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STUDIES ON THE HAIRCOAT OF HOLESTEIN FRIESIAN CALVES IN RELATION TO THEIR FUTURE PERFORMANCE

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ABSTRACT

This experiment was carried out using 397 newly born Friesian Holstein calves to study some of hair coat characteristics during the different seasons up to one year of age and their relations to some physiological parameters and animal body weight. Hair coat measurements involved field observations (coat depth, density, curliness and luster) and laboratory measurements (fiber density, fiber length, fiber crimping and fiber shedding). Physiological parameters dealt with rectal temperature, skin and hair temperature and respiration rate.

In the present study, hair coat characteristics of calves showed strong seasonal variations. Coat type was short, more medullated, less dense and had a very few number of crimps in summer, whereas in winter it was dense, long and low in percentage of medullated fibers.

Physiological parameters showed higher values in summer than those in winter season. Temperature gradients of rectal temperature and each of skin temperature, mid point coat temperature and surface coat temperature showed a higher value for insulation during winter season than those of summer.

Daily weight gain showed high positive correlation ($P<0.01$) with fiber density (0.611), fine undercoat length (0.603), coarse undercoat percentage (0.719), coat depth (0.838), curliness (0.734) and belly cover depth (0.775).

It could be concluded that the seasonal fluctuations in hair coat characteristics might be regarded as one means of animal adaptability to the environmental factors which surrounded the animals. Such fluctuations had also strong correlations with the physiological responses of animal body as well as with daily weight gain.

Keywords: Friesian calves, hair coat characteristics, physiological parameters, body weight

INTRODUCTION

The coat of cattle is an important integument, as it represents the boundary between the animal and its surrounding environment and affects the response of animals to that environment (Udo, 1978).

The seasonal changes in hair coat characteristics were reported to assist the animal to preserve its thermoregulation. Kassab & Stegenga (1965) and Udo (1978), for example, reported that in summer season the coat of Holstein Friesian cattle was shorter, thicker, more medullated and less dense than that of late autumn and winter where the thicker short hairs started to shed to give way to longer and thinner hairs. Thus the evaluation of various hair coat characteristics (density, medullation, depth and hair length) was considered useful to give a morphological description of the seasonal

changes (Ibrahim, 1979; Gonindiah & Nagaroenkar, 1983 and Benjamin, 1985).

Hair coat characteristics were found to affect some physiological parameters (rectal temperature, skin temperature, respiration rate) and the performance of animals (Udo, 1978 and Mount, 1980). In this concern, Ibrahim (1979) and Finch (1983) showed that the calf with long woolly coat would not be able to dissipate heat during summer months, thus, depressing the physiological functions, whereas a sleek shallow coat in cattle during summer would be in favour of thermal balance and maintenance of productivity.

The aim of the present work was to study some hair coat characteristics of Holstein Friesian calves from birth to one year of age for the animals born during winter and summer, and their relation to some physiological responses and productive traits.

MATERIALS AND METHODS

This experiment was carried out in a commercial farm (Koneiset Damsheet) in Gharbia Governorate where 397 newly born Holstein Friesian calves during winter and summer season were used to study the different hair coat characteristics during the four seasons up to one year of age. Numbers of calves were as follows:-

Season/year	Number of calves
Winter 87/88	103
Summer 88	92
Winter 88/89	101
Summer 89	101

1-Management:

Calves suckled the colostrum for the first week, after which they were transferred to boxes, for 45 days, where they received 4 lb. of milk replacers (16.52% spray dried whey, 26.25% soy protein concentrate, 0.02% L-lysine, 0.04% methionine, 22.51% lactose, 33.75% fat, 0.36% limestone, 0.50% mineral premix and 0.05% chlortetracycline) diluted with water in buckets and were given twice daily (2 lb each). In addition, calves were given about 250 gm of starter ration (yellow corn, cotton seed meal, wheat bran, molasses, bone meal, lime stone, salt, mineral mix. and vitamin mix.). Starter ration was provided only up to 45 days of age.

