Macroscopic Features of the Intugementary System of Geriatric Kintamani Dogs

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Abstract

Observing the health of Kintamani dogs, especially at geriatric age, is important as an effort to preserve their lives. Observations of the integumentary system can provide information related to clinical animal health. This study aims to determine the integumentary condition of Kintamani dogs macroscopically at geriatric age. This study used 5 Kintamani dogs of geriatric age with a healthy clinical condition. The research procedure was carried out by macroscopic observation of hair and skin by inspection and palpation methods. The results showed that the hair of geriatric dog samples experienced changes in color and texture when compared to productive age Kintamani dogs. Observation of skin flexibility showed that the skin flexibility of geriatric dogs was lower when compared to productive-age Kintamani dogs. Observations of the hair strength of Kintamani dogs showed that at the average geriatric age it was difficult to pull out during manual combing with the observer's hand. This observation shows that the integumentary system of geriatric Kintamani dogs is macroscopically not much different from productive-age Kintamani dogs.

Introduction

Canis lupus familiaris is one of the most popular pet species worldwide. This group can be distinguished from each other based on specific morphological, behavioral, and adoption traits. The morphological characteristics of this group can be largely defined by coat color and texture, and are considered to be highly advantageous traits in this species (Saif *et al.*, 2020). One of the canis lupus familiaris breeds that is now registered as a world class dog breed is the Kintamani Bali dog. Kintamanis are one of the local dogs originating from Sukawana Village, Kintamani Bangli. Kintamani dogs are also known as cicing gembrong or long-haired and bushy dogs (Gunawan *et al.*, 2016). The Kintamani dog is an emerging breed dog in Indonesia (Puja *et al.*, 2018). As they age, Kintamani dogs require special care, especially as geriatrics. The aging process is a multifactorial biological phenomenon that begins at birth and continues throughout life, characterized by a decline in physiological function and adaptability. This process will certainly also occur in Kintamani dogs and will also increase vulnerability. Given the increasing interest in the field of aging, this opens up new directions for future research in the field of clinical intervention strategies to prevent and control problems that may arise from this process. However, there is no scientific information regarding abnormalities in physical examination results in older Kintamani dogs.

There is a growing interest in healthcare and wellness of elderly dogs (Srikala *et al.*, 2020). The geriatric group of dogs has special needs and is more susceptible to chronic diseases. Aging is the single most important cause of disease, disability, and death in adult dogs. Aging has long been viewed as a mysterious and inevitable natural event that inevitably occurs and is understood to be a complex but understandable set of biological processes that are highly conserved across species. Although the phenotypic expression of these aging processes appears to vary, there are consistent patterns both within and between species (McKenzie *et al.*, 2022b). Geriatrics is a complex physiological process characterized by the observation of tooth wear, loss of skin elasticity, coarse and dull hair, and difficulty to move (Pati *et al.*, 2015).

The integumentary system is one of the factors that can be observed and evaluated when a dog has reached geriatric age (Miragliotta *et al.*, 2019). The integumentary system is one of the most important and largest organs in the dog's body and includes the skin, hair and nails (Hargis *et al.*, 2017). Skin has a function as a sense of touch, to control temperature, and acts as a defense against the outside world, the hair that covers it serving as an insulating layer between the dog's skin and the outside world. Dog hair can be observed in the diversity of dog breeds when viewed based on dog morphology and morphometry (Vaishnav *et al.*, 2021). Furthermore, the older the dog, the more its skin function declines. Several diseases are more prone to infect geriatric dogs, such as neoplasia (McKenzie *et al.*, 2022a) and bacterial infections like *Staphylococcus pseudintermedius* and *Pseudomonas aeruginosa* (Nocera *et al.*, 2021). So far, no studies have been found that discuss the description of the integumentary system of Kintamani dogs at geriatric age; therefore, this research is conducted. The purpose of this study was to determine the macroscopic condition of the integumentary system of geriatric Kintamani dogs and can be the basis for determining the health of geriatric

Kintamani dogs and a reference in continued health checks.

