

Preliminary analysis of the diet of wild boar (*Sus scrofa* L., 1758) in an agroecosystem of central Punjab, Pakistan

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Abstract: Wild boars (*Sus scrofa*) are considered serious agricultural pests in Pakistan. Their stomach contents were examined (n = 63) in central Punjab, Pakistan, and it was found that 32 types of food items were consumed. *Triticum aestivum*, *Saccharum officinarum*, *Zea mays*, *Oryza sativa*, *Prosopis juliflora*, and earthworms were the main staples. The major components of the diet of wild boar in central Punjab originated from 58% cultivated crops, 30% uncultivated crops, 9% animal matter, and 3% unidentified matter. Wheat made up 23% of the total dry weight. *O. sativa* was the most intensively consumed item during autumn (37.87%), followed by *Z. mays* (17.02%) and *S. officinarum* (7.66%). *T. aestivum* (29.45%), *S. officinarum* (22.26%), and earth worms (7.8%) were the most important food items in the winter, while wheat (55.90%) and *P. juliflora* (28.09%) were the most intensively consumed items during the spring and summer, respectively.

Key words: Central Punjab, food items, season, wild boar

Introduction

The Eurasian wild boar, *Sus scrofa* L., is distributed in a broad belt across North Africa, Europe, and Asia (Heptner et al., 1966), and Pakistan constitutes a part of its ancestral range. Boars are found at elevations as high as 1000 m throughout Punjab, parts of the North West Frontier Province, and in Sind, to the mouth of the Indus River (Roberts, 1977).

The wild boar was originally restricted to riverain tracts in Pakistan, but with the introduction of the canal irrigation system almost a century ago, it has considerably extended its distribution range due to dense cover, abundant water, and the seclusion

available to it. As agriculture spreads, the opening of the canal patches all over the Indus plain (Beg and Khan, 1982; Beg, 1990) brought wild boars in contact with croplands, from where they now obtain much of their food. The wild boar is a serious agricultural pest (Abbas et al., 2004) and damages ripe sugarcane, potatoes, wheat, and rice. Smiet et al. (1979) found that boars fed mainly on the roots and tubers of *Scripus* spp., while crops such as sugarcane, mustard, and clover were found only in a few stomachs. Khan (1983) analyzed the stomach contents of 48 wild boars around Faisalabad and found that wheat and molasses scum were the commonest food items, followed by *Cyperus* spp. tubers, maize (*Zea mays*),

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sorghum (*Sorghum vulgare*), cotton (*Gossypium hirsutum*), mesquite (*Prosopis juliflora*) pods and leaves, sugarcane (*Saccharum officinarum*), and rice (*Oryza sativa*). Animal remains constituted a smaller part of the diet. Multiple studies conducted on the food habits of wild boars in the last decade indicate that plant matter constitutes a major portion of their diet, while animals were less important (Shafi and Khokhar, 1986; Brooks et al., 1989; Schely and Roper, 2003); however, Hafeez et al. (2008) found higher garbage content (58%) in their diet in Islamabad. The main objective of this study was to determine the composition of the wild boar diet in the irrigated croplands to determine temporal variations in the food habits of the wild boar.

Materials and methods

Punjab (27.5-34.1°N and 69.5-75.2°E) is the northeastern province of Pakistan, and can topographically be divided into Potowar plateau in the north, plains in the center, and desert in the south. The northeastern parts of the province are extensively cultivated and thickly populated, while agriculture and human settlements become sparse towards the south and the west. Wheat, sugarcane, maize, rice, millet, oilseeds, pulses, and vegetables are the cash crops of Punjab. Stomach collection took place monthly from the fields and adjacent areas from January 2009 to December 2010. Reference slides of the vegetative parts of plants present in the area were prepared. The plant material was dried and soaked in a solution of distilled water and ethyl alcohol + glycerin (1:1:1 v/v) overnight, and washed with tap water. The contents after grinding in distilled water were poured into a micro sieve; a 6-cm-long hollow cylindrical, with 0.05 mm pores, and a rubber stopper at one end. The material was then soaked in a sodium hypochloride solution consisting of 5% clorox and 4 parts of distilled water for 20-30 min. Diluted acetic acid was added to neutralize its basic effects and it was placed in mordant solution for 15-30 min. The contents were placed in hematoxylin stain for 10-15 min. A drop of mounting medium (100 cc distilled water and 100 g Arabic gum) was added and spread on a slide (22 × 40 mm). After overnight fastening, the slides were examined under a microscope.

