

Prevalence of Tobacco Use and Associated Factors among Adults in Benin in 2015: Results of the National Survey of Non-Communicable Disease Risk Factors

Alexandrine Houinato¹, Roch Christian Johnson¹, Alphonse Kpozehouen², Fernand Guedou³, Christophe Houssou⁴, Dismand S. Houinato³

¹Inter Faculty Center of Training and Research in Environment for Sustainable Development, University of Abomey-Calavi, Cotonou, Benin

²Regional Institute of Public Health, University of Abomey-Calavi, Cotonou, Benin

³Laboratoire d'Epidémiologie des Maladies Chroniques Et Neurologiques (LEMACEN), Faculty of Health Sciences, Université d'Abomey-Calavi, Cotonou, Benin

⁴Faculty of Humanities and Social Sciences, University of Abomey-Calavi, Cotonou, Benin

Email: rochchristianjohnson@gmail.com

How to cite this paper: Houinato, A., Johnson, R.C., Kpozehouen, A., Guedou, F., Houssou, C. and Houinato, D.S. (2018) Prevalence of Tobacco Use and Associated Factors among Adults in Benin in 2015: Results of the National Survey of Non-Communicable Disease Risk Factors. *Open Journal of Epidemiology*, 8, 130-144. <https://doi.org/10.4236/ojepi.2018.83011>

Received: June 27, 2018

Accepted: August 12, 2018

Published: August 15, 2018

Copyright © 2018 by authors and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution-NonCommercial International License (CC BY-NC 4.0).

<http://creativecommons.org/licenses/by-nc/4.0/>



Open Access

Abstract

Introduction: Tobacco use and exposure to tobacco smoke are one of the most preventable causes of death and disability worldwide. The risk is even higher among daily tobacco consumers. The World Health Organization (WHO) recommended that surveillance of major risk factors for non-communicable diseases (NCDs), such as smoking, be imperative to predicting the future burden of NCDs, identifying adequate interventions to decrease future burden and monitor trends. In 2015, a survey on NCD risk factors was conducted in Benin to estimate the prevalence of major NCD risk factors. We analyzed the data from this survey to estimate the prevalence and risk factors associated with daily tobacco consumption in Benin. **Methods:** A nationwide representative sample of the population was constituted in the 12 departments of Benin. The WHO STEPS wise tool was used to collect data on behavioral and demographic characteristics, including daily tobacco consumption. Tobacco consumption was subdivided into three categories: The daily consumption of tobacco, the daily consumption of smoked tobacco and non-smoked tobacco. Multivariate analysis through the weighted logistic regression was used to identify potential factors associated with daily consumption of tobacco. **Results:** Over the 5.126 surveyed subjects, 7.49% were daily tobacco consumers, with 3.85% being daily users of smoked tobacco and 4.36% being daily consumers of non-smoked tobacco. Men were more likely

to be daily consumers of tobacco compared to women (OR = 7.42; $_{95\%}$ CI = [4.98; 11.06]). Compared to respondents aged 18 to 24, those aged 45 to 54 were five times more likely to consume tobacco (OR = 5.58; $_{95\%}$ IC = [2.71; 11.47]). Respondents residing in the departments of Atacora, Couffo and Borgou were respectively 4.28 times, 3.93 times and 2.63 times more likely to consume tobacco compared to those residing in the department of Alibori. Respondents with no education were more likely to consume tobacco daily compared to respondents who had finished high school or were in university (OR = 3.73; $_{95\%}$ CI = [1.36; 10.23]). Respondents who were overweight were less likely to be daily users of tobacco compared to people with normal weight status (OR = 0.57; $_{95\%}$ CI = [0.34; 0.96]). **Conclusion:** There is a relatively high prevalence of smoking in Benin, where one out of 8 people, consumes tobacco products daily. Being elderly, male, having no formal education, residing in Atacora, Borgou or Couffo were significantly associated with daily smoking. Prevention actions should thus target those sub-groups of the population.

Keywords

Tobacco, Non Communicable Diseases, STEP Wise, Benin

1. Introduction

Tobacco use and exposure to tobacco smoke is one of the most preventable causes of death and disability worldwide. The risk of disability is even higher among daily tobacco users. Compared to occasional smokers, daily smokers are at increased risk of ischemic stroke [1] and serum lipid and lipoprotein concentrations [2]. Projections show that between 2002 and 2030, tobacco-related mortality and exposure are expected to decrease by 9% in high-income countries, but would double by 3.4 million to 6.8 million in developing countries with low or middle income [3]. The World Report on Non Communicable Diseases (NCDs) 2010 of the World Health Organization (WHO) indicated that in Benin, smoking was a major risk factor for NCDs, which accounted for 16% of all deaths in the country [4]. WHO recommended that surveillance of the main risk factors for NCDs, such as tobacco use, be imperative in order to predict the future burden of NCDs, identify appropriate interventions to decrease the latter and to monitor current and emerging trends [5]. At present, surveillance of adult smoking in Benin is done through Benin Demographic and Health Surveys (BDHS) [6]. The BDHS provides national data on demographic and health characteristics and contains a section on smoking. However, BDHS only reports prevalence, does not link it to social and demographic characteristics, and does not assess the magnitude of the risk in terms of daily tobacco use. In 2008, the first NCDs risk factors survey was conducted in Benin, involving all 12 departments and using the WHO STEP wise approach, to estimate the prevalence of major risk factors for NCDs. This survey found a relatively high prevalence of

