

Bushmeat Hunting Practices in Jorgo-Wato Protected Forest, Western Ethiopia

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ABSTRACT

Bushmeat hunting is a secret activity posing threats to wildlife in protected areas of Ethiopia. Yet, information about bushmeat hunting practices are limited. Hence, this study aimed to assess the practices of bushmeat hunting in Jorgo-Wato Protected Forest. Data were obtained from 248 individuals of six Farmer Associations using open and closed ended questionnaires, group discussions, interview with poachers, survey of hunting incidents and informal interviews with conservation officers and wardens. Seven species of mammals which includes: bushbuck, bush pig, giant forest hog, common dicker, warthog, porcupine and buffalo were hunted mainly for subsistence. Gin traps (54.7%), spear and dogs (31.7%) were the most common hunting methods, and their frequency of use was much higher in the dry season (64.1%) compared to the wet season (27.0%). The probable risks encountered during hunting (30.21%), trappability (25.70%) and availability (20.9%) of species were the top determinants of hunters' decisions to hunt bushmeat species. As bushmeat hunting practice is highly secretive, well-designed strategies and awareness campaigns are needed to reduce the demand for bushmeat in villages surrounding Jorgo-Wato Protected Forest, whereas reducing the supply of bushmeat from the Jorgo-Wato Protected Forest will require better enforcement of laws that prohibit bushmeat hunting.

Key Words: Bushmeat, Conservation, Ethiopia, Jorgo-Wato Protected Forest

INTRODUCTION

Illegal bushmeat hunting is one among the many acts of harvesting wildlife in violation of wildlife law in many protected and unprotected areas in Africa. It is mostly practiced in Africa, Asia and Latin America (Barnes 2002, Fa et al. 2002), but is more prevalent and severe in poorly managed and remotely located protected areas (Fusari and Carpaneto 2006) in West and Central Africa (ACET 2014). Similarly, the trends are increasing in East and Southern Africa. Bushmeat hunting has been a known source of protein and a valuable forest product after timber. However, it threatens the sustainability of bushmeat species, ecosystem integrity and bushmeat-dependent poor people in remote rural areas (East et al. 2005, Van Vliet and Mbazza 2011). Increasing demand

for bushmeat, encroachment of people adjacent to protected areas, lack of alternative sources of protein, poor governance of protected areas and increasing demand of animal body parts are some among the many drivers of wildlife harvest (Lindsey et al. 2012, Swamy and Pinedo-Vasquez 2014). Illegal hunters use passive hunting methods such as snare, pitfall, neck trap and gin trap (trap buried in the ground along animal tracks) (Holmern et al. 2006, Kümpel et al. 2008, Tumusiime et al. 2010), and active hunting methods such as gun, spear and dogs (Holmern et al. 2006, Rogan et al. 2015). In most cases, however, both passive and active hunting methods are used (Lindsey et al. 2011a, b).

Bushmeat hunting is an issue of research concern due to its negative impacts on ecology, economy and the targeted species (Van Vliet and Mbazza 2011, ACET

2014). Unsustainable exploitation of wildlife reduces income generated through ecotourism and trophy hunting (East et al. 2005, Van Vliet and Mbazza 2011). It has been also the causes of known and unknown zoonotic diseases in Africa (ACET 2014). Several studies have been conducted on various aspects of bushmeat hunting in central and western Africa (Bennett et al. 2007, Fa and Brown 2009, Topp-Jørgensen et al. 2009, Kumpel et al. 2010). Similar studies have been increasing in East (Wato et al. 2006, Holmern et al. 2007) and Southern Africa (Hayward 2009, Lindsey et al. 2011a) due to the severe effects of bushmeat hunting. In East Africa, however, research on bushmeat hunting has been limited to few countries such as Tanzania (Ndibalema and Songorwa 2007, Holmern et al. 2007), Kenya (Okello and Kiringe 2004, Wato et al. 2006) and Uganda (Lwanga 2006, Olupot et al. 2009).

Wildlife policies have been enforced in unorganized, unplanned and poorly funded working systems in developing countries, which further escalates overexploitation of wildlife (Parr 2011). Similarly, Ethiopia has designed policies to combat illegal hunting and wildlife trading. However, it is still a major conservation threat in protected areas of the country (FZS 2012). Bushmeat hunting has been practiced in violation to wildlife laws in remote protected areas of Ethiopia. The Order Artiodactyla are the most hunted species whereas the Order Rodentia, non-human primates, odd toed ungulates and the family Suidea are prohibited as per the customs and religions of most Ethiopians. However, hunting of non-human primates and the Order Rodentia are rarely practiced in remote regions of the country (Hartmann 2004, Habtamu Tadesse and Afework Bekele 2008). Bushmeat hunting is a secret activity that poses a global threat to wildlife. The main objective of this paper is, therefore, to assess the practices of bushmeat hunting in Jorgo-Wato Protected Forest, Ethiopia.

