Samen werken aan diergezondheid

Schaap en Geit

SPASTIC PARESIS AND RECTAL/VAGINAL PROLAPSE IN DUTCH DAIRY GOATS

AN UNDERESTIMATED PROBLEM

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ABSTRACT

The problem of bilateral spastic paresis posterior and prolapses vaginae and/or recti is not uncommon in the Dutch dairy goat industry. From time to time, goats are seen with the characteristic symptoms. Steep positioning, caudal stretching and crossing of the hind legs are, together with tilting of the pelvis, arching of the (lower) back and a reduced muscularization of the hindquarters, the main symptoms in goats with spastic paresis. Rectal and/or vaginal prolapse is sometimes seen in addition to the symptoms of spastic paresis in the same animal. In this investigation, surveys directed at dairy goat farmers as well as at veterinarians and feed advisors in the Netherlands on general information and issues (at dairy goat farms) and more specific on the problems with spastic paresis and prolapses have been conducted. Furthermore some farms have been visited, whereby blood have been taken from affected (case) and unaffected (control) goats. Post-mortem examination of two affected animals has been performed. The survey returned a high percentage of case farms, so it seems to be an underestimated problem in the Dutch dairy goat husbandry. Blood analysis showed (significant) abnormal values of phosphorus, CTx, CPK, GSH-Px and osteocalcine. Pathological examination provided slight signs of inflammation in cerebrum and spinal cord and little alterations in the muscles of the hindquarters. Disorders with similar symptoms are mentioned in literature, but those show similarities as well as differences. Further investigation is necessary for specific determination of the cause of this problem.

Keywords: *goat, spastic paresis, prolapse, CTx, GSH-Px, osteocalcin*

INTRODUCTION

The Dutch population small ruminants consists of 1.798.022 animals in 2011. The dairy goat husbandry with 431.418 animals covers only a small part (23.99%), but has progressively grown in the last eight years. Dairy goats are held at a total of 10.132 farms. Goats kept as a hobby are included in these numbers[1]. Professional kept dairy goats are housed at 534 farms. An average professional dairy goat farm had 691 goats in 2011. Last year (2012), the average milk yield per goat was 798 kilo and it follows a rising trend. Total production in 2012 amounted 217 million kilograms and had a value over 108 million euro (€49.77 per 100 kilo milk)[2]. The vast majority of goat milk is used in cheese products, the other part is used as milk and milkpowder[3].

In this thriving sector, however, an (so far) unknown condition seems to occur. Spastic paresis in (dairy) goats is a relatively unknown phenomenon. It is suspected that the problem has been observed for several years in the dairy goat sector, but further research has never really been performed. This will also be influenced by the fact that the problem is relatively rare and the economic damage caused by the problem seems to be limited since it often involves only a few animals which will be discarded at a single farm. However, the GD-Animal Health Service perceives information that goats with the specific symptoms of bilateral spastic paresis posterior are still observed with some regularity. A number of these cases reported the occurrence of rectal and/or vaginal prolapse in addition to the symptoms of spastic paresis in the same animals. Recently (March 2013), a dairy goat farm reported a percentage of 10% affected animals from the total of 1400 animals. In September 2013, this same farm reported the percentage of affected animals went up to 20%. On the basis of an apparently increasing number of cases, it was decided to start an investigation in order to obtain a more detailed image of this syndrome so that it could be

easier recognized in the future and practical measures could be taken upon appearance. Since the condition is not yet studied, the term spastic paresis is used provisionally to describe the abnormality. Findings during further investigation may possibly provide an alternative description describing the symptoms more appropriately. Prolapse of the rectum and vagina is initially regarded as an isolated phenomenon, but further research should determine whether there might be a connection with the symptoms of spastic paresis.

The abnormal symptoms that occur in spastic paresis are seen in many different forms which occur alternately and range in severity in different animals. Both male and female goats are affected and it is observed at different ages. A steep position of both hind legs is observed in almost all affected animals (See figure 1).

Figure 1 Steep position of the hind legs *(©Thijs Koekkoek)*

This steep position is also described in studies of the problem spastic paresis in pygmy goats[4] and cattle[5-9]. Genetic predisposition could probably also induce a steeper position of the hind leg, since it is believed to do so in horses[10].

Besides the steep position of the hind legs, hyperextension of the tarsus, metatarsus and hip joint is observed, whereby caudal stretching of the hind legs is seen (See figure 2). Flexion of the knee joint occurs. One or both hind legs are raised from the ground in cases with extreme stretching.