tobacco consumption: 17.1% $_{95\%}CI = [15.9; 18.3]$ for overall tobacco consumption and 9.5% $_{95\%}IC = [8.6; 10.5]$ for smoked tobacco [7]. The study also revealed that subjects of male sex, elderly, of low education level, living in rural areas or in some specific departments of the country, were at higher risk of tobacco consumption. This situation has led the national program for NCDs control to strengthen its tobacco consumption prevention activities by targeting these sub-populations. We have used the opportunity of the STEPS survey 2015, as surveillance tool, to assess the current status of these findings by estimating the prevalence of the daily consumption of tobacco and determining potential factors associated to it.

2. Methods

A detailed description of the survey design, study population and sampling procedures has been presented elsewhere [8]. However we briefly present here some key features of the methods.

2.1. Study Design, Study Population and Sampling

The STEPS survey 2015 was a cross-sectional study conducted between October and December 2015. The target population consisted of adults from the twelve departments of Benin. Inclusion criteria comprised living in Benin for at least 6 months, being aged 18 to 69 years, being present at home on the day of the survey and having provided informed consent. Excluded potential participants included those who were given two unsuccessful home visits as well as those with disabilities (mentally deficient subjects) to answer questions. The sampling framework was provided by the National Institute of Statistics and Economic Analysis (INSAE) based on data from the Fourth General Population and Housing Census (RGPH4) in Benin in 2013. A three-stage random sampling technique was used: the first stage consisted of the random selection of 257 Population Size Estimation Areas (PSEA), the second stage consisted of the randomly selecting 20 households by PSEA and the third stage consisted of randomly selecting one individual per household, using the Kish method recommended by WHO for the STEPS survey. The sample size was calculated using the Scharwtz formula and the spreadsheet developed by the WHO for calculating the sample size in the STEPS surveys. The size of our sample was 5123 participants. The investigation team consisted of 60 trained field researchers and 6 supervisors.

2.2. The Measurements

Data were collected following the three steps recommended by WHO in the WHO STEPS methodology and using the latest French version of the WHO STEPS tool adapted for Benin [5]. The first step (STEP 1) consisted of the administration of a questionnaire to obtain information on the demographic, socio-economic and behavioral characteristics of the respondents. At the second

step (STEP 2), the physical measurements were completed on the respondents. Tobacco consumption (frequency, duration, quantity) was measured under STEP 1. Smoked tobacco products included those when used, can cause the combustion of the tobacco product and its smoke inhalation whereas smokeless tobacco products are those whose consumption involves chewing or snuff.

We considered tobacco users, respondents who reported using smoked tobacco products such as cigarettes, cigars, pipes, shisha and/or smokeless tobacco products such as snuff and tobacco chewing. The daily tobacco users therefore included respondents who declared using on a daily basis, either smoked or smokeless tobacco products or both.

2.3. Dependent Variable

The dependent variable was daily tobacco use. In our study, we considered that if a person smoked tobacco or consumed it in any other ways, that person daily consumed tobacco.

2.4. Independent Variables

We retained nine (09) variables at the level of the respondents to appreciate factors associated with tobacco consumption. These included 1) gender 2) age, 3) the level of education, 4) marital status, 5) professional status, 6) residence area (rural/urban) 7) department 8) body mass index (BMI) and 8) his waistline. BMI is calculated from the formula $IMC = \frac{\text{Weight (kg)}}{\text{Height}^2 (\text{m}^2)}$; WHO thresholds were

adopted to define the overall obesity if the $BMI \geq 30$, the overweight if $25 \leq BMI < 30$ and normal weight when the $BMI < 25$ [9]. To assess the abdominal obesity we used the waistline of the respondents; the WHO thresholds for the abdominal obesity were used: 94 cm for men and 80 cm for women [10] (see **Table 1** for the variables and their modalities).

2.5. Statistical Analysis

Data were directly captured with Personal Digital Assistant (PDA) devices using the pre-recorded WHO standardized questionnaire for STEPS survey [11].

For the descriptive analysis, proportions were estimated along with their 95% confidence intervals for the qualitative variables, while central and dispersion parameters were calculated for the quantitative variables.

To identify factors associated with daily smoking, a weighted logistic regression was used to estimate crude and adjusted odds ratios (OR) and their corresponding 95% confidence intervals ($_{95\%}$ CI). Using the significance threshold of 20%, a bivariate analysis was conducted to pre-select variables that were subsequently included in the multivariate model. These included sex, age, educational attainment, marital status, employment, geographic area of residence, urban/rural residence and weight status. We then used a step down (descending) modeling strategy for the gradual elimination of variables which are less significantly related

to the daily consumption of tobacco. Variables were retained in the final model if they had a statistical significance level of less than 5%. The weight of the respondents selection was considered for all statistical analyzes [12]. We looked for possible interactions and confounding factors. The fitness of the final model was verified with the test of Hosmer Lemeshow. All statistical analyses were performed using STATA version 12.

