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Is increased use of air-conditioning linked to increased rate of respiratory diseases in rabbits ?

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Lately, an increase in the rate of respiratory diseases has been noted in rabbits. This is particularly true in the USA, where air conditioning is widespread to cool the air and remove humidity inside home environments and, so, improve thermal comfort.

The wild European rabbit (*Oryctolagus cuniculus*) spends a great deal of time below ground. Environmental conditions inside the burrow remain fairly constant, with

temperatures varying between 15-20°C/59-68°F and humidity percentage ranging between 70 and 90%. Rabbits will go outside the burrow only when temperatures



Figure 1: Young Benny and older Yara and Kaspi enjoy going on a naturally-shaded balcony with many plants. The moistened concrete floor provides extra freshness on hot days.



Figure 2: Stretching out on cool tiles when the living environment is warm makes it more supportable for a rabbit. Here, 4.5 months old Benny. Photo: Arie van Praag

become cooler (Figure 1). Acclimatization and adaptation are, thus, essential to the survival of rabbits in warm environments. Several organs help regulate body temperature:

- Nasal cavity and mucosa. The sinuses contain an extensive system of *lamellae* that are filled with a large number of arteriovenous anastomoses and are drained via numerous small blood vessels. The passage of respiratory air through the *lamellae* contributes to the cooling of the blood. This system works well in medium and large rabbit breeds, but not in dwarfs.
- Lungs. Increasing the respiratory rate enables vaporization of moisture through the air in the lungs.
- Ears. The ear pinnae contain a complex and dense network of blood vessels and arteriovenous anastomoses that cool the blood through vasodilatation. When the ambient air temperature is too warm for the rabbit, but still below the rabbit's

body temperature (39.5°C-103.1°F), cooling of the blood, and thereby the body temperature, through convection (heat transfer, radiation, and evaporation) is possible by keeping the ears erect and moving them slowly back and forth. When the surrounding temperature rises above 39°C-102.2°F, it becomes difficult for the rabbit to cool itself.

The ears of middle-sized and giant breeds correspond in size and form to their function. Dwarf and lop-eared rabbits have, however, been selectively bred for their unusually small sized or shaped ears in disregard of function, which has resulted in an inefficient ear cooling system. These rabbits are thus at risk of developing hyperthermia in warmer weather when not provided a cool environment.

In the home of a dedicated owner it only rarely comes to extreme heat condition. On warm summer conditions, it can, however, reach 28°C-82.4°F or higher. This becomes



Figure 3: A wet towel placed over a rabbit helps prevent heat stroke. Here 3 months old Benny.

problematic and potentially dangerous, especially for young, older or sick rabbits, rabbits with longer hair like Belgian beard rabbits or Angora rabbits, or rabbits with hanging ears (lop). Measures must be taken to enable rabbits to stay comfortable. Many tricks and solutions exist and many webpages describe solutions like ice-bottle or ice-packs, cooled ceramic tiles or placing a wet towel over the body of a rabbit (Figures 2, 3). Good ventilation is also very important to create a flow of air and avoid a build-up of ammonia smell from the litter-box. A pedestal oscillating fan is particularly indicated to help circulate the air as the flow will not be directed on the rabbit only (Figure 5).

Air conditioner and health

Air conditioning is a technology that has brought and increased comfort for people

and animals. Since its existence, the rate of heat-stroke morbidity/mortality in man as well as pet animals has greatly decreased during the hot summer months in regions with a Mediterranean or tropical climate. Yet, there is debate about their effect on health too, especially when used continuously.

While people appreciate air-conditioning, information about the effects of the latter on the health of persons and pet animals is little known. Many factors play a role. The amount of time spent inside a climate controlled area is important as well as the set temperature in that area, which should be higher in summer and lower in winter. Indeed, a too low temperature in summertime can be a health risk to man as well as animals. Overuse and long-term or constant exposure to air conditioning must be avoided. Overexposure is not directly

linked to illnesses; the stress caused on the body can lead to various health issues. A study shows that young people constantly exposed to air-conditioned cold and dry air for 6 months presented an increased incidence of respiratory symptoms. Few other studies also indicate that persons living in air-conditioned environment are more susceptible to respiratory disorders. If persons are, so are pet animals and, in particular, pet rabbits.

Cool and dry air, and respiratory health

Studies have shown that the longer an individual spends time in an air conditioned area, the more he is at risk of developing upper and lower respiratory diseases and infections. Although studies were done in man mainly, effects on pet animals living in

air conditioned homes or rooms are similar, with young and older animals being at increased risk.

Air conditioners pull out humidity from the air, and the air in conditioned areas will become as dry and arid as in a desert. The drier air will dry out the airway surface fluid lining the mucous membranes of the upper respiratory systems, leading to irritation, breathing difficulties and vulnerability to infections and other illnesses.

In addition to irritation, cooling of the airways is observed when breathing temperate air at 20°C-68°F. The temperature of the trachea will decrease to 34°C-93.2°F at rest, whereas it can reach as low as 31°C-87.8°F during fast deep breathing (hyperpnea), when the air flow is



Figure 4: Normally furred Benny (Champagne d'Argent) and long haired Bella (Belgian bearded rabbit), enjoy spending time in the air-conditioned room, but are free to move out of the room and rest in the warmer parts of their living area.

increased within the airways, e.g. during or following exercise. The cooler and drier the ambient air is, the more rapidly the airway surface fluid lining the mucous membranes of the respiratory system will evaporate. Since the breathing of rabbits is nasal, this leads to cooling and drying of the nasal mucosal membrane. The lower airways are not affected at rest.

