Life and behaviour of Wolves: Built for the kill? Wolf diet and predatory adaptions

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Wolf diet and predatory adaptions

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From Jack London's man-eaters in "White Fang" to Mowat's mice-eaters in "Never Cry Wolf", much confusion and misinformation has long surrounded the hunting and dietary behaviours of wolves. Only in recent years has light truly been shed on the subject, and only through direct observations and hard science are we learning more about what wolves eat and how.

Wolf and prey flesh composition are similar and as such are nutritionally exchangeable. Providing that entire carcasses and a range of organs, bone and muscle tissues are consumed, all essential nutrients will be obtained and no deficiencies are experienced.

Estimates generated from basal metabolic rate and the energetic requirements of wild wolves puts consumption from 2.5 to 6 kg per wolf per day. A minimum daily requirement is estimated at 3.25kg per wolf per day. Productivity and survival have been found to decline when food availability falls below this level. Captive wolves can be maintained on a much smaller diet of 1.1 to 1.7 kg per wolf per day due to the reduced energetic requirements in comparison to their wild cousins.

Wild observations put food availability per wolf per day at 5.4kg in North America and 5.6kg in Eastern Poland. The proportion of this food availability lost to scavengers or cached for future consumption must however be subtracted from these estimates. The loss of food to scavengers is primarily dependent on pack size. Smaller packs tend to have higher food availability but take more time to handle and consume a carcass, allowing more opportunity to scavengers. Schmidt and Mech (1997) hypothesise that the ultimate explanation for group hunting in wolves is that breeding pairs can efficiently direct toward their offspring the short term surplus from kills that would be otherwise lost to scavengers.

Wolves are flexible, opportunistic feeders. Prey items range in size from 1 to 1000 kg, consisting of mice, rabbit, fish and birds through to deer, beaver, sheep and bison amongst many others. The wolf's diet greatly depends on availability and experience with particular prey items. Food sources may change throughout the year and prey-switching may occur due to changes in circumstance. This can occur negatively if wild prey stocks fall and switching to livestock occurs. Wolves do not always kill to obtain sustenance. They scavenge prolifically from wild and agricultural carcasses and even garbage sites. To a small extent wolves also forage, consuming berries, herbs and grass which are utilised to assist intestinal cleansing.

Wolves and their prey have coevolved in what is known as an 'evolutionary arms race'. Successful predators, and prey that are more adept at avoiding predation, are more likely to survive and pass on genes for beneficial adaptations. A positive feedback loop exists, leading to the specialisation of both predator and prey alike.

Wolves have a number of physical and behavioural adaptations allowing them to successfully source enough food items to survive and reproduce. The wolf's predatory lifestyle and carnivorous diet revolves around capturing prey and consuming them as quickly as possible. The wolf's ability to survive in a wide range of environmental conditions and predate upon a large variety of animals is made possible by its generalist carnivore dentition and digestive processes.

Canids usually dispatch prey with multiple opportunistic bites of a shallower depth and less precision than the deep single penetrating bites of felids. Wolf claws dulled by long distance travelling are unlike the retractable sharp claws of felids who hunt by ambush. Claws therefore do not play a role in the take-down of prey. A wolf skull does not reflect the extreme specialisation seen in other carnivores. It does not have the robust premolars, jaw and associated muscles of the hyena used for bone crushing, or the large, closing muscles and solidity of felid skulls. It also lacks the hinge adaptations of mustelids permitting the jaw to be locked around large, active prey. A wolf's jaw is connected in such a way as to help prevent dislocation whilst it undergoes severe stress in the act of clinging and pulling down moving prey. The skull is long, allowing maximal opening. Bone is reinforced with diagonal lines crossing the skull in order to help resist fractures.

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Wolf jaws contain a great variation of tooth types. Incisors and canines are the tools utilised in subduing prey. Canines puncture and grapple assisted by incisors. These teeth are subjected to enormous stress and the elliptical cross section of the canine is designed to resist the strong front-to-back forces exerted upon it when clinging to prey. Incisors are positioned in front of the canines to permit separate functioning in nipping and pulling live prey, removing tissues from dead prey and in handling non-struggling food items such as berries or small mammals. Carnassial teeth are primarily utilised in the consumption of food; they are self-sharpening with upper and lower blades shearing past each other, trapping and cutting meat and hide when the jaw closes. The molar's grinding surface is adapted to crushing and grinding although not as reinforced or specially shaped for bone crushing as in other carnivores.

Wolves possess relatively short guts because their carnivorous diet is highly digestible. Saliva facilitates swallowing and little mechanical breakdown of food in the mouth occurs. This permits quick maximal intake and minimal loss to scavengers or other pack members. Wolves usually feed upon body organs and muscle first. Early digestion is inefficient due to the large quantities of protein ingested which likely restricts enzyme function. Early scats are popular with ravens at kill sites. Easily digestible food passes through the digestive tract more slowly than food with indigestible components. Wolves have been observed to mix their food with indigestible components such as hair. This permits rapid emptying of the gut and further feeding thus reducing loss to scavengers. Hide and bones are last to be consumed and the degree to which these are consumed is a good indicator of food availability. Pack size also influences carcass utilisation. Hair and bone are the only dietary constituents not entirely digestible; hair acts as roughage and is also ingeniously wrapped around bone fragments in order to prevent damage when the wolf passes faecal matter.

Wolves store surplus food energy as fat, which composes 15% of overall weight. Wolves are often food-limited so typically exist at the lower end of fat content, often with depleted bone marrow fat stores; a precursor to starvation. Wolves have the ability to survive for long periods with low food consumption. In food shortage, weight is lost daily but wolves have the ability to alter enzyme systems according to diet and can recover from weight lost during fasting. Wolves are clearly adapted for a feast and famine diet but we still know little of the bodily functions that deal with the starvation process.

A wolf's senses make it a highly skilled predator and scavenger. The sense of smell is perhaps the wolves' most formidable tool. The surface area of a wolf's nose receptive to smell is 14 times that of our own and up to 100 times more sensitive. Wolf sight is equal to our own but their night vision is far more developed. Sight is utilised in more open areas whereas smell predominates in wooded areas. Wolf hearing allows determination of noises as far as six miles away in forested areas and ten miles in open tundra. Senses are used both in locating or tracking prey and determining which item can be caught and killed.

Wolves have great endurance and highly efficient respiratory systems allowing long-distance pursuits. Body composition and gait are developed to further efficiency. A slender frame, with long legs and narrow chest promote a streamlined motion covering large distances. Large feet allow effective traversing of snow. Muscle composition consists of slow-twitch long-distance fibres for pursuit and fast-twitch fibres for the rush and the final take-down permit the wolves' style of hunting.

Behaviours involved in the processes of obtaining prey, feeding patterns and geographic habits are another evolutionary adaptation to wolves' predatory lifestyle but require their own article for discussion.

It becomes clear that wolves are highly adapted for their generalist carnivorous diet and opportunistic hunting activity. Eons of evolutionary progression have led to this marvellous and efficient yet adaptable animal, making it one of the most successful species in the northern hemisphere prior to man's influence. This marks it as one of nature's great survivors.

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