2.6. Ethical Considerations

The study protocol obtained the approval of the National Ethics Committee for Health Research (CNERS) and the involvement of health authorities and local officials. Free and written informed consent was required from each participant. Data were collected anonymously.

3. Results

3.1. Characteristics of Participants

A total of 5126 people were surveyed. Women accounted for 50.30% of this population. Nearly half of the surveyed population (47.30%) had no level of education. A respondent out of two lived in urban areas (50.70%) and most of the people surveyed were married or living with a partner (73.80%). Two thirds of the respondents (67.70%) were self-employed and had an independent profession). Their average age was 34.21 years (Standard deviation = 0.31) (See **Table 1**).

Table 1. Description of the respondents characteristics in the STEPS Survey, Benin, 2015.

Variable	n	%
Sex		
Man	2,326	49.70
Woman	28	50.30
Age (Year)		
18 - 24	846	26.10
25 - 34	1,541	31.90
35 - 44	1,256	19.10
45 - 54	829	13.90
55 - 69	654	9.05
Education Level		
No formal education	2,593	47.30
Less than primary school	806	15.30
End of primary school	801	15.60
End of high school	482	11.20
End of high school/University	443	10.50

Continued**Marital status**

Never married	680	21.40
Married/living together	4,089	73.80
Separated/Divorced	113	1.49
Widower	244	3.26

Professional status

Employee	305	5.38
Self-employed	3,710	67.70
Student	333	11.10
Tutor	626	11.90
Volunteer/unemployed/disabled/Retired	152	3.84

Area

Rural	2,666	49.30
Urban	246	50.70

Department

Alibori	316	9.15
Atacora	416	7.36
Atlantique	716	13.40
Borgou	636	12.20
Collines	359	7.53
Couffo	197	7.64
Donga	299	7.46
Littoral	339	6.96
Mono	555	5.18
Oueme	575	9.17
Plateau	320	6.20
Zou	398	7.74

Weighted status

Normal	3,447	69.40
overweight	931	16.70
Obesity	748	13.90

Waistline

Normal	3,926	84.40
Abnormal	907	15.60

n: number of people surveyed. % weighted columns of respondents.

3.2. Prevalence of Tobacco Consumption

The results of the survey showed that the prevalence of daily smoked tobacco was 3.85% $_{95\%}\text{CI} = [3.20; 4.50]$, that of daily non smoked tobacco was 4.36% $_{95\%}\text{CI} = [3.58\%; 5.14\%]$ and the prevalence of daily consumption of tobacco (smoked or unsmoked) was 7.49% $_{95\%}\text{CI} = [6.54\%; 8.43\%]$.

3.3. Factors Related to Tobacco Use

3.3.1. Univariate Analysis: Daily Smoked Tobacco

Men smoked daily more than women (94.9% for men versus 5.09% for women). Men were 20.31 more likely to smoke than women (OR = 20.31; $_{95\%}\text{CI} = [10.27; 40.20]$). Respondents smoked mostly in the 55 - 69 age group. A gradual increase in the risk of smoking was noted with increasing age (see **Table 2**). Respondents with no education were those who smoked the most: the risk of smoking was 3 times higher among respondents without any formal education compared to those who had completed high school or had completed their university education. Separated or divorced respondents were more likely to smoke daily than single (OR = 7.90; $_{95\%}\text{CI} = [3.15; 19.82]$). The self-employed respondents (independent) were more likely to smoke tobacco daily than the employees (private/public) (OR = 4.83; $_{95\%}\text{CI} = [1.53; 15.24]$). The departments of Atacora, Couffo and Donga were those where the respondents smoked the most (the respective prevalence were 17.40%, 15.80% and 13.30%). Respondents of Atacora were more likely to smoke than those of Alibori (OR = 2.49; $_{95\%}\text{CI} = [1.09; 5.69]$), whereas those of Zou or Ouémé were less likely to smoke tobacco (the respective OR were 0.27, $_{95\%}\text{CI} = [0.10; 0.76]$ and 0.30; $_{95\%}\text{CI} = [0.10; 0.91]$). Overweight or obese were less likely to smoke than people who had “normal” weight status (OR = 0.42; $_{95\%}\text{CI} = [0.24; 0.76]$ and OR = 0.27; $_{95\%}\text{CI} = [0.13; 0.56]$, respectively; respondents who had a waistline superior to the normal were less likely to daily smoking (OR = 0.13; $_{95\%}\text{CI} = [0.05; 0.32]$) (see **Table 2**).

3.3.2. Univariate Analysis: Daily Non-Smoked Tobacco

Women consumed more smokeless than smoked tobacco (30% versus 5.09%). The older people got, the more they consumed smokeless tobacco; respondents who had no education were more likely to consume non-smoked tobacco compared to those who had completed high school or were in university. Volunteers, unemployed, disabled or retired were more likely to use smokeless tobacco (OR = 10.65; $_{95\%}\text{CI} = [1.95; 58.12]$) compared to people who had an activity (employees). Respondents from the departments of Couffo, Atacora, Borgou were at higher risk of consuming non-smoked tobacco compared to those from Alibori; the respective ORs were 3.82, 2.88, 2.18. Obese people compared to those with normal weight status (OR = 0.34, $_{95\%}\text{CI} = [0.15; 0.77]$) and those with an abnormal waistline (OR = 0.49, $_{95\%}\text{CI} = [0.25; 0.96]$) were less likely to consume non-smoked tobacco (see **Table 2**).