After this period, calves were moved to semi-open yards where the amount of milk replacers gradually decreased to about 2 lb twice daily (1 lb each). At the age of 90 days calves were weaned. After weaning, calves were fed roughage, rice straw or clover hay *ad lib.* and a concentrate mix. (43% yellow corn, 29% wheat bran, 15% sesame meal, 10% soybean, 2% lime stone and 1% salt. This was offered to the animals twice daily at 9.00 a.m. and 15.00 p.m. and ranged from 200 gm (at 3 months of age) up to 750 gm (at one year old). Water was always available to the animals.

2-Hair coat characteristics:

- Coat depth was measured in centimeters using a ruler, as the distance from the skin to the outer surface of hair coat.

- Coat density was measured using a scale of 3 where 1, 2 and 3 corresponded with dense, intermediate and low in fiber density, respectively (Plates 1 and 2).
- Curliness was determined using a scale of 3 where 1, 2 and 3 corresponded with very crimpy, crimpy and straight fibers, respectively.
- Belly cover degree was classified into 3 categories were 1, 2 and 3 indicated 1/3, 2/3 and a total area of the belly that was covered with fibers.
- Belly cover density and depth was determined as mentioned above.
- Luster of fibers was recorded as lustrous or not lustrous fibers.

Observations on the coat were made on six positions of the animal body; three dorsal (withers, back, hip) and three lateral (shoulder, mid-side, britch). These measurements were recorded at birth and at monthly intervals up to the age of 12 months. Calves were also weighed at the same intervals.

3- Laboratory measurements:

Fiber density was measured for a known area and sample weight , where a small tuft of hair sample, containing not less than 200 fibers was taken, weighed and sorted according to hair length and thickness into an outercoat and an undercoat. The outercoat fibers in turn were classified into medullated fiber of types A, B, C & D in which medulla occupied about 90, 70, 50 & 30% of the fibers volume, respectively.

- Fiber length was measured in millimeters using a ruler.
- Fiber crimping: fibers of the under coat were classified into coarse undercoat and fine undercoat, within each type, fibers were classified according to number of crimps/cm.
- Fiber shedding was determined as shed fibers, with an obvious club end, fibers about to shed, with the stalk before shedding and non shed fibers were counted.

4- Physiological parameters:

Physiological parameters were recorded at birth and at monthly intervals up to the age of 12 months. Parameters were taken at 8.00 h. and 14.00 h. at which, relative humidity and ambient temperature were recorded. Meteorological data of the region throughout the different seasons are recorded in Table (1).

Table (1) Metrological data of the region:

Elements	Air temperature (C°)			Wind speed (km/hour)	Relative Humidity %	Rainfall (mm)
Months	Maximum	Minimum	Average			
Jan	18.50	7.50	13.00	10.41	74.00	13.00
Feb	19.00	7.50	13.25	12.08	65.00	8.00
Mar	22.00	9.00	15.50	11.54	64.00	8.00
Apr	27.00	12.50	19.75	13.00	60.00	3.00
May	31.00	15.00	23.00	11.16	53.00	1.00
Jun	33.00	17.50	25.25	10.58	56.00	0.00
Jul	33.00	20.00	26.75	9.11	66.00	--
Aug	33.00	20.00	26.75	7.82	70.00	--
Sep	31.50	17.50	24.50	7.44	68.00	0.00
Oct	30.00	15.00	22.50	8.36	65.00	2.00
Nov	25.00	12.50	18.75	8.36	70.00	4.00
Dec	20.00	7.50	13.75	9.28	73.00	13.00
Mean annual	27.00	13.46	20.23	9.93	65.33	5.20

Rectal temperature was measured by a clinical thermometer inserted in the rectum for one minute. Skin temperature was taken using a telethermometer placed on the skin at the mid-side region. Hair temperature was taken at the hair surface and at a mid-point of the fibers using a telethermometer. Respiration rate was determined by counting the flank movements per one minute using a stop watch.