The stomach contents were placed in 10% formalin and put on a white paper of equal sized squares in a petri dish, where the fragments of the stomach contents were examined microscopically (Ward, 1970).

Plant parts of each species were each placed in a box, were calculated, and the total number of fragments were recorded according to the method of Hanson et al. (1971).

The overall percent relative frequency was calculated as follows:

$$\text{Relative frequency (\%)} = \frac{\text{Total number of fragments of a species}}{\text{Total number of fragments analysed}} \times 100$$

The relative frequency of different food items recorded from the stomach contents was compared among the different seasons to work out the feeding preference of the species.

Results and discussion

The wild boars consumed 32 types of food items (Table), which included *T. aestivum*, *S. officinarum*, *Z. mays*, *Oryza sativa*, *Eisenia foetida*, and *P. juliflora* as the main staples. *T. aestivum* constituted 22.95%, *S. officinarum* 9.43%, *Z. mays* 7.38%, *O. sativa* 6.97%, *E. foetida* 6.96%, and *P. juliflora* 4.92% of the total dry weight of the animal diet. Other food items included *C. rotundus*, *Trianthema portulacastrum*, *Acacia nilotica*, *Chenopodium album*, *Avena sativa*, *Pisum sativum*, vegetables, *Phalaris minor*, *Avena fatua*, *Medicago polymorpha*, *Convolvulus arvensis*, *Capsicum annum*, *Medicago sativa*, *Psidium guajava*, *Azadirachta indica*, *Melilotus indica*, *Rumex dentatus*, *Brassica campestris*, *Mangifera indica*, *Chenopodium murale*, *Fumaria indica*, *Echinochloa colona*, *Lathyrus aphaca*, bone pieces, *Reticulitermes* spp., and rat. Unidentified matter constituted 2.87% of the total dry weight, consisting of plant matter, hair, threads, and other inert substances. The overall picture of the Table shows that wild boars consumed 88.55% dry weight, comprising plant tissues (cultivated 58.21% and uncultivated 30.34%), animal matter 8.61% (consisting of *E. foetida*, *Reticulitermes* spp., bone pieces and rat hair), and unidentified matter 2.87%.

Table. Relative frequency and dry weight of different food items recovered from the stomach contents of wild boars in different seasons.

