Polish Journal of Veterinary Sciences Vol. 25, No. 3 (2022), 403–409

DOI 10.24425/pjvs.2022.142024

Original article

The application of videodermoscopic examination in assessing the skin and its products in pure Arabian horses in the summer and winter seasons

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Abstract

Videodermoscopic examinations have only recently started to be used in veterinary medicine and usually involve a small group of animals.

The aim of this study was to compare specific dermoscopic parameters in selected areas of the body of Arabian horses in the summer and winter seasons. The research was conducted between 2018-2019. The procedure was performed on the left side of the horse's body in seven areas: head, neck, chest, flank, rump, mane, and tail. 42 purebred Arabian horses aged 1-25 (median), 39 mares and 3 stallions were qualified for the study. An Italian Video-Dermascope 7 (Medici Medical SRL with the 3 VIDIX 5Mpx camera and the VX1 overlay - Contact type cap Ø 3.5 cm) was used in the dermatoscopic evaluation. Specialist Cellsens Olympus software for analysing microscopic images was used to perform the measurements. Regardless of the area assessed, the skin in the summer months is darker than in the winter months. Hair thickness ranged from 44.82 (chest in summer) to 87.45 um (mane in winter). Regarding hair density, the number of hairs in the field of view of the dermatoscope ranged from 990 (summer mane) to 3680 (head in winter). Our research showed that the season of the year influences the amount of hair without significantly affecting its thickness.

Key words: hairs, horses, skin, videodermoscopy

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Introduction

Videodermoscopic examinations have only recently started to be used in veterinary medicine and usually involve a small group of animals. Until now, they have been performed in dogs, cats and, to a limited extent, also in horses. In the case of the dogs and cats, healthy skin was assessed as well as various diseased cases. The basic method of using videodermoscopy is an improved (magnification and registration) trichoscopic examination (trichoscopy), i.e., visualisation of hair structures invisible to the naked eye and a measurable assessment of its features such as thickness, density, arrangement, intensity of pigmentation, possible distortions, and irregularities (Rudnicka 2008, Menzies 2013, Lallas 2014, Errichetti 2016). Trichoscopy is also a non-invasive research method which the assessement of the hair follicles, which is helpful in identifying the causes of alopecia (Tosti 2016). Videodermoscopic assessment of healthy skin and its products will facilitate the future development of this method in the diagnosis of diseases and the progress in their treatment. The identification of very specific skin abnormalities can be a very useful tool to improve the treatment methods and treatment outcomes.

In horses, the skin and its products were assessed in healthy animals, so far focusing on two selected seasons (summer and winter hair). The changes in the characteristics of the skin and above all, the qualitative and quantitative characteristics of the hair coat, depending on the season in which the test was performed, were not analysed. There are still many questions about horse skin due to the limited data and more research needs to be done - primarily on healthy horses to identify the baseline values that will explain when the values change.

The aim of this study was to compare specific dermoscopic parameters in selected areas of the body of Arabian horses in the summer and winter seasons.

Materials and Methods

Forty two pure Arabian horses aged 1-25 (median), 39 mares and 3 stallions, were qualified for the study. The largest group in terms of colour was grey horses (25), including 22 mares and 3 stallions. The next group was bay horses (14) consisting of mares only. The chestnut colour appeared in two mares and the seal brown in one. The horse all came from one farm. They were fed and used equally. During this period, the horses were not used for breeding. The research was conducted between 2018-2019. Dermoscopic evaluation of each individual was performed twice, in the months of February and July. The procedure was carried out in the corridor of the stable where the horses were permanently housed. The animals were restrained with a halter and tether by the stable workers. No other methods of restraining were necessary.

An Italian Video-Dermascope 7 (Medici Medical SRL with the 3 VIDIX 5Mpx camera and the VX1 overlay – Contact type cap Ø 3.5 cm) was used in the dermatoscopic evaluation.

The examination was performed on the left side of the body in seven areas: head, neck, chest, flank, rump, mane, and tail. Preparation of the tested field consisted of brushing, applying immersion oil, and visualising the skin by creating a parting in order to improve the contact of the head and image quality. Photographs were taken at 30x magnification using polarised light. The quantitative features of the hair, i.e., its thickness and density, and the qualitative features of the skin: appearance (pigmentation, visibility of the capillaries) were assessed.