Materials and Methods

This study was an observational study to observe macroscopic changes in the hair and skin of geriatric Kintamani dogs using five female dogs with geriatric age (8-12 years) with white hair color based on anamnesis and birth certificates. In this study, female Kintamani dogs of geriatric age with an average weight of 11 kilograms were used. Based on the body condition score (BCS), the geriatric Kintamani dogs used were included in the 5/9 score where the ribs, pelvis, and spine were palpable with a thin layer of fat covering them. The waistline and abdomen were clearly visible but not too prominent with a more gradual curve. The Kintamani dogs were kept in the same environment and in clinically healthy condition.Data collection was done by macroscopic observation of changes in hair color, hair strength, elasticity and physiological lesions on the skin. Observations began with collecting anamnesis and physical examination data, including physical examination which included reviewing the preassessment status, observing the condition of the teeth and general clinical observation of each sample dog. At the time of physical examination, evaluation was also carried out on the hair color of Kintamani dogs and observing lesions found on dogs through inspection of hair and skin.

Manual brushing of the dorsal part of the hair according to the direction of hair growth was done to observe the strength of the hair. The assessment of hair strength was adapted from the results of Farros *et al.* (2023) which stated that if the hair that is plucked during sweeping ranges between 1-5 strands, it indicates that the dog's hair is not easily plucked. Meanwhile, if more than five strands it indicates that the sample dog's hair is easily pulled out. Data collected based on the results of observations and observations were then evaluated descriptively.

Results

Observation of the lesions in the geriatric sample dogs showed the presence of secondary lesions in the form of hyperkeratosis (Table 1). Observations of skin elasticity showed that there was a decrease in elasticity in geriatric sample dogs when compared to productive age sample dogs. The results of observations of the hair quality of geriatric sample dogs showed changes in color and texture (Table 2). Judging from the strength of the hair of the geriatric sample dogs when carrying out manually combing of the dorsal region with the observer's hand, the number of hairs pulled out ranged from 1-5 strands. The hair color of the geriatric sample dogs also changed to a more brownish yellow and looked dull. The observation results also showed that the sample dog's hair had a change in texture and became coarser.

Table 1. Observation result of skin lesions

Name of The Dog	Primary Lesion	Secondary Lesions	Locations
AGB 1	-	hyperkeratosis	Cranial & caudal elbow
AGB 2	-	hyperkeratosis	Cranial & caudal elbow
AGB 3	-	hyperkeratosis	Cranial elbow
AGB 4	-	-	-`
AGB 5	-	hyperkeratosis	Cranial elbow

Note: AGB = *Anjing Geriatri Betina* (female geriatric dog)

Table 2. Hair observation results of geriatric Kintamani dogs

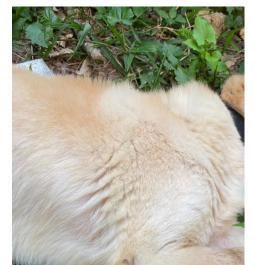|		SAMPEL CODE				
		AGB 1	AGB 2	AGB 3	AGB 4	AGB5
Hair color	White					
	Yellowish	√	√	√	√	√
	Dull	√	√	√	√	√
Hair Texture	Coarse					
	Smooth	√	√	√	√	√
Hair Strength	Easy to pull out	√				√
	Hard to pull out		√	√	√	

Figure 1. Hair of a geriatric Kintamani dog with yellowish discoloration

The determination of geriatric age in the sample dogs was reinforced by information from the owners and recorded on the birth certificate of each sample dog. The geriatric age of the sample dogs was also reinforced by the observation of tooth wear on the incisors and

canines on the upper and lower jaws. Geriatric age is a crucial phase in the life of Kintamani dogs because at this age it causes a loss of ability to maintain the normal physiological state of the body (Jayanti *et al.*, 2024). The results of this study indicate that the Kintamani dogs used are included in the geriatric category. Overall observation through inspection and palpation of the integumentary system in general showed that all sample dogs were in good condition (without any disorders of the integumentary system).