Food items	Autumn		Winter		Spring		Summer	
	% Frequency	% Dry Weight	% Frequency	% Dry Weight	% Frequency	% Dry Weight	% Frequency	% Dry Weight
Cultivated plants								
<i>Saccharum officinarum</i>	17.00	7.66	47.58	22.26	11.11	3.82	0.00	0.00
<i>Oryza sativa</i>	59.33	37.87	0.00	0.00	0.00	0.00	5.00	1.54
<i>Zea mays</i>	33.33	17.02	0.00	0.00	2.78	1.04	45.00	18.52
<i>Triticum aestivum</i>	0.00	0.00	57.58	29.45	80.83	55.90	16.00	5.25
<i>Avena sativa</i>	0.00	0.00	6.97	2.40	10.00	3.47	0.00	0.00
<i>Brassica campestris</i>	2.67	1.28	4.85	1.71	0.00	0.00	0.00	0.00
<i>Pisum sativum</i>	8.33	3.40	9.39	3.08	0.00	0.00	0.00	0.00
<i>Capsicum annum</i>	0.00	0.00	0.00	0.00	1.39	0.35	14.00	4.63
<i>Medicago sativa</i>	2.33	0.85	7.58	2.74	0.00	0.00	0.00	0.00
<i>Mangifera indica</i>	0.00	0.00	0.00	0.00	0.00	0.00	13.00	4.32
<i>Psidium guajava</i>	0.00	0.00	3.03	1.03	5.56	2.08	0.00	0.00
Vegetables	11.00	4.68	0.00	0.00	3.33	1.04	9.00	2.78
Uncultivated plants								
<i>Prosopis juliflora</i>	0.00	0.00	0.00	0.00	7.78	2.76	59.5	28.09
<i>Azadirachta indica</i>	8.33	3.40	0.00	0.00	0.83	0.35	5.00	1.54
<i>Acacia nilotica</i>	0.00	0.00	0.00	0.00	8.33	2.78	20.00	6.79
Weeds								
<i>Cyperus rotundus</i>	15.67	7.23	9.09	3.08	5.28	1.74	12.00	3.70
<i>Phalaris minor</i>	0.00	0.00	6.06	2.05	11.94	4.17	0.00	0.00
<i>Avena fatua</i>	0.00	0.00	2.12	0.68	10.28	3.47	0.00	0.00
<i>Echinochloa colona</i>	4.67	2.13	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chenopodium album</i>	9.67	4.26	10.30	3.42	3.06	1.04	0.00	0.00
<i>Chenopodium murale</i>	2.00	0.85	6.06	2.05	0.56	0.35	0.00	0.00
<i>Trianthema portulacastrum</i>	0.00	0.00	0.00	0.00	6.94	2.43	33.5	12.65
<i>Medicago polymorpha</i>	5.00	2.13	8.48	2.74	1.11	0.35	0.00	0.00
<i>Melilotus indica</i>	0.00	0.00	7.27	2.40	2.22	0.69	0.00	0.00
<i>Rumex dentatus</i>	0.00	0.00	8.48	2.74	1.67	0.68	0.00	0.00
<i>C. arvensis</i>	0.00	0.00	8.79	3.08	4.72	1.74	0.00	0.00
<i>Fumaria indica</i>	0.00	0.00	5.76	2.05	0.00	0.00	0.00	0.00
<i>Lathyrus aphaca</i>	0.00	0.00	1.82	0.68	0.83	0.35	0.00	0.00
Animal matter								
<i>Eisenia foetida</i>	7.34	2.98	20.91	7.88	15.83	5.56	21.00	7.10
<i>Reticulitermes</i> sp.	2.31	0.85	1.52	0.68	0.56	0.35	0.00	0.00
Bone pieces	1.33	0.43	1.50	0.67	1.67	0.69	2.50	0.93
Rat	1.31	0.42	0.61	0.34	0.83	0.36	0.50	0.81
Others								
Unidentified	6.00	2.55	8.18	2.74	7.22	2.43	6.00	1.85

T. aestivum (43.11%) was the main staple (Figure 1). Other consumed food items were *S. officinarum* (20.84%), *Z. mays* (16.81%), *O. sativa* (15.8%), vegetables (5.29%), *A. sativa* (4.96%), *P. sativum* (4.71%), *C. annuum* (2.77%), *M. sativa* (2.69%), *P. guajava* (2.52%), *M. indica* (2.18%), and *B. compestris* (2.02%), respectively.

Among the uncultivated plants, *P. juliflora* was the main staple (12.35%). Other consumed food items were *C. rotundus* (10.08%), *T. portulacastrum* (7.73%), *C. album* (6.22%), *A. nilotica* (5.8%), *P. minor* (5.29%), *M. polymorpha* (3.95%), *Convolvulus arvensis* (3.87%), *Avena fatua* (3.7%), *A. indica* (3.19%), *R. dentatus* (2.86%), *Melilotus indica* (2.69%), *C. murale* (2.35%), *F. indica* (1.6%), *E. colona* (1.18%), and *L. aphaca* (0.76%).

Seasonal changes in diet

During the autumn season, the stomach contents of 14 animals were examined. In all, 18 types of food items were represented in these contents (Table). Plant matter constituted 92.76% of the dry weight of the total food items (cultivated 72.76% and uncultivated 20.00%). The cultivated plant matter constituted 72.76% of the dry weight of the total food items and the uncultivated plant matter constituted 20%. Among the cultivated plants, *O. sativa*

(37.87%), *Z. mays* (17.02%), *S. officinarum* (7.66%), and vegetables (4.68%) were the main staples. Other consumed cultivated plants were *P. sativum* (3.40%), *B. compestris* (1.28%), and *M. sativa* (0.85%).

Among the uncultivated plants, *Cyperus rotundus* (7.23%) was the main staple. Other uncultivated food items were *C. album* (4.26%), *A. indica* (3.40%), *E. colona* (2.13%), *M. polymorpha* (2.13%), and *C. murale* (0.85%). Other food items were *E. foetida* (2.98%), unidentified (2.55%), *Reticulitermes* sp. (0.85%), and bone pieces (0.43%).

