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3 **Bushmeat consumption in West African large**

4 **urban centres**

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24 **Abstract** Bushmeat consumption in large Sub-Saharan African cities is perceived as a major
25 threat to the conservation of many species because their considerable population sizes can
26 generate a significant demand for bushmeat. The study of the effect of age, sex and
27 geographic location in bushmeat eating in African cities may offer valuable insights on which
28 population groups to target in behaviour change campaigns. Using 2,040 interviews in six
29 West African cities from four countries, in forest and savannah settings, we analysed the
30 differences between age and sex in people's frequency of bushmeat consumption. Overall, we
31 found similar patterns in all sampled cities. As many as 62.2 % males and 72.1% females
32 replied that they 'would not eat bushmeat at all', though only 12.8% males and 8.8% females
33 mentioned they regularly ate bushmeat. Younger generations of both sexes answered that they
34 'would never eat bushmeat' more often than older age groups, independently of their city of
35 origin. These trends are encouraging though further research needs to be undertaken to find
36 out whether bushmeat volumes consumed in cities are unsustainable and having a serious
37 impact of prey populations.

38 **Keywords:** sex; age; geographic location; Togo; Burkina Faso; Nigeria; Niger

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41 No part of the world is urbanizing faster than sub-Saharan Africa, with a projected doubling
42 of the continental population of about 1.1 billion by 2050. Over 80% of that growth will occur
43 in cities, especially in West Africa (World Bank, 2016). This expansion of cities has been due
44 to the heavy immigration from rural to urban areas, with people seeking a better life in the
45 city (World Bank, 2016). Such 'urbanization' process may have positive effects for example
46 in driving the economic development of the continent but will also increase political
47 instability and even cause unprecedented environmental damage (Oates et al., 2004).

48 The huge population growth in cities no doubt place greater demands on natural resources
49 used as food. Bushmeat is a crucial source of animal protein for many rural Africans and is
50 also eaten by many urban inhabitants, often as a commodity food than a basic need (Fa et al.,
51 2002a,b, 2006; Brashares et al., 2011). However, though bushmeat consumption may be less
52 important in terms of food security in large African cities (Hema et al., 2017; Luiselli et al.,
53 2017a, 2017b), the overall volume consumed could be substantially large and this can have
54 dire consequences on the supplying wildlife populations. Ways of shifting bushmeat
55 consumer preferences in cities are urgently needed to reduce the wildlife consumption in these
56 population centres (van Vliet et al., 2011; Wilkie et al., 2017). More particularly, to better
57 guide future behaviour change campaigns, there is a need to ascertain whether consumer
58 groups to be targeted within a city differ in their desire to eat bushmeat, and if this varies by
59 geographical locations. In this paper, we analyse the responses of over 2,000 interviewees
60 from six large urban centres (all > 500,000 inhabitants) in four West African countries and
61 highlight similarities and differences between them.

62

63 We interviewed a total of 2,040 individuals in Nigeria (Port Harcourt, n = 422 and Calabar, n
64 = 452), Togo (Lomé, n = 264), Burkina Faso (Ouagadougou, n = 262), Côte d'Ivoire
65 (Abidjan, n = 368) and Niger (Niamey, n = 271) (Fig. 1). During 2012-2017, we conducted
66 face-to-face interviews using a standardized questionnaire. All interviews were performed by
67 African scientists and students in our group in the local language. Interviewees were selected
68 by randomly choosing persons encountered at marketplaces, canteens, restaurants, roadsides,
69 hairdressing salons, food shops, and other gathering places. This consisted in stopping the
70 first person (we did not interview minors) met after a given time period (in minutes), with the
71 time interval randomly generated by a Random Number Generator. Interviewed persons were
72 informed of the aims of the project and were then asked for their verbal consent before
73 proceeding. In addition, the identity of interviewees was kept anonymous to ensure privacy

74 (St. John, 2010; Nuno et al., 2014). Interviews followed the ethical guidelines developed by
75 the British Sociological Association and the Code of Conduct for *Oryx* articles.

