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COMMUNICATION

Feeding ecology of Walia Ibex *Capra walie* (Mammalia: Artiodactyla: Bovidae) in Simien Mountains National Park, Ethiopia

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Abstract: Walia Ibex *Capra walie* is an endemic and endangered species residing in Simien Mountains National Park, Ethiopia. It has shifted its range within the Park in the last decade, and in this study our main objective was to provide information on their feeding ecology to inform recovery goals. We used a scan sampling method to collect foraging information during October 2009 to November 2011. Our observations suggest a diverse diet of more than 28 species of grasses, forbs, and shrubs. The most commonly used plants were *Festuca* sp., *Lobelia rhynchopetalum, Helichrysum citrispinum*, and *Helichrysum horridum*. Walia Ibex were active in feeding before and after mid-day, and time spent feeding was the highest compared with other diurnal activities. The percentage of time spent feeding on major plant species did not differ between wet and dry seasons ($p > 0.05$). Walia Ibex, however, tended to spend more time browsing than grazing. The generalist nature of foraging behaviour in Walia Ibex most likely contributes to complaints from the local people who witness Walia Ibex raiding crops cultivated in and around the Park. Thus, the contribution of crop raiding to the shifts in the species' range towards higher altitudes at Sebatminch within Simien Mountains National Park emphasizes the need to consider foraging ecology as community-based conservation efforts are developed to support Walia Ibex in the Park.

Keywords: Endemic, *Festuca* sp., *Lobelia rhynchopetalum,* scan sampling.

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Author contribution: DE involved in research proposal preparation, design of the research, data collection, data organization, data analysis, and write up of the manuscript. AB participated in design of the research, supervision of data collection, data analysis, and manuscript preparation. LP contributed in data analysis, location map preparation, and manuscript preparation.

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INTRODUCTION

Walia Ibex (*Capra walie* Ruüppell, 1835) is an endemic and endangered species (Gebremedhin et al. 2009; IUCN 2021) confined to Simien Mountains National Park, Ethiopia. The fascinating behaviour of this species of wild goat and its physical stature has led it to be used as a flagship species for Ethiopia. Walia Ibex is the only ibex species in Ethiopia (Nievergelt 1981; Last 1982; Haltenorth & Diller 1993), and is believed to have dispersed from the Middle East 26,000 to 14,000 years ago (Nievergelt 1981). Biologists have classified Walia Ibex as a generalist herbivore, as it obtains food through grazing and browsing, and the species is known to forage on grasses, herbs, shrubs, bushes, creepers, and lichens (Massicot 2001). Such mixed feeding behaviour is also observed in other ibex species such as the Iberian Ibex *Capra pyrenaica* (Accevedo & Cassinello 2009).

One of the current threats to walia ibex is conflict with livestock within Simien Mountains National Park. Livestock grazing in shared habitats may cause lower survival for offspring and therefore lower population growth (Namgail 2006). The problem of overgrazing of wildlife habitats is especially critical for female wildlife species using lower quality habitat areas, especially during the early lactation period (Ruttiman et al. 2008).

Indeed, the presence of livestock in the Iberian ibex habitat has a negative effect on its relative abundance and distribution, causing ibex to select poor habitats (Pelayo et al. 2007). Large areas of suitable habitats in Simien Mountains National Park have been abandoned as Walia Ibex retreated to the most inaccessible and steepest parts of the park (Hurni & Ludi 2000; Ejigu et al. 2015). The shift in range has occurred because the original Walia Ibex habitats have been modified by intensive human activities for various uses. Generally, ibexes prefer areas with steep slope and cliffs and avoid grasslands and flat hillsides (Feng et al. 2007); these realized preferences can be observed in Simien Mountains National Park, where the original habitats of Walia Ibex, especially in the central region of the park near Gich (Figure 1), have been occupied by livestock. As a result, the Walia Ibex population is now restricted to relatively inaccessible habitats within gorges and escarpments towards the eastern and southeastern parts of the Park (Hurni & Ludi 2000; Ejigu et al. 2015).