During the winter season, the stomach contents of 17 wild boars were examined. In all, 23 types of food items were represented in these contents. Plant matter constituted 87.64% of the dry weight of the total food items (cultivated 62.67% and uncultivated 24.97%) animal matter 9.58% (consisting of *E. foetida* 7.88%, *Reticulitermes* spp. 0.68%, bone pieces 0.68%, and rat 0.34%), and unidentified 2.74%.

Among the cultivated plants, *T. aestivum* (29.45%) and *S. officinarum* (22.26%) were the main staples. These were followed by *P. sativum* (3.08%), *M. sativa* (2.74%), *A. sativa* (2.40%), *B. compestris* (1.71%), and *P. guajava* (1.03%). Among the uncultivated plants, *C. album* (3.42%), *C. rotundus* (3.08%), and *C. arvensis* (3.08%) were the main ones consumed. The other uncultivated food items were *M. polymorpha*

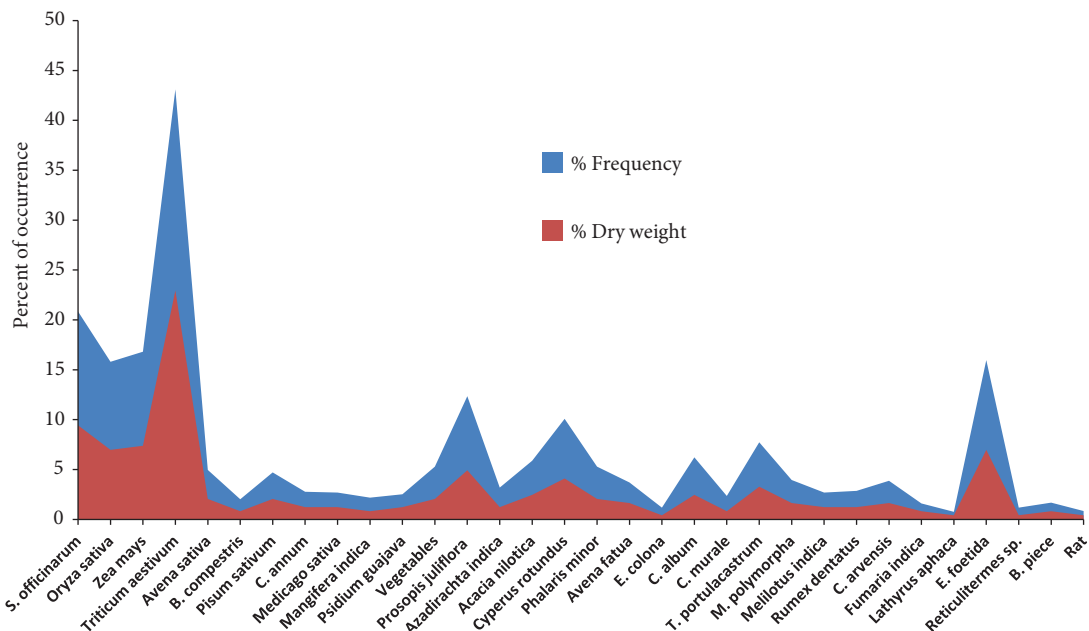


Figure 1. Frequency of occurrence and % dry weight of different food items recovered from the stomach contents of wild boars.

(2.40%), *P. minor* (2.05%), *C. murale* (2.05%), *F. indica* (2.05%), *A. fatua* (0.68%), and *L. aphaca* (0.68%).

The stomach contents of 15 wild boars were examined during the spring season. The tissues of 26 food items were present. Plant matter constituted 90.63% of the dry weight of the total food items (cultivated 67.70% and uncultivated 22.93%), animal matter 6.95% (earth worm 5.56%, *Reticulitermes* spp. 0.35%, bone pieces 0.69%, and rat 0.35%), and unidentified 2.43%, respectively. Among the cultivated plants, *T. aestivum* (55.90%) was the only dominant one. The other food items were *S. officinarum* (3.82%), *A. sativa* (3.47%), *P. guajava* (2.08%), *Z. mays* 1.04%), vegetables (1.04%), and *C. annum* (0.35%).