To calculate the average thickness of the primary hair, photos taken under 30x magnification were used. The diameter of each of the 10 randomly selected hairs was measured three times at three different locations and the mean of these measurements was used for further calculations. Cellsens Olympus specialised software for analysing microscopic images was used to perform the above measurements. Identical hair thickness tests were performed in each of the 7 selected body regions. Hair density in the examined areas was calculated automatically based on the above-mentioned software from the entire area of the individual photos (9.62 cm^2) at 30x magnification. A total of 294 photos were analysed. Statistically significant differences in hair thickness and hair density were calculated using the Mann-Whitney U test. The $p \leq 0.05$ was considered significant.

Results

Clinical results of the videodermoscopic evaluation

In the videodermatoscopic examination of the skin at 30x magnification, few differences between the summer and winter seasons were found. In the summer months, examining the skin is more difficult as the short hair covers the skin thickly and it is difficult to part it to visualise the skin surface. Longer winter hair is technically easier to test. Regardless of the area assessed, the skin in the summer months is darker than in the winter months.

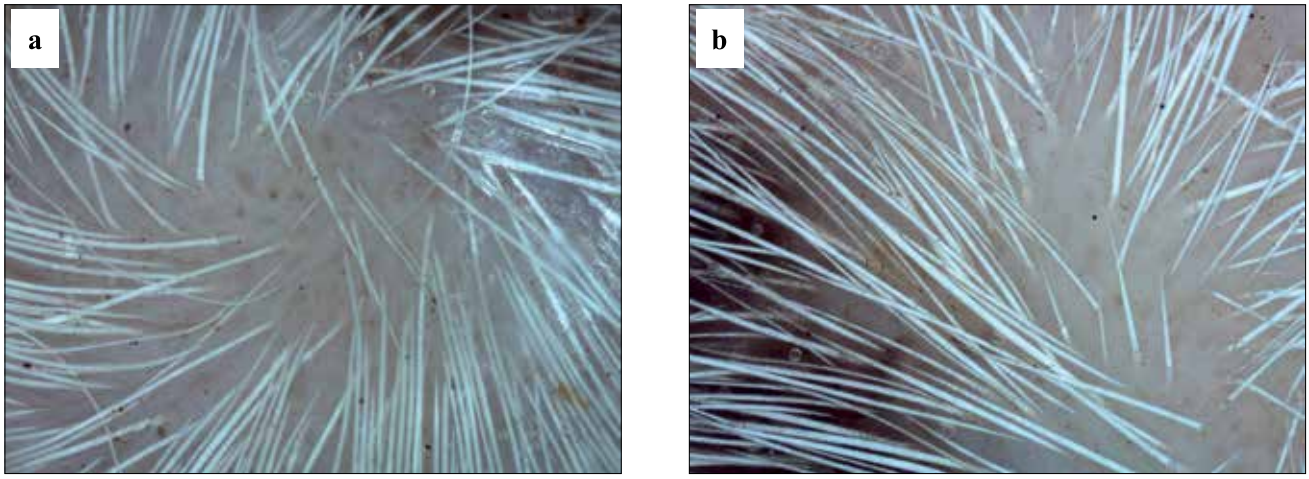

Fig. 1. Polarized dermoscopic image at 30× magnification (the area of the frontal whirlwind). a. Winter season. Blood vessels are visible in the unpigmented skin. b. Summer season. Short hair, fully visible in the field of view.

