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Brief Communication

Why People Eat Bushmeat: Results From Two-Choice, Taste Tests in Gabon, Central Africa

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INTRODUCTION

In Central Africa most of the 30 million people living in the forested regions of the Congo Basin use the meat of wild animals as a source of dietary protein. As a result over one million metric tons of bushmeat, primarily antelope, pigs, and rodents are killed and eaten each year (Wilkie and Carpenter, 1999) For many large-bodied and slow-growing species commercial hunting of bushmeat already exceeds their replacement rate and is unsustainable in many areas (Wilkie *et al.*, 2001). With human population in the region growing at 2–3% per year (Republique-Gabonaise, 1993), demand for bushmeat will double in 25–35 years if rates of bushmeat consumption do not fall and large-bodied wildlife species could be hunted to local extinction in most of the area by the year 2020. Loss of wildlife may threaten the food security of many marginalized forest foragers, and farmer-forager communities that are isolated from markets and depend on bushmeat as their primary protein source (Eves and Ruggiero, 2001).

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Understanding why people eat bushmeat, and the role that bushmeat consumption plays in household nutrition and income, is critical to developing politically acceptable ways to manage wildlife hunting and trading and halt unsustainable exploitation. If bushmeat is eaten because it is cheaper or there are no alternatives available in the market place then policy might target raising the relative price of bushmeat through law enforcement or taxation and providing incentives to increase availability of substitutes (Apaza *et al.*, 2002; Wilkie and Godoy, 2001). If, however, bushmeat is eaten because consumers prefer the taste of wildlife (Chardonnet *et al.*, 1995; Trefon and de Maret, 1999), then demand may be less responsive to price changes and the meat of livestock may not be an acceptable substitute. Bushmeat may also be eaten to add variety to the diet and for special occasions because it has cultural significance (Njiforti, 1996). In this case, if bushmeat is only eaten irregularly, is not the primary source of dietary protein, and is not culturally significant, then allowing non-threatened species to be consumed but strictly enforcing laws to halt the hunting and trading of threatened and endangered species may be politically acceptable, and ecologically rational.

Though hunger and the need for nourishment clearly influence food choice, so too do availability and cultural norms (cf., Rose, 2001). Moreover, many believe that humans prefer familiar flavors and aromas, and often express negative preferences for untried foods (cf., de Garine, 1993; Rose, 2001). Statements such as "bushmeat is universally preferred due to its superior taste" (King, 1994) suggest that Central African communities, in this case the Bakossi who live on the slopes of Mount Kupé in southwestern Cameroon, prefer and thus primarily eat bushmeat. Though most information on taste preferences is apocryphal rather than empirical, these statements have led to the widely held belief that bushmeat consumers prefer the taste of bushmeat over meat substitutes. Even when consumers are queried about their preferences, the focus is on distinguishing preferences for different types of bushmeat rather than between bushmeat and alternatives (cf., Fa *et al.*, 2002). The question therefore remains, do people in Central Africa prefer the taste of bushmeat compared to alternatives when given the choice, and are stated preferences congruent with observed choices?

In this paper we present results from five two-choice taste tests conducted in Gabon. These taste tests were designed to empirically compare stated with observed preferences for bushmeat and domestic alternatives, and to determine whether or not consumers could correctly identify the source of the meat offered. Results provide the first quantitative glimpse of Central African urban and rural consumers' observed and stated meat preferences, and an assessment of the relative role of taste in determining consumption of bushmeat relative to fish and domestic alternatives.

METHODS

Two hundred and thirty-seven individuals participated in five taste test sessions in Gabon between July and August of 2002. Taste tests were completed in three geographic locations that broadly captured the range of settlement size and proximity to bushmeat hunting areas typical for Gabon. Tests were carried out in the capital city (Libreville, subjects = 100) a provincial capital (Franceville, subjects = 86) and a rural village (Fala-Onkua, subjects = 51; Fig. 1). As there is an undefined but acknowledged health risk associated with eating bushmeat, we primarily selected subjects who had already made the choice to eat bushmeat (i.e., clientele of bushmeat restaurants) rather than using a random sample. Subjects included family and friends of Gabonese research assistants, clientele of the restaurants where the taste tests were conducted, and occasionally people off the street. All subjects were informed prior to participating that the test could involve consumption of bushmeat.

