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Characterization of Common Horse Feeds in Selected Areas of Ethiopia

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Methods: Feed samples were collected from three major groups namely; carthorse owners, horse feed traders and feed processors as replication for determination of chemical composition. The samples were collected systematically. Feed analysis was done at the National Veterinary Institute (NVI) Bishoftu, Ethiopia, based on the proximate feed analysis method.

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Characterization of Common Horse Feeds in Selected Areas of Ethiopia

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Result: The overall mean dry matters of wheat bran in Bishoftu, Adama, Debre Berhan and Hawassa were 90.96%, 91.56%, 91.9% and 89.96% accordingly. The overall mean of crude protein of wheat bran were 7.39%, 16.64%, 5.07% and 18.83% in Adama, Debre Berhan, Bishoftu and Hawassa respectively. Dry matter and crude protein of wheat bran across towns was highly significant. The dry matter and crude proteins of barley grain were 91.29% &12.23% and 87.78% & 8.92% in Debre Berhan and Hawassa respectively. There is no significant difference over towns in all chemical composition of barley grain over towns in all proximate compositions.

Conclusion: The chemical feed characterization indicated that there is a significant difference on the percentage of nutritive components of the feed pooled over towns. There is also a significant difference in dry matter and crude protein of wheat bran in all towns. However, there is a great difference utilizing percentage of all feed types in a proportion way. Authors recommend on the delivering of the inputs and improved technologies on types of feed based on the available resources, which is relevant to cart horse.

Keywords: carthorse, feed characterization, dry matter, chemical composition.

I. Introduction

Ethiopia is believed to have the largest livestock population in Africa (CSA, 2011). The population of horses, donkeys, and mules (Draft animals) are 2.03 million, 6.20 million, 0.38 million, respectively (CSA, 2011) in all the regions of the country excluding the non-sedentary population of three zones of Afar & six zones of Somali regions. These draft animals give services like transport and traction mainly (Thornton *et al*., 2002). Indeed, research suggests that working animals supply approximately 50% of agricultural power needs globally (Swann, 2006). In Ethiopia, it is estimated that among the horses aged 3 years and older (1,666,353); about 1.24 million were used for transportation, 0.21 million were for draught and the remaining 0.21 million were used for other purposes (CSA, 2012).

Horses, along with a number of other domesticated species, are still used for work power animals in many developing countries. They facilitate participation of the poor in the market economy (The Brooke, 2011). Despite their invaluable contributions, equines in Ethiopia are accorded low status and are consequently the most neglected animals. Working equines are prone to painful, debilitating and often fatal tropical illnesses. In addition, these animals work under difficult environmental conditions including intense heat, difficult terrain, and often inappropriate equipment, with inadequate feed and water, resulting in exhaustion, dehydration, malnutrition, lesions and hoof problems (Wilson, 2002). In some situations these animals experience the worst cases of abuse and neglect seen in all classes of horses. Owners of these animals usually find it difficult to make a living, and animal welfare is not their biggest concern (Schwean, 2005). The horses found in these situations are often overworked, abused and beaten as a method of extracting more work from the animal. Additionally, money is not available for proper nutrition or veterinary care in developing countries (Ramaswamy, 1998).

However, nutrition is a very important aspect which must be considered when examining the welfare of horses. One of the major costs of equines is feed, especially for those households residing in urban areas. According to The Brooke (2011), average annual costs of supplementary feeds (e.g. wheat bran, cereals, grass hay, green grass and rented grazing land) per house hold are high. Moreover, lack of knowledge on the nutritional requirements of horses and feeding systems opens more rooms for the mishandling by owners which in turn raises animal welfare concerns with a possible implication on loss of wealth.

Estimating the actual and potential horse feed resources available in a given region is a prerequisite for planning and launching sound cart horse power utilization and welfare issue, that largely benefits cart horse owners in which feed shortage is one of the major

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constraint of carthorses (cart horse) (Shilma, *et al*., 2006). In most urban regions of Ethiopia, where the major transfers are supported by cart horses; the utilization, supplementation of nutrition and welfare issue of horses are under appraisal. Various surveys have been conducted on fodder production and employment in Ethiopia for ruminants. Dinka, *et al*.(2006) also studied on the socio economic importance and feeding management of carthorse (cart horse) in the mid rift valley of Ethiopia. However, the focus of the studies was limited to the assessment of the socio economical importance and the feeding management of carthorse (cart horse). Very few studies have addressed issues on characterizing of common horse feeds and feeding system. The lack of such information could have a far-reaching consequence on the productivity and profitability of the horse owners, and potentially restricts the need to boost earn from horse by considering the welfare of horse. Therefore, dealing with feed availability and its quality is important to improve management practices and feeding system; which are required to enhance horse performance and welfare. Thus, this study was conducted with the objective of characterizing the common feed resources chemically in the selected areas of the Ethiopia.

