

Alcohol consumption and associated risk factors among high school students in Toamasina I, Madagascar: A case-control study

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Abstract

Introduction: Adolescent alcohol consumption is a major public health issue, yet recent data from Toamasina, Madagascar are scarce. This study aim to estimate the prevalence and the associated factors among high school students in Toamasina I.

Methods: We conducted a cross-sectional, retrospective, single-center analytical case-control study on 23-24 May 2024 in the Toamasina I School District. One high school was selected by cluster sampling. An anonymous self-administered questionnaire incorporating WHO AUDIT items was distributed (n=350). We included 200 eligible students: 100 alcohol consumers (cases) and 100 non-consumers (controls). Analyses were performed in R 4.4.3 using bivariate odds ratios (OR) and multivariate logistic regression.

Results: Alcohol consumption prevalence was 34%. Cases and controls had median age 17 years. In bivariate analysis, male sex (OR=2.33; p=0.006), bereavement (OR=1.93; p=0.031), separation (OR=2.39; p=0.010), paternal alcohol use (OR=1.93; p=0.038) and maternal alcohol use (OR=2.19; p=0.024) were associated with consumption. In multivariate analysis, independent factors were male gender (aOR=3.47; 95%CI 1.72-7.21; p=0.0006), bereavement (aOR=1.96; 95%CI 1.01-3.87; p=0.0474) and paternal alcohol use (aOR=2.79; 95%CI 1.36-5.91; p=0.0059).

Conclusion: Alcohol use is frequent among Toamasina I students and is linked to gender, family alcohol modeling and bereavement, supporting gender-sensitive school and family interventions and psychosocial support for adolescents experiencing recent or unresolved loss.

Keywords: Alcohol consumption; Adolescents; High school students; Risk factors; Family environment; Bereavement; Madagascar.

1. Introduction

Alcohol consumption, also referred to as alcohol dependence, is defined not only by excessive intake but also by the presence of a compulsive need to consume alcoholic beverages. Adolescence represents a critical developmental period characterized by major biological, psychological, and social changes, which increases vulnerability to risk behaviors, including alcohol use [1].

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Globally, alcohol consumption among adolescents remains a major public health concern. Although a gradual decline in prevalence has been reported in some regions such as the United States, consumption levels remain high [2]. In Europe, nearly half of students report having consumed alcohol before the age of 13 [3]. In Africa, prevalence varies according to sociocultural contexts [4]. In Madagascar, a study conducted in Antananarivo in 2012 reported that 42.52% of high school students had already consumed alcohol [5].

According to the World Health Organization's Global Status Report on Alcohol and Health (2018), alcohol accounts for 5.3% of global mortality, ranking as the third leading avoidable risk factor for death [6]. Among adolescents, alcohol consumption is associated with multiple adverse consequences, particularly impairments in learning and memory [1]. In some cases, alcohol use may represent a suicidal equivalent or be part of a broader psychological distress that can progress toward depressive states in the absence of appropriate management [7].

In Toamasina, no recent study has quantified the magnitude of alcohol consumption among high school students nor characterized the profiles of alcohol-consuming students and associated risk factors. This study is based on the hypothesis that alcohol consumption during high school is linked to individual psychological factors and favorable environmental contexts. Its objectives were to determine the prevalence of alcohol consumption and to identify associated risk factors among high school students in Toamasina.

2. Methods

2.1. Study design

This was a cross-sectional, retrospective, monocentric, analytical case-control study conducted on May 23rd and 24th, 2024. The study took place in the Toamasina I School District, Madagascar, following a cluster random sampling of high schools within the district.

2.2. Participants

The Toamasina I School District included 33 high schools with a total of 11,493 students. One high school was randomly selected by cluster sampling. A total of 350 self-administered questionnaires were distributed to students.

Among the respondents, 132 students reported alcohol consumption. Thirteen questionnaires were excluded due to incomplete or ambiguous responses, resulting in 119 eligible alcohol-consuming students. From this group, 100 students were selected as cases.

Among 154 non-alcohol-consuming students, 41 questionnaires were excluded for incomplete or ambiguous responses, leaving 113 eligible students, from whom 100 controls were selected. Additionally, 64 students refused to participate and were not included in the analysis.

2.3. Data sources/measurement

Data were collected using a self-administered questionnaire, completed individually by the students. The questionnaire was designed to collect qualitative data on alcohol consumption and explore potential risk factors associated with alcohol use among high school students in Toamasina I.