THE STUDY AREA

The study was carried out in Jorgo-Wato Protected Forest (JWPF) which is located between 8°40' 20"– 8°48' 06" N and 35°48' 01"– 35°56' 40" E, about 509 km west of Addis Ababa. JWPF was proposed as one of the National Forest Priority Areas of Ethiopia in 1976 and demarcated in 1988 with a total area of 19, 875 ha. However, the total area of JWPF has been reduced to 8503.49 ha due to various anthropogenic pressure. JWPF

was threatened by deforestation, selective logging, coffee plantation, overgrazing, debarking trees for beehive construction, collection of wild coffee seeds and seedlings, harvest of *Rhamnus prinoides* for income generation and cutting of trees for construction. In addition, poaching signs such as removed gin traps, dogs, gunshots, poachers tracking and carcasses of animals were observed in the forest (Erena et al. 2019). JWPF harbours more than 20 medium and large sized mammals confirmed through community information, infrared remote camera traps, and direct and indirect evidence. JWPF is bordered by six Farmer Associations. The Oromo's are the predominant ethnic group in all Farmer Associations surrounding JWPF. They are agro-pastoralists who lead their livelihood through subsistence cultivation (maize, teff, sorghum, wheat, pea, bean and barely), poultry and livestock such as cattle, sheep, goat, donkey, mule and horse

METHODS

Household Interview

All households located about 5 km from the forest were selected purposively assuming that they have easy access, increased activity and more information about resource use patterns than distantly located residents (Bitanyi et al. 2012). All household respondents were informed about the objectives and the anonymity of the interview. Individual respondents involved from each household were selected from six Farmer Associations (smallest local administrative unity of a government): Harbu Abba Gada ($n = 51$), Siba Selassie ($n = 27$), Siba Kobi ($n = 24$), Siba Dalo ($n = 57$), Asgori Sora ($n = 34$) and the Wato Golbe ($n = 55$). Data were collected using open and closed ended questionnaires from household heads, their wives or any available male or female older than 18 years. The locations of surveyed households were recorded and marked on the map of the study area (Figure 1). Most interview questions were designed to acquire baseline information about the nature of bushmeat hunting practices. As illegal hunting inside and outside protected areas of Ethiopia is prohibited by the law, all consent respondents were asked to report hunting activity of others (Nuno and St. John 2014) regardless of their involvement, to avoid fear of consequences. The interview was entirely conducted in *Afan Oromo*, the language of the local people.