Figure 2 Caudal stretching of the hind legs *(©Thijs Koekkoek)*

This is also observed in pygmy goats and cattle (in case of spastic paresis). A more cranial placement of the hind legs (instead of the caudal placement) is seen in some cases, where the legs are placed under the body. In those cases, the pelvis is tilted and kyphosis occurs (See figure 3). The entire hindquarters are sometimes lifted off the ground and the animal only stands on his front legs.

Figure 3 Arching of the back, tilted pelvis and crossing of the hind legs. All of the body weight is placed on the front legs *(© Thijs Koekkoek)*

Crossing of the hind legs is seen at rest in some animals (See figure 4). The goat does not put weight on the crossed leg. The left and right hind leg are crossed alternately. No clear descriptions of this symptom is available in literature.

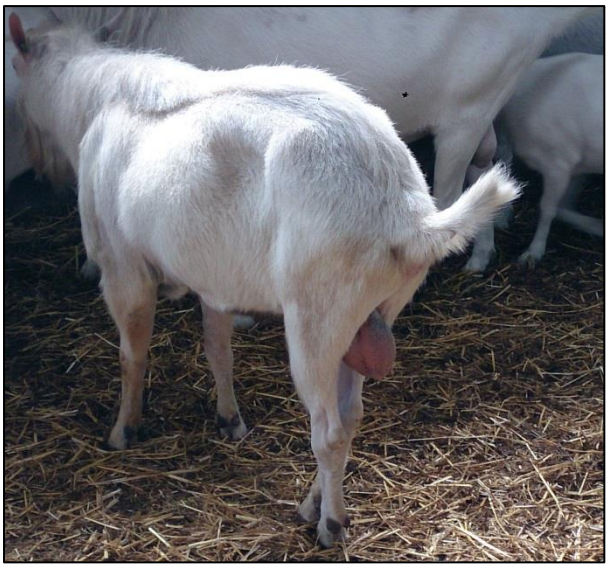

Figure 4 Crossing of the hind legs *(© Thijs Koekkoek)*

The affected animals have moderate to poorly muscled hindquarters.

The behaviour of the animals is not abnormal at first sight. The general impression showed an attentive goat that behaved normally. However, specific behaviour was observed in some animals which hind legs were placed on the raised (+20 cm) pot rim. While doing this, the hind legs were stretched out and crossed. The posture of the goats was, as mentioned above, abnormal and varied between different forms. Their movement was abnormal with stiff, stretched hind legs which were insufficiently flexed during movement. The claws are sometimes dragged over the ground.

The nutritional status varies from moderate to (too) well. It should be noted that the actual nutritional status of goats is difficult to assess by means of the manual Body Condition Score (BCS), since the storage of fat in goats is mainly internal. The condition of the coat and the claws in case animals varied from moderate to good on different farms and was equal to other animals (without symptoms of spastic paresis) in the same herd. Apart from the presence of a prolapse (rectal and/or vaginal) in some animals, there were no other prominent clinical abnormalities that occurred generally in these goats with spastic paresis.

Rectal and/or vaginal prolapse is seen in some goats with spastic paresis, but also occurs as a separate phenomenon (See figure 5). The prolapse seems to occur passively, without dyschezia. Literature mentions dyschezia, chronic coughing, denervation of the pelvic region, intoxication with zearalenone and Atropa belladonna intoxication as a probable cause of rectal and/or vaginal prolapse.

Figure 5 Some dairy goats with rectal and/or vaginal prolapses. The abnormal arched back and the stance of the hind legs should be mentioned *(©Dairy goat farmer)*

The specific symptoms, which are seen in dairy goats, are described in the literature in many other diseases, although those diseases do not cover the full spectrum of symptoms. First of all, the severity and the occurrence of the disease within the Dutch dairy goat industry was studied, by a survey. Subsequently, individual animals with the symptoms (case animals) have been visited and followed-up for further investigation. This included blood analysis and pathological examination. The results of these tests did provide information which could (partly) confirm or exclude certain diseases (mentioned in the literature) with similarities to the problem in the dairy goats.