Table 2. Univariate analysis: Demographic and socio-cultural factors related to tobacco.

Variable	Daily consumption of tobacco														
	Smoked ¹					Not – smoked ²					Smoked and/or not – Smoked ³				
	n	%	OR	95% CI	p-value	n	%	OR	95% CI	p-value	n	%	OR	95% CI	p-value
Sex															
Man	198	94.9	20.32	[10.27; 40.20]	<0.001	161	70.00	2.45	[1.59; 3.79]	<0.001	335	81.40	4.91	[3.33; 7.24]	<0.001
Woman	13	5.09	1	-	-	59	30.00	1	-	-	66	18.60	1	-	-
Age															
18 - 24	8	5.31	1	-	-	11	6.57	1	-	-	19	6.56	1	-	-
25 - 34	54	36.5	5.83	[2.50; 13.59]	<0.001	40	26.20	3.35	[1.45; 7.71]	0.005	89	31.20	4.11	[2.25; 7.51]	<0.001
35 - 44	58	24.8	6.66	[2.88; 15.43]	<0.001	57	24.80	5.40	[2.38; 12.26]	<0.001	107	25.10	5.69	[3.13; 10.36]	<0.001
45 - 54	47	16.80	6.17	[2.61; 14.55]	<0.001	69	27.60	8.49	[3.82; 18.86]	<0.001	105	22.10	7.02	[3.85; 12.83]	<0.001
55 - 69	44	16.60	9.62	[3.99; 23.18]	<0.001	43	14.80	6.90	[2.97; 15.99]	<0.001	81	15.00	7.39	[3.97; 13.75]	<0.001
Education Level															
No formal education	128	60.60	3.06	[1.28; 7.32]	0.012	171	74.00	47.11	[11.52; 192.64]	<0.001	282	68.30	6.84	[3.00; 15.59]	<0.001
Less than primary school	38	18.2	2.83	[1.10; 7.27]	0.031	25	15.10	28.70	[6.50; 126.75]	<0.001	56	15.40	4.59	[1.89; 11.12]	0.001
End of primary school	24	9.92	1.48	[0.56; 3.89]	0.428	15	8.75	16.06	[3.34; 77.20]	0.001	37	9.53	2.69	[1.07; 6.81]	0.036
End of high school	13	6.72	1.40	[0.48; 4.10]	0.543	7	1.99	4.51	[0.78; 26.08]	0.092	17	4.27	1.66	[0.60; 4.54]	0.327
End of high school/University	8	4.56	1	-	-	2	0.38	1	-	-	9	2.45	1	-	-
Marital status															
Never married	15	7.36	1	-	-	13	9.44	1	-	-	27	8.69	1	-	-
Married/living together	173	86.10	3.51	[1.84; 6.71]	<0.001	175	80.10	2.53	[1.17; 5.49]	0.018	324	82.8	2.93	[1.69; 5.08]	<0.001
Separated/Divorced	14	3.69	7.90	[3.15; 19.82]	<0.001	11	4.17	7.12	[2.25; 22.51]	0.001	22	3.91	7.83	[3.40; 18.07]	<0.001
Widower	9	2.86	2.61	[0.92; 7.42]	0.71	21	6.31	4.71	[1.84; 12.07]	0.001	28	4.59	3.76	[1.81; 7.82]	<0.001
Professional status															
Employee)	4	1.63	1	-	-	3	0.91	1	-	-	7	1.37	1	-	-
Self-employed	199	95.10	4.83	[1.53; 15.24]	0.007	196	83.80	7.71	[1.90; 31.31]	0.004	365	88.10	5.56	[2.27; 13.60]	<0.001
Student	2	1.07	0.31	[0.41; 2.40]	0.264	0	0.00	1	-	-	2	0.55	0.19	[0.03; 1.29]	0.089
Tutor	2	0.56	0.15	[0.02; 0.94]	0.042	13	8.86	4.53	[0.92; 22.29]	0.063	15	5.45	1.83	[0.58; 5.81]	0.306
Volunteer/unemployed/disabled/	4	1.61	1.39	[0.29; 6.64]	0.682	8	6.44	10.65	[1.95; 58.12]	0.006	12	4.58	5.05	[1.50; 16.99]	0.009
Area															
Rural	132	52.90	1	-	-	135	50.70	1	-	-	253	53.20	1	-	-
Urban	79	47.10	0.86	[0.60; 1.23]	0.411	85	49.30	0.94	[0.65; 1.37]	0.764	148	45.80	0.85	[0.64; 1.12]	0.240
Department															
Alibori	10	9.18	1	-	-	12	9.36	1	-	-	19	8.35	1	-	-