II. Materials and Methods

a) Description of the Study Area

This study was conducted in four purposively selected areas of Ethiopia namely; Adama, Bishoftu, Debre brehan and, Hawassa in the period from November 2012 to April 2013. The towns were selected based on that as they are project area of SPANA, which have high cart horse distribution as well geographically distributed in Ethiopia from other project areas. Description of each area, based on information collected from respective *woreda* Agriculture Offices, is given below:

Adama is one of the major cities in the Oromia Regional State located in East Shewa Zone. It's located at 8.55°N 39.27°E at an elevation of 1712 meters above sea level, 99 km southeast of Addis Ababa.

Bishoftuis a town lying 47 km south east of Addis Ababa. The town is located in the East Shewa Zone of the Oromia Region, and has a latitude and longitude of 8°45′N38°59′E with an elevation of 1,920 meter above sea level. It has an annual average rainfall of 851 mm with mean annual temperature of 17.9°C.

Debre Berhanis found in North Shewa administrative zone of the Amhara National Regional State and is located at 130 km north of Addis Ababa, at 09°36' N latitude and 39°30' E longitude. It is a typical highland area with an elevation of 3,360 meters above sea level. It receives an annual average rainfall of 731 to 1068 mm and has an annual temperature range of 6 to 20°C.

Hawassa, the regional capital of Southern Nations, Nationalities and People's Regional State (SNNPR), is found 275 km south of Addis Ababa. It has an altitude of 1750 meter above sea level, and is located at 6°83' to 7°17' N and 38°24' to 38°72' E. It has an annual average rainfall of 955 mm with mean annual temperature of 20°C. The map of the study areas is shown in Figure 1.

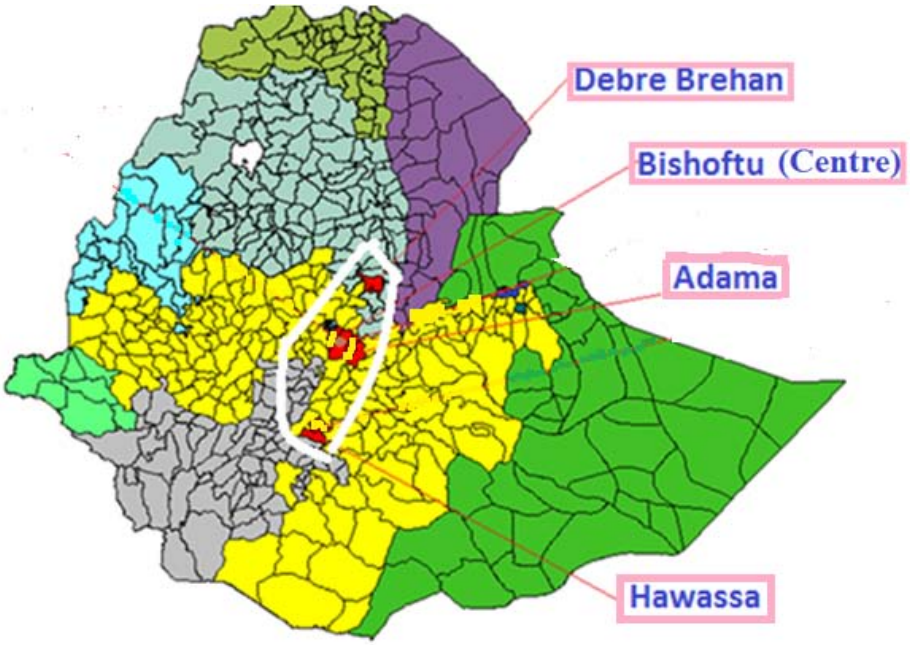

Figure 1 : Map of Ethiopia, indicating the study area (Adama, Bishoftu, Debre brehan, and Hawasa).