Each participant was asked to state their preference amongst poultry, livestock meat (i.e., beef, pork, lamb, goat), fish, and bushmeat, and for those who chose bushmeat, which species they preferred. We did not ask subjects to distinguish between fresh or frozen meat or fish. Subjects were also asked to report how often they ate poultry, livestock meat, fish, and bushmeat using the categories: never, less than once a month, one to three times per month, once a week, and twice or more a week. Each subject then participated, sequentially, in two, two-choice taste tests, where neither the subject nor the interviewer was told what type of meat was being offered in each plate.

All surveys were conducted in French by trained Gabonese research assistants. Taste tests were conducted in restaurants because it simplified the logistics of serving four different meats to each participant The village taste test was conducted in the market center. All restaurants in the study regularly offered bushmeat to their clientele and advertised their daily selection of bushmeat species on street menus.

Each restaurant provided a cook to prepare the four fresh meat dishes using the same recipe and cutting the meat into approximately the same sized pieces. Each dish was prepared in a tomato-based sauce, and differed only in the type of meat used. Chicken and porcupine (*Atherurus africanus*) were used for the first taste test, and beef and blue duiker (*Cephalophus monticola*) were used for the second taste test. We used the meat of porcupine and blue duiker because they are very commonly consumed as bushmeat, are abundant in the forest, are resilient to hunting, and are not threatened or endangered throughout most of their range in Central Africa. We paired chicken and porcupine as they have comparably light meat, but also

Fig. 1. Study locations in Gabon.

because porcupine is one of the most popular bushmeat species and chicken is the most commonly consumed domestic alternative (Wilkie *et al.*, 2005). We paired beef and blue duiker because of their similar color and texture.

Dishes were numbered one through four, with only the cook and study directors knowing the identity of the meat within each dish. Subjects were asked to taste a different meat sample from each of two plates – chicken and porcupine in the first test, beef and blue duiker in the second test. The two tests were conducted sequentially. After each two-choice taste test, subjects were asked: (a) which of the two dishes they preferred and why, and (b) to identify the type of meat in both dishes and how they were able to identify it. All subjects were asked to participate in both taste tests. Eight individuals from the chicken/porcupine taste test, and seventeen from the beef/blue duiker taste test either opted not to participate because they were unable to wait their turn or told the interviewer that they did not want to participate in a particular test.

We used Chi-squared goodness of fit to test whether the observed frequency that subjects chose bushmeat over the meat of domestic animals differed from parity. We examined whether the frequency of selection of bushmeat varied between the two choice tests and across the different locations at which tests were conducted. We also examined whether stated preference for particular types of animal protein and their frequency of consumption influence the likelihood that subjects would choose bushmeat during the taste test.

RESULTS

Our sample reflects people that are likely to be familiar with bushmeat as a dietary item as they either frequent bushmeat restaurants or were willing to participate in a study during which they would be consuming bushmeat. As a consequence this non-random sample of Gabonese consumers is likely to exhibit higher preference rates and consumption frequencies of bushmeat than the general population of Gabon. This assertion is borne out, at least for Libreville where 27% of taste test subjects reported eating bushmeat one or more times per week, more than three times the average observed consumption rate of a random sample of households (Wilkie *et al.*, 2005).

Said-Preferences for Different Meats

Less than half the subjects reported a primary preference for bushmeat (44%; Fig. 2). The majority preferred fish (28%) or the meat of domestic animals (poultry 19% and livestock meat 6%). Three percent of subjects

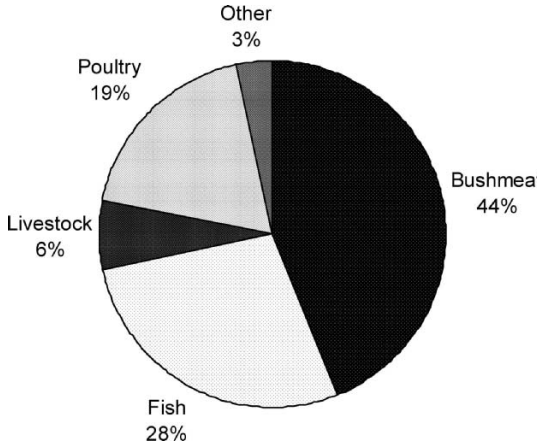

Fig. 2. Subjects' stated preferences for different types of meat ($N = 237$ subjects).

reported vegetable material as their preferred source of protein. The majority of village subjects (65%) stated a preference for bushmeat over other sources of meat. In contrast only 42% of Libreville subjects and 34% of Franceville subjects stated a preference for bushmeat (Table I).