In man, tests of the pulmonary function have shown modifications when a person is exposed to air-conditioning. The forced expiratory flow (FEF), or the expiratory speed of air coming out of the lung during the middle portion of a forced expiration, was studied:

- **FEF50%:** 50% may be indicative of medium-small airway caliber.
- **FEF75%:** 75% reflects small airway status. Decreased values in FEF75% would be expected in the asthmatic patient, even if symptoms are not apparent.

FEF was significantly decreased in persons living in air-conditioned areas. These results indicate that these persons are more prone to suffer from respiratory dysfunction and have an increased incidence to develop respiratory diseases of the small lung airways, e.g. chronic obstructive pulmonary diseases. It can be speculated that pet animals living in the same environment are affected in the same way.

Studies of the peak expiratory flow rate (PEFR) allow to assess the strength of expiratory muscles and the airway patency of the trachea, bronchi and larger bronchioles. It also is indicative of the caliber of the bronchi. The obtained results show a significant decrease of PEFR in persons living in an air-conditioned environment. This is indicative of constriction of the larger lung airways (bronchoconstriction) and the person may develop obstructive lung diseases.

Anatomical studies have, furthermore, shown that airways exposed to regular cool air from air-conditioned air and, as a consequence, desiccation have a thicker *lamina propria* with infiltration of inflammatory cells such as eosinophils, neutrophils, and mast cells.

Risk of mold

While cooling and decreasing humidity in the ambient air, the extracted water will condensate in the indoor section of the air conditioning unit when it is running. This promotes growth of mold and mildew. In the colder months, when the air-conditioning is not used, mold continues to grow. Its presence in the air can lead to respiratory problems.

Summary of effect of air conditioner on the respiratory system

Nasal inhalation of air-conditioned cold and dry air may lead to respiratory dysfunction. Thin-walled venous sinuses, located in the connective tissue (*lamina propria*) underlying the nasal epithelium will warm up and moisten inhaled air before it reaches deeper into the respiratory system. Engorgement of the thin walled venous sinuses after inhaling cool dry air will lead to congestion, sneezing, and discharge of mucus from the nose (rhinorrhea).

Pulmonary function is also affected. Inhaling air-conditioned cold and dry air can induce bronchoconstriction. This is particularly the case during hyperventilation, when larger volumes of air are inhaled, leading to repetitive dehydration of small airways.

Inhalation of cold dry air can also lead to chronic obstructive pulmonary disease (COPD). This can lead to cough or breathlessness, more rarely to asthma or community-acquired pneumonia.

Respiratory problems caused by air-conditioning and sensitivity to infections and diseases vary greatly from one individual to another.

Similar effects are observed in rabbits

Lately, there seems to be a correlation between the number of rabbits living in long term air-conditioning and respiratory disease. Several cases are known to the author where not one rabbit of several living in an air-conditioned home is affected, but all the rabbits living that home develop incurable respiratory disease. It happens that a fan is used in addition to air-conditioning. In other cases, young and adult rabbits coming healthy into a home and exposed constantly to air conditioner on a daily basis, started to show clinical signs of upper respiratory disease with sneezing and nasal discharge within a few weeks. As exposure continued, they developed severe bacterial infections of the upper and lower respiratory airways that remained refractive to any treatment with antibiotics or nebulization. In some rabbits, the infection of the nasal cavity spread to the middle and inner ear via the Eustachian duct.

How to prevent AC associated respiratory disease in rabbits ?

Nowadays, it is hard to imagine what it would be like to live without air-conditioning. Yet, it is important to limit to some extent the use of air conditioners in order to avoid

“air conditioning sickness” if not used appropriately. It is important to alternate its use with other adequate means of ventilation:

- Avoid setting an air-conditioning on full blast.
- Correctly adjust the room temperature and humidity by avoiding to set the



Figure 5:

A pedestal oscillating fan helps circulate air. This will cool the air slightly and prevent build-up of ammonia in the litter-box area.



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temperature too low, e.g. a temperature between 22-26°C/72-79°F, depending on the temperature outside the home environment.

- Opening windows in the evening or on days with fresher outer temperatures to help bring fresh air inside and reduce indoor contaminants (Figure 1).
- Alternate use of a fan (Figure 5).

Adverse effects of air conditioning and fan on joint and muscle pain

The increase of barometric pressure caused by air-conditioning as well as the cold and dry air is also known to cause stiffness of joint and muscles and worsen pain caused by both rheumatoid and osteoarthritis as well as pain caused by the inflammation of joints or neuralgia (neuritis) in the head, toothaches and headaches. Deterioration of the affected bones and the cartilage layer that cushions between the ends of two bones (meniscus) is also observed.

Women and elderly persons are particularly concerned as their body muscle mass is smaller than in men. As a result, heat generation in the body is smaller and women are more prone to catch chills.

Rabbits show a similar pattern. Female rabbits have usually a smaller muscular mass than male rabbits, independently of being spayed and neutered. And owners often mention that their rabbits living in a constantly air-conditioned cold environment often suffer from arthritis too.

Continuous air conditioning has further effects on the body, on the heart function, blood pressure, sensitivity to heat, skin dryness, immune diseases, and also hypothermia. It may also affect sleep.

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