



**EARLY HOURS OF TREATMENT IN A NEONATE NINE-BANDED ARMADILLO  
(Dasypus novemcinctus) RESCUED FROM ILLEGAL TRAFFICKING IN ECUADOR.  
PRIMERAS HORAS DE TRATAMIENTO EN UN NEONATO DE ARMADILLO DE  
NUEVE BANDAS (Dasypus novemcinctus) RESCATADO DE TRÁFICO ILEGAL EN  
ECUADOR.**

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**SUMMARY**

This paper presents the case of a baby nine-banded armadillo (*Dasypus novemcinctus*), which was rescued from illegal wildlife trafficking in the province of Pastaza (Ecuador) and was delivered to the Center for Wildlife Rescue Flor de la Amazonia Wayra Urku (Km.35 via Arajuno, Puyo-Pastaza, Ecuador).

This animal had at the time of rescue, severe hypothermia and dehydration, was treated and later was introduced to a change in diet ideal for raising it.

In this review we discuss the different ways to approach the case and the treatment chosen to avoid premature death of the animal.

It is believed that proper protocol was chosen to correct the initial unstable state and start hand rearing.

Keywords: nine-banded armadillo, hypothermia, dehydration, hand-rearing

## RESUMEN

En este trabajo se expone el caso de una cría de armadillo de nueve bandas (*Dasyus novemcinctus*) que fue rescatado del tráfico ilegal de especies en la provincia de Pastaza (Ecuador) y que fue entregado al Centro de Rescate de Fauna Silvestre Flor de la Amazonía Wayra Urku (Km.35 vía Arajuno, Puyo-Pastaza, Ecuador).

Dicho animal presentaba en el momento del rescate una severa hipotermia y deshidratación de la que fue tratado y posteriormente se instauró el cambio de dieta ideal para la crianza a biberón del neonato.

En este trabajo se discuten las diferentes formas de abordar el caso así como los tratamientos elegidos para evitar la muerte prematura del animal.

Se considera que se eligió un correcto protocolo para corregir el estado inestable inicial y comenzar con la crianza a mano de la cría.

Palabras clave: armadillo de nueve bandas; hipotermia, deshidratación, crianza a mano.

## INTRODUCTION

Armadillos are considered the most primitive living placental mammals from the Neotropical region.

Under the new proposed classification of mammals of Wilson and Reeder (2005) and following the criteria of McKenna and Bell (1997), armadillos form the new order called Cingulata, discarding previous criteria where armadillos were included along with aardvarks and anteaters in the common order Edentata or Xenarthra (Tirira 2007).

The nine-banded armadillos are widely distributed in Ecuador and are often hunted for their meat, their shells being used for other purposes (eg. musical instruments). In these places where armadillos are hunted, armadillos populations result in a low number (Tirira 2007). For identification purposes, it is useful to study its back covered with a bony armor, with nine (but also 8 to 11) rows of bony plates located in the middle of the body (Tirira 2007). The head is fitted with an armored shield on the forehead. Ears are very close together without bony plates

between them. The eyes are small. The tail is smaller than the size of the head and body together. The front legs have four toes with strong claws and the hind legs have five toes (Tirira 2007).

## **MATERIAL AND METHODS**

The Center for Wildlife Rescue Flor de la Amazonia Wayra Urku receives native mammals, birds and reptiles from the illegal traffic and wildlife that are injured or in need of veterinary care as well.

In this case, the young female nine-banded armadillo which joined the center was rescued from trafficking, presumably after having killed the mother, which is common when babies are seized or juveniles of any species.

At the time of rescue, the baby armadillo presented severe dehydration together with hypothermia of 29.3 °C. The nine-banded armadillos have a wide spectrum of body temperature by several investigators, which can vary between 30-36 °C (Arruda and Arruda; Almeida and Fialho, 1924; Eisentraut, 1932; Wislocki and Enders, 1935; Enders and Davies, 1936; Johansen, 1961; Burns and Waldrip, 1971; Mercer and Hammel, 1989). Also our patient presented coma, bradycardia and bradypnea. The mucous membranes were colored pale with a capillary refill time longer than two seconds and a delay in the retraction of the fold of skin with sunken eyeballs and dried mucous membranes. With this information we were given a state of dehydration of between 6-8%.

The anal mucous membrane showed obvious signs of diarrhea with bits of undigested food (eg. worm) that had been fed during their captivity. The estimated age of the animal is difficult to quantify precisely because armadillo is a specie which young are born well developed, with open eyes and teeth made up of permanent teeth homodontos no difference between them (no deciduous dentition as most mammals) (Tirira 2007).