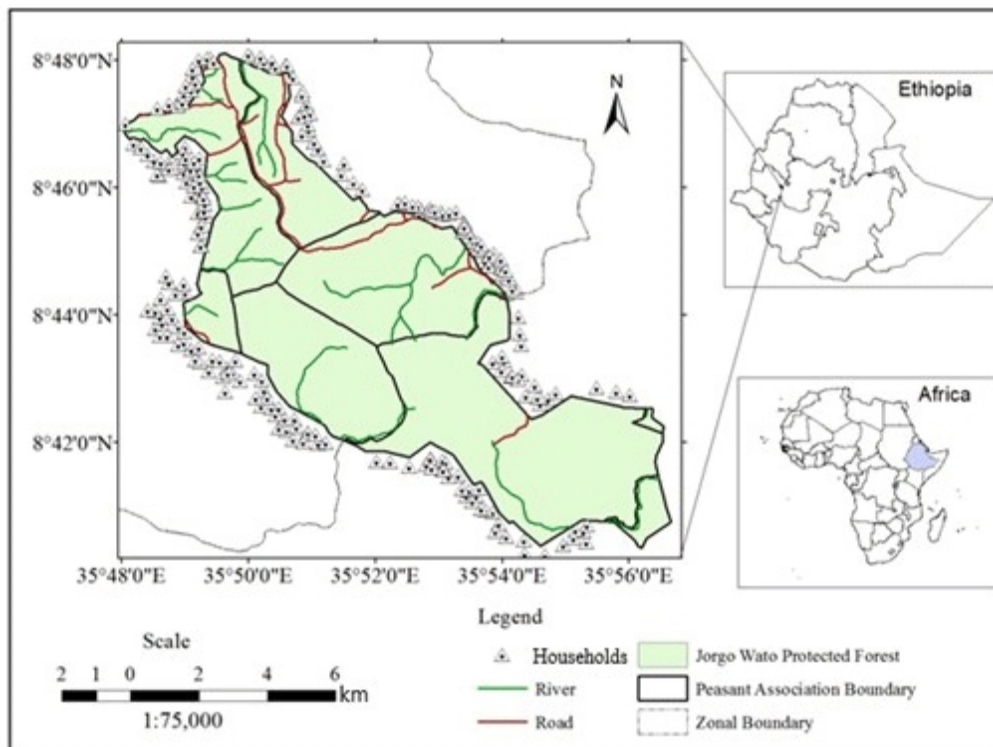


Figure 1. Map of JWPF showing the locations of surveyed households

Individual Interview and Group Discussion

Interview with bushmeat hunters was conducted through snowball sampling technique (Bernard 2002). Key informants were identified after several visits of the study area, and trust relationship was developed (Knapp 2012) as most hunters were involved as field guides and data collection. Focus group discussions were held with elders, who have been living in the area to complement information with the data collected from other informants. The participants were first informed about the objectives of the research and focus group discussion. They were asked to share their views concerning bushmeat hunting, wildlife laws and their awareness about protected areas. Moreover, informal interviews were carried out with forest wardens, district and zonal office workers, and with everybody encountered during trip to the area, coffee and tea occasions during data collection periods.

Different software packages such as IBM SPSS version 24, Microsoft excel and PAST Version 3.15 were used for data analyses. Chi-square goodness-of-fit test was used to test the differences between the incidents of bushmeat hunting, and attitudes of respondents towards wildlife conservation. One-way analysis of

variance (ANOVA) was used to test differences in the mean values of reasons for bushmeat hunting among Farmer Associations. The differences between active and passive hunting techniques, trends of bushmeat hunting and stated reasons of bushmeat hunting practices were tested by Chi-square test. Based on motives of hunters to hunt bushmeat species, first ranked species was given 3 points, second score 2 points and third score 1 point. Motives of hunters were ranked based on the scores assigned to each rank and estimated as the sum of each rank score multiplied by its rank frequency i.e. Total score = $\sum (\text{Rank score} \times \text{rank frequency})$ (Olupot et al. 2009). A non-parametric Spearman's rank Correlation was used to test the correlation between the ranks of hunting motives that determine hunters' decision to hunt bushmeat species. The mean body mass (kg) of each bushmeat species was used from literature (Nowak 1999, Stuart and Stuart 2000, Foley et al. 2014) to correlate with the black market price of bushmeat species. Mean body mass and black market prices were log-transformed and tested by simple linear regression analysis. Knowledge of hunting seasons and trends of bushmeat hunting were reported descriptively. Data from individual interviews and focus group discussions were described using textual analysis method (Dey 1993).

RESULTS

Hunted Bushmeat Species

A total of seven mammals were illegally hunted for bushmeat in JWPF (Table 1). All hunted mammals were grouped under the Orders Artiodactyla and Rodentia. None of the other animals were reported to be hunted for bushmeat in the area. As stated by respondents, bushbuck, *Tragelaphus scriptus* (96.0% respondents), bush pig, *Potamochoerus larvatus* (90.3% respondents) and giant forest hog, *Hylochoerus meinertzhageni* (73.4% respondents) were the top three commonly harvested bushmeat species in the area. Common duiker, *Sylvicapra grimmia* (47.2% respondents), warthog *Phacochoerus africanus* (43.5% respondents), crested porcupine, *Hystrix cristata* (21.4% respondents) and Cape buffalo *Syncerus caffer caffer* (13.0% respondents) were also reported to be illegally hunted for bushmeat. In JWPF, carnivores and primates were rarely hunted as retaliation for depredation of livestock (by carnivores) and crops (by primates), but not for bushmeat. Sometimes carnivores such as hyena were killed by poisoning the dead body or carcass of livestock consumed and leftover by other predators.

Reasons for Bushmeat Hunting

Respondents have mentioned five main reasons why bushmeat species were hunted in JWPF. These include hunting for subsistence to fulfill their protein needs, income generation to cover some livelihood expenses, hunting both for subsistence and income, for traditional or cultural reasons and medicinal values. The majority (95.5%) of the respondents claimed that bushmeat

species were hunted for subsistence to fulfill their protein needs. Bushmeat hunting both for subsistence and income (85.0%) were the second reasons, followed by traditional medicine (77.8%), income (64.4%) and culture (40.8%). The views of respondents among Farmer Associations about the reasons for bushmeat hunting practices were significantly different ($F_{5, 24} = 8.67, p < 0.05$).