5- Statistical analysis:

Means and correlation analyses were calculated by SAS computer program (1988). Total variance was portioned into parts attributed to non-genetic source of variance assumed to influence each trait. Factors included in the model thought to exert an effect on hair coat characteristics and the physiological parameters were; season, sex, parity, year, body region, colour and age.

For filed observations the fixed –effect linear model was;

$Y_{ijkl} = U + S_i + H_j + P_k + R_l + b_{1\,x\,ijkl} + b_{2\,x}{}^{2}{}_{ijkl} + e_{ijkl}$

Where;

Y is the observation.

U is a general mean.

S_i is the effect due to i^{th}, season of observation, i = 1, 2, 3 and 4.

H_j is the effect due to $_j{}^{th}$, sex of animal $_{j = 1 \text{ and } 2}$

P_k is the effect due to k^{th}, parity, k = 1, ... and 6

R_l is the effect due to l^{th} year, l = 1 and 2

b_1 (x) is the partial regression coefficient of Y_{ijkl} on age.

b_1 $(x)^2$ is the partial regression coefficient of Y_{ijkl} on $(age)^2$.

e is a random error.

For laboratory observations of hair coat characteristics the model was;

$Y_{ijklm} = U + S_i + H_j + X_k + O_l + N_m + e_{ijklm}$

Where;

Y is the observation.

U is a general mean.

S_i is the effect due to i^{th}, season, i = 1, 2, 3 and 4.

H_j is the effect due to $_j{}^{th}$, sex of animal $_{j = 1 \text{ and } 2}$

X_k is the effect due to k^{th}, age, k = 1, ... and 12

O_l is the effect due to l^{th}, colour, l = 1and 2

N_m is the effect due to m^{th}, body region, m = 1, ... and 6

e is a random error.

RESULTS AND DISCUSSION

1- Seasonal changes in hair coat characteristics:-

Field observations of hair coat characteristics (Table 2) showed that the highest values of hair density, hair coat curliness and belly cover degree score were encountered in winter whereas the lowest scores were those of summer (see plates 1 and 2).

Table (2): Seasonal changes of field observations of coat density, curliness, luster, colour and belly cover degree scores in Friesian calves (Means ± S.E.)

Trait	Season				Total average
	Winter	Spring	Summer	Autumn	
Dorsal coat density	1.37a ± 0.081	2.23b ± 0.127	2.37b ± 0.237	1.85b ± 0.134	1.54 ± 0.191
Lateral coat density	1.36a ± 0.137	2.25b ± 0.211	2.38b ± 0.178	1.83b ± 0.235	1.55 ± 0.203
Curliness	1.89a ± 0.213	2.62b ± 0.316	2.69b ± 0.273	2.54b ± 0302	2.49 ± .0445
Luster	1.65 ± 0.174	1.76 ± 0.310	1.39 ± 0.093	1.57 ± 0.123	1.51 ± 0.238
Dorsal colour	1.58 ± 0.213	1.57 ± 0.128	1.35 ± 0.372	1.55 ± 0.163	1.55 ± 0.231
Lateral colour	1.59 ± 0.279	1.59 ± 0.413	1.59 ± 0.313	1.56 ± 0.273	1.58 ± 0.312
Belly cover degree	2.61a± 0.274	2.00a ± 0.312	1.53b ± 0.279	2.20a ± 0.312	1.99 ± 0.237

Means with different letters in the same column are significantly different (P<0.05).

Laboratory observations of some hair coat characteristics also revealed a seasonal trend (Table 3). The most pronounced differences in hair coat characteristics occurred between winter and summer. In winter, for example, values of outer coat length and number of crimps/cm in coarse under coat were about twice as those in summer. On the other hand, percentage of medullated fibres in summer was 2.5 times as that of winter, also medullation index in summer reached about twice as that of winter. However, values of fibre density, coat depth, belly cover length, fine under coat length and number of crimps/cm in fine under coat in winter were three times as much as those of summer. In other words, during winter hair fibres were characteristically long, more dense, more crimpy and less medullated. These characteristics underwent great changes in summer to give shorter, less dense and more medullated fibres. Changes in the coat structure among seasons might throw some light on the role of some hair coat characteristics in thermoregulation, and hence adaptation to the external environment.