Of those that stated a preference for bushmeat, 56% identified porcupines as their favorite bushmeat species (Fig. 3). One subject stated a preference for elephant meat, and another a preference for primate meat.

Ability to Correctly Identify Bushmeat and the Meat of Domestic Animals

Almost all subjects were able to identify correctly the meats they were given. For the pooled sample, 84% of subjects identified porcupine meat and 78% blue duiker meat correctly (Table II). Similarly, subjects were easily able to correctly identify chicken (94%) and beef (82%). Ability of

Table I. Stated Preference for Bushmeat in Three Locations in Gabon

Location	N Subjects	Bushmeat	Other	Preferred bushmeat %	Chi-square	*p*
Libreville	100	42	58	42	2.56	0.110
Franceville	86	29	57	34	9.12	**0.003**
Village	51	33	18	65	4.41	**0.036**
Total	237	104	133	44	3.55	0.060

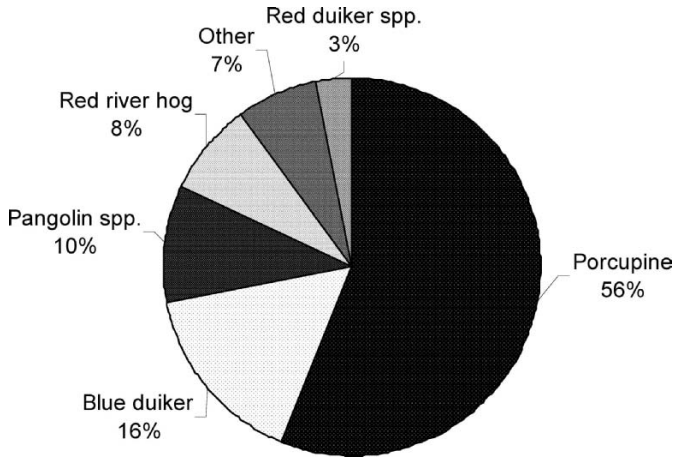

Fig. 3. Stated species preferences of subjects who said they preferred bushmeat ($N = 104$ subjects). *Note*. The category 'other' includes crocodile (2 subjects), Gambian rat, elephant, monkey, python, and generic bushmeat (1 subject each).

respondents to identify meat correctly did not vary by location, except in the case of beef, where people in the villages identified it correctly slightly less often.

Observed Preferences

For the pooled sample, 62% of subjects chose porcupine over chicken when offered the two. Similarly, 61% of subjects chose blue duiker over beef. The proportions of subjects choosing porcupine and blue duiker are both significantly different from a 50–50 split that would be expected if preference was random ($p \leq 0.001$ and $p \leq 0.001$ respectively). However,

Table II. Ability of Subjects to Correctly Identify the Source of Meat Offered in a Taste Test

Plate type	# responses	Correct	Incorrect	Missing	Correct %	Chi-square	$p \leq$
Bushmeat	453	367	86	21	81	174.30	0.001
Domestic meat	451	399	52	23	88	266.98	0.001
Porcupine	229	193	36	8	84	107.64	0.001
Chicken	229	216	13	8	94	179.95	0.001
Blue duiker	224	174	50	13	78	68.64	0.001
Beef	222	183	39	15	82	93.41	0.001

Note. 237 subjects were asked to identify the source of the meat in two different tests (porcupine & chicken and blue duiker & beef).