Hunting Methods

Most respondents claimed that gin trap (54.7 %) and spear and dogs (31.7%) were the most common methods used to hunt bushmeat species in the area. Except Cape buffalo, all hunted bushmeat species were captured by gin trap. The combined utilization of spear and dogs were the second effective methods used during hunting. Machete, axe and chisel were also used during hunting with dogs. Bush pig (60.5%) and giant forest hog (59.3%) were easily captured by dogs, while common duiker (2.4%) was the least captured species by this method. Hunting with neck trap (24.2%) was not common, but set for common duiker (31.1%) and bushbuck (17.3%). All respondents (100%) stated that Cape buffalo was exclusively hunted by gun, which was obtained from the local militias so that they reap meat in return. Pitfall trap (19.8%) was used only to trap crested porcupine, though they were more commonly captured by gin trap (68.1%) set adjacent to maize and potato farmlands. Gin trap was set along animal trails, at the edge of the forest (close to human residences) and a few distance from road. Frequencies of the respondents claiming to use the various hunting techniques to hunt bushmeat species in JWPF differed significantly ($\chi^2 = 26.26, df = 4, p < 0.05$). Use of passive (56.6%) and

Table 1. List of mammal species hunted for bushmeat in JWPF (% is greater than 100 due to multiple responses).

Species name	Common name	Number of Responses	Percentages (%)
<i>Tragelaphus scriptus</i>	Bushbuck	238	96.0
<i>Potamochoerus larvatus</i>	Bush pig	224	90.3
<i>Hylochoerus meinertzhageni</i>	Giant forest hog	182	73.4
<i>Sylvicapra grimmia</i>	Common duiker	117	47.3
<i>Phacochoerus africanus</i>	Warthog	108	43.5
<i>Hystrix cristata</i>	Crested porcupine	53	21.4
<i>Syncerus caffer caffer</i>	Cape buffalo	32	13.0

Table 2. Preference score and factors determining hunters' decision prior to going to bushmeat hunting in JWPF (See text for detail calculations).

Determinants of hunters decision	Rank and rank frequency			Total frequency	Total score	Relative score (%)
	Rank 1	Rank 2	Rank 3			
Probable risks encountered	101	76	28	205	483	30.21
Trappability	82	62	41	185	411	25.70
Availability	55	64	44	163	337	21.07
Body size	26	51	31	108	211	13.20
Taste	8	23	23	54	93	5.82
Medicinal	11	13	5	29	64	4.00

active (43.4%) hunting methods among hunted bushmeat species differed significantly ($\chi^2 = 715.52$, $df = 6$, $p < 0.05$).

Hunting Seasons and Determinants of Hunters' Decision

Bushmeat hunting was reported to occur during different seasons of the year. The majority of the respondents claimed that it occurred during the dry (64.1%) than the wet seasons (27.0%). However, about 8.9% of them claimed that hunting occurs during both seasons. This difference was statistically significant ($\chi^2 = 48.34$, $df = 2$, $p < 0.05$). Household respondents have also ranked factors that govern hunters' decisions prior to going to bushmeat hunting in JWPF. Accordingly, 30.21% of respondents claimed that the probable risks that hunters would encounter during hunting was given priority, followed by species trappability (25.70%) and availabi-

lity (20.9%). About 13.20% of respondents also asserted that the body size of the species has significant impacts on hunters' decision during hunting. However, the taste (5.82%) and medicinal value (4.00%) of bushmeat species were less likely to determine hunters' decision during hunting (Table 2).

Bushmeat Species Preference

Bushbuck (19.4%) and bush pig (18.8%) were the most commonly preferred species, whereas Cape buffalo (9.3%) was the least preferred with respect to trappability (Table 3). Bushbuck (21.6%) and bush pig (17.6%) were also preferred because of their availability. Giant forest hog (14.5%) and Cape buffalo (14.4%) have similar availability and accessibility, whereas crested porcupine (9.3%) and common duiker (9.0%) were the least available species. The majority (69.0%) of respondents claimed that Cape buffalo was ranked first

Table 3. Rank of hunted bushmeat species based on the hunting motives that determine hunters' decision in JWPF (See text for detail descriptions of calculations; TS= Total score; Figures shown as superscript indicates rank of species as per each determining factor).

Bushmeat species	Trappability	Availability	Risks encountered	Body size
	TS (%)	TS (%)	TS (%)	TS (%)
Bushbuck	313(19.4) ¹	350(21.6) ¹	83(5.1) ⁴	261(17.8) ²
Bush pig	303(18.8) ²	286(17.6) ²	96(6.0) ³	245(16.7) ³
Giant forest hog	251(15.6) ³	235(14.5) ³	165(10.2) ²	189(12.9) ⁵
Common duiker	214(13.3) ⁴	221(13.6) ⁵	75(4.6) ⁶	298(20.3) ¹
Warthog	199(12.4) ⁵	148(9.0) ⁷	82(5.1) ⁵	207(14.1) ⁴
Crested porcupine	181(11.2) ⁶	150(9.3) ⁶	0(0.0) ⁷	165(11.2) ⁶
Cape buffalo	149(9.3) ⁷	234(14.4) ⁴	1117(69.0) ¹	103(7.0) ⁷