76 In each interview, we recorded the interviewees' gender (male or female) and age (18-25
77 years, 26-50 years, ≥ 51 years). To avoid non-independence of the data, we did not question
78 persons in the same family or those living in the same house, even if they were not relatives
79 (Hema et al., 2017).

80 We asked the following main questions: (1) Do you like eating bushmeat? (2) If yes, we
81 would ask how often they would eat bushmeat and if not, respondents were requested to tell
82 us if they still ate it on occasions. We also asked reasons for consuming (e.g. because
83 bushmeat is a cheaper alternative) or not eating bushmeat, such as the interviewee was not
84 the person choosing the family meal (a frequent case among the younger age-class).

85 Interviewees were then asked if they ate bushmeat regularly (normally at least once a week
86 but at least 2-3 times per month), occasionally (about once per month or less) or never.

87 Persons who answered that they consumed bushmeat only occasionally were then asked
88 whether they selected the type of animal, or whether they would just buy/eat whatever species
89 was available or if it was based on its price compared to domestic meat.

90 Although we informed all interviewees that our study was not linked to any government
91 department, we acknowledge that some level of misrepresentation may have occurred due to
92 fear of repercussions since bushmeat trade is illegal in some countries (e.g. Burkina Faso, see
93 Hema et al., 2017).

94 To compare frequency differences among respondents who often, rarely or did not eat
95 bushmeat, we used a χ^2 test. We used PASW 11.0 for all statistical analyses, and alpha was set
96 at 5%.

97 *Answers across cities.* – An average of $62.2 \pm 26.2\%$ (median = 68.1) of males and $72.1 \pm$
98 22.1% (median = 77.5) of females answered that they would not eat bushmeat at all
99 (difference between samples: $\chi^2 = 0.10$, $df = 5$, $P = 0.999$). By contrast, $12.8 \pm 8\%$ of males
100 and $8.8 \pm 1.7\%$ of females ate bushmeat regularly (intersexual difference: $\chi^2 = 0.17$, $df = 5$, P
101 $= 0.998$). There were no significant differences for people responding that they ate bushmeat
102 only rarely ($\chi^2 = 7.79$, $df = 5$, $P = 0.169$).

103 *Answers within cities.* – Frequency of males declaring that they never eat bushmeat was
104 significantly different between cities ($\chi^2 = 29.13$, $df = 5$, $P < 0.0001$), with significantly less
105 persons in Ouagadougou and Lomé stating that they would never eat bushmeat than in the
106 other cities (Fig. 2). Frequency of females declaring that they never eat bushmeat also varied
107 significantly across cities ($\chi^2 = 27.4$, $df = 5$, $P < 0.001$), with a same pattern in Ouagadougou
108 and Lomé as seen for the males.

109 Frequency of both males and females declaring that they rarely eat bushmeat varied
110 significantly across cities ($\chi^2 = 24.2$, $df = 5$, $P < 0.0001$ and $\chi^2 = 23.7$, $P < 0.0001$), with
111 Ouagadougou differing significantly from the other cities in that more people than expected
112 answered positively to this question (Fig. 2).

113 The frequency of males declaring that they frequently eat bushmeat varied significantly across
114 cities ($\chi^2 = 25.4$, $df = 5$, $P < 0.0001$), with significantly more people answering positively to
115 this query option in Lomé than in the other cities (Fig. 2). Frequency of females declaring
116 they ate bushmeat frequently did not differ significantly across cities ($\chi^2 = 10.1$, $df = 5$, $P =$
117 0.068). In general, younger generations answered that they would never eat bushmeat more
118 often than older age groups, independently of their city of origin (Fig. 3) and gender (χ^2 test, P
119 > 0.500).

120 Our study is the first to examine bushmeat consumption patterns in large cities in West
121 Africa. Given the large sample of interview responses collected in our study, we are confident
122 that the patterns emerging are significant. Moreover, given the simplicity of our questions,
123 we consider that the chance for significant bias is unlikely. Since all interviews were
124 administered by nationals and in their own language, false interpretations of the sense of the
125 questions by the interviewees were also unlikely. However, certain demographic groups were
126 under-represented in the study sample in at least some cities (for instance, in Ouagadougou,
127 only 7 males of 18-25 years were interviewed), and this may have partially affected our
128 conclusions.

