# Animal Nutrition -Doedicurus clavicaudatu

## Doedicurus clavicaudatus

**New animal species:** *Doedicurus clavicaudatus* (glyptodont species)

* Literature
* Description
* The *Doedicurus clavicaudatus* is a ‘pestle tailed’ extinct animal of a glyptodont species associated with Pleistocene megafauna till the end of the glacial period (Soibelzon and Prevosti, 2014).
* Found in South America
* 1900 to 2370 kg weight and overall height of 4 meters
* Inhabited woodlands and grasslands
* Herbivore
* Affiliated to modern day armadillos
* Fossil records
* Found and distributed in South America (Lujan Argentina, San Jose Uruguay, and Santa Vitoria do Palmar Brazil).
* Historical records
* Lujan formation in Argentina
* Dolores and San Jose Formation of Uruguay
* *Doedicurus clavicaudatus* nutrients requirement Proposal
* Herbivore feeding nutrients: Low nitrogen, high carbon, and cellulosic rich materials (Mead and Baez, 2007).
* Feeding plan for *Doedicurus clavicaudatus* suitable in a modern zoological park
* Extensive feeding and supplemental feeding plan
* Working diet: full working diet during off-season scheduled 4-5 P.M after the *Doedicurus clavicaudatus* return from field work (Soibelzon and Prevosti, 2014).
* Rest diet: Gur, Salt, Sugar cane, grass-based hay, Wheat and left to rest.
* Estimation of yearly cost of feeding *Doedicurus clavicaudatus* on food
* Comparative physiological studies on large herbivores such as elephants and hippos eat approximately 10% of the body weight daily (Hill and Broom, 2009).
* Approximately 250kg per day and 91500kgs yearly in food
* $133,000 per year for each *Doedicurus clavicaudatus* to receive sufficient food
* Reliable data supporting *Doedicurus clavicaudatus* nutrients requirements, yearly cost of food and feeding plan program.
* Comparative physiological data on big herbivorous animals
* Actual molecular data and approach
* Palaeoecological data
* Biogeoraphical data

## *Doedicurus clavicaudatus:* Nutritional Proposal (Nutrients Requirements) (280 words)

Based on historical and fossil records about the *Doedicurus clavicaudatus’* environment and biogeographical are of discovery, low nitrogen, high carbon, and cellulosic rich materials (fiber content) are proposed as the nutrients requirements for the *Doedicurus clavicaudatus* (Blanco and Rinderknecht, 2009). The *Doedicurus clavicaudatus* is a big herbivorous animal with almost the size of an elephant inhabiting woodlands and grasslands of South America. Based on the fossil records’ feeding height stratification of *the Doedicurus clavicaudatus* and its historical affiliation to the modern day armadillos justifies the dietary needs of the *Doedicurus clavicaudatus* (Cardonatto and Montalvo, 2016).

The comparative physiology and actual molecular data obtained from animals of equal weight, height, and feeding patterns (cranial and postcranial materials) associate the *Doedicurus clavicaudatus* with glyptodont species related to Pleistocene megafauna until the end of the glacial period (Carlini and Aguilera, 2008). The comparative physiology of closely related creature to *Doedicurus clavicaudatus* of woodlands and grasslands environment suggests a likelihood of adoption of similar nutritional requirements. According to De los Reyes and Arrouy (2013) associated animals identical to *Doedicurus clavicaudatus* and its related climatic conditions utilize an extensive system feeding and supplemental feeding plan that is adequate in low nitrogen, high carbon, and cellulosic rich materials (fiber content).

Similarly, the nutrients requirements of the *Doedicurus clavicaudatus* exceptionally rich in grains and forage diet is based on the marker methods of determining the digestibility and metabolism processes of related woodland and grassland inhabited animals (Hancocks, 2011). For example, the fecal matter analysis of elephants and rhinos of also similar height and weight indicates grains and forage diet that are rich in cellulosic and carbon nutrients are beneficial to the *Doedicurus clavicaudatus* (Soibelzon and Prevosti, 2014).

## Feeding Plan Suitable in a Modern Zoological Park (195 words)

The proper feeding plan proposed for the *Doedicurus clavicaudatus* is an extensive an extensive feeding system and supplemental feeding plan in a modern zoological park (Villavicencio and Barnosky, 2016). The combination of comprehensive feeding system and supplemental system plan is suitable for practical conservation of the *Doedicurus clavicaudatu*s in a modern zoological park as it enables adequate and sustaining nutrients to the *Doedicurus clavicaudatus* based on its nutrimental requirements and food-to-weight ratio (Zurita and Scaglia, 2016). Similarly, the proposed feeding plan is efficient since it accounts for the working and resting diet for the *Doedicurus clavicaudatus*. Within the extensive feeding system plan, a full working menu during off-season scheduled between 4-5 P.M enabled sufficient eating after the *Doedicurus clavicaudatus* returns from the fieldwork (Hill and Broom, 2009). Similarly, resting diet mostly consisting of supplements such as gur, salt, sugar cane, and wheat are provided before the *Doedicurus clavicaudatus* left to sleep at night. Combined extensive feeding system and supplemental feeding plan enable sufficient and adequate feeding plan for the *Doedicurus clavicaudatus* to reasonably assimilate to the natural feeding behavior of the *Doedicurus clavicaudatus* in a natural environment of woodland and grasslands (Mead and Baez, 2007).