with regard to the probable risks that hunters encountered such risks as being caught and fined in court, and attack by wounded and ambushed buffalo. However, only minimum number of respondents admitted the likely encounter of risks when hunting giant forest hog (10.2%), bush pig (6.0%), warthog (5.1%), bushbuck (5.1%) and common duiker (4.6%). In our study area, large bodied species were less targeted for bushmeat hunting. As stated by the respondents, common duiker (20.3%) was preferred, followed by bushbuck (17.8%) and bush pig (16.7%) for their small body size. However, Cape buffalo, the largest mammal of the area, was the least preferred species (7.0%). Crested porcupine, was the least preferred (11.2%) next to Cape buffalo. Bushmeat species trappability was positively correlated with species availability (Spearman's rank: $r_s = 0.75$) and body size of species (Spearman's rank: $r_s = 0.71$), the probable risks encountered (Spearman's rank: $r_s = 0.07$), but the correlations were not significant ($p > 0.05$). However, there was a negative correlation between the probable risks encountered and body size of bushmeat species (Spearman's rank: $r_s = -0.36$, $p > 0.05$).

Bushmeat Price

Bushmeat was reported to be sold fresh in the villages and in the nearby towns. The majority (79.7%) of the

respondents mentioned that bushmeat was transported to the nearby town on horse or donkey back concealed in old fertilizer bags. Few respondents (20.3%) indicated that bushmeat was shared among close relatives and or sold in the village with whom they keep the secrets of bushmeat. The prices in dollars for all bushmeat species of the area are shown in Figure 2. Cape buffalo had the largest mean price (US\$ 32.1 \pm 7.6), followed by bush pig (US\$20.9 \pm 5.9) and giant forest hog (US\$ 18.7 \pm 5.4). Bushbuck (US\$ 12.6 \pm 4.9) and common duiker (US\$7.9 \pm 2.3) had low price. Crested porcupine costs US\$17.7 \pm 7.9 regardless of its body size compared to other species. The mean commercial values among bushmeat species differed significantly ($\chi^2 = 19.91$, $df = 5$, $p < 0.05$).

The relationship between mean body mass and black market prices of bushmeat species are indicated in Figure 3. A simple linear regression analysis done for the mean body mass and local bushmeat price have a slope that was significantly different from zero at 0.05 critical alpha level ($t_5 = 2.73$, $p = 0.041$) and used to predict changes between the two variables. Thus, there was a positive significant relationship between the mean body mass and price of bushmeat species. The coefficient of determination, $R^2 = 59.8\%$, which indicates 60% of changes in the price could be explained by body mass of bushmeat species, but 40% of the changes could be explained by other factors, but not by the regression.

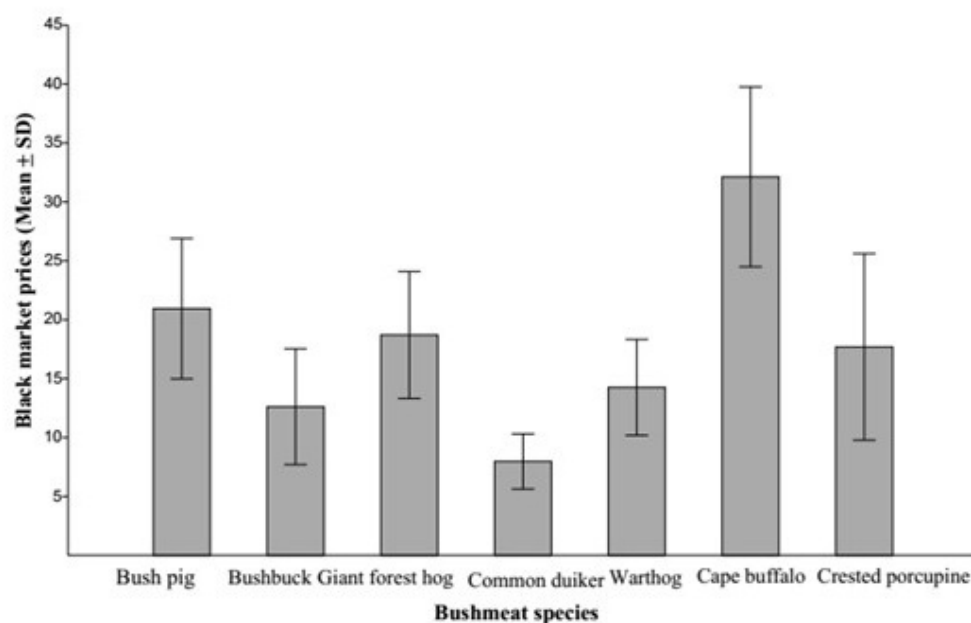


Figure 2. Black market prices (US\$) (Mean \pm SD) of bushmeat species around JWPF (Bp = Bush pig, Bb = Bushbuck, Gfh = Giant forest hog, Cd = Common duiker, W = Warthog, Cb = Cape buffalo, Cp = Crested porcupine)