129 Three clear results emerge from our surveys: 1) about 30% of people eat bushmeat in West
130 African cities, but many of them only occasionally, 2) no difference emerges between sexes,
131 but 3) younger cohorts of both sexes do not consume bushmeat. These patterns demonstrated
132 significant differences in bushmeat consumption frequency between cities and rural areas
133 (Luiselli et al. 2017a, 2017b).

134 That younger men and women state that they do not eat bushmeat in comparison to the older
135 generations is a crucial finding, since it may indicate a shift in eating patterns, from traditional
136 to 'modern' processed foods. This trend may be related to nutritional transition changes in
137 sub-Saharan populations that modernize as a result of socio-economic development,
138 urbanization, and acculturation (Vorster et al. 2011). Informal observations with young
139 interviewees that never eat bushmeat, are visibly non-traditional in their dress sense (dressing
140 exclusively western-style-cloths), go to clubs and discotheques on weekends, use daily social
141 media and smartphones, often their own personal computer, watch every day pay-per-view
142 television channels, and routinely consume fast food (hamburgers, shawarma, pizza). Thus,
143 most of them are deeply influenced by western media, and tend to consider some of their most
144 profound 'cultural attributes' (such as bushmeat consumption) as 'uncool'.

145 The fact that only a minority of people mentioned they consumed bushmeat in large West
146 African cities is compelling. This is so in spite of: 1) distinct geographic locations, and hence
147 vegetation zone surrounding the cities – forest in Abidjan, Port Harcourt and Calabar, Guinea
148 savannah in Lomé, Sudanese savannah in Ouagadougou and Sahel savannah in Niamey; 2)
149 local culture and ethnicity since many independent ethnic groups participated in our surveys;
150 3) religion given that Niamey and Ouagadougou are mostly Muslim, whilst Lomé, Port
151 Harcourt and Calabar are almost entirely Christian, and Abidjan mostly Christian but with a
152 considerable Muslim percentage; 4) human development levels, average income in Niamey is
153 much lower than, for instance, in Port Harcourt, and 5) level of ‘westernization’ where
154 Abidjan, Lomé, Port Harcourt and Calabar possess more ‘western’ life-styles in terms of food,
155 media, habits and clothes than Ouagadougou or more so Niamey. Thus, given the above, a
156 unifying reason for the apparent low levels of bushmeat consumption among such a disparate
157 sample of countries could be related to factors such as the supply of bushmeat to urban
158 markets or the impact of the recent Ebola crisis, which caused a collapse in bushmeat
159 consumption in Nigeria (Akani et al., 2015a) and Côte d’Ivoire (Ordaz-Németh et al., 2017).
160 In Ouagadougou, a lack of bushmeat consumption in this city could be related to the fact that
161 this type of meat is illegal and hidden, and that the source areas (mostly protected areas and
162 adjacent buffer zones) are at a considerable distance (Hema et al., 2017). On the other hand,
163 in Nigeria where bushmeat markets are generally open, and close to the main urban centres
164 (for instance, the Oigbo and Omagwa markets for Port Harcourt metropolitan area), social
165 factors may be more important (Akani et al., 2015b).

166 We predict that, with the ongoing expansion of the cities in West Africa, progressively lesser
167 numbers of people will consume bushmeat on a regular basis. We also suggest that there will
168 be an increasing trend in the people’s attitude towards bushmeat in those cases where growth
169 of urban centres will be very fast. The implications of these developments could be positive
170 for conservation. However, we are aware of the fact that we still need to quantify and

171 understand whether the volume of bushmeat still consumed in the cities is negatively harming
172 the wild prey populations and depriving rural populations of an important protein resource. In
173 this regard, the eaten species matters very much, as consuming large apes has surely a much
174 dramatic effect for the conservation than eating rodents or other unthreatened species.