MATERIALS AND METHODS

In September 2013 a survey has been distributed to all professional dairy goat farmers in the Netherlands with more than 100 goats (n=342). Another survey has been sent to farm visitors (i.e. veterinarians and feed advisors) of the above mentioned farms (n=160). The surveys are

attached in Annex I and II. In totally 502 surveys have been sent out. The surveys were made in the online survey tool NetQ (NetQuestionnaires Nederland B.V.). The respondents were approached digitally by email and an acclaimed letter. The survey could only be entered and filled out digitally and the response have been processed anonymously.

The survey for the visitors has been organized in order to get an impression on the occurrence and severity of the disease in the dairy goat industry in the Netherlands. Visitors often have multiple clients within the industry which gives them a broader overview of the sector.

In the other survey, dairy goat farmers were asked about the occurrence of specific events on their farm. Besides this, questions were asked on more general situation and issues surrounding their farm (such as company size, ration, housing, etc.). Depending to the given answers and only if the farmer is open to it (and provided contact details), he/she was contacted for a farm visit. This was done both in a number of case farms as well as in a number of audit farms, which are unknown with the specific clinical symptoms. When selecting these farms, an attempt was made to create a good reflection of the dairy goat industry in the Netherlands (in terms of geological distribution, number of animals, farm system, etc.). The goal has been set to visit an audit farm near every case farm, to exclude or possibly include regional influences. Results collected during the farm visits were processed completely anonymous and were never traceable to the participated farms.

A specific protocol had been prepared for the farm visits (Annex III), which focusses more closely on the abnormal signs. Besides this, the protocol also focusses on more common affairs. Those common things were noted to allow comparison between the different farms.

At case farms, blood (serum and heparin) was collected from two (2) or three (3) clinical positive goats (if possible) and also from two (2) clinically negative animals (if possible) as internal controls. At audit farms, blood (serum and heparin) was collected from two (2) to four (4) clinical negative goats for the control group of the investigation. Blood sampling was done lege artis (BD Vacutainer® Flashback Blood Collection Needle, BD Vacutainer® One Use Holder, BD Vacutainer® LH 170 I.U./BD Vacutainer® Serum Separator Tube SST™ II Advance) (Figure 6). Three (3) tubes with blood were taken from each goat (2x serum, 1x heparin). The blood was analyzed (with the different techniques) for calcium (Ultraviolet (UV)/Visible light (VIS)-spectroscopy), potassium (Ion-Selective Electrode module (ISE)), magnesium (Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP – AES)), vitamin B12 (Chemoluminiscense), Creatine Phospho Kinase/Creatine Kinase/CPK (UV/VIS), glutathione peroxidase/GSH-Px (UV/VIS),

Figure 6 - BD Vacutainer® Flashback Blood Collection Needle, Heparin and Serum Tubes *(©Thijs Koekkoek)*

anorganic phosphorus (UV/VIS), copper (Inductively Coupled Plasma Mass Spectrometry (ICP – MS)), C-terminal crosslinked telopeptide/CTx (Enzyme Immuno Assay (EIA)) and osteocalcine (EIA). The chosen analyses were accredited by the Council of Accreditation and performed by the GD-Animal Health Service, Deventer, the Netherlands.

Two (2) (or more) animals with clinical evident signs of paresis and/or prolapse (rectal and/or vaginal) were euthanized during the farm visit so they could be brought to the GD-Animal Health Service for post-mortem investigation. A specific protocol has been established for this post-mortem investigation. Besides the common post-mortem investigation, more attention was paid to

possible alterations related to the clinical signs. This protocol is added in Annex IV. The protocol also includes guidelines for further microscopic pathological investigation (i.e. which tissue sample must be taken) and conservation of tissue samples for additional investigation at a later date.

Follow-up investigations and storage of tissue samples are carried out by the GD-Animal Health Service according to standard protocols and the associated techniques.

Data-analysis has been accomplished with IBM® SPSS® Statistics Version 22.