Although the range shift of Walia Ibex has been observed (Ejigu et al. 2015), biologists lack information on foraging and the feeding ecology to determine if the range shifts have pushed ibex into regions that are not able to provide resources to sustain the population in the future. Recovery goals and conservation planning require information on foraging and diet. Thus, the main objective of this research was to study feeding ecology of walia to determine the level of specificity of diet and to identify the major plant species consumed by the species to design appropriate conservation measures.

MATERIALS AND METHODS

Description of the study area

The study was carried out in Simien Mountains National Park (SMNP), which is located in the Amhara National Regional State of Ethiopia in the North Gondar Administrative Zone (37.857–38.491 ^{0}E & 13.112–13.386 ^{0}N), about 865km north of Addis Ababa and 132km north-east of Gondar Town. The foraging study was part of a larger assessment of the habitat selection and range shift of the species (Ejigu et al. 2015).

SMNP includes broad undulating plateaux and the highest mountain of Ethiopia, Ras Dejen (4,620m), which is also the fourth highest mountain in Africa (Puff & Nemomissa 2001, 2005). It is an area of high summits with unique land features in the Horn of Africa. The mountains symbolize an area of the extreme Ethiopian highlands (Hurni & Ludi 2000). Prior to the 1960s, the area had been used as a controlled hunting area, and was regarded as a royal hunting ground (Falch & Keiner 2000). During its establishment, SMNP was the smallest park in the country with an area of only 136km^2 (Hurni & Ludi 2000) but has been enlarged to 412km^2 (Anonymous 2009) (Fig. 1).

The main rainy season in SMNP lasts from the end of June to September, while the dry season encompasses December to April. Rainfall shows significant variation across different altitudes with a maximum at about 3,500m (Puff & Nemomissa 2005). Thus, annual rainfall in Simien Mountains varies from 1,000mm in the lowlands to 1,500mm in the highlands (Hurni & Ludi 2000). Meteorological data obtained from National Meteorological Agency shows that the 10-year (2000–2009) mean annual rainfall of SMNP was 1,054mm.

Ground frost commonly occurs at night during the dry season, especially in February and April. The area shows variation in mean annual minimum and maximum temperatures. As described by Hurni (1982), the mean annual temperature at Gich is 7.7°C, which is often accompanied by dry winds during the daytime. At night, however, the area experiences temperature variations ranging from +2°C to -10°C. The 10-year (2000–2009) mean annual minimum and maximum temperature data were 8.6°C and 19.9°C, respectively. Despite fluctuations in daily temperatures, seasonal variations in temperature

