneva, Switzerland: World Health Organization.
- 3 World Health Organization. *Preventing chronic diseases : a vital investment : WHO global report*. Geneva, Switzerland 2005.
- 4 Yusuf S, Reddy S, Ounpuu S, *et al.* Global Burden of Cardiovascular Diseases: Part II: Variations in Cardiovascular Disease by Specific Ethnic Groups and Geographic Regions and Prevention Strategies. *Circulation* 2001;**104**:2855-64.
- 5 Sitas F, Parkin M, Chirenje Z, *et al.* Cancers. In: Jamison D, Feachem R, Makgoba M, *et al.*, eds. *Disease and Mortality in Sub-Saharan Africa*. Washington, DC: The World Bank 2006.
- 6 Ezzati M, Lopez A. Estimates of global mortality attributable to smoking in 2000. *Lancet* 2003;**362**:847-52.
- 7 Lunet N, Williams L, Govind M, *et al.* Tobacco advertising in Maputo, Mozambique: how will they keep pressing? *Gac Sanit* 2006;**20**:251-2.
- 8 Eriksen MP, Cerak RL. The Diffusion and Impact of Clean Indoor Air Laws. *Annu Rev Public Health* 2008;**29**:171-85.
- 9 Gallus S, Schiaffino A, La Vecchia C, *et al.* Price and cigarette consumption in Europe. *Tob Control* 2006;**15**:114-9.
- 10 Lopez AD, Collishaw NE, Piha T. A descriptive model of the cigarette epidemic in developed countries. *Tob Control* 1994;**3**:242-7.
- 11 Townsend L, Flisher AJ, Gilreath T, *et al.* A systematic literature review of tobacco use among adults 15 years and older in sub-Saharan Africa. *Drug Alcohol Depend* 2006;**84**:14-27.
- 12 Popkin BM. Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. *Am J Clin Nutr* 2006;**84**:289-98.

- 13 Pinto M, Lunet N, Williams L, *et al.* Billboard advertising of food and beverages is frequent in Maputo, Mozambique. *Food Nutr Bull* 2007;**28**:365-6.
- 14 Yach D, Leeder S, Bell J, *et al.* Global Chronic Diseases. *Science* 2005;**307**:317.
- 15 Fisher M, Gordon T. The relation of drinking and smoking habits to diet: the Lipid Research Clinics Prevalence Study. *Am J Clin Nutr* 1985;**41**:623-30.
- 16 Ramos E, Barros H. Diet and smoking in Spain and Portugal: a comment. *Eur J Public Health* 1998;**8**:89-92.
- 17 Laaksonen M, Lahelma E, Prattala R. Associations among health-related behaviours: sociodemographic variation in Finland. *Soz Praventivmed* 2002;**47**:225-32.
- 18 Rust P, Lehner P, Elmadfa I. Relationship between dietary intake, antioxidant status and smoking habits in female Austrian smokers. *Eur J Clin Nutr* 2001;**40**:78-83.
- 19 Majem LS, Vinas BR, Barba LR, *et al.* Food consumption and nutrient intake in relation to smoking (article in Spanish). *Med Clin (Barc)* 2001;**116**:129 -32.
- 20 Morabia A, Curtin F, Bernstein M. Effects of smoking and smoking cessation on dietary habits of a Swiss urban population. *Eur J Clin Nutr* 1999;**53**:239-43.
- 21 Morabia A, Wynder EL. Dietary habits of smokers, people who never smoked, and exsmokers. *Am J Clin Nutr* 1990;**52**:933-7.
- 22 Dallongeville J, Marécaux N, Fruchart J-C, *et al.* Cigarette smoking is associated with unhealthy patterns of nutrient intake: a Meta-analysis. *J Nutr* 1998;**128**:1450-7.
- 23 Marangon K, Herbeth B, Lecomte E, *et al.* Diet, antioxidant status, and smoking habits in French men. *Am J Clin Nutr* 1998;**67**:231-9.
- 24 Palaniappan U, Starkey L, O'Loughlin J, *et al.* Fruit and vegetable consumption is lower and saturated fat intake is higher among Canadians reporting smoking. *J Nutr* 2001;**131**:1952-8.
- 25 Hebert JR, Kabat GC. Differences in dietary intake associated with smoking status. *Eur J Clin Nutr* 1990;**44**:185-93.
- 26 Margetts BM, Jackson AA. Interactions between people's diet and their smoking habits:the dietary and nutritional survey of British adults. *BMJ* 1993;**307**:1381-4.