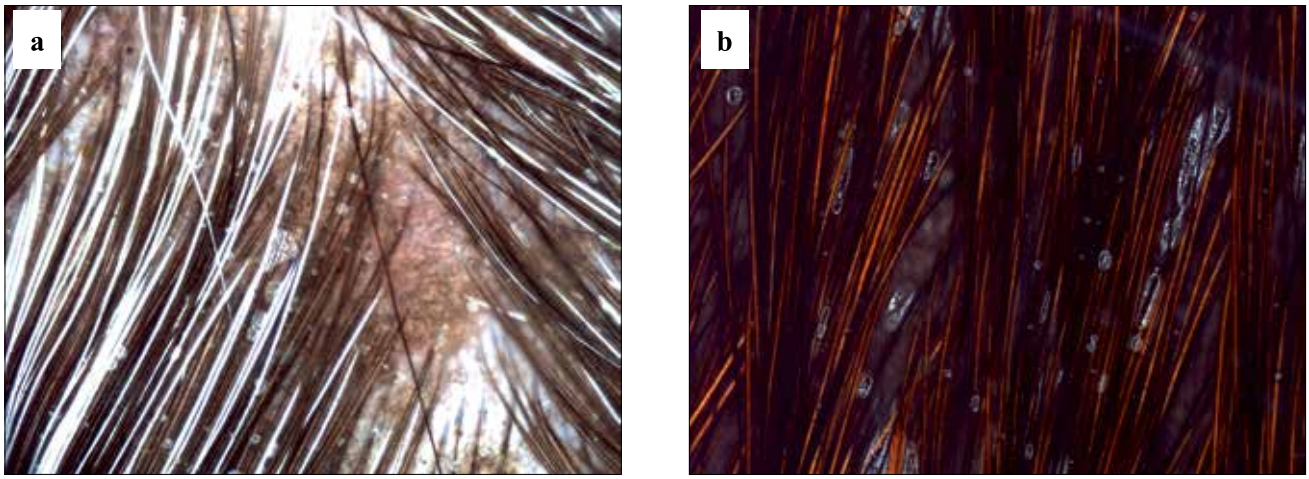

Fig. 2. Polarized dermoscopic image at 30× magnification (the area of the neck) . a. Winter hair is easy to part and expose the skin. b. Summer hair is to short to expose the skin. The skin in the summer season is darker than in the winter season.

Head

The photos taken in the area of the frontal whirlwind show the spiral-shaped orifices of the hair follicles surrounded by a characteristic darker keratin border.

In the study carried out in the winter, the hair on the head is longer, while in the summer it is shorter and fully visible in the field of view. Additionally, in the summer season, new hair growth can be observed (Fig.1).

Neck and chest

The hair appears thinner on the neck than on the head. In individuals with less pigmentation, the hair folicular ostia are not visible. Blood vessels may be visible on unpigmented skin. In completely grey horses with pigmented skin, the hair medulla is clearly visible, while the cortex is slightly marked. In grey horses with unpigmented skin, the hair medulla is completely invisible. In bay or chestnut horses, the hair surface is integral, and it is not possible to distinguish the medulla from the cortex.

Both in winter and summer, the hair is so long that it is impossible to see the full length in the field of view of the videodermoscope, but the winter hair is easy to part and expose the skin, which is not possible in summer. The skin in the summer season is darker than in the winter season (Fig. 2).

Flank

Hair follicles (folicular ostia) and vessels are not visible.

In the winter, the hair on the flanks tends to be very long, making it easy to visualise the skin. The summer hair in this area is short and tightly covers the dark skin (Fig. 3).

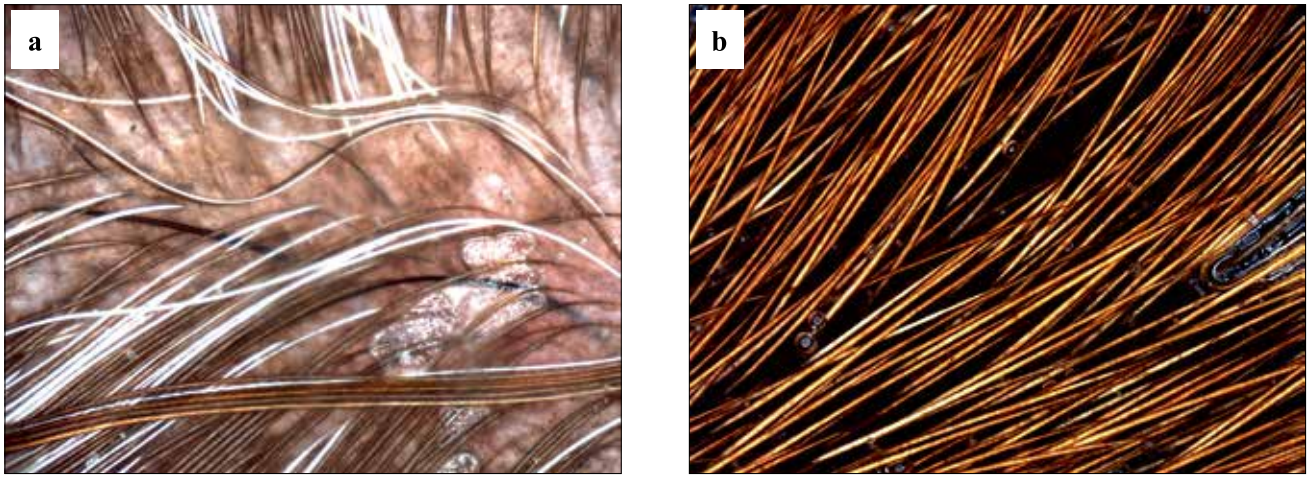

Fig. 3. Polarized dermoscopic image at 30× magnification (the area of the flank). a. In the winter, the hair on the flanks tends to be very long, making it easy to visualise the skin. b. The summer hair in this area is short and tightly covers the dark skin.