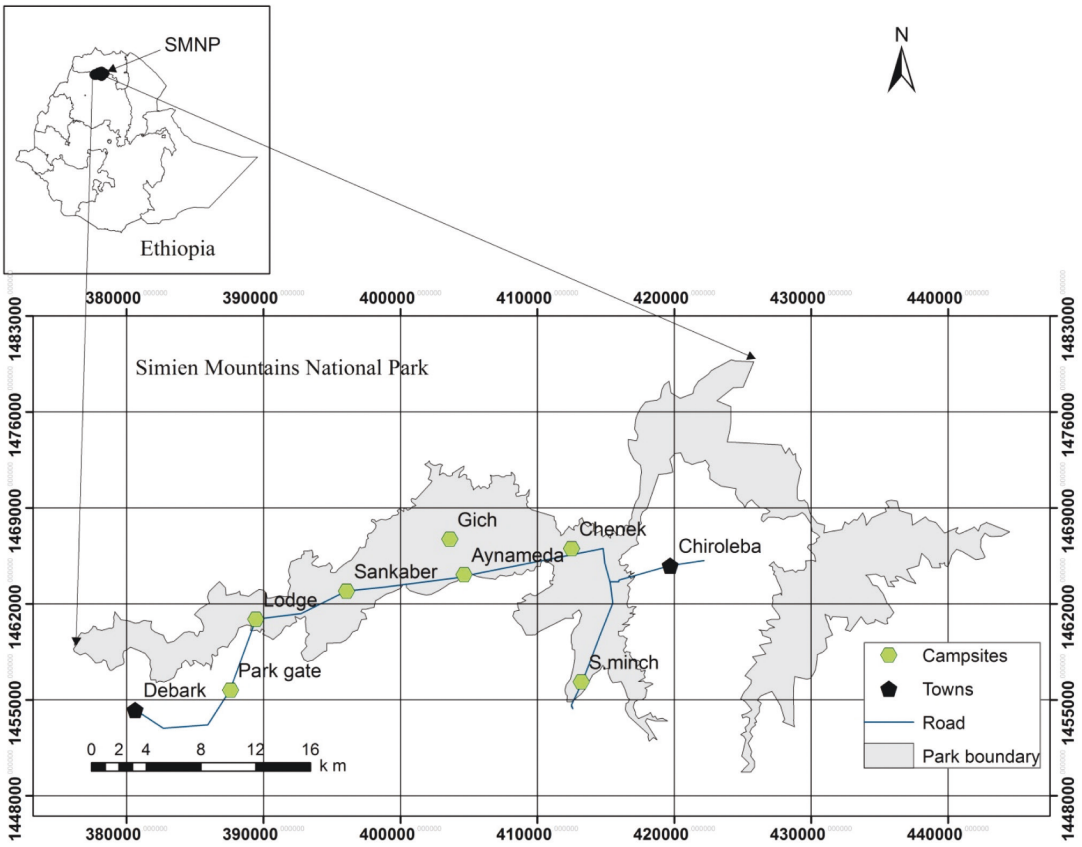

Figure 1. Simien Mountains National Park (SMNP) within Ethiopia (inset).

are minimal due to Ethiopia's proximity to the equator (Nievergelt, 1990). As a result, variations in diurnal temperature far exceed seasonal ones.

According to Puff & Nemomissa (2001), approximately 550 taxa of flowering plants grouped into over 95 families and 319 genera are known from Simien Mountains. Habitat types mainly consist of a mixture of Afro-alpine woods, heath forest, high mountain vegetation, montane savannah and montane moorland (Hurni & Ludi 2000). Common species include *Erica arborea*, *Lobelia rhynchopetalum*, *Hypericum revolutum*, *Rosa abyssinica, Helichrysum* sp., and *Solanum* sp. (Anonymous 2009).

With its unique landscape and magnificent scenery, the Park supports some of Ethiopia's most important endemic mammals in addition to the Walia Ibex, such as the Ethiopian Wolf *Canis simensis* and the Gelada Baboon *Theropithecus gelada*. Thus, the unique flora and fauna and its remarkable landscape make the Park a natural priority for conservation and centre of endemism in eastern Africa (Hurni & Ludi 2000).

At least 20 large and 14 small mammal species reside in the Park (UNESCO 2001). Large herbivores including Menelik's Bushbuck *Tragelaphus scriptus meneliki*, Grimm's Duiker *Sylvicapra grimmia*, Klipspringer *Oreotragus oreotragus* occur commonly in the park and are considered to be wild competetors with Walia Ibex (Anonymous 2009).

Field methods

Data on feeding ecology in Walia Ibex were collected for 15 days every other month from October 2009 to November 2011, including both the wet and dry seasons (Images 1–6). Dietary data for a herd of ibex were collected using the scan sampling method (Pellew 1984) with binoculars or telescope within five-minute intervals (Altman 1974), and individuals from the herd were selected randomly to start scanning (Wallace 2006). We observed each individual for 10 seconds to determine the species of plant eaten, and we observed a different animal until all animals in the herd had been sampled, following Toit & Yetman (2005). Each scan of the herd took approximately five minutes to complete, and each individual was observed from five to ten seconds after being detected.

Our sampling was designed to match the foraging patterns of Walia Ibex. *Capra* species, like other large

Image 1. Herb of Walia Ibex in open habitat of Simien Mountains National Park, Ethiopia.

Image 2. Herb of Walia Ibex in rocky habitat of Simien Mountains National Park, Ethiopia.

Image 3. Adults of Walia Ibex at the cliffs of Simien Mountains National Park, Ethiopia.