## Estimated Yearly Cost of Food (216 words)

The estimation of a yearly cost of feeding *Doedicurus clavicaudatus* (a single animal) on food is approximately $133,000 per year. The justification of the annual estimation of the cost on a menu for the *Doedicurus clavicaudatus* is based on comparative physiological studies on large herbivores such as elephants and rhinos that consume approximately 10% of the body weight on food daily (Poiré and Tonni, 2015). The *Doedicurus clavicaudatus* body weight is roughly 1900kg to 2370kg weight and overall height of 4 meters. Based on 10% of the body weight daily consumption assumptions, the *Doedicurus clavicaudatus* consume approximately 250kg per day and nearly 91500kgsyearly on food (Soibelzon and Prevosti, 2014).

Consequently, the estimated yearly cost of food for keeping a *Doedicurus clavicaudatus* in a modern zoological park is expected to $133,000 per year for a single $133,000 per year to receive sufficient food basing estimation on the standard cost per kilogram of food consumed daily by a single *Doedicurus clavicaudatus* (Politis, 2008). Besides, evaluating the feeding pattern of relatively essential animals in a modern zoological park, approximately 80% of large animal’s day such as elephants is spent on feeding. Consequently, the *Doedicurus clavicaudatus* is likely to spend much of its day in a modern zoological park eating justifying the yearly food estimation for feeding the *Doedicurus clavicaudatus.*

## Reliable Data and Approach used for Nutrients and the Cost of Food Proposal (224 words)

The marker methods of determining the digestibility and metabolism processes, comparative physiology, and actual molecular approach available in the current literature support the proper proposed feeding plan and nutritional requirements for the *Doedicurus clavicaudatus* (Soibelzon and Prevosti, 2014). The biogeographical records associated with *Doedicurus clavicaudatus* and its closely related animals inhabiting in woodland and grassland suggest that the *Doedicurus clavicaudatus* is an herbivorous animal that needs special diet and care (Prado and Alberdi, 2015). From the paleoecological data obtained from the *Doedicurus clavicaudatus* records, the *Doedicurus clavicaudatus* morphological structure and arrangement based on cranial and postcranial materials are related to the modern-day armadillos occupying the ecological niche of herbivores although relatively small.

The paleoenvironmental data of the glyptodont species associated with the *Doedicurus clavicaudatus* indicates morphological congruence of the *Doedicurus clavicaudatus* with other hyper-herbivorous adaptive animals that utilize the suggested great feeding plan and nutritional requirements (Soibelzon and Prevosti, 2014). The comparative physiology of the *Doedicurus clavicaudatus* and its affiliated animals of the Pliocene period support the dietary requirements, feeding plan, and the yearly cost estimations for conserving a single *Doedicurus clavicaudatus* in a modern zoological park (Quick, 2011; Zurita and Scaglia, 2016). Comparatively, the sedimentological and taphonomic data available in the recent literature indicate the suitability of adopting the proposed nutritional requirements and feeding of the *Doedicurus clavicaudatus* in a modern zoological park.

## Discursive Analysis (801 words)

According to Scanferla and Molinari (2013), *Doedicurus clavicaudatus* is a ‘pestle tailed’ extinct animal of a glyptodont species similar to the modern-day armadillos although relatively huge compared to its affiliates in both height and weight. Based on historical and fossil records of the *Doedicurus clavicaudatus*, the biogeographical and paleoecological data retrieved from historical and fossil records suggest that the creature (*Doedicurus clavicaudatus*) lived in woodland and grassland. The association of the *Doedicurus clavicaudatus* with the Pleistocene megafauna to the end of the glacial period, woodland, and grasslands found and distributed in South America (Lujan Argentina, San Jose Uruguay, and Santa Vitoria do Palmar Brazil) justify its herbivorous (Soibelzon and Prevosti, 2014). Being an herbivore, low nitrogen, high carbon, and cellulosic rich materials (fiber content) soot the *Doedicurus clavicaudatus* nutritional requirement in its natural environment even although restricted to a modern zoological park (Villavicencio and Barnosky, 2016).

The assessment of the comparative physiology (digestion and metabolism) of the current herbivorous animals inhabiting the woodland and grasslands demonstrate a more significant relationship of the *Doedicurus clavicaudatus* based on dietary requirements and feeding plan (Soibelzon and Prevosti, 2014). The *Doedicurus clavicaudatus* being a large herbivorous animal with almost the size of an elephant is likely to consume a relatively same amount of food as the elephant (Villavicencio and Barnosky, 2016). Nutritionally correct and high-quality food provided in sufficient quantities are required to keep big animals’ weight and health in a modern zoological park such as the elephants and rhinos with the almost the same size and weight with the *Doedicurus clavicaudatus* (Zurita and Scaglia, 2016). The *Doedicurus clavicaudatus* being a giant vegetarian in woodland grassland is likely to eat a variety of plants with a well-balanced diet.