Macroscopic observations of the skin showed a decrease in skin elasticity and the presence of hyperkeratosis lesions in the geriatric sample dogs. As dogs age, various skin changes occur; these include callus formation, loss of elasticity and wrinkling, as well as alterations in hair color and texture. Hyperkeratosis is a thickening of the outer layer of the skin (stratum corneum) so that macroscopically it forms a callus. Hyperkeratosis in the sample dogs occurred because, when entering geriatric age, they will more often stay and lie down. This change in habits causes the dog's body weight to rest on the elbows, experiencing prolonged exposure to pressure and resulting in continuous friction so that hyperkeratosis forms (Banovic *et al.*, 2023). Hyperkeratosis in this sample dog is a common physiological change that occurs as a result of aging. That is because hyperkeratosis in the geriatric sample dogs was not accompanied by inflammation, bleeding and abnormal discharge. The decrease in skin elasticity of the geriatric sample dogs occurred due to reduced cellular regeneration in the skin layer due to the aging process. Bellows *et al.* (2015) stated that the decrease in skin elasticity in geriatric dogs is due to an increase in calcium content and pseudo elastin in elastic fibers. In a study on Toy Poodles, it showed there was a significant association between the skin extension index and gender. In Toy Poodles, a greater risk of skin extensibility could be related to being female (Takeda *et al.*, 2022).

The results of macroscopic observations showed a change in color to a more brownish yellow when compared to productive age Kintamani dogs. Color changes in normal geriatric Kintamani dogs occur as a natural process of aging. Entering the geriatric age, the dog will experience a decrease in melanin production which results in the dog's hair color changing with increasing age (Bychkova *et al.*, 2021). Observations of the hair also showed that the hair of the geriatric sample dogs looked dull with a smooth surface. This is similar to the research of Bellows *et al.* (2015) which states that aging dogs experience functional changes in the skin and hair becomes dull as a physiological process. Dullness in dog hair is caused by a decrease in the amount of sebum (Sartori and Peruccio, 2020; Srikala *et al.*, 2020). This was observed when the flashlight light was reflected with a mirror onto the dog's hair, and there was no light reflection on the dog's hair. This is also related to hair composition, where the composition of primary hair is greater than that of (Jayanti *et al.*, 2024). More primary hair composition in geriatric age causes the texture of the sample dog's hair to be coarser.

The health of the integumentary system is a reflection of the physiological health of the animal (Rana, 2023). Observations of integumentary system health can be made macroscopically and microscopically. Macroscopic observation is a simple observation by inspecting the skin and hair so that it can facilitate a quick assessment of the

condition of the integumentary system (Mosca *et al.*, 2023).

Decreased quality of hair and skin in geriatric dogs is the first indicator that can be attributed to the aging process. Hair coloring in animals is controlled primarily by a series of genes as well as environmental factors, primarily nutrition (Watson *et al.*, 2017). Geriatric dogs exhibit an imbalance in melanin biosynthesis, characterized by the depletion of melanocytes within hair follicles and a reduction in tyrosinase enzyme activity. This imbalance leads to alterations in hair pigmentation and the manifestation of hyperpigmentation. Furthermore, the reduction in tyrosinase enzyme activity is associated with changes in sebum production, potentially resulting in xerosis (dry skin) and a dull appearance of the coat (Bellows *et al.*, 2015). This is similar to the opinion of Fascetti and Delaney (2023) who state that aging changes in dogs can be assessed by changes in the integumentary and musculoskeletal systems. Geriatric dogs have seborrhea lesions, hair becomes dry and dull, and skin is greasy (Cohen, 2017). This contradicted the deterioration of hair and skin in geriatric Kintanami dogs, where no seborrhea lesions or oily skin were found. This is thought to be due to nutritional factors obtained by the geriatric sample dogs during the maintenance period being sufficient to maintain the body's hemostatic balance. This can be observed from the skin of the geriatric sample dogs which remained moist, and the surface of the hair was smooth during manual touching. This was affected by the nutrition given to geriatric Kintamani dogs. Providing appropriate feeding aims to optimize quality of life and minimize the risk of disease in geriatric dogs (Moyers, 2015; Outerbridge and Owens, 2023).