Results obtained were in agreement with those of Kassab and Stegenga (1965), Udo (1978)and Gebremedhin (1987). They concluded that cyclic changes in hair coat characteristics particularly in summer and winter seasons might help the animal to become more adapted to the environmental factors in those seasons. However, biological and histological studies might be necessary to throw some light on the seasonal changes of hair coat characteristics. Dowling and Nay (1960), working on different strains of beef Shorthorn cattle, reported that hair follicles underwent two resting and two active phases in the year even in a tropical environment. In this connection, Udo (1978) added that seasonal changes in fibre density could be attributed to some empty follicles in spring and summer, where follicles produced non medullated hairs in autumn and shed their hairs in spring to remain empty in summer.

Plate 1 : An insulating winter coat type, with dense, long and less medullated fibers.

Plate 2 : Smooth summer coat type, with short, less dense and more medullated fibers.

Table (3) Seasonal changes of some hair coat characteristics in Friesian calves(Means±SE)

Traits / Season	Fibre density /cm²	Belly cover length cm	Outer coat		Fine under coat			Coarse under coat			Medullation index
			%	Depth mm	%	Depth mm	No. of crimps/cm	%	Depth mm	No. of crimps/cm	
Winter	973.45a ±121.23	2.93a ±0.513	30.76a ±3.12	32.53a ±4.15	40.88a ±7.13	15.13a ±1.31	3.16a ±0.351	28.36a ±4.19	14.07a ±2.17	2.95a ±0.378	29.73a ±4.14
Spring	615.14b ±83.11	2.30b ±0.63	47.97b ±6.73	25.13b ±3.70	26.75b ±4.13	10.54b ±0.47	2.97a ±0.278	25.28a ±2.78	9.93b ±1.38	2.13a ±0.21	37.11b ±6.81
Summer	302.17c ±43.12	0.95c ±0.429	79.73c ±9.35	15.59c ±2.48	9.34c ±2.35	4.77c ±0.523	1.01b ±0.16	10.93b ±2.14	4.08c ±1.02	1.12b ±0.09	59.43c ±8.33
Autumn	495.89d ±52.14	1.56d ±0.324	49.36b ±6.39	23.54b ±3.74	26.87b ±5.14	7.33c ±0.359	1.95c ±0.132	23.77a ±4.17	8.11b ±2.34	1.73b ±0.08	41.18d ±6.84

Means with different letters in the same column are significantly different (P<0.05).

In the present work, two peaks of fibre shedding (Table 4) were encountered in autumn and spring, during which density showed low values, confirming the observations of Udo (1978). It should be added that the lowest percentage of shedding in winter (Table 4) indicated that animals retained more persistent fibres required for heat conservation that was necessary for the cold weather.

Table (4): **Average percentages ± S. E. of fibres (shed & about to shed) as percentages of the outer coat in different seasons in Friesian calves**

Season	Position						Dorsal average	Lateral average	Total average
	withers	Back	Hip	Shoulder	Midside	Britch			
Winter	9.80a ± 0.314	11.56a ± 1.161	10.37a ± 0.629	10.20a ± 0.544	9.35a ± 0.676	8.57a ± 0.435	10.56a ± 0.217	9.37a ± 0.432	9.95a ± 0.537
Spring	31.50b ± 0.505	33.10b ± 0.575	36.03b ± 0.560	33.73b ± 0.669	33.57b ± 0.682	32.01b ± 0.619	33.52b ± 0.739	33.09b ± 0.378	33.31b ± 0.973
Summer	16.71c ± 0.863	14.32a ± 0.790	14.21a ± 0.650	12.50a ± 0.501	14.62c ± 0.700	14.74c ± 0.599	15.05a ± 0.563	13.93a ± 0.637	14.47a ± 0.537
Autumn	36.98b ± 0.743	39.65b ± 0.661	35.05b ± 0.631	35.73b ± 0.745	35.45b ± 0.701	35.01b ± 0.753	37.18b ± 0.938	35.41b ± 0.817	36.32b ± 0.937

Means with different letters in the same column are significantly different (P<0.05).