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179

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182

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186 Conflict of Interest: The authors declare that they have no conflict of interest.

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229

230 AUTHORS' BIOSKETCHES:

231 ALL AUTHORS have been working since more than 20 years on projects focusing at the interface
232 between ecology, sociology and conservation biology, in different countries of West Africa. Their
233 projects are especially focused in the forest region of coastal West Africa, but also in the Sahel
234 countries, and were carried out in cooperation with leading academic institutions in West Africa and in
235 Europe.

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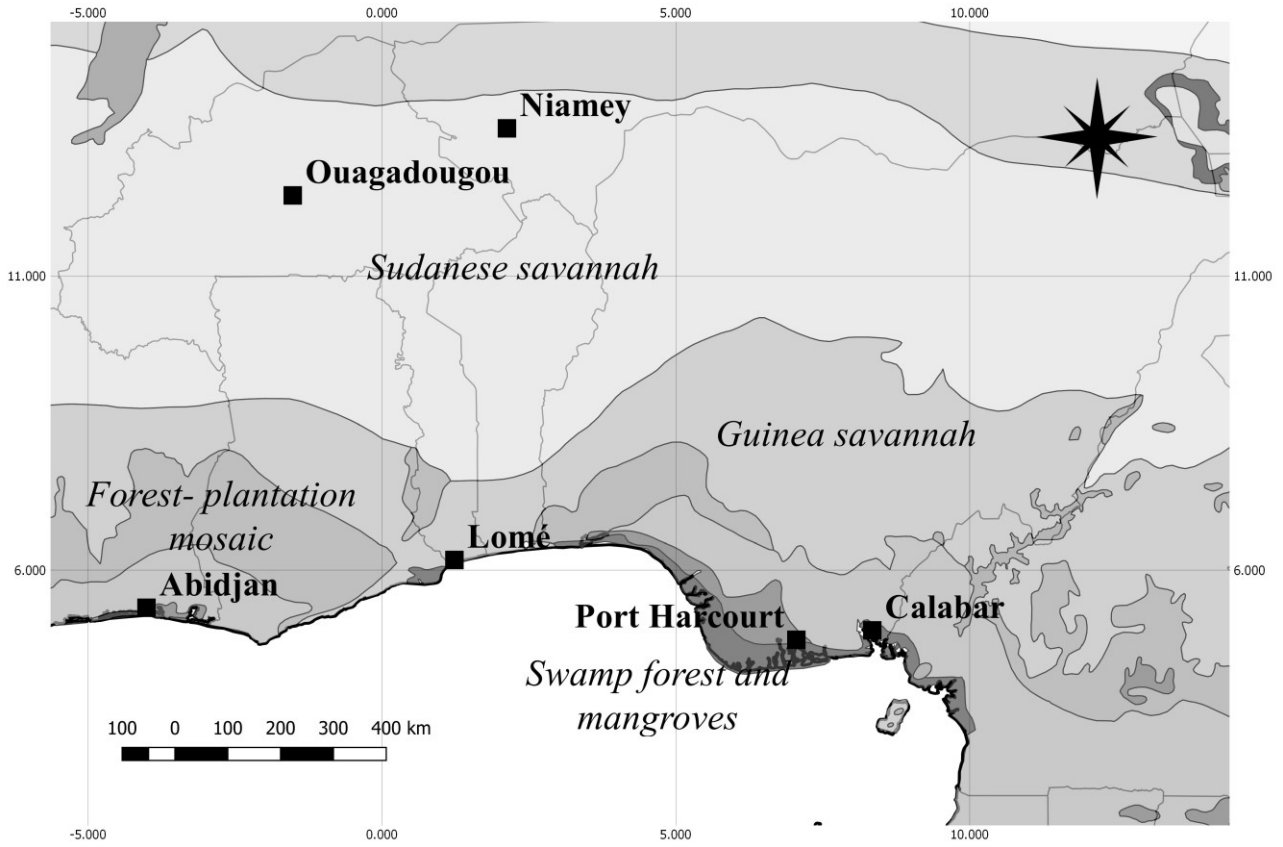
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240 Figure 1. Map of the study region. showing the cities where interview campaigns were done.