Conclusion

Based on macroscopic observations that have been made, it can be concluded that geriatric Kintamani dogs have a change in hair color to yellowish with a rough and dull texture. Kintamani dogs also have decreased skin elasticity at geriatric age. In geriatric Kintamani dogs, secondary lesions in the form of hyperkeratosis were found.

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Author's Contribution

NPAI: Formal analysis, encompassing research methodology, conceptualization, and article drafting. INW, IWNFG, and PDJ: Article review, editing, conceptual input, validation, and secured funding.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

The data in this study have not been accessed and shared, but if readers want to obtain access to the data in this study, they can contact the authors listed in this article.

References

Banovic, F., Olivry, T., Artlet, B., Rothstein, E., Beco, L., Linek, M., Zabel, S., Peters-Kennedy, J., Welle, M., Wilkes, R. and Austel, M. 2023. Hyperkeratotic erythema multiforme variant in 17 dogs. *Veterinary Dermatology*, 34(2), pp.125-133.

Bellows, J., Colitz, C.M., Daristotle, L., Ingram, D. K., Lepine, A., Marks, S. L., Sanderson, S. L., Tomlinson, J. and Zhang, J. 2015. Common physical and functional changes associated with aging in dogs. *Journal of the American Veterinary Medical Association*, 246(1), pp.67-75.

Bychkova, E., Viktorovskaya, O., Filippova, E., Eliseeva, Z., Barabanova, L., Sotskaya, M. and Markov, A. 2021. Identification of a candidate genetic variant for the Himalayan color pattern in dogs. *Gene*, 769: 145212.

Cohen, M. H. 2017. Smelly Old Dog: Addressing the Dermatological Concerns of Our Geriatric Patients. In: Gardner, M. and McVety, D. (Eds.), *Treatment and Care of the Geriatric Veterinary Patient*, pp.77-85. John Wiley.

Debraekeleer, J., Gross, K. L. and Zicker, S. C. 2010. Feeding mature adult dogs: middle aged and older. In: Hand, M. S., Thatcher, C. D., Remillard, R. L., Roudebush, P. and, Novotny, B. J. (Eds.), *Small Animal Clinical Nutrition*, 5th ed. pp.273-279.

Farros, C. K., Sudira, I. W. and Samsuri. 2023. Efektivitas Lumatan Daun Kembang Sepatu untuk Meningkatkan Kualitas Rambut Anjing Kintamani Bali. *Buletin Veteriner*, 15(3).

Fascetti, A. J. and Delaney, S. J. 2023. *Feeding the healthy dog and cat*.

Gunawan, I. W. N. F., Kardena, I. M., Suatha, I. K. and Puja, I. K. 2016. Coconut water-based extender effects on motility, viability, and DNA integrity of chilled Kintamani dog semen. *Veterinary Science and Medicine Journal*, 4(1), pp.17-21.

Hargis, A. M. and Myers, S. 2017. The integument. In: Zachary, J. F. (Ed.), Pathologic Basis of Veterinary Disease, p.1009. Mosby.

Jayanti, P. D., Gunawan, I. W. N. F, Sukernayasa, I. W. and Puja, I. K. 2024. Identification of microbiome in genital tract of geriatric Kintamani bitch. *International Journal of Veterinary Sciences and Animal Husbandry,* 9(1), pp.469-472.