2- Interrelationships of hair coat characteristics:-

High positive simple correlation coefficients (P<0.01) were encountered (Table 5) between coat depth and each of coat density and hair coat curliness. About 60% and 40% of the variability in coat depth could be explained by coat density and hair coat curliness, respectively. High correlation coefficients between belly cover density and each of belly cover length and belly cover degree (P<0.01) showed also that 38% and 60% of the variability in belly cover density could be accounted for by belly cover length and belly cover degree.

Table (5) Simple correlations (r) between hair coat characteristics

	Coat density	Coat depth	Curliness	Belly cover depth	Belly cover density
Belly cover degree	0.453	0.335	0.445	0.536	0.776
Belly cover density	0.576	0.543	0.463	0.617	
Belly cover depth	0.436	0.663	0.237		
Curliness	0.513	0.632			
Coat depth	0.776				

*** significant at p < 0.05, ** significant at p < 0.01**

It was suggested that the different values of correlation coefficients between hair coat characteristics might be due to physiological background of these characteristics (Udo, 1978). For instance, in winter months coat type becomes more dense, long, with fewer medullated fibres and tends to have a higher coat depth than that of summer. Therefore, the strong positive correlations particularly between coat depth and coat density, belly cover density and belly cover depth and between belly cover degree and belly cover density might explain the role of these characteristics in physiological responses of animal body to the environmental factors. However, Bennett (1964) confirmed this opinion when he recorded correlation coefficients of

0.948 and 0.976 between still air in hair coat and each of coat density score and coat depth, respectively.

3- Hair coat characteristics and physiological parameters:-

Relationships between physiological parameters and hair coat characteristics (Table 6) revealed the magnitude of association between them. It was of interest to note that high correlation coefficients were recorded between coat depth and skin temperature, between coat density and skin temperature and between curliness and each of rectal temperature and skin temperature. Some high correlation coefficients were also reported (Table 7) between skin temperature and each of outer coat length, outer coat percentage, fine under coat length, fine under coat percentage and number of crimps/cm in the under coat type. In winter, these hair characteristics are favorable, the increase of which would be advantageous to thermoregulation. However, high correlation coefficients, particularly between rectal temperature and each of outer coat length, outer coat percentage and medullation index would explain also the role of hair characteristics in heat dissipation.

4- Hair coat characteristics and body weight gain:-

High positive correlations were encountered (Table 8) between daily gain and each of coat depth, curliness and belly cover depth ($P<0.01$). In this respect about 70.22, 60.06 and 53.87% of the variability in daily gain could be explained by each of coat depth, belly cover depth and hair coat curliness, respectively. In laboratory observations (Table 9) high positive correlations were found between daily gain and each of coarse under coat percentage, number of percentage/cm of fine undercoat of fibers, fibre density and the medullation index, where about 51.70, 42.90, 37.33 and 50.84% of the variability in daily gain could be explained by the above traits, respectively. However, Schleger and Turner (1960) recorded a value of 0.705 as a multiple correlation coefficient between body weight gain and each of medulla, diameter, length, depth, curvature and follicle angle. Turner and Schleger (1970) on Hereford and Shorthorn and their crosses with Africander cattle, reported that body weight gain was significantly associated with the total number of new hairs. Correlation coefficient in this respect was 0.418. In the same way Udo (1978) found that 0.81 of variance in body weight gain was accounted for by the percentage of medullated fibres.