Image 4. Walia and Geladas living together in their common habitat.

Image 5. Ice formed at the mount tips of Simien during data collection period.

Image 6. Data collection by the researcher using binoculars.

herbivores, show a diurnal activity pattern of two distinct peaks of feeding and moving (Hess 2002). Thus, Walia Ibex is crepuscular, active for feeding and moving early in the morning and late in the afternoon, and resting on rocks and cliffs during the mid-day. At noon, they become inactive and tend to remain in the shade to protect themselves from hot sun and predators (Dunbar 1978; Ejigu et al. 2020). Therefore, herds were located early in the morning and followed until late in the afternoon to identify their important food sources.

The scan sampling method involves observing the individual for a five-minute session broken in the following way; observe on the focal animal for 10 seconds, mark its location, then the next focal animal for 10 seconds and so on for the entire herd. We collected the following information during scan sampling: date, time, location, age, and sex of the animal (Ruckstuhl 1998; Namgail 2006). We also identified and recorded the plant species on which Walia Ibex foraged, and we validated our observations with samples collected and identified after the herd had moved from the sampling location as adopted from Kaplin & Moermond (2000) and Gad & Shyama (2009). Due to difficulties in identification at a distance, we lumped related grass species together (Dankwa-Wiredu & Euler 2002). We quantified the time spent feeding on different plant species to calculate the proportion of time spent on each plant. Diet selection was determined from the relative proportions of the number of scans spent feeding on different plant species. We collected and pressed plants that could not be identified in the field and took to the National Herbarium, Addis Ababa University, for identification using the herbarium samples.

Analysis methods

We described the time spent foraging on different plants with proportions, and we used Chi-square tests to evaluate differences in time spent foraging on species among age and sex classes of Walia Ibex. Statistical tests were two-tailed ($\alpha = 0.05$), and the data were analysed using SPSS software version 16.0 (SPSS Inc. Chicago).

RESULTS

A total of 7,387 feeding bouts were recorded during scan sampling of Walia Ibex. Our samples were evenly divided between the wet season (50.5% of bouts, n= 3,728) and the dry season (49.5%, n= 3,659). When time spent feeding on the four major food plants species was compared, Walia Ibex spent more time foraging on *Festuca* sp. during the wet season (37.2% of bouts, n= 1,387) than in the dry season (22.2%, n= 813; $c^2= 3.81$, $p= 0.051$). Moreover, the percentage of time spent foraging on three other main plant species did not differ between seasons (*Lobelia rhynchopetalum*, wet: 20.3%, n= 757, dry: 17.8%, n= 651, $p= 0.423$; *Helichrysum citrispinum*, wet: 17.1%, n= 638, dry: 22.3%, n= 815, $p= 0.746$; *Helichrysum horridum*, wet: 10.3%, n= 383, dry: 19.3%, n= 705, $p= 0.095$).

Although 70–80 % of their diet was from the four main plant species (*Festuca* sp., *Lobelia rhynchopetalum*, *Helichrysum citrispinum* and *Helichrysum horridum)*, Walia Ibexes were observed foraging on more than 23 and 28 plant species during the wet and dry seasons, respectively (Tables 1, 2).

Walia Ibex spent 38.0% (1416) and 22.9% (836) of time feeding on grasses, 9.6% (357) and 12.2% (446) on herbs, 48.2% (1795) and 60.4% (2210) on shrubs and 3.7% (137) and 4.1% (148) on trees during the wet and dry seasons, respectively (Fig. 2). As foraging patterns did not change between wet and dry seasons ($p> 0.05$), Walia Ibex foraging behaviour reflected that of a generalized herbivore. During the wet season, Walia Ibex spend similar time browsing and grazing, but it spent more time browsing than grazing during the dry season ($c^2= 8.49$, $p< 0.05$).