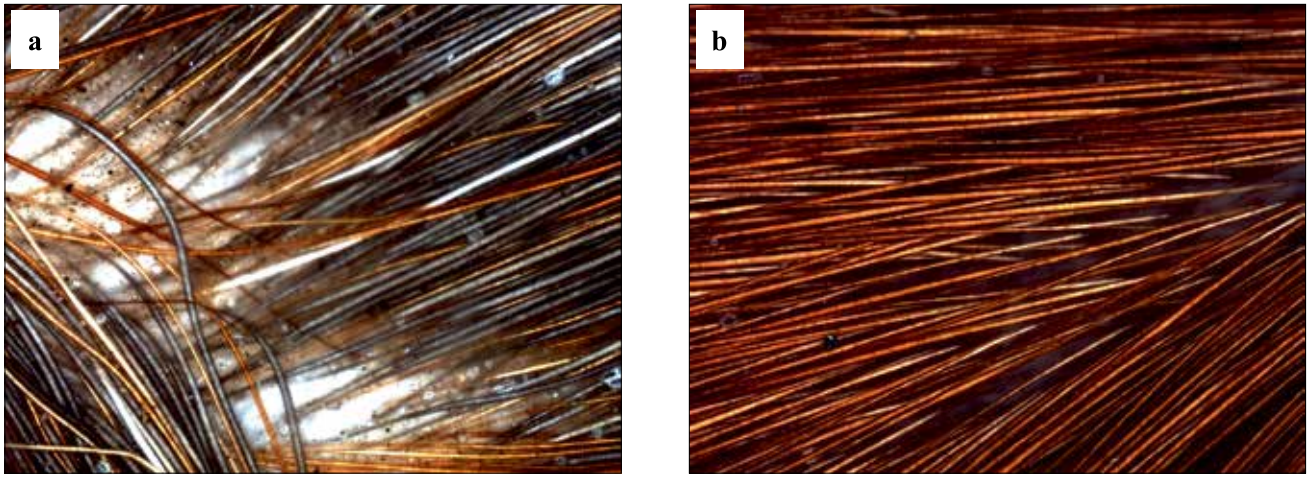

Fig. 4. Polarized dermoscopic image at 30× magnification (the area of the rump). a. In the winter season, dirt, easily visible in the photo, indicates that the nature of the hair hinders the removal of any impurities. b. In this region, compared to winter hair, summer hair is just as dense but shorter. Impurities are not visible.

Rump

Depending on the colour of the skin, hair follicles (folicular ostia) or blood vessels may be visible.

The hair in the rump area in winter is long and thick. The dirt visible in the photo indicates that the nature of the hair hinders the removal of impurities. The summer hair is just as dense and shorter, and we observe no impurities (Fig. 4.). The skin is darker in the summer.

Mane

Blood vessels are not visible

The hair of the mane is clearly thicker than hair elsewhere on the body. There are no visible differences in the hair of the mane between the summer and winter seasons. Greater skin pigmentation was noted in the summer, and in the summer, there is also a greater number of empty hair follicles from which no hair grows (Fig. 5).

Tail

The hair in the tail is slightly thicker compared to the hair elsewhere on the body, excluding the mane. There are no visible differences in the hair of the tail between the summer and winter seasons. The dirt visible in the photo indicates that the nature of winter hair makes it difficult to remove impurities (Fig. 6).

Hair thickness and hair density

Hair thickness (diameter) ranged from 44.82 (chest in summer) to 87.45 um (mane in winter). The thinnest hair in both winter and summer is on the neck and the thickest in both seasons is the hair of the mane.

With regards to thickness, it was found that in the six areas examined (head, neck, chest, rump, mane,