Continued

Atacora	45	17.40	2.49	[1.09; 5.69]	0.031	62	20.00	2.88	[1.37; 6.02]	0.005	99	18.80	3.23	[1.77; 5.90]	<0.001
Atlantique	18	9.48	0.70	[0.28; 1.72]	0.432	3	1.30	0.09	[0.02; 0.39]	0.001	21	5.63	0.44	[0.21; 0.91]	0.027
Borgou	29	11.00	0.90	[0.38; 2.12]	0.802	67	25.70	2.18	[1.03; 4.60]	0.042	94	20.40	1.96	[1.06; 3.61]	0.032
Collines	13	4.46	0.58	[0.21; 1.59]	0.291	12	4.01	0.51	[0.21; 1.26]	0.146	24	4.56	0.65	[0.32; 1.33]	0.234
Couffo	15	15.80	2.16	[0.85; 5.51]	0.108	26	26.50	3.82	[1.69; 8.62]	0.001	35	20.20	3.36	[1.70; 6.64]	<0.001
Donga	19	13.30	1.83	[0.73; 4.63]	0.200	17	8.18	1.07	[0.44; 2.61]	0.875	34	10.50	1.60	[0.80; 3.21]	0.180
Littoral	8	3.05	0.43	[0.14; 1.26]	0.124	1	0.33	0.04	[0.01; 0.35]	0.003	8	1.57	0.23	[0.09; 0.61]	0.003
Mono	24	4.91	0.94	[0.39; 2.26]	0.894	15	3.13	0.58	[0.24; 1.39]	0.220	33	3.35	0.69	[0.36; 1.35]	0.282
Oueme	7	2.84	0.30	[0.10; 0.91]	0.034	1	0.56	0.06	[0.01; 0.45]	0.007	8	1.79	0.20	[0.08; 0.51]	0.001
Plateau	14	6.39	1.03	[0.38; 2.76]	0.955	2	0.55	0.08	[0.02; 0.39]	0.002	16	3.60	0.62	[0.28; 1.39]	0.247
Zou	9	2.19	0.27	[0.10; 0.76]	0.013	2	0.38	0.05	[0.01; 0.21]	<0.001	10	1.23	0.16	[0.07; 0.38]	<0.001
Weight status															
Normal	181	86.00	1	-	-	187	81.70	1	-	-	341	82.90	1	-	-
overweight	18	9.07	0.42	[0.24; 0.76]	0.004	21	12.50	0.62	[0.33; 1.19]	0.150	37	11.80	0.56	[0.35; 0.90]	0.016
Obesity	12	4.88	0.27	[0.13; 0.56]	<0.001	12	5.80	0.34	[0.15; 0.77]	0.037	23	5.30	0.30	[0.17; 0.53]	<0.001
Waistline															
Normal	200	97.60	1	-	-	197	91.50	1	-	-	370	94.40	1	-	-
Abnormal	7	2.36	0.13	[0.05; 0.32]	<0.001	18	8.50	0.49	[0.25; 0.96]	0.037	23	5.58	0.30	[0.16; 0.54]	<0.001

¹Smoked: Product of tobacco that gives smoke during consumption (cigarette, cigars, cigarillos, hand rolled cigarettes). ²Not-smoked: Tobacco product that is consumed in any other forms without smoke (chewing, snuff). ³Smoked and/or Not Smoked: Tobacco in general consumed in all its forms. n: number of people surveyed. %: proportion of respondents who consume tobacco. OR: Odds Ratio.

3.3.3. Univariate Analysis: Daily Smoked or Non-Smoked Tobacco (SONST)

Trends observed among respondents for the consumption of smoked or non-smoked tobacco were noted for SONST consumption. The departments in which people consumed more SONST were Borgou (20.40%), Couffo (20.20%), Atacora (18.80%), and Donga (10.50%). The risk of daily consumption of tobacco in all its forms was lower in the Atlantique Departments (OR = 0.44; _{95%}CI = [0.21; 0.91]), Littoral (OR = 0.23; _{95%}CI = [0.09; 0.61]), Ouémé (OR = 0.20; _{95%}CI = [0.08; 0.51]) and that of Zou (OR = 0.16; _{95%}CI = [0.07; 0.38]) in relation to the department of Alibori. Overweight or obese people were less likely to consume SONST; the respective ORs were 0.56; _{95%}CI = [0.35; 0.90] and 0.30; _{95%}CI = [0.17; 0.53]. Respondents who had an abnormal waistline were less likely to consume SONST (OR = 0.30; _{95%}CI = [0.16; 0.534]) (see **Table 2**).

3.3.4. Multivariate Analysis: Daily Smoked or Non-Smoked Tobacco (SONST)

In multivariate analysis, men were more at risk of consuming SONST than women (OR = 7.42 _{95%}CI = [4.98; 11.06]). Compared to respondents who were in the 18 to 24 age group, respondents who belonged to other age groups were more likely to consume SONST (see **Table 3**). Respondents with no education

Table 3. Multivariate analysis: Demographic and socio-cultural factors related to tobacco consumption in Benin, STEP survey, 2015.

