Macedonian Veterinary Review 27, 1/2 p.47-54 (1998)
UDC: 636.3.083.6

HEALTH STATUS IN SHEEP UNDER DIFFERENT BREEDING CONDITIONS - LATENT THERMAL STRESS AND ENDOPARASITIC INVASIONS

M. Pogacnik , Polona Juntes , M. Dobeic

Proceedings of the "6th International Conference on Sheep and Goat Production and 4th Symposium on the Reproduction of Domestic Animals" September 9-11, 1998 Ohrid, Macedonia

Climate is one of factors that can affect some animal physiological processes, which can be shown on the animal health status and production outcomes. Due to latent thermal stress (sensible heat loss), decreased immune resistance can occur and the result can be manifested in higher incidence in intestinal parasite's infestation. The scope of our investigation was to establish the influence of different grazing conditions on the body surface temperatures measured on different parts of animal and correlation with lower weight gain and higher incidence in parasite infestation. The results showed that climate and weather conditions could influence the body surface temperature considerably, but the differences established between animals at various grazing conditions in our preliminary measurements, were insignificant.

***Key words**: sheep breeding, climate, intestinal parasites, body surface temperature*

INTRODUCTION

Owing to the fact that the sheep is a grazing (1) animal, many questions arise regarding the right approaches to management and different ways of grazing. Traditional way of grazing which is characterised by constant movement of sheep in order to obtain the food is still widely in use (2). The others alternative ways of grazing are controlled grazing and silvo-pastoral type of pasturing (3) where the animals are kept in forest pastures overgrown with trees of economic value (for crops and woods). All types of grazing have their own advantages and disadvantages.

Our work presented in this paper, is part of the project of revitalisation and recultivation of abandoned karstic hilly areas. During other experiments which are part of this project we followed up the body weight and parasitic infestations in sheep under different grazing conditions. It came out that there are differences in body weights in animals grazing under controlled conditions and those grazing in traditional way. We were interested in how the climate can influence the body surface temperature of several exposed body areas of sheep exposed various climate conditions. The climate in forest pastures and open pastures are slightly different. Due to climate differences, certain physiological responses of sheep to the environment can change, especially heat exchange between the animal and the environment. The latter can influence other physiological parameters and results in lower health resistance and even illness. (4). In our study, we tried to establish whether there are any connections between the latent thermal stress (due to climate conditions) and higher incidence in parasite infections (due to decreased immunity) (4,5).

MATERIAL AND METHODS

1. Groups of animals

Animals included in measurements were divided in three groups, with 3 animals in each group, all together 9 animals.

The first (TH1) and the second group (TH2) of animals on which the measurements were performed, were selected from the flock of sheep grazing under controlled regime (experimental animals) on the fenced pasture. The third group (TH3) was formed of animals selected from the flock

grazing in traditional way (control animals). They were all born in the last lambing season, meaning that they were about eight months old.

During the time in which the measurements were made, the animals were kept under the same conditions as the flock they originated from. That means, the first and the second group (TH1 and TH2) were kept on fenced areas, while the animals in the group TH3 grazed together with the main flock freely walking around, during the day and were located at the same location as the main flock in the night. The first group of sheep was placed in location with bushes and some trees that protected the animals from the sun and the wind. The second group was placed in area with no trees and bushes and was exposed to the sun and the wind during the day and the cold during the night. The third group of animals, which grazed the traditional way, came to the measurement site on the other side of the valley, approximately 100 m from the first two groups of experimental animals. This place was the resting-place for the night for the whole flock and was well protected with high bushes from the wind during the night.

2. Place and season

The measurements were made in the flock of sheep located on the karstic mountain Vremščica. Pastures are located at the altitude of approximately 900 meters. This area is exposed to strong winds typical for this part of the country, the so called burra. We performed measurements in the August, when the weather conditions were rather warm and stable. They were performed for one week.

3. Measurements

3.1. Climate

We measured the air temperature, relative humidity and air speed on all three locations, with thermohygrographs (Lambrecht, Gottingen 251/28716 and hygrograph Fischer, Dreibach, type 305W2065), placed on each to register the daily oscillations in air temperature and relative humidity, and it was left there for one week. Besides the thermohygrograph, individual climate parameters (air temperature, relative humidity, air speed) were measured on daily basis with the instrument Solomat model MPM 2000 (2013).