McKenzie, B. A., Chen, F. L., Gruen, M. E. and Olby, N. J. 2022a. Canine geriatric syndrome: a framework for advancing research in veterinary geroscience. *Frontiers in Veterinary Science*, 9, pp.853743.

McKenzie, B. A., Chen, F. and LaCroix-Fralish, M. L. 2022b. The phenotype of aging in the dog: how aging impacts the health and well-being of dogs and their caregivers. *JAVMA*, 260(9), pp.963-970. DOI: https://doi.org/10.2460/javma.22.02.0088

Miragliotta, V., Buonamici, S., Coli, A. and Abramo, F. 2019. Aging-associated perifollicular changes and calcium deposition in poodles. *Veterinary Dermatology*, 30(1), pp.56-e15.

Mosca, M., Legain, M., Noël, G., Idée, A. and Pin, D. 2023. Macroscopic Skin Examination Can Determine the Number of Strips Necessary to Study the stratum corneum in Dogs. *Veterinary Science*, 10(9), pp.547.

Moyers, T. 2015. Canine nutrition for a healthy old age. *The Veterinary Nurse*, 6(8), pp.452-459.

Nocera, F. P., Ambrosio, M., Fiorito, F., Cortese, L. and De Martino, L. 2021. On Gram-positive and Gram-negative-bacteria-associated canine and feline skin infections: A 4-year retrospective study of

the University Veterinary Microbiology Diagnostic Laboratory of Naples, Italy. *Animals*, 11(6), pp.1603.

Outerbridge, C. A. and Owens, T. J. 2023. Nutritional management of skin diseases. In: Fascetti, A.J. and Delaney, S.J. (Eds.). *Applied Veterinary Clinical Nutrition*, pp.345-383. John Wiley.

Pati, S., Panda, S. K., Acharya, A. P., Senapati, S., Behera, M. and Behera, S. S. 2015. Evaluation of geriatric changes in dogs. *Veterinary World*, 8(3), pp.273.

Puja, I. K., Sawitri, N. M., Maharani, N., Gunawan, I. W. N. F. and Heryani, L. G. S. S. 2018. A comparative study on the effects of coconut water-based extenders on the quality of Kintamani dog semen preserved at 4OC. *Advances in Animal and Veterinary Sciences,* 6(5), pp.192-196.

Rana, T. (Ed). 2023. *Introduction to Diseases, Diagnosis, and Management of Dogs and Cats*. Elsevier.

Saif, R., Iftekhar, A., Asif, F., Alghanem, M. S. 2020. Dog Coat Colour Genetics: A Review. *Advances In Life Sciences*, 7(4), pp.215-224.

Sartori, R. and Peruccio, C. 2020. A case of sebaceous adenitis and concurrent meibomian gland dysfunction in a dog. *Veterinary Sciences*, 7(2), pp.37.

Srikala, D., Kamran, A., Kumari, N. K., Ramesh, P. T., Rao, S. and Yathiraj, S. 2020. A study on different clinical manifestations of geriatric dogs. *The Pharma Innovation Journal,* 9(10), pp.206-210.

Takeda, M., Arai, N., Koketsu, Y. and Mizoguchi, Y. 2022. Factors associated with canine skin extensibility in toy poodles. *Journal of Veterinary Medical Science*, 84(2), pp.282–288. DOI: https://doi.org/10.1292/jvms.21-0266

Watson, A., Le Verger, L., Guiot, A-L., Feugier, A. and Biourge ,V. 2017. Nutritional components can influence hair coat colouration in white dogs. *Journal of Applied Animal Nutrition*, 5, pp.e5. DOI: https://doi.org/10.1017/jan.2016.3

Vaishnav, L., Parashar, S., Kumar, A. and Sachdeva, M. P. 2021. A study on hair analysis of different Canidae breeds. *Forensic Science International*, 3(1), pp.100-169.