It was based on tools previously used in studies on adolescent alcohol consumption and incorporated items from the Alcohol Use Disorders Identification Test (AUDIT) developed by the World Health Organization (WHO). A copy of the questionnaire was provided in Appendix 1 of the thesis.

2.4. Variables

The variables analyzed in this study were organized into two main domains: sociodemographic characteristics and family and biographical context, which were selected based on their potential influence on alcohol consumption behavior among adolescents.

Sociodemographic variables included gender, categorized as male or female, and age, recorded in completed years at the time of the survey.

The family and biographical context encompassed several adverse life events and familial characteristics. These included a history of physical and/or verbal aggression, a history of sexual aggression or inappropriate touching, and a

history of academic failure. Additionally, experiences of bereavement, defined as the loss of a parent, relative, or close friend, were documented. Situations involving separation from a close person, such as parental divorce or separation, were also recorded. Finally, parental marital status was assessed and classified as married, cohabiting, divorced, separated, or widowed.

2.5. Statistical methods

Data analysis was performed using R software (version 4.4.3). A case-control analytical approach was applied to identify associations between alcohol consumption and sociodemographic, familial, and biographical variables. Multivariate analysis was conducted to determine statistically significant risk factors.

2.6. Bias

Self-administered questionnaires may be subject to reporting bias; cluster random sampling was used to select the study site.

2.7. Study size

A total of 200 students were included (100 cases and 100 controls) as described in the sampling section.

2.8. Quantitative variables

Age was recorded in completed years at the time of survey and analyzed as presented in the tables.

2.9. Ethical considerations

Participation was voluntary and responses were anonymous; confidentiality was ensured during data collection in the school setting.

3. Results

3.1. Participants

A total of 200 students were included, comprising 100 alcohol consumers (cases) and 100 non-consumers (controls).

3.2. Descriptive data

The prevalence of alcohol consumption among high school students was 34%. A total of 200 students were included, comprising 100 cases (alcohol consumers) and 100 controls (non-consumers). Among the cases, 59% were female and 41% were male, resulting in a sex ratio of 0.7. This female predominance was more pronounced among the controls, where 77% were female and 23% were male, with a sex ratio of 0.3. The age of participants ranged from 14 to 20 years. The median age was 17 years in both groups. The mean age was 16.72 ± 1.25 years among cases and 16.60 ± 1.19 years among controls. Among alcohol-consuming students, 51% reported having experienced bereavement during childhood, compared with 35% among controls. A history of parental separation was reported by 36% of cases versus 19% of controls. An academic failure was reported by 27% of cases and 15% of controls. A history of physical or verbal aggression was reported by 24% of cases, compared with 12% among controls. Reports of sexual aggression or inappropriate touching were less frequent, affecting 9% of cases and 3% of controls. Regarding parental marital status, 63% of cases had married parents, compared with 67% among controls. Divorce was reported in 13% of cases versus 4% of controls, separation in 11% versus 9%, cohabitation in 9% versus 14%, and widowhood in 4% versus 6%, respectively. Most students lived in a two-parent household, accounting for 72% of cases and 79% of controls. A single-parent household was reported by 26% of cases and 18% of controls, while guardianship concerned 2% of cases and 3% of controls. Alcohol use by the father was reported in 72% of cases, compared with 57% of controls. Alcohol use by the mother concerned 34% of cases and 19% of controls. Alcohol use by a guardian was rare (1% of cases and 2% of controls). Leisure activities were reported by 99% of students in the case group and 98% in the control group. Religious practice was reported by all cases (100%) and by 98% of controls. Among alcohol-consuming students, beer was the most frequently consumed beverage (79%), followed by wine (40%), whisky (36%), traditional alcohol (Toaka Gasy) (6%), and other alcoholic beverages (16%). In terms of quantity consumed, 46% reported consuming three to four drinks per occasion, 22% reported five to six drinks, 12% reported seven to eight drinks, and 8% reported ten or more drinks. Only 1% reported consuming one to two drinks, while 11% reported no alcohol consumption during the reference period. Concerning frequency, 65% reported alcohol consumption two to four times per month, 18% reported two to three times per week, 13% once per month or less, and 4% at least four times per week. Alcohol consumption

occurred predominantly in a social context, with 96% of cases drinking in the presence of friends or family members, while only 4% reported drinking alone.