Measurements of the climates were made in three hour intervals from 5 a.m. until 11 p.m., i.e. 7 times per day (5 a.m., 8 a.m., 11 a.m., 2 p.m., 5 p.m., 8 p.m., 11 p.m.). Each time measurements were made at six measurement sites marked TH1/1, TH1/2, TH1/3,TH2/4, TH2/5, TH2/6, TH3/7, TH3/8, TH3/9, TH4, TH5 and TH6. The parameters were measured at the stakes the sheep were tethered to, at the head height of the animals. The sites marked TH4 (pasture no.5, bottom of the valley), TH5 (near the weather house) and TH6 (on the hill above pasture 5) served as comparison. The exact position of the measurement sites is shown in picture 1.

3.2. Animals

Body surface temperature measurements of animals in groups TH1 and TH2 were made four times per day, at 5 a.m., 11 a.m., 5 p.m. and 11 p.m.. In the group TH3 body surface temperature was measured only twice, due to different management of animals and type of grazing of the main flock. In these sheep body temperature was measured at 5.a.m., before leaving of the main flock to pastures, and again after returning from a whole day pasture at 5 p.m..We measured body surface temperature of five body parts: right side of the muzzle, external part of the right ear, the right front leg under the carpus, the abdomen in front of the udder and the back. To measure the body surface temperature, we used the infrared thermometer Everest Interscience inc. model 310, serial number 998.

4. Body weight

Body weight was measured four times (monthly, from May to August) in flocks of animals, were sheep for the measurements of the body temperature were selected from. The average body weight and the weight gain off all animals in these groups were calculated (Table1).

Table 1:

Breed	Number of animals	Control periods of weighting and measuring				Average weight gain
		May	June	July	August	
K IP	5	22.8	25.5	29.6	34.3	11.5
K DRUGE	5	25.3	26.7	29.7	32.8	7.5
P2 IP	19	25	29.8	31.8	31.8	6.8
P2 DRUGE	26	27.7	32.3	33.8	33.8	5.1

5. Control of parasitic infestations

We controlled intestinal parasites infestation on regular basis, starting at the beginning of the main experiment in May and finishing in August. Altogether feces was examined for gastrointestinal parasites 13 times. At the beginning all sheep were free of parasites. At the beginning of July Eimeria spp. infestation was diagnosed and animals were treated. At the end of July and at the end of August they were treated again, due to infestation with Trichostongylus spp. At the time of climate measurements and measurements of the body temperature, the animals in both main flocks were only mildly infested with gastrointestinal parasites.

MEASUREMENT RESULTS

When measuring the climate, where temperature, relative humidity and air speed were measured, we found relatively considerable oscillations which were, however, more or less similar in all measured areas. The air temperatures (Graph 1, 3, 5) in the measured areas were between 7.5o C in the morning and 32o C in the afternoon, the values of the relative humidity oscillated between 30% at noon and 100% in the morning. The results of the air speed measurements (Graph 1 , 3, 5) showed the most deviations among the measurement sites. On average, the highest air speed was measured at TH2/6 (1.91 m/s), only somewhat lower average values were measured at TH2/5 (1.81 m/s) and TH2/4 (1.48 m/s). The measurement sites were on the open part of the pasture, where air movements were not hindered. A relatively high air speed was also measured at measurement sites TH1/3 (1.68 m/s) and TH1/2 (1.28 m/s) which were somewhat covered by trees and bushes against the wind, but closest to the open pasture. If the above averages are compared to the averages of the established air temperatures at sites TH1, as a site protected by vegetation, and TH2, as an unprotected measurement site, it can be established that the average temperatures at both measurement sites were very similar. They were slightly lower at measurement site TH1 (Graph 1). The average values of the relative humidity at TH1 were somewhat higher than at TH2 (Graph 3). Measurement site TH3 must be treated separately since animals did not stay in that area during all day. The average air speed at TH3 (Graph 5) was somewhat below that measured at TH1 and TH2 (Graph 1, 3), temperature averages were somewhat less than a grade higher, while the humidity was on average similar to that at TH2 (Graph 3).

As the air temperature together with the humidity changed in accordance with the air speed, we were interested to what measure the changing of the daily weather conditions influence the sheep body surface temperatures.

Muzzle Temperature Measurements

When measuring the muzzle temperatures, we found that they change in dependence with the temperature and air speed in the environment (Graph 2-6). That means that when the temperature in the environment falls together with the air speed, the temperature on the surface of the muzzle also drops and vice versa. On average, the muzzle temperatures were between 27.1*C and 28.8*C, with the highest temperatures being established at measurement site TH3, then TH2 and TH1 (Graph 2-6). Among the measurement sites, the temperatures of the animals' muzzles (TH1, TH2, TH3) are not characteristically different (P>0.05).