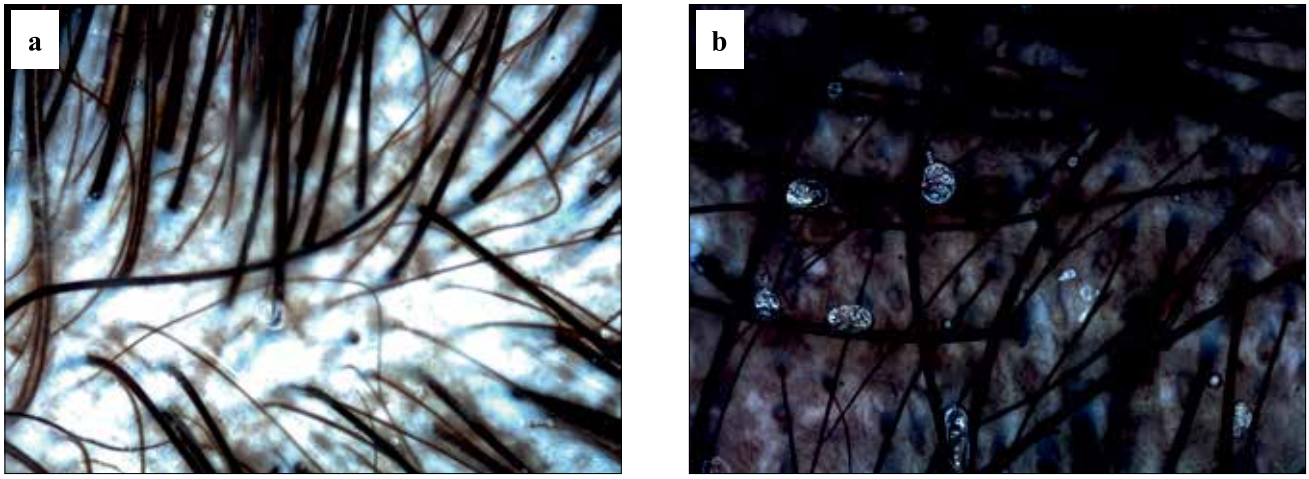

Fig. 5. Polarized dermoscopic image at 30× magnification (the area of the mane). a. There are no visible differences in the hair of the mane between the summer and winter seasons. b. Greater skin pigmentation is visible in the summer, and there is the greater number of empty hair follicles from which no hair grows.

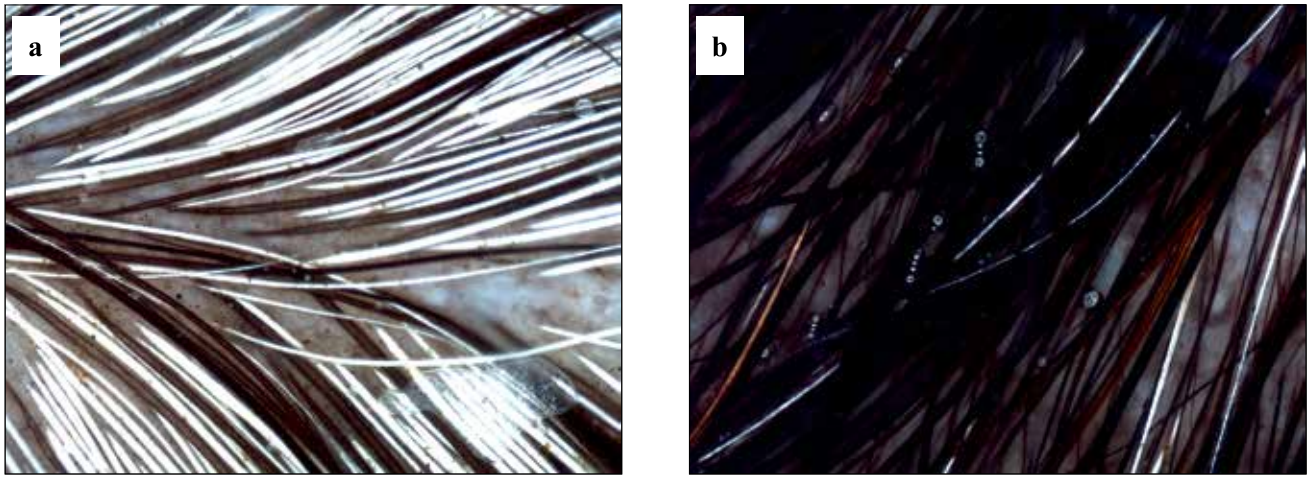

Fig. 6. Polarized dermoscopic image at 30× magnification (the area of the tail). a. There are no visible differences in the hair of the tale between the summer and winter seasons. In the winter season, dirt is more often visible in this regon. b. The skin is darker in the summer. Empty hair follicles are visible.

and tail) the hair was thinner in summer than in winter, but these differences are not statistically significant. The results regarding the thickness of the hair are presented in Table 1.