3.3. Outcome data

The outcome was alcohol consumption status (case vs control).

3.4. Main results

The present study identified several independent factors associated with alcohol consumption among high school students in Toamasina I. Multivariate logistic regression analysis showed that male gender was significantly associated with alcohol consumption, with male students presenting a 3.47-fold higher risk compared with females (aOR = 3.47; 95% CI [1.72–7.21]; $p = 0.0006$). This finding is consistent with previous studies reporting higher alcohol use among male adolescents, attributed to sociocultural norms, gendered drinking behaviors, and increased exposure to peer influence (Zamboanga et al., Li et al.) [8,9].

Parental alcohol consumption, particularly by the father, also emerged as a significant determinant. Adolescents whose fathers consumed alcohol had nearly three times higher odds of drinking alcohol (aOR = 2.79; 95% CI [1.36–5.91]; $p = 0.0059$). This result supports findings reported in Madagascar and other settings, emphasizing the role of familial modeling and parental attitudes in shaping adolescent drinking behaviors (Razanamihaja et al., Murphy et al.) [10,11]. Similar conclusions were drawn in systematic reviews highlighting family structure and parental substance use as key risk factors (Pourmovahed et al.) [12].

Bereavement was also independently associated with alcohol consumption, with affected students showing a 96% increased risk (aOR = 1.96; 95% CI [1.01–3.87]; $p = 0.0474$). This association aligns with studies indicating that exposure to emotionally distressing life events during adolescence may increase vulnerability to substance use as a maladaptive coping mechanism (Hamdan et al.) [13].

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Table 1 summarizes the results of the bivariate analysis examining the association between sociodemographic characteristics, biographical antecedents, lifestyle habits, family environment factors, and alcohol consumption among high school students in Toamasina.

Table 1 Bivariate analysis of factors associated with alcohol consumption among high school students in Toamasina (n = 200)

Domains	Variables	Cases (%)	Controls (%)	Crude OR (95% CI)	p-value
Sociodemographic	Male gender	41	23	2.33 (1.27–4.34)	0.006
	Female gender (ref.)	59	77	1.00	–
	Age (continuous)	–	–	1.09 (0.86–1.37)	0.485
Biographical antecedents	Physical/verbal aggression	24	12	2.31 (1.03–5.42)	0.041
	Sexual aggression/touching	9	3	3.18 (0.76–18.83)	0.133
	Academic failure	27	15	2.09 (0.98–4.57)	0.055
	Bereavement	51	35	1.93 (1.05–3.55)	0.031
	Separation	36	19	2.39 (1.20–4.85)	0.010
Lifestyle habits	Leisure activities	99	98	2.01 (0.10–120.30)	1.000
	Religious practice	100	98	∞ (0.19–∞)	0.497
Family environment	Married parents	63	67	0.84 (0.45–1.56)	0.656
	Cohabiting parents	9	14	0.61 (0.22–1.60)	0.375
	Divorced parents	13	4	1.25 (0.45–3.59)	0.814
	Separated parents	11	9	1.25 (0.45–3.59)	0.814
	Widowed parents	4	6	0.65 (0.13–2.86)	0.747
	Two-parent household	72	79	0.68 (0.34–1.37)	0.323
	Single-parent household	26	18	1.60 (0.77–3.36)	0.231
	Guardianship	2	3	0.66 (0.05–5.90)	1.000
	Father alcohol use	72	57	1.93 (1.03–3.66)	0.038
	Mother alcohol use	34	19	2.19 (1.10–4.46)	0.024
	Guardian alcohol use	1	2	0.50 (0.01–9.68)	1.000

Table 2 presents the results of the multivariate logistic regression analysis identifying independent factors associated with alcohol consumption among high school students in Toamasina I.