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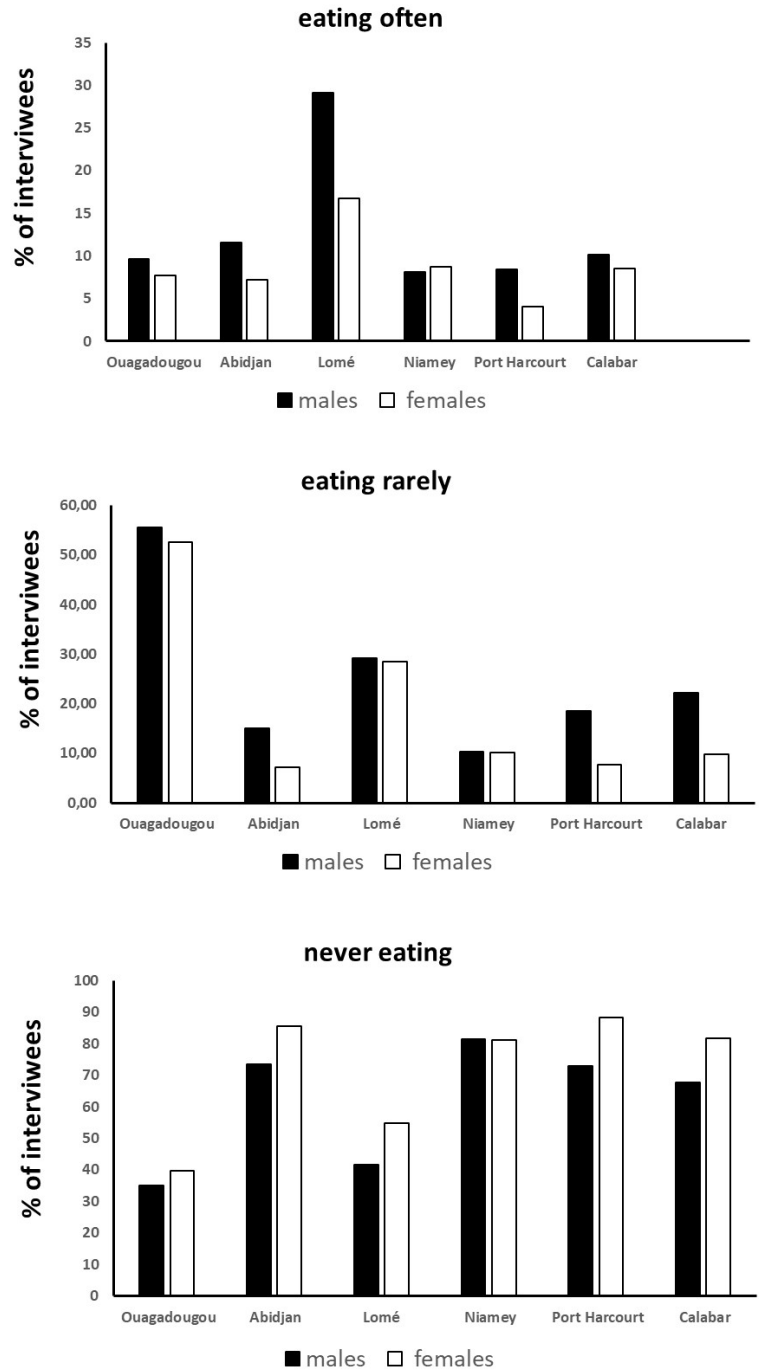


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243 Figure 2. Percent of male and female interviewees giving each of the three potential answers (i.e., never
 244 eating, eating rarely and eating often) by city.

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246



247 Figure 3. Distribution (%) of ‘never eating’ answers by age. in the different cities used as survey sizes. Note
248 that younger generations would never eat bushmeat more often than older generations independently of their
249 city of origin.

250