- 27 Woo J, Ho S, Sham A, *et al.* Dietary habit of smokers in a Chinese population. *Int J Food Sci Nutr* 2001;**52**:477-84.
- 28 Padrao P, Lunet N, Santos A, *et al.* Smoking, alcohol, and dietary choices: evidence from the Portuguese National Health Survey. *BMC Public Health* 2007;**7**:138.
- 29 Osler M, Tjonneland A, Surtum M, *et al.* Does the association between smoking status and selected healthy foods depend on gender? A population-based study of 54 417 middle-aged Danes. *Eur J Clin Nutr* 2002;**56**:57-63.
- 30 Billson H, Pryer J, Nichols R. Variation in fruit and vegetable consumption among adults in Britain. An analysis from the dietary and nutritional survey of British adults. *Eur J Clin Nutr* 1999;**53**:946-52.
- 31 Pollard J, Greenwood D, Kirk S, *et al.* Lifestyle factors affecting fruit and vegetable consumption in the UK Women's Cohort Study. *Appetite* 2001;**37**:71-9.
- 32 Koh WP, Yuan JM, Sun CL, *et al.* Middle-Aged and Older Chinese Men and Women in Singapore Who Smoke Have Less Healthy Diets and Lifestyles than Nonsmokers. *J Nutr* 2005;**135**:2473 - 7.
- 33 Wilson D, Smith B, Speizer I, *et al.* Differences in food intake and exercise by smoking status in adolescents. *Prev Med* 2005;**40**:872-9.
- 34 Oshaug A, Bjonnes C, Bugge K, *et al.* Tobacco smoking, an independent determinant for unhealthy diet? A cross-sectional study of Norwegian workers on platforms in the North Sea. *Eur J Public Health* 1996;**6**:196-202.
- 35 La Vecchia C, Negri E, Franceschi S, *et al.* Differences in dietary intake with smoking, alcohol, and education. *Nutr Cancer* 1992;**17**:297-304.
- 36 Faruque O, Khana MR, Rahmana M, *et al.* Relationship between smoking and antioxidant nutrient status. *British Journal of Nutrition* 1995;**73**:625-32.
- 37 Instituto Nacional de Estatística. II Recenseamento Geral de População e Habitação, 1997. Maputo, Mozambique 1997.
- 38 Willett W. *Nutritional Epidemiology*. New York: Oxford University Press 1990.

- 39 Accortt N, Waterbor J, Beall C, *et al.* Need to educate primary caregivers about the risk factor profile of smokeless tobacco users. *J Cancer Educ* 2005;**20**:222-8.
- 40 McClure JB, Divine G, Alexander G, *et al.* A Comparison of Smokers' and Nonsmokers' Fruit and Vegetable Intake and Relevant Psychosocial Factors. *Behav Med* 2009;**35**:14-22.
- 41 Vardavas C, Linardakis M, Hatzis C, *et al.* Smoking status in relation to serum folate and dietary vitamin intake. *Tob Induc Dis* 2008;**4**:8.
- 42 Manach C, Scalbert A, Morand C, *et al.* Polyphenols: food sources and bioavailability. *Am J Clin Nutr* 2004;**79**:727-47.
- 43 Holland B, Welch A, Unwin I, *et al.* *McCance and Widdowson's The Composition of Foods* London: Ministry of Agriculture, Fisheries and Food and The Royal Society of Chemistry The Royal Society of Chemists 1991.
- 44 Tonstad S, Gorbitz C, Sivertsen M, *et al.* Under-reporting of dietary intake by smoking and non-smoking subjects counselled for hypercholesterolaemia. *J Intern Med* 1999;**245**:337-44.
- 45 Trobs M, Renner T, Scherer G, *et al.* Nutrition, antioxidants, and risk factor profile of nonsmokers, passive smokers and smokers of the Prevention Education Program (PEP) in Nuremberg, Germany. *Prev Med* 2002;**34**:600-7.
- 46 Stegmayr B, Eliasson M, Rodu B. The decline of smoking in northern Sweden. *Scand J Public Health* 2005;**33**:321-4.
- 47 Giraud D, Martin H, Driskell J. Plasma and dietary vitamin C and E levels of tobacco chewers, smokers, and nonusers. *J Am Diet Assoc* 1995;**95**:798-800.
- 48 Berrigan D, Dodd K, Troiano R, *et al.* Patterns of health behavior in U.S. adults. *Prev Med* 2003;**36**:615-23.
- 49 Galan I, Rodriguez-Artalejo F, Diez-Ganan L, *et al.* Clustering of behavioural risk factors and compliance with clinical preventive recommendations in Spain. *Prev Med* 2006;**42**:343-7.