Adult females spent 41.7% (wet season) and 22.7% (dry season) of feeding time foraging on grasses, 27.6% & 14.7% on herbs, 24.6% & 56.6% on shrubs, and 4.7% & 3.9% on trees. Adult males spent 23.9% & 22.8% of feeding time foraging on grasses, 25.6% & 7.1% on herbs, 42.3% & 65.2% on shrubs, and 4.7% & 3.5% on trees during the wet and dry seasons, respectively. In sub-adults, yearlings and kids time spent feeding on different plants during the wet and dry seasons is also as presented in figures (Figs. 3, 4) below. Time spent feeding on grasses between the wet and dry seasons showed significant differences only in sub-adult males ($c^2= 9.60$, df= 1, $p< 0.05$) and kids ($c^2= 8.45$, df= 1, $p< 0.05$). Time spent feeding on herbs between the wet and the dry seasons showed significant differences only in adult females ($c^2= 3.93$, df= 1, $p< 0.05$) and in sub-adult females ($c^2= 4.26$, df= 1, $p< 0.05$), while time spent feeding on shrubs and trees in all age classes of Walia Ibex indicated that they fed more on shrubs and trees during the dry season than the wet season, and the difference was statistically significant ($p< 0.01$).

Feeding activities of Walia Ibex declined shortly during 08.00–10.00 h and increased after 10.00h during the wet season. Feeding reached its peak at around 11.00h and declined slowly during 11.00–13.00 h, and increased again and reached a maximum at 17.00h. During the dry season, feeding activity decreased during 08.00–11.00 h and increased during 11.00–15.00 h, and then increased sharply up to 17.00h. In the evening, however, it declined

Table 1. Plants foraged by Walia Ibex during the wet season.

	Scientific name	Family	Local name	Habit	feeding bouts	%
1	*Festuca* sp.	Poaceae	guassa	grass	1387	37.20
2	*Lobelia rhynchopetalum*	Campanulaceae	Jibra	shrub	757	20.31
3	*Helichrysum citrispinum*	Asteraceae	Yewaliashoh	shrub	638	17.11
4	*Helichrysum horridum*	Asteraceae	Tifrgina	shrub	383	10.27
5	*Thymus schymperi*	Lamiaceae	Tosign	herb	121	3.25
6	*Alchemilla pedata*	Rosaceae	Yayet joro	herb	109	2.92
7	*Erica arborea*	Ericaceae	wuchena	tree	101	2.71
8	*Mosses & liver*	Grimmiaceae	Yemeret shibet	herb	60	1.61
9	*Usnea* sp.	Usneaceae	Yezaf shibet	herb	42	1.13
10	*Hypericum revolutum*	Hypericae	Amja	tree	36	0.97
11	*Carex erythrorhiza*	Cyperaceae	Shefshefo	grass	24	0.64
12	Unidentified	Unidentified	Unidentified	grass	23	0.62
13	Unidentified	Unidentified	Yemidir wuchena	herb	15	0.40
14	*Spermacoce sphaerostigma*	Rubiaceae	Kesign	shrub	07	0.19
15	*Globsis* sp.	Unidentified	Unidentified	shrub	05	0.13
16	Unidentified	Unidentified	Key sar	grass	05	0.13
17	*Simenia acaulis*	Gentianaceae	Yebahir teza	herb	04	0.11
18	*Urtica simensis*	Urticaceae	sama	herb	03	0.08
19	*Clematis simensis*	Ranunculaceae	Azoareg	shrub	03	0.08
20	*Phagnalon phagnaloides*	Asteraceae	Sinbita	herb	02	0.05
21	*D. chrysanthommifilia*	Asteraceae	yewesferas	herb	01	0.03
22	*Dryopteris inaequalis*	Dryopteridaceae	yejibchama	shrub	01	0.03
23	*Solanum indicum*	Solanaceae	Embuay	shrub	01	0.03
	Total				3,728	100