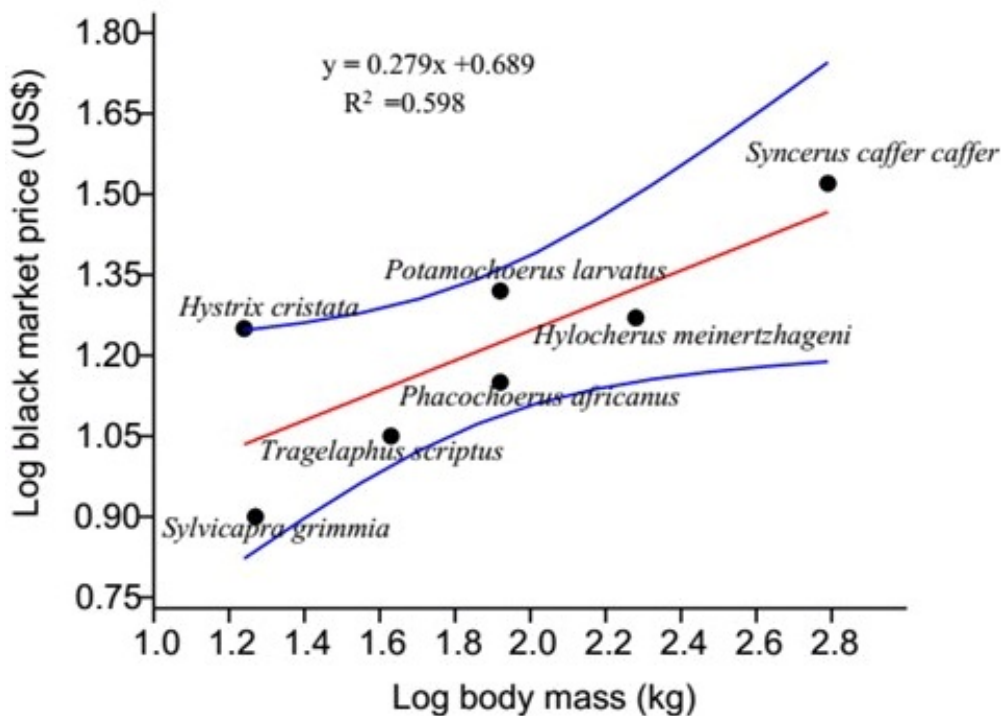


Figure 3. Regression line (middle) of the mean body mass (kg) and local prices of bushmeat species (US\$) at 95% confidence intervals (border lines) (1 US\$ = 22 Ethiopian birr during 2015).

Status of Bushmeat Hunting

The majority of the respondents (38.7%) mentioned that the status of bushmeat hunting had not changed, whereas 35.9% claimed that it had increased. However, about 19.0% and 6.5% the respondents stated that the trend had decreased and became uncertain, respectively. There was a significant difference between respondent's view regarding the status of bushmeat hunting ($\chi^2 = 27.39$, $df = 3$, $p < 0.05$). Respondents view about the trends of bushmeat hunting differed significantly between age categories ($\chi^2 = 24.35$, $df = 9$, $p < 0.05$) and duration of residence ($\chi^2 = 28.52$, $df = 12$, $p < 0.05$), but insignificant between gender ($\chi^2 = 3.38$, $df = 3$, $p > 0.05$), occupation ($\chi^2 = 6.57$, $df = 9$, $p > 0.05$), religion ($\chi^2 = 4.12$, $df = 6$, $p > 0.05$) and educational level ($\chi^2 = 9.02$, $df = 9$, $p > 0.05$).

DISCUSSION

Artiodactyla, Rodentia and Primates were reported as the top three orders of mammals hunted for bushmeat in west and central Africa (Fa et al. 2006, Mbete et al. 2011). Several studies have also reported that even-toed

ungulates constituted the largest portion of the bushmeat harvest in Tanzania (Ndibalema and Songorwa 2007), Cameroon (Muchaal and Ngandjui 1999), Republic of Congo (Eves and Ruggiero 2000) and Gabon (Van Vliet and Nasi 2008). Similarly, most targeted bushmeat species in our study area belonged to the Order Artiodactyla. Only porcupine was used from the order Rodentia. However, non-human primate species were not harvested for bushmeat in JWPF. The consumption of the Order Rodentia, Primates, the family Suidea (bush pig, giant forest hog and warthog) and odd-toed ungulates are prohibited as per the religions and culture of most Ethiopians, but rarely practiced by few ethnic groups in the remote parts of the country. As reported by Habtamu and Bekele (2008), many species of the Order Rodentia have been consumed by Gumuz people in the northwestern parts of Ethiopia. Furthermore, black and white colobus monkey (*Colobus guereza*) and porcupine (*Hystrix cristata*) have been consumed by Manjo people in the Southern Nations and Nationalities, Southwest Ethiopia (Hartmann 2004). In our study area, the taboo of consuming porcupine and the family Suidea have been disregarded due to their diverse medicinal value for humans and livestock. However, eating non-human primates is not accepted in the area due to their similarity

to humans. If consumed, it leads to social exclusion as in the case of Manjo people (Hartmann 2004). The variation in bushmeat species consumption in Ethiopia could be attributed to the cultural and religious based dietary taboo diversity among the ethnic groups in the country.