The high magnitudes of correlation coefficients between daily gain and some of coat characteristics might explain its role in affecting daily gain. In the present work, for example, coat type might be related to body weight gain through its influence on the efficiency of temperature regulation. The woolly dense coat type encountered in winter season tended to have a great depth, hair of low medulla and more crimps in the under coat, characteristics of which might have an important role in reducing heat transfer from the animal body, thus keeping the internal balance and maintaining the productivity. On the other hand, calves with long insulating coat in summer season might not be able to dissipate body heat which would depress the physiological conditions and the metabolic attributes which would affect body weight gain.

Table (6): Simple correlation coefficients between some of hair coat characteristics (field observations) and physiological parameters at 8.00 a.m. and 14.oo p.m. in Friesian calves.

Trait	R.T.		S.T.		R.R.		SCT		MPCT	
	8 a.m.	2 p.m.	8 a.m.	2 p.m.	8 a.m.	2 p.m.	8 a.m.	2 p.m.	8 a.m.	2 p.m.
Coat depth	0.367*	0.488*	0.753**	0.782**	0.343**	0.562**	0.493**	0.633**	0.574**	0.730**
Coat density	0.306*	0.419*	0.538*	0.637*	0.513*	0.627*	0.734**	0.813**	0.813**	0.837**
Curliness	0.793**	0.817**	0.731*	0.819*	0.413	0.417	0.316	0.517	0.418*	0.688**
Belly cover degree	0.331*	0.732*	0.237**	0.338**	0.459*	0.537*	0.533*	0.731*	0.519**	0.713**
Belly cover density	0.431**	0.581**	0.389	0.410	0.577	0.632	0.631**	0.813**	0.399*	0.573**
Belly cover length	0.252	0.335	0.428*	0.467*	0.684**	0.734**	0.509**	0.611**	0.498**	0.634**

R.T., Rectal temperature; S.T., Skin Temperature; R.R., Respiration rate; SCT., Surface coat temperature; MPCT., Mid point coat temperature ,
*** significant at P< 0.05 ** significant at P< 0.01**

Table (7): Simple correlation coefficients between some of hair coat characteristics (lab. observations) and physiological parameters at 8.00 a.m. and 14.00 p.m. in Friesian calves.

Trait	R.T.		S.T.		R.R.		SCT		MPCT	
	8 a.m.	2 p.m.	8 a.m.	2 p.m.	8 a.m.	2 p.m.	8 a.m.	2 p.m.	8 a.m.	2 p.m.
Outer coat length	0.663**	0.711**	0.843**	0.887**	0.778**	0.599**	0.133*	0.738*	0.631**	0.691**
Outer coat%	0.479**	0.654**	-0.513	0.732**	0.517**	0.618**	0.710**	0.632**	0.511	0.317
Coarse under coat length	0.618*	0.416**	0.601**	0.527	-0.813**	-0.725**	0.227	0.510	0.413	0.379
Coarse under coat%	0.519**	0.708**	0.603**	0.718**	0.389*	0.413*	0.513**	0.610**	0.314*	0.509*
Fine under coat length	-0713**	-0.513	0.833**	0.701**	0.359	-0.313	0.237	0.133	0.277	0.138
Fine under coat%	0.722**	0.618**	0.701**	0.799**	-0.412	-0.327	0.388**	0.442**	0.379	0.393
No.of crimps in fine under coat	0.314	0.218	0.618**	0.799**	0.487*	0.510*	0.403*	0.433*	0.509**	0.578**
No. of crimps in coarse under coat	0.404*	0.517*	0.784**	0.817**	0.230	0.318	0.217*	0.388*	0.411*	0.391*
Fibre density	0.298	0.273	0.801**	0.823**	0.418*	0.433*	0.217	0.338	0.308	0.355
Medullation index	0.789**	0.813**	-0.513	-0.412	-0.634	-0.711**	0.217	0.302	0.281*	0.318*

R.T., Rectal temperature; S.T., Skin Temperature; R.R., Respiration rate; SCT., Surface coat temperature; MPCT., Mid point coat temperature , significant at $P < 0.05$ ** significant at $P < 0.01$

Table (8): Simple correlation coefficients between daily gain and some hair coat characteristics in Friesian calves.