III. Study Methodology

a) Sample size determination and sampling procedure

All carthorse owning households living in the four selected towns of Ethiopia were considered as the study population. Before undertaking any sampling procedure, background information on carthorse population in four selected towns through rapid exploratory field visits coupled with secondary information from cart horse association leaders and municipalities was collected. Then, 10% of cart horse owners or responsible person for carthorses which has town identification (cart plate number) for cart at each town was selected for the informal stage of the study. Each carthorse owner or responsible person was considered systematically from working line, every third person at carthorse stations. Totally, 355 carthorse owners/responsible persons were considered which became 101, 110, 39 and 105 in Bishoftu, Adama, Debre Berhan and Hawassa, respectively.

After conducting the informal survey, feed samples were collected from three major groups namely; cart horse owners, horse feed traders and feed processors as replication for determination of chemical composition. The samples were collected systematically based on order of interview where every fifth cart horse owner, and those randomly selected from horse feed traders and feed processors were the sources for sampling. For the purpose, the most commonly used feeds were considered from which half a kilogram of composite samples were taken from each feed for laboratory.

b) Data Collection

The whole design of the study involved collection and analyses of both primary and secondary data collected following qualitative and quantitative research methodologies involving surveys and feed composition analysis, among others. Descriptions of the methods are presented in the subsequent sub-sections.

c) Feed Analysis

Feed analysis was done at the National Veterinary Institute (NVI) Bishoftu, Ethiopia, with the objective of determining the chemical composition of the common horse feed resources, according to the proximate method of feed analysis.

d) Data management and statistical analyses

Descriptive statistics (mean, maximum, minimum, percentages, cross tabulation and t-test) were employed to summarize data on feeds and feeding systems, and cart horse management practices. Moreover, ANOVA (one-way) was run to see the effect of location difference on the chemical composition of common feedstuffs using the SPSS software (version 20) (SPSS 2011).

IV. Results

a) Horse Feeds and Feeding Practices

i. *Common horse feeds*

The lists of commonly used feed types in each of the towns are shown in Table 1. The major feed resources for horse in the study towns were agro-industrial byproduct, crop residues from cereals and legumes and non-conventional feedstuffs. Wheat bran, wheat straw, chickpea straw, lentil straw, vetch straw, poultry litter, barley grain, barley '*gird*' (unproductive barley seed and weed seeds) were the common horse feeds type in Bishoftu. Mill house scraps (a mixed form of a flour factory byproduct including seed covering straw, unproductive wheat seed and weed seeds) and wheat bran were the common horse feeds type in Adama. Wheat bran, barley straw, '*Atela*' (byproduct of traditional alcohol production mainly from '*areqe*'), barley grain, barley '*gird*' (unproductive barley seed and weeds) and oat seed were the common horse feeds type in Debre Brehan. Wheat bran, chopped cane, native grass fodder and barley grain were the common horse feeds type in Hawassa.

Table 1 : Common horse feeds type across towns according to utilization percentage.

Feed type	Bishoftu N (101)	Adama N (110)	DebreBerhan N (39)	Hawassa N (105)	Total (N=355)
Percentage (%)					
Wheat bran	100	80.1	100	100	93.5
Barley grain	80.1	0	38.4	58.8	43.5
Mill house scraps	0	96.4	0	0	29.5
Chick pea straw	98.0	0	0	0	27.9
Native fodder grass	0	0	0	84.8	25.1
Wheat straw	53.2	0	0	0	20.8
Chopped cane	0	0	0	64.7	19.2
Barley straw	0	0	100	0	11
Barley '*gird*'	26.7	0	5.1	0	8.2
'*Atela*'	0	0	43.7	0	4.8
Poultry litters	4	0	0	0	1.1
Oat seed	0	0	5.1	0	0.6
Lentil straw	1	0	0	0	0.3
Vetch straw	1	0	0	0	0.3

N=number of respondents

b) Feed Characterization

The chemical composition of feeds at varies towns is shown in Table 2, 3 and 4. The overall mean dry matters of wheat bran in Bishoftu, Adama, DebreBerhan and Hawassa were 90.96%, 91.56%, 91.9% and 89.96% accordingly. The overall mean of crude protein of wheat bran were 7.39%, 16.64%, 5.07% and 18.83% in Adama, Debre Berhan, Bishoftu and Hawassa. The significance test shown in Table 3, dry matter and crude protein of wheat bran across towns was highly significant. But there is no significant difference in ash, crude fiber, ether extract and calcium. The dry matter and crude proteins of barley grain were 91.29% and 12.23% and 87.78% and 8.92% in Debre Berhan and Hawassa respectively. There is no significant difference over towns in all chemical composition of barley grain.