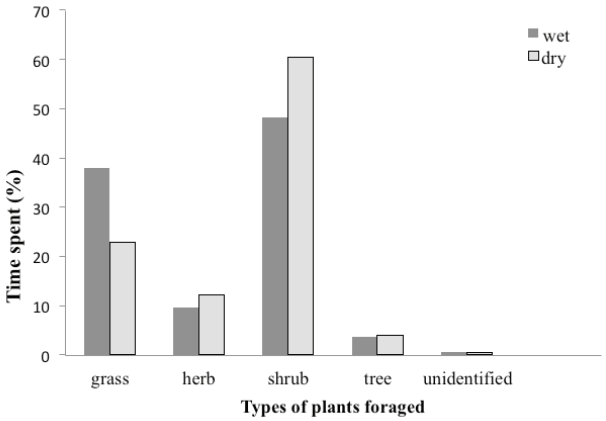

Figure 2. Percentage of time spent foraging by Walia Ibex in Simien Mountains National Park in Ethiopia during the wet and dry seasons, October 2009 to November 2011.

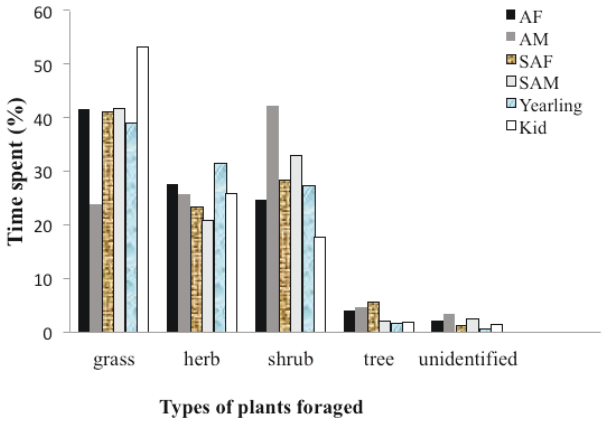

Figure 3. Percentage of time foraging by different age and sex classes of Walia Ibex in Simien Mountains National Park in Ethiopia during the wet seasons, October 2009 to November 2011. AM—Adult Males | AF—Adult Females | SAM—Sub-adult Males | SAF—Sub-adult Females.

both during the wet and dry seasons (Fig. 5). Nevertheless, feeding activity between the wet and dry seasons did not show significant difference (c^2= 0.01, df= 1, p> 0.05).

A total of 18, 236 diurnal activities of Walia Ibex were recorded during the entire study period. Our sampling was evenly distributed between the wet season (51.6%, n= 9,407) and the dry season (48.4%, n= 8,829). Feeding comprised 40.5% (7,387), moving 17.9% (3,261), standing 10.1% (1,849), resting 23.5% (4,281), vigilance 1.6% (289),

Table 2. Plants foraged by Walia Ibex during the dry season.

	Scientific name	Family	Local name	Habit	feeding bouts	%
1	*Helichrysum citrispinum*	Asteraceae	Yewaliashoh	shrub	815	22.27
2	*Festuca* sp.	Poaceae	Guassa	grass	813	22.22
3	*Helichrysum horridum*	Asteraceae	Tifrgina	shrub	705	19.27
4	*Lobelia rhynchopetalum*	Campanulaceae	Jibra	shrub	651	17.79
5	*Alchemilla pedata*	Rosaceae	Yayet joro	herb	220	6.01
6	*Erica arborea*	Ericaceae	Wuchena	tree	96	2.62
7	*Usnea* sp.	Usneaceae	Yezaf shibet	herb	84	2.29
8	*Thymus schymperi*	Lamiaceae	Tosign	herb	63	1.72
9	*Mosses &liver*	Grimmiaceae	Shibet	herb	57	1.56
10	*Hypericum revolutum*	Hypericeae	Amja	tree	50	1.37
11	*Carex erythrorhiza*	Cyperaceae	Shefshefo	grass	23	0.63
12	Unidentified	Unidentified	Unidentified	Unidentified	19	0.52
13	*Dryopteris inaequalis*	Dryopteridaceae	Yejibchama	shrub	13	0.35
14	*Solanum indicum*	Solanaceae	Embuay	shrub	09	0.25
15	*Kniphofia foliosa*	Asphodalaceae	Dudya	herb	06	0.16
16	*Spermacoce sphaerostigma*	Rubiaceae	Kesign	shrub	6	0.16
17	*Carduus macracanthus*	Astraceae	Kosheshile	herb	05	0.14
18	Globsis	Unidentified	Unidentified	shrub	05	0.14
19	*Siminia acaulis*	Gentianaceae	Yebahir teza	herb	03	0.08
20	*Helichrysum* sp.	Asteraceae	Unidentified	shrub	03	0.08
21	*Clematis simensis*	Ranunculaceae	Azoareg	shrub	03	0.08
22	*Urtica simensis*	Urticaceae	Sama	herb	03	0.08
23	*Phagnalon phagnaloides*	Asteraceae	Sinbita	herb	02	0.06
24	*Denbia torida*	Unidentified	Wulkfa	tree	01	0.03
25	*Acanthus ebracteatus*	Acanthaceae	Unidentified	herb	01	0.03
26	*H. splendidum*	Asteraceae	Fotena	herb	01	0.03
27	*Olea europaea*	Oleaceae	Weyera	tree	01	0.03
28	Unidentified	Unidentified	Yemidir wuchena	herb	01	0.03
	Total				3,659	100