Table III. Subjects Choice of Bushmeat by Location

Location	Restaurant	N subjects	Meat chosen: Porcupine	Meat chosen: Chicken	Choosing porcupine %	Chi-square	$p \leq$
(a)							
Franceville	A	39	21	18	54	0.23	0.631
Franceville	B	43	21	22	49	0.02	0.879
Libreville	A	48	26	22	54	0.33	0.564
Libreville	B	50	41	9	82	20.48	**0.001**
Villages	A	49	33	16	67	5.90	**0.015**
Total		229	142	87	62	13.21	**0.001**

Location	Restaurant	N subjects	Meat chosen: Blue duiker	Meat chosen: Beef	Choosing blue duiker %	Chi-square	$p \leq$
(b)							
Franceville	A	36	26	10	72	7.11	**0.008**
Franceville	B	41	22	19	54	0.22	0.639
Libreville	A	48	24	24	50	0.00	1.000
Libreville	B	47	27	20	57	1.04	0.307
Village	A	48	36	12	75	12.00	**0.001**
Total		220	135	85	61	11.36	**0.001**

the significance of the preferences for both porcupine and blue duiker depends greatly on the results of tests at particular locations (Table IIIa and b). The preference for porcupine over chicken depends strongly on the results of one test in Libreville where 82% of subjects chose porcupine ($p \leq 0.001$) and on the village test where significantly more subjects (67%, $p \leq 0.05$) chose porcupine over chicken. In contrast, the results of the three other tests showed no significant differences in the number of subjects choosing either porcupine or chicken (Table IIIa). Similarly, the preference for blue duiker in the pooled sample depends greatly on preferences in the village test (75%, $p \leq 0.001$) and one of the Franceville tests (72%, $p \leq 0.01$). The results of the three other tests all showed no significant preference for either blue duiker or beef (Table IIIb). Only in the village was there a consistent choice of bushmeat in both the porcupine–chicken and blue duiker–beef tests.

Factors Influencing Observed Preference for Bushmeat

Stated preference for bushmeat best predicted observed preference for porcupine (81%, $p \leq 0.001$) and blue duiker (72%, $p \leq 0.001$). A stated preference for fish increased the likelihood that the subject would select bushmeat when offered porcupine or chicken (64%, $p \leq 0.05$) but had no

Table IV. Subjects Choice of Bushmeat by Stated Preference

Stated preference	N subjects	Meat chosen		Choosing porcupine %	Chi-square	$p \leq$
		Porcupine	Chicken			
(a)						
Bushmeat	102	83	19	81	40.16	**0.001**
Fish	64	41	23	64	5.06	**0.024**
Meat	15	5	10	33	1.67	0.197
Other	7	4	3	57	0.14	0.705
Poultry	41	9	32	22	12.90	0.000
Stated preference	N subjects	Meat chosen		Choosing blue duiker %	Chi-square	$p \leq$
		Blue duiker	Beef			
(b)						
Bushmeat	99	71	28	72	18.68	**0.001**
Fish	60	36	24	60	2.40	0.121
Meat	15	6	9	40	0.60	0.439
Other	7	3	4	43	0.14	0.705
Poultry	39	19	20	49	0.03	0.873

effect on their choice of blue duiker or beef. A stated preference for chicken significantly reduced the likelihood that subjects selected porcupine over chicken (22%, $p \leq 0.001$), but had no effect on their choice when offered beef or blue duiker. Subjects who stated a preference for the meat of domestic animals selected bushmeat less often than expected by chance (Table IVa and b).

Stated frequency of consumption of bushmeat and other sources of protein have ambiguous effects on observed preference for bushmeat in a choice test (Table V). Subjects who reported eating bushmeat two or more times per week were significantly more likely to choose bushmeat when offered it (67%, $p \leq 0.001$). However, so were those who ate fish (64%, $p \leq 0.001$) and chicken (62%, $p \leq 0.001$) more than two times per week. All subjects that reported eating the meat of livestock (i.e., beef, pork, and lamb) were significantly more likely to eat bushmeat when offered it (Table V). This suggests that both familiarity with eating bushmeat and contrarily eating the meat of domestic animals, and a desire for variety in the diet might determine observed preference for bushmeat.