Table 2 : The effect of location on variation proximate composition of wheat bran and Barley grain

Feed type	Towns	DM	Ash	CF	CP	EE	Ca
Wheat bran	Adama	91.38±0.18^{c}	4.78±0.26	10.81±3.2	7.39±0.36 ^{a}	4.49±0.56	12.61±2.54
	Debre Berhan	91.5±0.22 ^{a}	5.19±0.32	10.26±3.9	16.64±1.79^{c}	4.84±0.68	10.92±3.14
	Bishoftu	91.15±0.18^{d}	5.12±0.26	9.36±3.2	5.07±1.46 ^{d}	3.87±0.56	4.33±2.54
	Hawassa	89.88±0.18^{b}	5.02±0.26	8.66±3.2	18.83±1.36^{b}	2.75±0.56	1.91±2.54
Significance		**	NS	NS	**	NS	NS
Barley grain	Bishoftu	91.29±0.69	6.28±1.57	4.59±3.18	12.23±3.13	1.94±0.21	1.45±0.52
	Hawassa	87.78±0.69	2.99±1.57	5.76±3.18	8.92±3.13	1.28±0.21	0.85±0.52
Significance		NS	NS	NS	NS	NS	NS

*** =significance at 1%, NS not significance, a, b, c, d = location means followed by different letters vary significantly, DM= dry matter, CF= crude fiber, CP= crude protein, EE= ether extract, Ca= calcium*

The descriptive statistics for chemical compositions of six horse feeds are shown in Table 3. The average dry matter, ash, crude fiber, crude protein, ether extract and calcium for the feeds was observed to be 94.76±2.98, 8.58±1.89, 26±17.75, 10.91±9.09, 2.09±0.92 and 22.82±15.66, respectively.

Table 3 : Chemical compositions of six horse feeds that were prevalent at single tows and from single source

		Percentage (%)					
Feed type	Towns	DM	Ash	CF	CP	EE	Ca
Barley grain	Dbere Berhan	92.6	4.96	6.47	9.45	2.2	7.19
Barley *'gird'*	Dbere Berhan	92.2	8.78	10.52	8.44	3.42	32.53
vetch straw	Bishoftu	97.03	8.34	43.69	4.63	1.97	39.19
lentil straw	Bishoftu	98.03	9.41	39.37	15.88	2.75	37.4
Poultry litter	Bishoftu	91.43	9.84	12.9	26.32	1.24	3.46
Wheat straw	Bishoftu	97.26	10.17	43.08	0.74	0.96	17.13
Mean		94.76	8.58	26	10.91	2.09	22.82
SD		2.98	1.89	17.75	9.09	0.92	15.66
Min		91.43	4.96	6.47	0.74	.0.96	3.46
Max		98.03	10.17	43.69	26.32	3.42	39.19

DM= dry matter, CF= crude fiber, CP= crude protein, EE= ether extract, Ca= calcium, SD= standard deviation, Min= minimum, Max= Maximum

The chemical compositions of eight horse feeds are given in Table 3. The average dry matter, ash, crude fiber, crude protein, ether extract and calcium for eight feeds were 91.91±4.44, 10.79±5.07, 27.64±16.73, 11.01±3.96, 3.77±2.22 and 7.60±5.39 accordingly.

Table 3 : Chemical compositions of eight feeds prevalent in a town from two sources.

		Percentage (%)					
Feed type	Town	DM	Ash	CF	CP	EE	Ca
Barley *'gird'*	Bishoftu	91.33	6.77	7.38	17	3.13	1.37
Chick pea straw	Bishoftu	97.68	14.82	38.29	8.9	3.02	12.14
Mill house scraps	Adama	92.4	16.89	21.56	11.22	5.57	13.12
Barley straw	Dbere Berhan	96.73	7.93	37.89	9.78	1.64	8.19
Oat seed	Dbere Berhan	92.39	5.87	12.06	9.48	5.68	12.6
'Atela'	Dbere Berhan	93.49	9.26	12.68	16.05	7.44	10.7
Chopped cane	Hawassa	85.35	6.48	36.19	4.69	1.09	1.01
Native grass fodder	Hawassa	85.95	18.32	55.08	10.98	2.55	1.7
Mean		91.92	10.79	27.64	11.01	3.77	7. 60
SD		4.45	5.07	16.73	3.96	2.22	5.39
Min.		85.35	5.87	7.38	4.69	1.09	1.01
Max.		97.68	18.32	55.08	17.00	7.44	13.12

DM= dry matter, CF= crude fiber, CP= crude protein, EE= ether extract, Ca= calcium, SD= standard deviation, Min= minimum, Max= Maximum

V. Discussion

In horses, for normal growth, reproduction and performance provision of good nutrition is essential. Every day, horses should receive feeds that are adequate, but not excessive in required nutrients. Nevertheless, just providing the right feeds is often not enough to ensure that horses are receiving optimal nutrition. It showed be known the types of feed horses are taking and the number and timing of meals that a horse receives.