Hair coat characteristics / Trait	Coat depth	Coat density	Curliness	Belly cover degree	Belly cover density	Belly cover depth
Daily weight gain	0.838**	0.484**	0.427	0.427	0.464	0.775**

** significant at $p < 0.01$

Table (9): Simple correlation coefficients between daily weight gain and laboratory observations of some hair coat characteristics in Friesian calves

Hair characteristics	Outer coat		Fine under coat			Coarse under coat			Fibre density/cm^2	Medullation index
Trait	%	Length mm	%	Length mm	No. of crimps/cm	%	Depth mm	No. of crimps/cm		
Daily weight gain	0.372*	0.418*	0.411*	0.603**	0.655**	0.719**	0.381*	0.513*	0.611**	0.713*

* significant at $p < 0.05$ ** significant at $p < 0.01$

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دراسات على غطاء الشعر في العجول الغريزيان وعلاقة ذلك بمستقبل أدائها

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أجريت هذه التجربة باستخدام عدد ٣٩٧ من العجول الغريزيان عمر يوم وذلك لدراسة بعض خصائص غطاء الشعر خلال المواسم المختلفة حتى عمر عام كامل وعلاقة ذلك ببعض المقاييس الفسيولوجية المختلفة وأيضا وزن الجسم. اشتملت مقاييس الشعر على بعض القياسات الحقلية (عمق الغطاء، كثافة الشعر، التعرج وأيضا درجة لمعان الشعر)، بينما اشتملت المقاييس المعملية (على كثافة الألياف، طول الألياف، درجة التعرج وأيضا معدل سقوط الألياف). اشتملت المقاييس الفسيولوجية (على درجة حرارة الجسم، درجة حرارة كل من الجلد والشعر بالإضافة إلى قياس معدل التنفس).

أظهر غطاء الشعر للعجول الغريزيان في هذه الدراسة تباينا موسميا واضحا حيث كان غطاء الشعر قصيرا محتويا على كثير من الألياف النخاعية، أقل كثافة وأيضا يحتوى على أقل عدد من التعرجات خلال موسم الصيف. على النقيض من ذلك تميز غطاء الشعر خلال موسم الشتاء بكونه كثيفا، طويلا ومحتويا على أقل نسبة من الألياف النخاعية.

أظهرت المقاييس الفسيولوجية (درجة حرارة الجسم، درجة حرارة الجلد ومعدل التنفس) أيضا تباينا واضحا خلال المواسم المختلفة حيث سجلت هذه المقاييس معدلات أعلى في موسم الصيف عنه في موسم الشتاء. سجل التدرج الحراري بين كل من درجة حرارة الجسم وكل من درجة حرارة الجلد ودرجة حرارة الشعر (عند السطح والمنتصف) قيما أعلى في موسم الشتاء عنه في موسم الصيف مما يعكس أهمية غطاء الشعر فى عملية العزل أثناء موسم الشتاء.

أظهر معدل النمو اليومي ارتباطا ايجابيا (عند مستوى معنوية ١%) مع كل من كثافة الشعر (٠,٦١١)، غطاء الشعر الداخلي (٠,٦٠٣)، نسبة الألياف النخاعية الداخلية (٠,٧١٩)، عمق الغطاء (٠,٨٣٨)، درجة تعرج الألياف (٠,٧٣٤) وأيضا عمق الغطاء في منطقة البطن (٠,٧٧٥).

من النتائج المتحصل عليها في هذه الدراسة يمكن الاستنتاج بأن التباينات الموسمية في غطاء الشعر تعد أحد الوسائل الفعالة لأقلمة الحيوان للظروف البيئية المحيطة به. مثل هذه التغيرات تلعب أيضا دورا فعالا فيما يتعلق بالتغير في وزن الجسم وأيضا مدى الاستجابة الفسيولوجية للحيوان.