Ear Temperature Measurements

The results of the temperature measurement concerning the right ears of the sheep are, as far as the comparison with the temperature and air speed in the environment is concerned, similar to those established in measuring the muzzle. Here, a direct correlation between body surface and environmental conditions (Graph 2-6) was also established. On average, ear temperatures were from 21.8*C to 25.0*C and were on average almost equal at measurement sites TH2 and TH3 and somewhat lower at measurement site TH3 (Graph 2.6). The differences in ear temperatures of the animals between the measurement sites were not characteristic (P>0.05).

Front Leg Temperature Measurements

The measured leg temperatures were directly dependent on the changes in the air temperature and air speed (Graph 2-6), which meant that the temperature of legs decreased together with a decrease in the air temperature on the surface. On average, leg temperatures were between 22.12 oC and 24.2 oC and were, with a slight deviation, highest at measurement site TH2, while at TH1 and TH3 they were on average almost the same (Graph 2-6). The differences in the temperatures of the distal parts of animals' front legs between the measurement sites were not characteristic (P>0.05).

Abdomen Temperature Measurements

In contrast with the results of the temperature measurements of other parts of the body, we discovered that abdomen temperatures also change in dependence with air temperature and air speed, but in the opposite direction (Graph 2-6). We found that abdomen temperatures tend to increase with the lowering of the environment temperature and the simultaneous decrease in air speed. This is especially evident in measuring the sheep marked TH1/1, TH1/2, TH1/3, TH2/4 and all experimental animals at TH3. The average abdomen temperatures were from 29.4 oC to 33.6 oC and were on average the highest at measurement site TH1, then TH2 and TH3 (Graph 2-6).

The differences in the abdomen temperatures of the animals between the measurement sites were not characteristic (P>0.05).

Back Temperature Measurements

Somewhat less obvious, the measurements of back temperature of sheep compared to the temperatures in the environment showed a similar picture as with abdomen temperatures. Similar tendencies of a reverse proportions to air temperature and air speed in the environment were established when measuring the sheep temperature at TH1/2 and TH 1/3 (Graph 2-6). The average back temperatures were from 28.1oC to 31.1oC and were on average the highest at measurement site TH3, then TH1 and TH2 .

The differences in the back temperatures of the animals between the measurement sites were not characteristic (P>0.05).

The Level of Infestation with Intestinal Parasites as a Negative Influence on Weight Gain under the Conditions of the Experiment

In May, before the beginning of the experiment, we faeces samples of the animals chosen to be included in the experiment, were negative. They were also controlled in June and July. This time,

the control of the sheep in the experimental pasture showed a minor infestation with Trichostrongylidae and with some of the animals also with coccidiae. In the beginning of June, the experimental group of animals were treated against coccidiosis due to the increasing infestation with Coccidiae and, after two weeks, the state was inspected again. The treatment was successful and the control only showed a mild infestation with Trichostrongylidae in the experimental group as well as in the main flock. In July and in the beginning of August, only a small number of animals were infested severely by Trichostrongylidae (infestation level from ++ to +++). In the July-August period, the body weight of animals in the experimental group stagnated, irrespective of the mild level of infestation with parasites in both groups. The same status was established in the time of climate and body measurements.

In the last third of August, animals with established stronger infestation already prevailed in the experimental and the control groups, therefore we immediately treated them with antihelmintics. After one week, another control confirmed the successfulness of the treatment. In mid September, i.e. at the end of the experiment, we re-established the presence of Trichostrongylidae (average infestation level of +) and individual Coccidia oocysts.

Weight Gain of Animals

The analysis of the animals' weight showed that, in the pasture season of 1997, sheep which grazed in the traditional manner gained significantly more weight than those which grazed under control. That means that, in the pasture season, the sheep in the control group gained 9,5 kg of weight, whilst the sheep in the experimental group gained 6,0 kg.

DISCUSSION AND CONCLUSIONS

If we sum up the results of climate and body surface measurements, we can conclude the following: Vremščica is a karst plateau above Seno•ece, at the altitude of 1000 m above sea level. Among other features, characteristic for the karst, there are also typical weather conditions which can change very quickly. Changing weather condition mean especially the strong north wind typical of the karst. Because of the unstable weather and strong winds, grazing at the Vremščica plateau is often difficult, especially when the animals do not have appropriate protection against the sun, the wind or the rain. In areas without high vegetation an increase in air convection can results, when the air temperature is low and the relative humidity is high, and it can causes a rapid heat loss of the animal. Such environmental conditions are also on some parts of our experimental areas. Enhanced thermoregulation due to a decrease in animal's body temperature leads to increase in metabolic energy production and as a result the food conversion is worsened. The animals are exposed to latent thermal stress (6). Though sheep, having woollen coat, are less exposed to latent thermal stress than other domestic animals are, they can also be affected by changes in the weather. They are even more affected if their exercise is restricted. And, if the animals are exposed to strong sun, the possibilities for the appearance of latent thermal stress are also present (7).