A combined extensive feeding system and supplemental (dietary enrichment and supplements for herbivorous animals) feeding plan are likely to benefit the *Doedicurus clavicaudatus* with sufficient nutrients supply for its health and weight maintenance (Hill and Broom, 2009). Within the extensive feeding system and supplemental feeding plan, grass-based hay, and lots of it constituting the nutrients duplications found in woodland and grasslands should be provided as daily diet (working diet). An elephant with almost equal weight as the *Doedicurus clavicaudatus* chomps up approximately 100 pounds of grass-based hay daily practically 50% -70% daily diet (Vizcaino and Milne, 2011).

Comparatively, the *Doedicurus clavicaudatus* is likely to consume about 80-100 pound of grass-based hay daily based on its digestion and metabolism similarities with an elephant of almost equal weight and size. Despite extensive feeding system, special supplements consisting of pellets, salt, fruits, and vegetables with the necessary minerals and vitamins requirements are likely to be beneficial for the *Doedicurus clavicaudatus* dietary requirements (Zurita and Scaglia, 2016). The special nutritional plan provided also accounts for grains supplements, pound-for-pound, and more protein for the *Doedicurus clavicaudatus* growth and weight maintenance.

The yearly costs estimation for feeding a single *Doedicurus clavicaudatus* in a modern zoological park is dependent on many factors such as age, sex, and the animal’s weight. However, the standard estimation for feeding a single *Doedicurus clavicaudatus* is likely to be approximately $133,000 per year. The yearly cost estimations on food seem expensive for conserving a single *Doedicurus clavicaudatus* in a modern zoological park, but the estimated cost is standard and justifiable considering the actual molecular studies of closely related animals placed on similar restrictive conditions (Villavicencio and Barnosky, 2016). Most big vegetarian animals (herbivores) in a modern zoological park consume 10% of the total body weight and spend approximately 80% of the day eating justifying the estimations. Comparative studies of animals of similar body size and physiological morphology such as the elephants and rhinos consume roughly $150,000 per year (Hancocks, 2011). Thus, the *Doedicurus clavicaudatus* slightly smaller than the elephant is likely to share the similar pattern of cost estimation on food but also marginally smaller based on approximate body weight to that of an elephant.

Similarly, the yearly cost estimation on food proposal for the *Doedicurus clavicaudatus* in a modern zoological park is based on the costs of special diet and supplements. For example, if huge herbivore such as elephants (morphological size) approximately 10 pounds of pellets daily, the *Doedicurus clavicaudatus* is likely to consume almost the same amount and cost of food justifying the yearly approximation. Besides, special diets and supplements rich in protein, pound-to-pound, cellulose, and carbon are likely to be costly (Vizcaino and Milne, 2011). The actual molecular analysis and comparative physiology of giant herbivores (fecal matter) demonstrate that much of the food eaten by giant herbivores is excreted and little amount of necessary nutrients is digested. An extra amount of food supplements and special diet added to maintain the body weight of the *Doedicurus clavicaudatus* reflects the estimated yearly cost spend on keeping a *Doedicurus clavicaudatus* in a modern zoological park (Soibelzon and Prevosti, 2014).

## Approach and Reflective Statement (230 words)

Multiple methods were used to evaluate and analyze the dietary requirements, proper eating plan, and yearly cost estimations on food for restricting *Doedicurus clavicaudatus* in a modern zoological park. Marker methods of determining the digestibility and metabolism processes, actual molecular methods, and comparative physiology of related woodland and grassland inhabited animals were used to analyze shared feeding pattern, feeding plan and nutritional requirements of the *Doedicurus clavicaudatus* (Soibelzon and Prevosti, 2014). Comparative physiological studies on the metabolism and digestive processes of giant herbivores such as elephants provided a good insight of suggesting the amount, nutrients requirements, feeding plan, and the yearly cost estimations on food the *Doedicurus clavicaudatus* is likely to consume in a zoo setting (Villavicencio and Barnosky, 2016).

Reflectively, the dietary requirements, feeding plan, and the yearly cost estimation on food for the extinct *Doedicurus clavicaudatus* can be analyzed and traced back to its ancient DNA of its affiliated animals who exhibit similar morphological and environmental conditions. The studies on the historical and fossil records of the extinct animals such as *Doedicurus clavicaudatus* provide a deep understanding of species diversity levels, ecosystem function, and snapshot analysis of endangered species. The study of paleoecological, biogeographical, and sedimentological data of the *Doedicurus clavicaudatus* provide the necessity of protecting and maintaining biodiversity especially on nutritional requirements, feeding plan, and yearly budget on food for animals restricted in a modern zoological park.

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