At the time of exploration the baby armadillo weighed 220 grams. The common weight at birth is 100 grams (Fowler and Miller, 1986), which made us assume (along with its size) that the animal was not more than two weeks old. The first step taken was to reinstate the normal body temperature. Subcutaneous fluids were used to rehydrate the animal. The

intravenous route was out for an inability to catheterize a vein due to the small size of the veins. Also because of the hypotension of the patient it was practically impossible to visualize the typical places of venipuncture in armadillos (jugular, cephalic, saphenous) (Moore, 1983), so we decided to use the subcutaneous route rather than intravenous rehydration. Was also ruled out the intraosseous route because it can lead to osteomyelitis due to our inability to ensure proper aseptic technique in the center.

Recovery of the individual's body temperature to normal was necessary to prevent death of the animal and to begin with fluid therapy. If we had started with subcutaneous fluids without reaching the normal body temperature of the patient, subcutaneous fluids absorption would be practically null, because of hypoperfusion of peripheral tissue during a state of hypothermia. To achieve optimum animal's body temperature one can use hot water bottles, thermal blankets (not in direct contact with the individual to not cause burns), ventilation of hot air or tempered fluids, among others. In our case, we decided, due to lack of some tools and the small size of the animal, to introduce it into a latex glove and then soak it in water at a temperature of 38-40 °C, thus achieving a more rapid effect and homogeneous throughout the animal's body surface.

After intermittent dives over a period of twenty minutes we achieved recovering her consciousness and increased the animal's temperature to 35.8 °C. After that we began with subcutaneous fluid therapy. For dehydrated infants it is recommended to use a mixture of dextrose 0.9% and NaCl 2.5% (Hoskins, 1996) (to correct hypoglycemia concomitant typical in this state). The volume to be infused is necessary to calculate the losses from dehydration and diarrhea. Using the subcutaneous route, the sites of puncture will be the lateral zones of the individual, with particular attention to the volume to be injected. Is strongly recommended using multiple points of infusion. Momentarily recovered hydration status, we use the oral rehydration route as the next step to continue hand-rearing.

In armadillos orphans orogastric intubation is regarded as a reliable method to administer liquid, foods or serum in neonates (Fowler and Miller, 1986).

Our protocol was designed to feed our patient only with oral rehydration solution during the first 12 hours or until diarrhea subsided. As proposed the oral rehydration Oralyte© or Pedialyte© in an amount not exceeding the 30-40 ml/kg, which is the volume that stomach

can hold in a neonate (Fowler and Miller, 1986). In our case it was proposed oral rehydration solution-based diet orally every 2 hours until remission of diarrhea, at which point we could start with the formula. We used a flexibly urogenital cat catheter as orogastric intubation tube. A 8 French feeding tube can be use if the individual weighs at least 100 grams (Fowler and Miller, 1986).

The tube can be lubricated with petroleum jelly and then inserted into the animal's mouth, hoping that it swallows it (hence this technique can not be used in unconscious animals. It has to be previously measured to reach the patient's stomach (between the sixth and eighth intercostal space is usually sufficient). Following the introduction of the tube it is important to ensure proper placement before infusing a liquid. We recommend introducing the tip of the feeding tube in a beaker with water, so if we observe bubbles it means that we are in the respiratory tract and we can cause an aspiration pneumonia.

The infusion rate of fluids through the tube must be slow enough to not cause the patient's stomach dilatation and reflux of content into the esophagus (the author proposes a rate of approximately 1 ml/30-40 seconds). After ending the infusion volume, it is necessary to inject air into the tube to completely empty its contents into the stomach, since this decreased the risk of aspiration pneumonia while extracting the tube from the animal.

Our patient, after a period of 18 hours of oral rehydration and after remission of the diarrhea, was considered to start with the oral formula. The diet of these animals in captivity in adulthood is well known (Wampler, 1969; Storrs and Grier, 1973; Meritt, 1976; Meritt, 1985; Fowler and Cubas, 1996; Fowler and Miller 2003; Rosa *et al.*, 2009) but it is difficult to find literature to propose formulas for baby armadillos. Among the literature, we recommend Esbilac© milk diluted in water in proportion 1 part milk to three parts water (Fowler and Miller, 1986), or the compound used in the Sao Paulo Zoo which successfully raised a 25 days old baby and which consisted of milk powder (presumably for human consumption), eggs, honey and vitamins (Wampler, 1969; Storrs and Grier, 1973; Meritt, 1976; Meritt, 1985; Fowler and Cubas, 1996).

Our baby was subjected to an initial mixture of formula Enfamil© Lactose Free and oral rehydration in an initial dilution of 1 part milk to 5 parts of oral rehydration, which we would concentrate on the basis of the consistency of the faeces. The choice of milk was

according to the protein, fat and carbohydrate concentration, but within the products we use are only those targeting human consumption. The absence of lactose in the preparation was intended to prevent diarrhea caused by malabsorption of this sugar.