Wild animals have been hunted for protein and income or for cultural and recreational purpose (Bitanyi et al. 2012). Though, reasons for bushmeat hunting varied among countries and societies, it has been historically known as subsistence in most rural parts of Africa (Wilkie and Carpenter 1999). Similarly, our study revealed that subsistence and income generation were the main reasons for bushmeat hunting in the area. This could be due to viewing domestic animals as savings by hunters as reported by Wright and Priston (2010). Bush pigs and giant forest hogs were hunted both for subsistence, medicinal purpose and for income generation, whereas porcupine was hunted only for medicinal purpose. Contrary to our study, bushmeat hunting in the West and Central Africa was practiced more for income than for subsistence (de Merode et al. 2004, Kämpel 2006).

The majority of bushmeat hunting was conducted using gin trap, followed by spear and dogs. Gin trap was preferred over the others because it is simple, silent and effective in bushmeat species harvest. As hunting is prohibited by law, hunters use less detectable and silent methods (passive) than active hunting methods (Lindsey and Bento 2012). However, gin trap is undesirable from conservation perspective, because it captures non-targeted species similar to cable snare (Lindsey et al. 2009). In our study area, gin trap was directed for medium and large-sized mammals as stated by Lindsey and Bento (2012). However, Cape buffalo was not captured by gin trap rather exclusively hunted by gun. In contrast to cable snare, animals captured by gin trap were less likely wasted (Lindsey et al. 2009) as it is checked more regularly than snares (Lindsey et al. 2012). In JWPF, gin trap was buried in the ground late afternoon and checked next day early in the morning to make sure that the captured animal does not move far from the trapping site or to collect the trap not to be stolen. In order to increase trap success, human urine was accumulated at home and poured into a small excavated hole, anterior to the buried gin trap which serves as attractant for bushbuck and common dicker. In addition, two or more large wooden logs are laid on the left and the right side of the buried gin trap to block licking urine from sides. Gin trap was mostly set at forest edges, closer to human residences, which makes setting

and rechecking traps easier, and a little distance from the road as bushbuck and common duiker were mostly attracted by roadside urination. However, gin trap targeted for other species was buried along their trails and covered with fallen dry leaves.

Bushmeat hunting was practiced both during the wet and dry seasons, but common during the dry season. This could be attributed to the long resting periods of the local hunters and easy access into the forest due to the reduction of understory covers. In addition, fruits of *Ficus sur* was ripped and serve as good hunting site as mammals frequently visit to consume fallen fruits. Similarly, previous studies reported that illegal hunting appears to peak during the dry season due to reduced grass cover and reduced and concentrated water sources (Lindsey et al. 2009, Lindsey and Bento 2012). In contrast, Fonkwo et al. (2011) and Obioha et al. (2012) reported that illegal bushmeat hunting increase during the rainy season because animals move out of their resting place after rain to avoid moisture. Furthermore, the visibility of animal trail during the rainy season makes tracking and setting trap easier than the dry season.

In our study area, hunters analyse and prioritize different factors before they decide to hunt a particular species. These factors help hunters to decide which species to hunt or when and how to hunt a particular species. Accordingly, the probable risks that hunters encountered (risk of attack by game animals or risk of captured by government militias during hunting), trappability and availability of a species were considered most by hunters before they go to hunt. Hunters always give due attention to keep the secrets of bushmeat hunting at the same time fulfilling their intrinsic needs. Hunting techniques were designed in a way to avoid the likely occurrence of risks by game animals or capture or seen during hunting. Similarly, the risks of capture and large game have been second to availability of species in determining the hunting grounds of hunters in Okavango Delta, Botswana (Rogan et al. 2015). In the Serengeti, bushmeat off-take was determined by the relative abundance of the species rather than other preferences (Ndibalema and Songorwa 2007). Emphasis given to the probable risks of capture and game in JWPF revealed the extent that bushmeat hunting practice was secretive in the area. Besides, hunters preferred species that can easily subdued in terms of time and effort. For instance, hunters less likely targeted Cape buffalo regardless of its availability and bulk meat because it is dangerous and the hunting tool (gun) will less likely secure the secrets of hunting.