Feed types classified into three main types: (1) roughages, (2) concentrates, and (3) mixed feeds. Roughages include pasture forages, hays, silages, and byproduct feeds that contain a high percentage of fiber. Concentrates are the energy-rich grains and molasses, the protein- and energy-rich supplements and byproduct feeds, vitamin supplements, and mineral supplements. Mixed feeds may be either high or low in energy, protein, or fiber; or they may provide "complete" balanced rations.

The present study showed that the major feed resources for horse in the study towns were mainly as agro-industrial byproduct, crop residues from cereals, legumes, and non-conventional feedstuffs. Similar findings by Berhanu *et al*. (2009) supported as fine wheat bran to horse is a good source of nutrients in Wukro Northern, Ethiopia areas. Berhanu *et al.* (2009) also indicated, as wheat bran is a major feed resource in the area, which is similar with present study (93.5%). Besides as reported in (http://www1.agric.gov.ab.ca/ $department/ deptdocs.nsf /all/hrs6287), forages such as pea straw can also be used for horses. Pea straw nutrient values for this feed is highly variable with feed nutrient analysis of as found Dry matter (90%), Crude protein (6.0%)and calcium (1.5%), in which analysis of these feed values are lesser in values except the calcium value in the current study. This suggests that these feed could be reasonable sources of digestible energy and protein as shown in Table 3.

On the other hand, about 4% of horse owners in "*Bishofitu"* town use poultry litter as a horse feed, which is not recommended. Based on a report in (http:// agriculture.vic.gov.au/agriculture/livestock/beef/feeding-and-nutrition/Use-of-Poultry-Litter,-Manure-and-Feed-in-Livestock-System) feeding of poultry litter to any type of farm animal is a highly unsanitary practice, which may result in the spread of diseases such as salmonellosis. Horses are much more sensitive to salmonella than other livestock because of their digestive tract physiology (http://www.equinews.com/article/poultry-litter-not-recommended-fertilizing-horse-pastures). This implies that there should be an intervention to be done in this area regarding the horse feeding management to avoid risks associated poultry litter feeding.

The average for the combined feeds of (Barley grain, Barley '*gird',* vetch straw, lentil straw, poultry litter and wheat straw) at "*Debere Berhan*" and "*Bishofitu*". The dry matter, ash, crude fiber, crude protein, ether extract and calcium contents of these feeds were observed as 94.76±2.98, 8.58±1.89, 26±17.75, 10.91±9.09, 2.09±0.92 and 22.82±15.66, respectively as shown in Table 3. In this study, lentil straw, barley grain and barley "*gird*" showed high proportion of crude protein source in a single town analysis survey.

VI. Conclusions

From the present study it could be concluded that the general feed types in the study towns were not similar to each other except wheat bran, barley grain and barley '*gird'*. Wheat bran, wheat straw, chickpea straw, lentil straw, vetch straw, poultry litters, barley grain, barley '*gird'* (unproductive barley seed and weed seeds) were the common horse feed resources in Bishoftu. Mill house scraps (a mixed form of a flour factory by products including seed covering straw, unproductive wheat seed and weed seeds) and wheat bran were the common horse feed resources in Adama. Wheat bran, barley straw, '*Atela'* (byproduct tin traditional alcohol production mainly from '*areqe'*), barley grain, barley '*gird'* (unproductive barley seed and weeds) and oat seed were the common horse feed resources in Debre brehan. Whereas, wheat bran, chopped cane, native grass fodder and barley grain were the common horse feed resources in Hawassa. The chemical feed characterization indicated that there is a significant difference on the percentage of nutritive components of the feed pooled over towns. As well, there is a significant difference in dry matter and crude protein of wheat bran in all towns. However, there is a great difference utilizing percentage of all feed types in a proportion way. Authors recommend on the delivering of the inputs and improved technologies on types of feed based on the available resources, which is relevant to cart horse.

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