DISCUSSION AND POLICY IMPLICATIONS

To summarize the results: a) most subjects are able to identify the source of animal protein they are eating, b) only rural subjects show a

Table V. Subjects Choice of Bushmeat by Stated Frequency of Consumption of Bushmeat, Fish, Poultry and the Meat of Livestock

		Meat chosen		Choosing bushmeat		
Frequency eaten	N subject	Bushmeat	Domestic	%	Chi-square	$p \leq$
Bushmeat						
Never	18	9	16	36	1.96	0.162
<1 per month	69	77	55	58	3.67	0.056
1–3 times per month	50	63	33	66	9.38	**0.002**
1 per week	18	20	16	56	0.44	0.505
>1 per week	81	106	52	67	18.46	**0.001**
Total	236					
Fish						
Never	4	5	3	63	0.50	0.480
<1 per month	13	12	12	50	0.00	1.000
1–3 times per month	19	19	18	51	0.03	0.869
1 per week	34	38	27	58	1.86	0.172
>1 per week	167	203	112	64	26.29	**0.001**
Total	237					
Poultry						
Never	13	15	10	60	1.00	0.317
<1 per month	23	26	18	59	1.46	0.228
1–3 times per month	35	46	21	69	9.33	**0.002**
1 per week	30	32	27	54	0.42	0.515
>1 per week	136	158	96	62	15.13	0.001
Total	237					
Livestock						
Never	22	27	15	64	3.43	0.064
<1 per month	47	57	31	65	7.68	0.006
1–3 times per month	46	53	34	61	4.15	0.042
1 per week	47	56	33	63	5.94	0.015
>1 per week	75	84	59	59	4.37	0.037
Total	237					

Note. 237 subjects were asked to pick the preferred meat in two different tests (blue duiker & beef and porcupine & chicken). As not all subjects provided responses to all questions, the totals of column 3 and 4 do not equal 474.

consistent preference for bushmeat, c) subjects who state a preference for bushmeat are also likely to choose bushmeat when offered it, d) subjects that state a preference for poultry do not typically choose bushmeat when offered it, e) subjects that eat bushmeat almost every day are more likely to choose bushmeat, otherwise the frequency of bushmeat consumption has little influence on observed preference, f) a desire for variety in the diet might explain why subjects who ate alternative sources of animal protein more than two times per week preferred to eat bushmeat when given a choice.

The primary message from this first empirical test of consumer taste preferences for bushmeat in Central Africa is that assertions that

"bushmeat is universally preferred" are clearly exaggerated. In fact, consumers in Gabon have only a weak preference for bushmeat and it is only rural consumers who consistently prefer bushmeat over alternatives. This result is particularly striking given that the study population overrepresented bushmeat consumers. This suggests that it is not simply taste that is driving demand for bushmeat, but that price or other culturally mediated factors such as familiarity, tradition, and prestige play a role. Recent studies have shown that price and income have significant roles in determining the level of consumption of bushmeat, fish, chicken, and beef (Apaza *et al.*, 2002; Wilkie and Godoy, 2001; Wilkie *et al.*, 2005).

Moreover, the ambiguous results obtained from the porcupine and blue duiker choice tests at most locations suggest that consumers differentiate amongst bushmeat species and that wildlife cannot be treated as a generic food source. For example, consumers with a stated preference for fish chose porcupine rather than chicken but did not choose duiker more often than beef. This suggests that porcupine and fish might be considered by consumers as acceptable substitutes, but fish and blue duiker are not. Similarly, consumers who stated a preference for chicken overwhelmingly avoided porcupine and showed no preference for blue duiker or beef. This might suggest that once consumers have grown accustomed to and developed a preference for chicken, they may chose to eat less bushmeat. Stated preferences of bushmeat consumers for different types of bushmeat support these conclusions.

From a policy perspective, if we plan on providing alternatives to reduce demand for unsustainably hunted wildlife, then these results show that we need a clear understanding of consumer stated *and* actual preferences for *both* wildlife and alternatives (Fig. 2). The fact that consumers do not treat bushmeat as a generic food item strongly suggests that, at least in Gabon, captive raising of non-preferred bushmeat species such as cane rats (*Thryonomys swinderianus*) may do little to reduce demand for preferred species such as porcupines. Similarly, it is unclear from the results whether increasing the availability of the low quality beef typically sold in Gabon would encourage consumers to switch away from eating duiker or other bushmeat. That said, increasing the quality of beef and the availability of chicken, particularly in rural areas may alter consumption patterns and reduce hunting pressure on wildlife.

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