Bushbuck and bush pig were highly preferred by hunters because of their easy trappability and availability. Bushbuck was easily captured by traps (gin and neck), and bush pig by spear and dogs, and gin trap. Species of the family Suidea were easily trapped by dogs because they always back to defend dogs while they fled. Moreover, dogs locate and restrain movement of the species so that hunters can easily kill using spear, axle or machete as stated by Olupot et al. (2009). In our study area, Cape buffalo was hunted mostly during the wet season and during Easter when people are engaged in agricultural activities and festival celebrations, respectively. Contrary to this, there was no fear regarding the risk of getting caught in trapping porcupine. This could be attributed to small body size and serious pest status of the species. Common duiker was the most preferred species in terms of body size, though ranked least in terms of availability. Similarly, duikers have been preferred by both hunters and consumers because they are economical in terms of transportation and capture as reported by Fa et al. (1995). Several other studies have also reported preferences for duiker and medium-sized mammals in Africa (Colell et al. 1994, Mfunda and Roskaft 2010, Gandiwa et al. 2013). Though, large-bodied species are more profitable in terms of meat harvest, hunters switch to smaller species as their populations decline (Milner-Gulland et al. 2003). However, Eniang et al. (2017) reported that hunters targeted small to medium-sized mammals to minimize expenses associated with the traditional system of having to share meat of large bushmeat species with close relatives. In our study area, preference for small-sized species could be linked to hunter's interest of exclusive bushmeat use to keep the secret of hunting at home level.

Bushmeat and animal body parts have frequently been observed in markets of most African countries (Reid 1992). For instance, bushmeat trade has been underway in Southwestern Nigeria (Anadu et al. 1988), Equatorial Guinea (Fa et al. 1995), Benin (ACET 2014) and Republic of Congo (Nasi et al. 2011). In our study area, meat was sold as underground market in the villages or nearby towns for medicinal and income as described by Barnett (2000). Though the extent, type and trade of bushmeat varied across Africa, it was very mysterious in JWPF as of the hunters decision of a species to be hunted up to the bushmeat supply to the black market. Similarly, wild meat is sold in open markets in Uganda (Olupot et al. 2009), Tanzania (Ndibalema and Songorwa 2007) and Ghana (Mendelson et al. 2003). Moreover, there has been no enforcement of

bushmeat trade bans in Rio Muni, Equatorial Guinea (Kümpel 2006).

In JWPF, the price of bushmeat species was determined based on the individual carcass or body parts (forelimbs, hind limbs, ribs) rather than in kg. This could be attributed to the traditional system of sharing meat in rural areas where weight measurements are lacking. However, several studies reported that bushmeat was weighed and sold in kg (Ndibalema and Songorwa 2007, Martin et al. 2012, Lindsey and Bento 2012). The price of bushmeat species varied based on the size and medicinal value of the species. This agrees with the report of Ndibalema and Songorwa (2007), who stated that bushmeat price was determined by the quality, size and type of species in the Serengeti, Tanzania. The price of bushmeat is also correlated with the demands of a species in the community (Kümpel 2006). In our study area, Crested porcupine has the smallest body weight, but almost equal (US\$ 17.7) with the price of giant forest hog (US\$ 18.7). This has revealed the high demand of porcupine meat in the area.

In Ethiopia, wildlife law is very strict at policy level and at the level of higher conservation authorities, but loosely implemented at the lower level as observed in JWPF. As reported by Lindsey et al. (2011b), the control of illegal hunting in protected areas is weakened because scouts dishonestly patrol, and they themselves sometimes hunt as they are paid low salary. In JWPF, respondents revealed that law enforcement and penal system were very serious during the Derg regime, but gradually loosen since 1991. As reported by Bennett (2011), political instability of a country is the cause for intensification of illegal wildlife harvest. Poor governance and low penal system (Naughton-Treves 1998, Bennett 2011, Nielsen 2006), failure of realizing property rights of wildlife and communities (Bulte and Horan 2002) and increase of human populations around protected areas have been reported to increase bushmeat hunting. In JWPF, the status of bushmeat hunting has not shown a positive change since the last three decades. This could be ascribed to the poor penal system, lack of clear rights and awareness creation on how to use resources from protected areas. To combat the current scenarios of bushmeat hunting practices in JWPF, awareness creation and wildlife laws should be implemented.

ACKNOWLEDGEMENTS

We would like to thank Addis Ababa and Wollega Universities for financial and material support. We are

also grateful to Oromia Forest and Wildlife Enterprise for allowing this research to be conducted in Jorgo-Wato Protected Forest, our consent respondents and field assistants for their support during data collection.

Author Contributions: The first author was involved in data collection, data analysis and preparation of the manuscript as per the guideline of the journal. The second and third authors supervised research work and corrected the manuscript.

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Received 16 December 2019

Accepted 29 April 2020