Daily and nocturnal oscillations of weather conditions are common for the late summer in this karst region. Sheep, as grazing animals, are adopted to such weather conditions, with the woollen coat enabling relatively stable thermal energy balance. Sheep as a species have wide thermoneutral range, which means that they are relatively insensitive to oscillations in air temperature, airspeed and relative humidity. Though it is important that they, as grazing animals, perform exercise and as they rest, they have appropriate shelter from sun, wind, rain, especially during the night.

However, latent thermal stress due to changes in environmental factors can lead, in connection with other factors (poor quality feed, thirst, fences, etc.), to higher incidence in contracting illness and lowering the feed conversion. Controlled system of grazing is less common in our country than traditional type. Because of specific conditions, when pasture surfaces are limited, which is the case in such systems, there exsists higher possibility of heavy parasitic infestations. That fact led us to create the hypothesis that higher incidence of parasitic infestations could be the result of latent

thermal stress and sheep grazing under such conditions. Sheep in the fenced paddocks might be more sensitive due to the lack of exercise and proper shelter against bad weather conditions than sheep grazing freely. Thus, we measured body surface temperatures of the sheep in fenced paddocks at sites with enough vegetation for protection, of the sheep grazing at exposed sites with no trees or bushes offering shelter to animals and of the sheep that grazed in traditional way.

Body surface's temperatures were measured at three exposed - less hairy areas and at two well overgrown areas. We established that temperatures of the same body areas measured at sheep grazing at different conditions regarding the grazing system (controlled or traditional) and regarding the measurement site (sheltered with vegetation, no vegetation), practically did not differ (Graph 1-3). The explanation for the stated fact is logical, for sheep substitute heat loss or heat excess from the environment with their thermoregulation. The balance of energy is disturbed, catabolic energy is deducted on behalf of anabolic energy originally intended for tissue growing and production. The result is decreased food conversion and it consecutively leads towards a decreased immunity and higher incidence in health problems.

We also found that air temperature and air convection, in an almost parallel manner, influence the surface temperature in less hairy, but that in the abdomen and the back, which are well overgrown, there is an inverse proportion to the temperature and air convection. In the first case, a decrease in the environment temperature leads to a fall in the body surface temperature whilst, in the second case, the decrease in the environment temperature causes the body temperature of the fury areas to rise. The latter is also directly connected to the thermo-regulatory processes since the animals make a good use of the less overgrown areas for cooling through convection, radiation and conduction, with the furriness being a good heat insulator. Thus, low temperatures are expected to cause frostbite in areas not covered by hair while, with high temperatures, a thick woollen coat can cause thermal stress.

The measurement results do not show major differences in measurement results concerning climate factors between the measurement sites which could, in the time of the experiment, cause lower or higher production of heat or an excessive cooling of the animal surface at any of the measurement sites. There were also no large deviations in body temperatures of some parts of body surfaces.

Therefore, we can conclude that these preliminary results could not prove but also did not exclude major influences of the climate on the body temperature of sheep. For that we need more relevant results. Measurement should be repeated in a longer period with a higher number of sheep. More attention should also paid to extreme weather conditions where differences in the surface body temperature would probably be more obvious. However, we believe that animals which would be appropriately protected against various weather conditions would have a higher level of production as the living conditions would be better.

In animals which grazed in the experimental pasture in the controlled manner, higher infestation with internal parasites was found in the summer months (July, August) of the previous pasture season. The establishment of the infestation level of the animals in the experimental and the control group was thus an important factor which was assessed in the complex of negative and positive, internal and external factors, important for the weight growth of animals. To control internal parasites, we prepared a special programme adjusted to specific conditions experienced by the experimental animals. In recent years, we established major health problems in this flock mostly due to severe infestations with Trichostrongylidae and lancet fluke; consequently, the programme was appropriately adjusted.