social activity 2.1% (379), rutting 2.3% (414), and other activities 2.1% (376).

DISCUSSION

Walia Ibexes were observed while foraging on more than 28 species of plants grouped as grasses, forbs, and bushes & shrubs. The most commonly foraged plants both during the wet and dry seasons were *Festuca* sp., *Lobelia rhynchopetalum*, *Helichrysum citrispinum*, and *Helichrysum horridum*. Percentage of time spent feeding on major plant species between the wet and dry seasons did not show significant differences.

Walia Ibex tended to spend more of their time browsing than grazing. As a general herbivore, Walia Ibexes can graze and browse available forage to maximize their nutrient requirements. In the afro-alpine ecosystem of SMNP, the availability of above ground vegetation that has been browsed by Walia Ibex decreases as the altitude increases, and Walia Ibex must feed on grass at the higher altitudes. Such ability to shift in diet has allowed the Walia Ibex to respond to the loss of forage at lower altitudes after livestock grazing. During the dry season, however, as the grass becomes less palatable, the food habits of Walia Ibex mainly depended on scarcely available shrubs. Thus, they also tended to browse more during the dry season than the wet season. Our findings were similar to that reported by Dunbar (1978).

All age classes of Walia Ibex tended to spend more

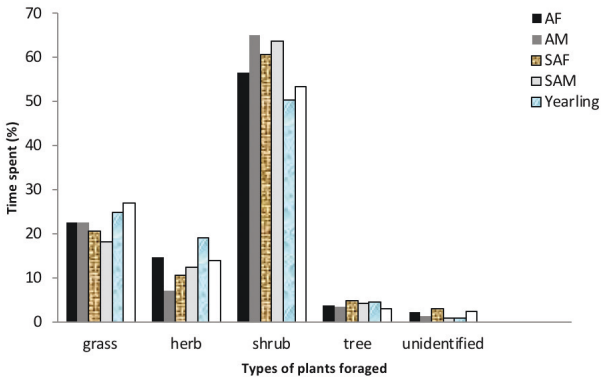

Figure 4. Percentage of time foraging by different age and sex classes of Walia Ibex in Simien Mountains National Park in Ethiopia during the dry seasons, October 2009 to November 2011. AM—Adult Males | AF—Adult Females | SAM—Sub-adult Males | SAF—Sub-adult Females.

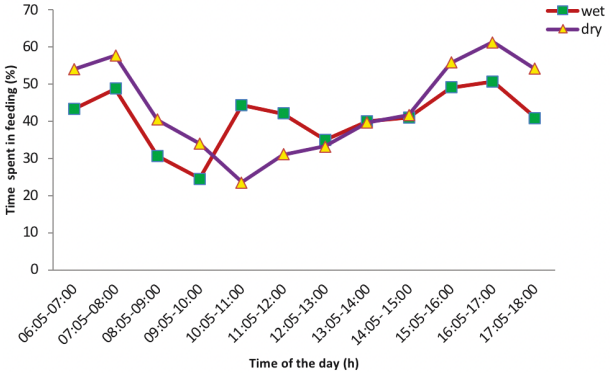

Figure 5. Duirnal feeding activity pattern of Walia Ibex in Simien Mountains National Park in Ethiopia during the wet and dry seasons, October 2009 to November 2011.