Variables	Tobacco consumption (in all its forms)		
	OR	95% CI	P-value
Sex			
Man	7.42	[4.98; 11.06]	<0.001
Woman	1		
Age			
18 - 24	1		
25 - 34	3.55	[1.84; 6.84]	<0.001
35 - 44	4.31	[2.14; 8.70]	<0.001
45 - 54	5.58	[2.71; 11.47]	<0.001
55 - 69	4.48	[2.19; 9.17]	<0.001
Education Level			
No formal education	3.73	[1.36; 10.23]	0.011
Less than primary school	2.89	[0.99; 8.43]	0.051
End of primary school	1.47	[0.47; 4.56]	0.506
End of high school	1.22	[0.40; 3.72]	0.721
End of high school/University	1		
Marital status			
Never married	1		
Married/living together	1.42	[0.77; 2.62]	0.261
Separated/Divorced	2.81	[1.01; 7.83]	0.049
Widower	2.33	[0.89; 6.11]	0.085
Professional status			
Employee	1		
Self-employed	3.17	[1.00; 10.13]	0.051
Student	0.58	[0.08; 4.52]	0.606
Tutor	3.03	[0.74; 12.49]	0.125
Volunteer/unemployed/disabled/Retired	6.60	[1.63; 26.75]	0.008
Area			
Rural	1		
Urban	1.32	[0.95; 1.82]	0.093
Department			
Alibori	1		
Atacora	4.28	[2.24; 8.18]	<0.001
Atlantic	0.62	[0.30; 1.30]	0.207
Borgou	2.63	[1.39; 4.98]	0.003
Collines	0.97	[0.44; 2.11]	0.932

Continued

Couffo	3.93	[1.88; 8.24]	<0.01
Donga	1.79	[0.87; 3.69]	0.115
Littoral	0.33	[0.12; 0.92]	0.034
Mono	0.82	[0.40; 1.66]	0.577
Oueme	0.22	[0.09; 0.58]	0.002
Plateau	0.58	[0.25; 1.35]	0.204
Zou	0.17	[0.07; 0.41]	<0.001
Weighted status			
Normal	1		
overweight	0.57	[0.34; 0.96]	0.034
Obesity	0.71	[0.38; 1.32]	0.281

were more likely to consume SONST than those who had been to high school or university (OR = 3.73; 95%CI = [1.36; 10.23]). Divorced people were more likely to use the SONST compared to respondents who have never been married. Volunteers, unemployed, disabled or retired were 7 times more likely to consume SONST than those who worked (public or private employees). Compared to the department of Alibori, respondents in the departments of Atacora, Borgou, Couffo were more at risk of consuming SONST. The overweight people were less at risk of consuming SONST (OR = 0.71 95%CI = [0.38; 1.32] than those who had a normal BMI (See **Table 3**).

4. Discussion

4.1. Achievement of the Purpose of the Study

The prevalence of daily smoked tobacco was 3.85% 95%CI = [3.20; 4.50], that of daily non-smoked tobacco was 4.36% 95%CI = [3.58; 5.14] and that of daily tobacco consumption (smoked or non-smoked) was 7.49% 95%CI = [6.54; 8.43].

From our analyses, factors related to tobacco consumption included being: male subjects ($p < 0.001$); aged from 18 to 69 ($p < 0.001$); with no education ($p = 0.011$); separate or divorced ($p = 0.049$); volunteers, unemployed, disabled or retired ($p = 0.008$ and from the departments of Atacora ($p < 0.001$)).

Variables such as living environment (urban or rural), weight status, and waistline were not significantly associated with daily smoking.

4.2. Validity of Results

The methodology used is consistent with that recommended by WHO for this type of study. The size of our sample was large enough for the results to be generalizable for the Beninese population. Also, the use of a standardized questionnaire means that the results obtained could be compared to those of other countries. A limitation of this study was its cross-sectional design that could not allow any temporal relationship. Another limitation was the definition of the va-

riable “daily consumption of tobacco,” which excluded occasional tobacco users and could therefore underestimate the extent of smoking in Benin. Alternative variable for WHO STEPS survey was “current smoking” which did not either specify the duration, was vague and subject to interpretations from the respondents. Future STEPS surveys should include a time component in the assessment of “current smoking”. In addition, the evaluation of the “daily tobacco consumption” was based on self-reports that could introduce a bias. Finally, the present study was not able to cover the passive tobacco consumption, which in fact, is quite difficult to measure.

4.3. Comparison of Results

4.3.1. Overall Prevalence

The overall prevalence of daily tobacco consumption in Benin during our study was higher than that obtained in the Democratic Republic of Congo (DRC) in 2005 when a STEPS survey conducted among subjects aged from 15 to 64 found 4.4% [13]. It was also higher than that found in the STEPS survey in Ethiopia in 2006, (4.6%) among individuals aged from 25 to 64 [14] and that found in the STEPS survey 2008 in Zambia in adults over the age of 25 (5.0%) [15]. These differences could be explained by the difference between the sizes of the age groups considered. The prevalence of daily tobacco consumption was lower than that found in Benin in 2008 [16] during the STEPS survey., This reduction in prevalence could be explained by the various interventions conducted by the Ministry of Health and civil society for the dissemination of the STEPS survey 2008 results. The prevalence was also lower than that found in 2014 in Uganda during a national survey (9.2%) [17], in Tanzania (15.9%) in 2012 [18] and in Mozambique (16.7%) in 2005 [19] during the STEPS investigation on subjects aged from 25 to 64. In 2017, in France, the prevalence of daily smoking was 26.9% [20]. A study conducted among students in Syria in 2010 also showed a higher prevalence of 20.75% [21]. The difference could be explained by the difference in study populations.