RESULTS

The response to the surveys which were sent out to the dairy goat farmers was 28% (97/342). Among the respondents, 46 farmers (47%) indicated they had observed signs of bilateral spastic paresis posterior ór prolapse (rectal and/or vaginal) ór a combination of paresis and prolapse within the same goat(s) at their farm. The number of goats observed with signs of bilateral spastic paresis posterior was 171 due to the respondents, seen at a total of 33 dairy goat farms. The reported number of animals with prolapse (rectal and/or vaginal) was 407 on a total of 47 farms. Animals that showed both symptoms of spastic paresis ánd prolapse were seen 37 times on a total of 11 farms. The sum of reported goats with clinical symptoms was 615 animals (paresis and/or prolapse). The farming systems of the surveyed farms varied between biological (15.9%) and conventional held dairy goats (84.1%). Almost the same percentages were seen within the case farms (respectively 15.6% and 84.4%). Further blood testing or post-mortem examination earlier (on case animals) initiated by the farmers was performed at 31 case farms (67.3%). The course of the syndrome/disorders varied among the respondents. A progressive course was reported by 16.2%, the same amount of respondents reported a regressive course whereby (spontaneous) recuperation occurred. 32.5% reported a stable state whereby no progressive or regressive developments were seen. The other 34.8% of the respondents reported different courses in different goats. The bedding of both case and audit farms was in majority straw (70.6% of the kids up till 97.0% of the lactating goats). The mean size of the case farms (772 ± 363 goats) was bigger (+54.2%) than the mean size of the audit farms (501 ± 291 goats).

The response from the farm visitors to the survey was 31% (50/160). As regards the prevalence of the disease, 42.9% of the visitors reported they had seen the signs of spastic paresis, 69.4% had seen the signs of prolapse (rectal and/or vaginal) and 15.2% had seen the signs of paresis ánd prolapse within the same goat. When questioned about the probable cause of the disease, multiple answers were provided by the farm visitors. For instance heredity, ration, pregnancy and stance of the goat were mentioned. The clinical signs were seen for just a few weeks ago (3.4%) to more than five (5) years ago (31.0%) and the percentage of affected goats in a flock seems to vary from 0.5% up to 15.5%.

Before and on the basis of the response to the surveys, farm visits were planned in consultation with the farmers. Six (6) farms were visited. Two (2) of them were audit farms and four (4) of them were case farms. In purpose to ensure the privacy of the participating farms, specific observations are mentioned in common and further details of the individual farms/goats will not be discussed. Animals with clinical symptoms of either paresis or rectal and vaginal prolapse were not seen at the two audit farms. During the visit of these farms, attention was paid to recognize other diseases/abnormalities of the goats. No striking things were seen (besides a single lame goat, a kid with growth retardation and a flock of kids with respiratory problems). Both of the audit farms

were conventional. The ration of audit farm 1 consisted of silage, beet pulp, brewer's grains, flour lava, natural hay, crushed corn and straw. At audit farm 2, the ration consisted of silage, sugar beet pulp, alfalfa, standard (kids) pellets, corn and straw. Goat colostrum was administered at both audit farms, followed up by milk replacers, administered through an automatic milk feeder. The bedding consisted of straw for all of the goats and they were standing on a flat surface. Blood was subsequently taken from a number of clinical healthy goats (n=12).

62.2% of the farmers with affected goats reported they had contacted their veterinarian about the problem. Typical representatives with clear clinical symptoms of bilateral spastic paresis posterior were selected at case farms. A steep position of the two hind legs, the (spastic) stretch of both hind legs, tilting of the pelvis, kyphosis, abnormal crossing of the hind legs and moderate muscularity of the hindquarters was seen in these goats. Hypotension of the perirectal and/or perivaginal region was also seen in some cases together with the other symptoms. Sometimes in such a severity whereby rectal or vaginal prolapses occurred. All of the goats had a normal level of consciousness but by these tendencies had a clearly abnormal posture and gait. The average calcium value in case animals (2.28 ± 0.26 mmol/L) was slightly lower (-3.80%) than the average calcium value in the control animals (2.37 ± 0.22 mmol/L). The average potassium value in case animals (7.65 ± 2.71 mmol/L) was higher (+26.24%) than in the control animals (6.06 ± 1.09 mmol/L). The average value of magnesium in the case animals (1.08 ± 0.11 mmol/L) was slightly lower (-0.92%) than the average value of the control animals (1.09 ± 0.08 mmol/L). The average vitamin B12 value in the case animals (422.29 ± 171.23 pmol/L) was lower (-3.97%) than in the control animals (439.75 ± 184.75 pmol/L). The average creatine phospho kinase value in case animals (331.58 ± 146.96 IU/L) was higher (+42.00%) than in the control animals (233.50 ± 148.38 IU/L). The average GSH-Px value in case animals (750.92 ± 124.66 IU/g Hb) was lower (-7.12 %) than in the control animals (808.50 ± 184.34 IU/g Hb). The mean phosphorus value in case animals (2.39 ± 0.51 mmol/L) was higher (+1.27%) than in the control animals (2.36 ± 0.54 mmol/L). The average copper value in case animals (16.78 ± 4.23 mol/L) was slightly higher (+10.54%) than in the control animals (15.18 ± 3.73 mmol/L). The average value CTx in case animals (0.91 ± 0.45 µg/L) was higher (+24.66%) than in the control animals (0.73 ± 0.48 µg/L). The average value osteocalcin in case animals was equal to the mean value of the control animals and could not be measured in both groups (all of the results were beneath the threshold level of 5.00 µg/L, except one control animal with 5.10 µg/L).