time foraging on grasses during the wet season than the dry season. Kids prefer fresh grass, and they spent more time foraging on grasses than other types of plants. Fresh and more palatable grass is present during the wet season, and kids responded to grass availability. In similar fashion, adult and sub-adult females spent more time feeding on herbs during the wet season, because of the availability of herbs during this season. All age classes of walia ibex shifted to spend more time feeding on shrubs and trees during the dry season when herbs and grasses were less available. The ability of Walia Ibex to shift to browsing during the dry season allows them to utilize essential nutrients required for their survival.

Percentage of time spent feeding in walia ibex was the highest (40.5%) and vigilance the lowest (1.6%) behaviour compared with time spent for its other diurnal activity patterns. This result is consistent with previous results conducted on foraging ecology of feral goats (Stronge et al. 1997). Although intense human and livestock disturbances are common in habitats of walia ibex, they appear to have adapted to human and livestock presence. Such low levels of vigilance also suggest a low level of predators and poaching in our study area.

Feeding behaviour in other *Capra* species was bimodal, with higher foraging activity rates detected in the earliest and latest hours of the day (Dunbar 1978; Hess 2002; Accevedo & Cassinello 2009). Time spent feeding in walia ibex was higher after 10.00h and declined in the mid-day. It increased gradually and reached its peak late in the afternoon, and then declined again in the evening. All age classes of ibex spent the majority of their time feeding in both seasons. The similar proportions of time spent feeding in wet and dry seasons are not unexpected in areas where there is minimal variation in temperatures between seasons (Nievergelt 1981, 1990). An increase in feeding time with decreasing food availability during the dry season, however, has been observed for several African grazers (Own-Smith 1982).

Adult Walia Ibex females tended to spend more time feeding than adult males, which is also true in feral goats (Stronge et al. 1997) and bighorn sheep (Ruckstuhl 1998). In ungulates, males require lower diet and habitat quality than females (Mysterud 2000). Moreover, females would be expected to select habitats that provide forage to maximize the ability to raise young because nutrition can limit reproductive success (Mysterud 2000; Ruckstuhl & Neuhaus 2002; Accevedo & Cassinello 2009). Differences in diet are more pronounced in dimorphic ungulates (Stronge et al. 1997). In Alpine Ibex, for example, adult males spent only 8.5% of the time feeding and it is likely that they compensate such reduced feeding times by foraging at night (Neuhaus & Ruckstuhl 2002). At our study site, a similar scenario has been reported for male Walia Ibex that raid crops at night. Time spent feeding in sub-adult females and sub-adult males was higher compared to both adult females and adult males as additional energy is required in these age classes for their active growth and development. As yearlings and kids are at the active stage of growth, more energy should be required for various metabolic activities. Thus, they try to spend more time feeding than time spent for other diurnal activities.

In conclusion, the generalist approach to foraging may be a key factor in the plasticity of Walia Ibex to adapt to anthropogenic disturbances in the Park. Indeed, their populations appear to be growing during the past decade (Ejigu 2013; Ejigu et al. 2013). The recovery of Walia Ibex could be augmented in SMNP through management programs designed to improve foraging habitats. The use of prescribed fire or grass cutting by local residents would initiate the growth of fresh grass used as forage by

Walia Ibex and other herbivore wildlife species of the park. Certainly, avoiding livestock gazing in the park would allow Walia Ibex to have access to more feed and fodder. If food availability in the park was sufficient, walia ibex would most likely stay within the park, which would reduce conflict from crop raiding. Such prohibition of grazing within the park will take careful work with local residents who consider the park to be a resource for their livelihood. The results obtained from feeding ecology of Walia Ibex serve to guide and design appropriate conservation planning for this critical species in Simien Mountains National Park.

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