4.3.2. Prevalence by Sex

The male predominance observed in our study was also found in the STEPS survey in Benin in 2008 (22.5% vs. 5.9%) [16], in 2014 in Uganda during a national demographic survey (15.9% vs. 4.7%) [17] and in the DRC in 2005 during the STEPS survey (14.1% vs. 1.4%) [13]. This predominance could be explained by the fact that in African culture, the education given to girls does not allow them to smoke, not even to declare it. They are therefore less likely to smoke than boys and even the majority of those who smoke will not always be able to declare it during the surveys because they are afraid of the judgment of others. In contrast, the study conducted in the United States and South Korea found no link between gender and smoking [22]. This difference could be explained by the difference between the target populations. In fact the study only targeted teenagers while ours has considered all the general population. Also, the difference

between the results can also be explained by the fact that in the culture of the Western people, there is no blame in society about women who smoke. They are therefore free as much as men to smoke.

4.3.3. Prevalence by Age

The age group of adults who were the most at risk in our study was similar to that found in Nepal in 2011, where the age group from 36 to 49 was concerned by smoking [23]. It was also similar to that found in Uganda in 2014 (30 to 49 years old) [17]. National studies carried out in Benin in 2008 [16], in Togo in 2010 [24] and in Burkina Faso in 2013 [25], found an age group at risk higher than that of our study (55 to 64 years old). This trend of predominance of tobacco use among older adults could be explained by the fact that most anti-smoking activities are directed towards young people, hence the reduction of prevalence among the latter. It should be added that during the rites in Africa, tobacco is used and mostly by elderly persons, which could explain our results.

4.3.4. Prevalence by Level of Education

The link between low education and smoking was also found in a study conducted in Pakistan in 2004 and 2005 [26]. The National Population Survey conducted in Nepal in 2011 also found the same result ($p < 0.01$) [23]. This could be explained by the fact that educated individuals would be more aware of the consequences of smoking and be wary of non-educated individuals.

4.3.5. Prevalence by Occupation

The fact that people who do not have full-time jobs are more at risk of smoking is similar to the observation made in Togo in 2010 during the STEPS survey [24]. This could be explained by the fact that unemployment leads individuals to smoking to forget the problems linked to their status. The type of occupation was linked to smoking in France in 2014. Laborers smoked more daily than other workers and employees smoked less [27]. This same remark was made in Nepal in 2011, during the demographic survey. This difference could be explained by the difference in methods of study. It could also be explained by the fact that occupations that require a lot of physical effort are quite stressful, so the workers indulge in smoking to better manage stress.

4.3.6. Prevalence According to Marital Status

In contrast to our study, the demographic survey conducted in Nepal in 2011 showed that married couples were more at risk of using tobacco [27]. ($p < 0.01$). The difference could also be explained by the difference between the methods used. However, our results could be supported by the fact that, being divorced, people tend to smoke to cope with problems related to such a status.

5. Conclusions

There is a high prevalence of daily smoking in Benin with nearly one out of 8 people using tobacco daily. Being old, being of a male gender, having no formal

education, residing in Atacora, Borgou or Couffo were significantly and positively linked to daily smoking while being overweight were inversely associated with it.

The results of this study provide useful information to the National Program against smoking for public health interventions designed for the control and the prevention of smoking in Benin.

Competing Interests

The authors state that they have no competing interests.