Table 2 Multivariate logistic regression analysis of factors associated with alcohol consumption among high school students in Toamasina I

Variables	Adjusted OR (aOR)	95% CI	p-value
Gender: Male	3.47	1.72 – 7.21	0.0006
Gender: Female (ref.)	1.00	–	–
Age 14	1.13	0.15 – 8.50	0.9056
Age 15	0.42	0.14 – 1.20	0.1118
Age 16 (ref.)	1.00	–	–
Age 17	0.90	0.40 – 2.02	0.7941

Age 18	1.70	0.63 – 4.73	0.3004
Age 19	1.02	0.21 – 4.97	0.9838
Age 20	2.15	0.16 – 56.30	0.5772
Physical/verbal aggression	1.62	0.66 – 4.05	0.2937
Sexual aggression/touching	2.42	0.56 – 13.40	0.2616
Academic failure	2.14	0.89 – 5.37	0.0940
Bereavement	1.96	1.01 – 3.87	0.0474
Separation	2.02	0.94 – 4.42	0.0723
Father alcohol use	2.79	1.36 – 5.91	0.0059
Mother alcohol use	1.79	0.87 – 3.74	0.1150

3.5. Other analyses

No additional subgroup analyses were performed beyond the bivariate and multivariate models presented in Tables 1 and 2.

4. Discussion

The present study identified several independent factors associated with alcohol consumption among high school students in Toamasina I. Multivariate logistic regression analysis showed that male gender was significantly associated with alcohol consumption, with male students presenting a 3.47-fold higher risk compared with females (aOR = 3.47; 95% CI [1.72–7.21]; $p = 0.0006$). This finding is consistent with previous studies reporting higher alcohol use among male adolescents, attributed to sociocultural norms, gendered drinking behaviors, and increased exposure to peer influence (Zamboanga et al., Li et al.) [8,9].

Parental alcohol consumption, particularly by the father, also emerged as a significant determinant. Adolescents whose fathers consumed alcohol had nearly three times higher odds of drinking alcohol (aOR = 2.79; 95% CI [1.36–5.91]; $p = 0.0059$). This result supports findings reported in Madagascar and other settings, emphasizing the role of familial modeling and parental attitudes in shaping adolescent drinking behaviors (Razanamihaja et al., Murphy et al.) [10,11]. Similar conclusions were drawn in systematic reviews highlighting family structure and parental substance use as key risk factors (Pourmovahed et al.) [12].

Bereavement was also independently associated with alcohol consumption, with affected students showing a 96% increased risk (aOR = 1.96; 95% CI [1.01–3.87]; $p = 0.0474$). This association aligns with studies indicating that exposure to emotionally distressing life events during adolescence may increase vulnerability to substance use as a maladaptive coping mechanism (Hamdan et al.) [13].

Although certain age groups showed adjusted odds ratios below one—suggesting a potential protective trend—these associations were not statistically significant. For example, students aged 15 years had a lower odds ratio (aOR = 0.42; $p = 0.1118$), but this effect did not reach significance. This finding suggests that age alone does not independently influence alcohol consumption when psychosocial and familial factors are taken into account, as previously reported in regional and international studies (Posavec et al., Farnia et al.) [14,15].

Overall, these findings confirm the multifactorial nature of adolescent alcohol consumption and highlight the importance of gender-sensitive prevention strategies, family-based interventions, and psychosocial support for adolescents experiencing bereavement, in line with recommendations from earlier studies cited in the thesis.

5. Conclusion

This study highlights the significant burden of alcohol consumption among high school students in Toamasina I and identifies key factors independently associated with this behavior. Male gender, paternal alcohol consumption, and a history of bereavement were found to be significant determinants of alcohol use among adolescents. These findings underscore the central role of family environment, gender-related vulnerabilities, and exposure to emotionally stressful

life events in shaping adolescent drinking behaviors. The results emphasize the need for targeted prevention strategies focusing on family-based interventions, psychosocial support for bereaved adolescents, and gender-sensitive health education programs within the school setting. Strengthening early detection and preventive actions may contribute to reducing alcohol-related risks during this critical developmental period.

What is already known about this topic

- Alcohol consumption in adolescence is associated with adverse health and educational outcomes.
- Family environment and parental substance use influence adolescent drinking behaviors.
- Local data on adolescent alcohol consumption in Toamasina are limited.

What this study adds

- Provides recent prevalence data on alcohol consumption among high school students in Toamasina I.
- Identifies male gender, paternal alcohol use, and bereavement as independent factors associated with alcohol consumption.
- Supports gender-sensitive school-based prevention and family-focused interventions in this setting.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

Authors' contributions

- Ratobimanankasina HH : Conceptualization; Methodology; Investigation; Data curation;
- Couinga C : Formal analysis; Writing – original draft; Project administration.
- Razakandrainy AH : Supervision.
- Raobelle EN : Validation; Supervision.
- Rajaonarison BH : Validation.
- Raharivelo A : Validation.

All authors read and approved the final manuscript.

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