In experimental animals, besides the fact that they grazed in a considerably limited area which is connected to the higher infestation level per surface unit compared to other pasture surfaces, a lower growth in body weight compared to control animals was reported. Considering that there were also differences in weight growth to the benefit of the control group in the period when average intestinal parasites infestation did not exceed that in the control group, a hypothesis was formulated that the influence of external factors can be the decisive or at least very important factor which has a

decisive influence on a lower weight growth of animals and indirectly also on the decrease in the general immunity. On one hand, a decrease in immunity indirectly contributes to a higher infestation of the organism with parasites, on the other hand, it also causes larger energy losses of an organism and, consequently, lower weight growth due to a lower protection of the animals on the experimental pasture against negative climate influences (low and high temperatures, precipitation with cold wind). In the grazing season of 1997, the negative influence of external factors was especially obvious in the first half of the season, mainly due to a long winter and a cold and wet spring which ended in likewise cold summer with a lot of precipitation and then turned into an expressly dry period with high temperatures.

Measurements of climate factors and the temperature of some body parts of sheep were made in the period from 11 to 17 August, 1997. Considering the results of parasitological inspections, the intestinal parasites infestation level in this period was not yet critically high. When analysing internal and external factors which could directly or indirectly negatively influence the accumulation and loss of the body energy and weight growth of the experimental animals, we excluded the parasites, with respect to the parasite infestation level in the time of the measurements, as the most important factor influencing the weight growth of animals in the experimental conditions. For when analysing weights and weight growth of young animals, we established that animals which graze in the traditional manner gained more weight than those grazing in fenced pastures. The latter, if we exclude the factor of parasite infestation, nevertheless indicated possible influences of the climate on the state of the animals. We could say that climate influences, especially if animals are not appropriately protected against the wind and the sun and at the same time do not have enough space for movement, can negatively influence the weight growth.

REFERENCES:

1. Lynch, J.J., Hinch, G.N., Adams, D.B. The behaviour of sheep, biological principles and implications for production, CAB International 1992.

2. Pogacnik M. et al. Ocena gospodarnosti reje drobnice v Sloveniji. V: Zbornik Možnosti razvoja reje drobnice v Sloveniji, Postojna, 27-29. november 1996; p:63-72.

3. Vidrih T., M. Pogacnik, M. Kotar, D. Kompan, T. Kotnik. Drevesno pašniški sistem z vidika reje drobnice. V: Zbornik Možnosti razvoja reje drobnice v Sloveniji, Postojna, 27-29. november 1996; p:25-30

4. Pogacnik M. et al. Stanje i značaj zdravstvene zaštite ovaca i koza u SR Sloveniji. V: Zbornik Značaj zdravstvene zaštite u ovčarstvu i kozarstvu, Jugoslovenski odbor za ovčarstvo i kozarstvo, XII savetovanje, Lipica, november 1988.

5. Brglez J. Nacrtno zatiranje zajedavskih bolezni pri drobnici. V: Zbornik Možnosti razvoja reje drobnice v Sloveniji, Postojna, 27-29. november 1996;p:197-202.

6. Sainsburry D. and P. Livestock health and housing, 3rd ed., Bailliere Tindall, 1988.

7. Clark J. A. Environmental aspects of housing for animal production, Butterworths 1981.

ЗДРАСТВЕНАТА СОСТОЈБА НА ОВЦИТЕ ВО РАЗЛИЧНИ УСЛОВИ НА ОДГЛЕДУВАЊЕ- ЛАТЕНТЕН ТЕРМАЛЕН СТРЕС И ЕНДОПАРАЗИТСКИ ИНВАЗИИ

М. Погачник[1], Полона Јунтес[2], М Добеиц[3]

1. Проф. Д-р на Институтот за патолошка морфологија, судска и управна ветерина, Ветеринарен факултет, Љубљански универзитет, Гербичева 60, Љубљана,Словенија

2. Д-р на Институтот за патолошка морфологија, судска и управна ветерина, Ветеринарен факултет,Љубљански универзитет, Гербичева 60, Љубљана,Словенија

3. Доц.Д-р на институтот за хигиена на околината и животните со етологија,Ветеринарен факултет, Љубљански универзитет, Гербичева 60, Љубљана,Словенија

Клучни зборови: *одгледување на овци, клима, цревни паразити, температура на површината на телото.*

Климата е еден од факторите кои може да влијаат врз некои физиолошки процеси на животното, што може да се манифестира во здрастената состојба на животното и продуктивноста на животното. Заради латентниот термален стрес, може да дојде до намалување на имунолошката отпорност, што може да се манифестира со поголема инвазија на цревни паразити. Опсегот на нашето истражување беше да се утврди влијанието на различните услови на пасење врз температурите на површината на телото измерена на различни делови од телото на животното и врската со губиток во килажа и поголемата стапка на појава на инвазија со паразити. Резултатите покажаа дека климата и временските состојби можат значително да влијаат врз температурата на површината на телото, но разликите кои беа утврдени меѓу животните во различни услови на пасење во нашите прелиминарни мерења беа незначителни.