References

- [1] Bhat, V.M., Cole, J.W., Sorkin, J.D., Wozniak, M.A., Malarcher, A.M., Giles, W.H., *et al.* (2008) Dose-Response Relationship between Smoking and Risk of Ischemic Stroke in Young Women. *Stroke*, **39**, 2439-2443.
<https://doi.org/10.1161/STROKEAHA.107.510073>
- [2] Craig, W.Y., Palomaki, G.E. and Haddow, J.E. (1989) Cigarette Smoking and Serum Lipid and Lipoprotein Concentrations: An Analysis of Published Data. *BMJ*, **298**, 784-788. <https://doi.org/10.1136/bmj.298.6676.784>
- [3] Castellsague, X., Munoz, N., Destefani, E., Victora, C.G., Castelletto, R., Rolon, P.A., *et al.* (1999) Independent and Joint Effects of Tobacco Smoking and Alcohol Drinking on the Risk of Esophageal Cancer in Men and Women. *International Journal of Cancer*, **82**, 657-664.
[https://doi.org/10.1002/\(SICI\)1097-0215\(19990827\)82:5<657::AID-IJC7>3.0.CO;2-C](https://doi.org/10.1002/(SICI)1097-0215(19990827)82:5<657::AID-IJC7>3.0.CO;2-C)
- [4] WHO (2010) Global Status Report on Noncommunicable Diseases.
http://www.who.int/nmh/publications/ncd_report_full_en.pdf
- [5] World Health Organization (2015) STEPwise Approach to Monitoring (STEPS).
<http://www.who.int/chp/steps/en/>
- [6] INSAE and ICF International (2013) National Institute of Statistics and Economic Analysis (INSAE) and ICF International. Demographic and Health Survey (EDSB IV) of Benin 2011-2012. Calverton, MD.
- [7] Nubukpo, P., Gbary, A.R., Ouendo, E.M., Kounouhehoua, N., Segnon, J., Laqueille, X., *et al.* (2012) Smoking in the General Population in Benin. *Alcoholology and Addictology*, **34**, 265-272.
- [8] Ministry of Health (2016) Final Report of the Survey for the Surveillance of Risk Factors for Noncommunicable Diseases using the STEPwise Approach of the WHO STEPS 2015 SURVEY in Benin. National Program for the Control of Non-communicable Diseases.
- [9] World Health Organization. Consultation on obesity Classification according to Body Mass Index. Geneva; 1993.
- [10] World Health Organization (2008) Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation. WHO, Geneva.
http://apps.who.int/iris/bitstream/handle/10665/44583/9789241501491_eng.pdf;jsessionid=84221925D95DDECB187F2454821
- [11] World Health Organization (2014) WHO STEPS Questionnaire (Basic and Expanded Module).
- [12] Bennett, S., Woods, T., Liyanage, W. and Smith, D. (1991) A Simplified General Method for Cluster-Sample Surveys of Health in Developing Countries. *World*

Health Statistics Quarterly, **44**, 98-106.

- [13] Longo, M. (2005) Democratic Republic of Congo (City of Kinshasa) STEPS Survey 2005 Factsheet. http://www.who.int/chp/steps/2005_DRC_FactSheet_EN.pdf
- [14] Tesfaye, F. (2003) Ethiopia (Butajira) STEPS Survey 2003 Fact Sheet. http://www.who.int/chp/steps/2006_Ethiopia_FactSheet_EN.pdf
- [15] Zambia Ministry of Health, World Health Organization Country Office (2008) Prevalence Rates of the Common Noncommunicable Disease Risk Factors in Lusaka District, Zambia. http://www.who.int/chp/steps/2008_Zambia_FactSheet_EN.pdf?Ua=1
- [16] Ministry of Health (2008) Final Report of the Survey for the Surveillance of Risk Factors for Non Communicable Diseases Using the STEPSwise Approach of WHO Survey "STEPS 2008" in Benin. National Program for the Control of Non Communicable Diseases.
- [17] Kabwama, S.N., Ndyabangi, S., Mutungi, G., Wesonga, R., Bahendeka, S.K. and Guwatudde, D. (2016) Tobacco Use and Associated Factors among Adults in Uganda: Findings from a Nationwide Survey. *Tobacco Induced Diseases*, **261**, 1169-1173. <https://doi.org/10.1186/s12971-016-0093-8>
- [18] Mayige, M. (2012) Tanzania STEPS Survey 2012 Fact. http://www.who.int/chp/steps/UR_Tanzania_FactSheet_2012.pdf?ua=1
- [19] Damasceno, A.A. (2005) Mozambique STEPS Survey 2005 Factsheet. http://www.who.int/chp/steps/2005_Mozambique_FactSheet_EN.pdf?u=1
- [20] Public Health France (2016) Weekly Epidemiological Bulletin.
- [21] Al-Kubaisya, W., Abdullaha, N., Al-Nuaimya, H., MuzaKahn, S., Halawanyc, G. and Kurdyc, S. (2010) Factors Associated with Smoking Behavior among University Students in Syria Pacific. *International Conference on Environment-Behavior Studies*, Kuching, December 2010.
- [22] Sung, S.C. and Kyoung, H. (2014) Risk Factors for Current Smoking among American and South Korean Adolescents, 2005-2011. *Clinical Scholarship*, **46**, 408-415. <https://doi.org/10.1111/jnu.12099>
- [23] Khanal, V., Adhikari, M. and Karki, S. (2013) Social Determinants of Tobacco Consumption among Nepalese Men: Findings from Nepal Demographic and Health Survey 20011. *Harm Education Journal*, **10**, 10.
- [24] Ministry of Health (2010) Final Report of the STEPS TOGO 2010 Survey. Non-Communicable Diseases Department of Division and Epidemiology.
- [25] Ministry of Health (2013) Report of the National Survey on the Prevalence of the Main Common Risk Factors for Non Communicable Diseases in Burkina Faso STEPS 2013 Survey.
- [26] Ali, Y.A., Azhar, I., Khalif, B.M., Ronald, E.M., Ashfaq, A. and Sania, M. (2008) Investigating Socio-Economic-Demographic Determinants of Tobacco Use in Rawalpindi, Pakistan. *BMC Public Health*, **8**, 50.
- [27] Guignard, R., Beck, F., Richard, J.-B., Lermenier, A., Wilkin, J.L. and Nguyen-Thanh, V. (2015) Smoking in France in 2014: Characteristics and Recent Evolutions. *Evolutions Results of Studies and Research in Prevention and Health Education*, **31**, 1-6.