Among the uncultivated plants, *P. minor* (4.17%) was at the top. It was followed by *Avena sativa* (3.47%), *P. juliflora* (2.78%), *A. nilotica* (2.78%), *T. portulacastrum* (2.43%), *C. rotundus* (1.74%), *C. arvensis* (1.74%), *C. album* (1.04%), *M. indica* (0.69%), *R. dentatus* (0.69%), *A. indica* (0.35%), *C. murale* (0.35%), and *M. polymorpha* (0.35%).

The stomach contents of 17 wild boars were examined during the summer season. In all, 15 types of food items were represented in these contents. Plant matter constituted 89.80% of the dry weight of the total food items (cultivated 37.03% and uncultivated 52.77%), animal matter 8.34% (including *E. foetida* 7.10%, bone pieces 0.93%, and rat 0.31%), and unidentified 1.85%. Among the cultivated plants, *Z. mays* (18.51%) was the most intensively eaten item. The other food items were *T. aestivum* (5.25%), *C. annum* (4.63%), *M. indica* (4.32%), vegetables (2.78%), and *O. sativa* (1.54%). Among the uncultivated plants, *P. juliflora* (28.09%) was the most intensively eaten item. The other food items were *T. portulacastrum* (12.65%), *A. nilotica* (6.79%), *C. rotundus* (3.70%), and *A. indica* (1.54%).

Plant material constituted about 88.55%, while animal matter comprised 8.61% of the total dietary intake of the wild boar. Of the plant food, 58.21% came from cultivated plants, with 30.34% from uncultivated plants. Among the cultivated plants, *T. aestivum* (22.95%), *S. officinarum* (9.43%), *Z. mays* (7.38%), and *O. sativa* (6.97%) were the main staples. Among the uncultivated plants, *P. juliflora* (4.92%), *C. rotundus* (4.10%), and *T. portulacastrum* (3.28%) were the main contributors.

The intensity of the utilization of various plant parts is shown in Figure 2, and the results revealed that leaves and seeds were eaten throughout the year, followed by stems, whereas roots were consumed negligibly. In winter the bulk of the stomach comprised plant stems, leaves, and roots, whereas in summer seeds, fruits, and plant tubers were the main sources of nutriment.

The observed seasonal variation in the diet was due to a variation in the choices available to the wild boar from season to season. Ahmad et al. (1991) examined the stomach contents of 393 wild boars. Plant material, both cultivated and uncultivated, comprised 96.9% of the total mass, while animal matter 2.50% and mud 0.60% made up the rest. Brooks et al. (1989) collected the stomach contents of 273 wild boars from the area of Faisalabad. Their study revealed *T. aestivum*, *S. officinarum*, *Z. mays*, and *O. sativa*. Genov (1981) in Poland found that cultivated plants made up 71% of the total mass and occurred in 89% of 181 stomachs.

Undoubtedly, the wild boar is an omnivorous and versatile feeder. Exploratory capacity and learning behavior help the wild boar adapt to changing situations (Haber, 1966; Gerard et al., 1991; Durio et al., 1995). However, the factors that influence food selection and food detection are not well known. Food preference is also affected by the earlier experiences of animals. The wild boar has a significant impact on crops and a reduction in the damage to those crops is amply justified if adequate measures to control the wild boar can be developed. The wild boar of the central Punjab agroecosystem is primarily an herbaceous consumer (Ahmad et al., 1991).

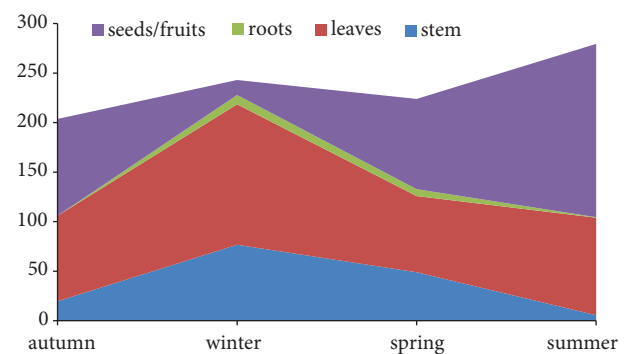


Figure 2. Intensity of utilization of different plant portions collected from the stomach of wild boars.

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