With regards to the hair density, the number of hairs in the field of view of the dermatoscope ranged from 990 (summer mane) to 3680 (winter head). In the four areas examined (head – p=0.000099, chest p=0.010525, flank p=0.030257, mane p=0.005327), hair was statistically significantly less sparse in summer. Only on the neck did amount of hair in summer exceed that in winter, but it was not a statistically significant difference. The results regarding the thickness and density of the hair are presented in Table 2.

Discussion

The coat characteristics of the same species can vary greatly both between races and within races (Morgan 1997). Primitive horses and their crossbreeds have a "thicker" and longer coat than warm-blooded breeds kept under the same conditions (Langlois 1994). Hair in different breeds may even differ in structure within the same species, which has been demonstrated in dogs (Tumiłowicz 2018). The results are most reliable if they were obtained on a homogeneous group of animals kept in a similar environment and lifestyle (Firoza et al. 2012, Duteil et al. 2017). For this reason, the research was carried out on horses of one breed kept in the same conditions.

The length of the hair of healthy horses is influenced by many factors: time of year (length of day), environmental temperature, as well as genotype,

Table 1. Comparison measurements of hair thickness (diameter) in different areas of the skin in Arabian horses in two seasons.

Head		Neck		Chest		Flank		Croup		Mane		Tail	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
55.38± 15.83	58.72± 9.05	44.82± 18.31	53.01± 8.78	49.77± 9.61	52.70± 10.37	52.99± 8.03	52.85± 9.86	51.45± 15.15	60.44± 14.36	75.54± 16.79	87.45± 23.28	52.29± 37.84	71.39± 30.97

Table 2. Comparison of the density of hair in the dermoscope field of view (9.62 cm^2) in different areas of the skin in Arabian horses in two seasons.

Head		Neck		Chest		Flank		Croup		Mane		Tail	
Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
1020.05± 666.93	3680.20± 2349.92	3004.67± 2602.04	1927.20± 611.83	1816.15± 1824.35	3501.95± 6289.09	1873.71± 1247.30	2665.82± 1566.10	1996.66± 1348.52	1458.36± 691.23	990.21± 490.56	2356.18± 3005.64	1326.21± 1066.61	1838.7± 2354.68

method feeding use (blanketing, etc.) (Cymbaluk and Christison 1989, Dunnet 2005, Bocian et al 2017).

Air temperature has been shown to be the main factor stimulating the hair growth (Pruski et al. 1963, Brinkmann et al. 2012, Bocian at al. 2017). During the winter season, a phenomenon called piloerection occurs. This is the organism's physiological response to low temperature, and its primary importance is that of thermal insulation (Tansey and Johnson 2015).

In piloerections the hair is lifted and twisted in different directions, which in turn generates a longer hair length and has a positive effect on the body's isolation from the environment. Piloerection can increase the depth of the hair coat by 10-30% (Young and Coote 1973, Bocian at. al. 2017).

In Central European conditions, the change of the coat from winter to summer begins in horses in September (Young and Coote 1973, Akajewski 1994, Bocian et al. 2017). That is, the seasonal shedding of hair and the change of coat are therefore associated with the adjustment of body temperature to the external weather conditions (Harkey 1993, Davies et al. 2006). The distribution of the hair coat on the horse's body is a direct result of thermoregulation (Stenn and Pans 2001) and the hair on different parts of the body has various effects on maintaining the optimal body temperature. Earlier studies have shown that both the thickness and the amount of hair may differ on individual parts of the body of horses of the same breed (Pomorska et al 2021). The hair is most dense on the head and chest, while the thickest hair is on the mane and tail.

Our research showed that the season of the year influences the amount of hair without significantly affecting its thickness. Although the hair in winter was thicker in almost all areas examined (six out of seven assessed), it was not a statistically significant difference. The number of hairs was greater in most areas in winter (also in six out of seven of the examined areas, of which the differences were significant in 4). Winter hair is, therefore, first of all, denser than summer hair. A likely explanation for the increased amount of hair in winter may be that some of the hairs stopped growing during the summer. This may mean that not all hairs enter the active growth (anagen) phase during the summer. With regards to the qualitative assessment of the skin, it is worth paying attention to the increase in pigmentation in the summer period, which should be associated with increased exposure to UV radiation resulting from both the season and the scarcer, shorter, and thinner hair. Darkening of the skin due to sunlight is well known in the case of skin diseases in dogs which develop non-inflammatory alopecia (such as in alopecia x) (Scott 2001). The other qualities of the skin did not differ significantly between the assessed seasons.

Summing up, the change in hair density between seasons in horses depends primarily on the increase in their number, and to a lesser degree on the hair thickness.

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