After three doses of milk powder, in a two and half hours interval, we saw proper stool consistency after which we progressively concentrated the mixture in order to maintain a concentration of three parts of water and one part milk. It is interesting to note the need to add vitamin K to food of these animals for possible diseases in this specie by its lack of this vitamin. (Wampler, 1969; Storrs and Grier, 1973; Meritt, 1976; Meritt, 1985; Fowler and Cubas, 1996; Fowler and Miller 2003).

## DISCUSSION

Although we had little time working with this patient, we chose to maintain a correct course of action to reverse clinically hypothermic and dehydrated state of the neonate. Because of the absence of sucking reflex of teats and no appropriate tools appropriate to the shape of the patient's mouth the most appropriate option for raising the patient was conducting orogastric intubation as our only choice in feeding. It is important to emphasize the difficulty of the chosen technique and its possible consequences for a bad practice, being aspiration pneumonia the main medical complication during rearing. It would be useful for further studies and reviews of hand-rearing of this species, especially if there are reports of breeding armadillos in captivity but keeping the parents (Job *et al.*, 1984; Job *et al.*, 1987; Carvalho *et al.* 1997).

## BIBLIOGRAPHY

Almeida, O. & Fialho, BA. Temperature et metabolisme du tatou. *C. R. Soc. Biol.*, 90:734, 1924.

Arruda, MSP; Arruda, OS. Estudio sobre la ramificacion de la arteria sacral mediana y la temperatura corporal del armadillo (*Dasyus novemcinctus*) Revista chilena anatomía v.17 n.2 Temuco.

Burns, TA & Waldrip, EB. Body temperature and electrocardiographic data for the nine-banded armadillo (*Dasyus novemcinctus*). *J. Mammal.*, 52(2):472-473, 1971.

- Carvalho RA, Lins-Lainson ZC, Lainson R. Breeding nine-banded armadillos (*Dasyus novemcinctus*) in captivity. *Contemp Top Lab Anim Sci.* 1997 May;36(3):66-8.
- Eisentraut, M. Biologische un Bolivianischen Chaco. IV. Die warme regulation beim kugelgurtieltier (*Tolipeutes conorus* J S Geoff.). *Z. Vgl. Physiol.* 18:174-85, 1932.
- Enders, RK & Davies, DE. Body temperature of some Central American mammals. *J. Mammal.*, 17:165-166, 1936.
- Fowler, ME; Miller, RE. Zoo and wild animal medicine. Fifth Edition. Saunders.2003
- Fowler, ME; Miller, RE. Zoo and wild animal medicine. Second Edition. 1986.
- Fowler,ME.; Cubas Z. Biology, medicine and surgery of South American wild animals. First Edition. Saunders. 1996.
- Hoskins, JD. Pediatría veterinaria. Desde el nacimiento hasta los seis meses. Second Edition. Interamericana. 1996
- Job CK, Sanchez RM, Diggs C, Hunt R, Stewart M, Hastings RC. Our experiences with breeding of nine-banded armadillos (*Dasyus novemcinctus*) in captivity. *Indian J Lepr.* 1987 Jul-Sep;59(3):239-46
- Job CK, Sanchez RM, Kirchheimer WF, Hastings RC Attempts to breed the nine-banded armadillo (*Dasyus novemcinctus*) in captivity--a preliminary report. *Int J Lepr Other Mycobact Dis.* 1984 Sep;52(3):362-4.
- Johansen, K. Temperature regulation in the nine-banded armadillo (*Dasyus novemcinctus mexicanus*). *Physiol. Zool.*, 34:126-44, 1961.
- Mercer, JB & Hammel, AT. Total calorimetry and temperature regulation in the nine-banded armadillo. *Acta Physiol. Scand.*, 135:579-89. 1989.
- Meritt, DA.: Edentate diets, 1. Armadillos. In G.G. Montgomery Ed. *The Evolution and Ecology of Armadillos, Sloths and Vermilinguas.* Washington D.C, Smithsonian Institution Press, p.p.429-437. 1985
- Meritt, DA.: The nutrition of edentates, *International Zoo Yearbook.* 16:38-46. 1976
- Moore DM .; Venipuncture sites in armadillos (*Dasyus noveminctus*) *Lab Anim Sci.* 1983 Aug;33(4):384-5.
- Rosa PS, Pinke CA, Pedrini SC, Silva EA. The effect of iron supplementation in the diet of *Dasyus novemcinctus* Linnaeus, 1758) armadillos in captivity. *Braz J Biol.* 2009 Feb;69(1):117-22.
- Storrs, EE. y Grier, WE.: Maintenance and husbandry of armadillo colonies. *Laboratory of Animal Science.* 22:823. 1973
- Tirira SD. Mamíferos del Ecuador. Guía de campo. Ed. Murciélago Blanco. 2007.

Wampler, SN. Husbandry and health problems of armadillos. *Laboratory of Animal Care*. 19: 391. 1969.

Wislocki, GB & Enders, RK. Body temperature of sloths, anteaters and armadillos. *J. Mammal.*, 16:328-329, 1935.