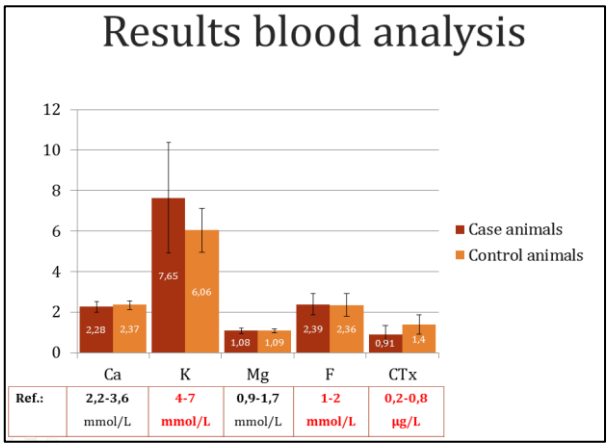

Figure 7 Results blood analysis Dutch dairy goats (case: spastic paresis; case: n=14, control: n=12; ©Thijs Koekkoek)

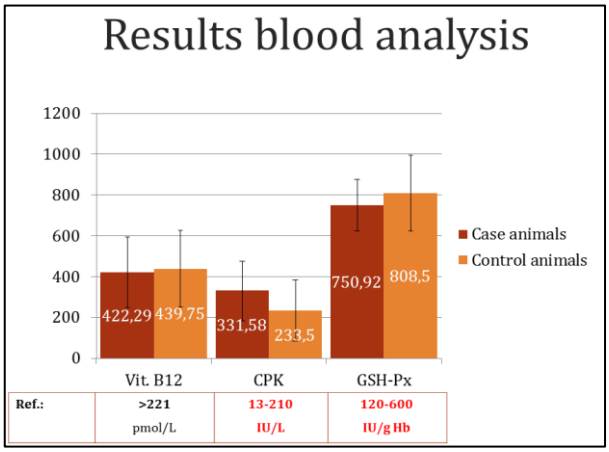

Figure 8 Results blood analysis Dutch dairy goats (case: spastic paresis; case: n=14, control: n=12; ©Thijs Koekkoek)

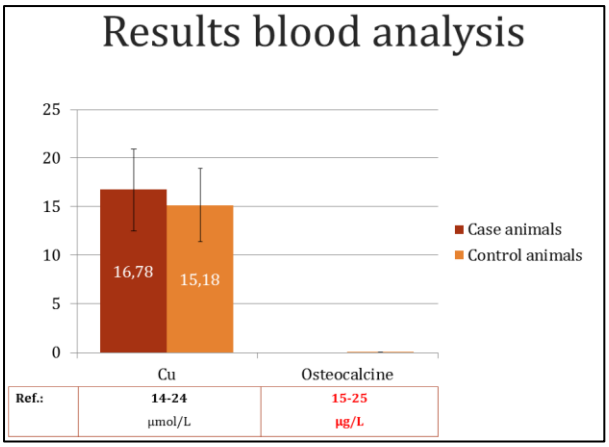

Figure 9 Results blood analysis Dutch dairy goats (case: spastic paresis; case: n=14, control: n=12; ©Thijs Koekkoek)

Pathological examination (both macroscopic and microscopic) was performed on two (2) case animals, a three (3) year old buck and a two (2) year old buck, both Saanen breed. During post-mortem examination from the three year old buck, some fibrinous material and an engorged left tarsus were found. The body condition of both animals was good or even excessive. The brains were not aberrant in both animals, as well as the oral cavity, the trachea (besides some frothy content in the two year old buck), the heart, the kidneys, the liver, the muscles, the other joints and the spinal cord. The rumen was in both animals moderately to well filled with normal roughage. The abomasum had a normal content and was adequately filled. The small intestine in both animals contained some pasty content and the colon contained little solid/paste-like contents. The rectum of the two year old animal was empty. This animal also had slightly swollen lymph nodes (lnn. mesenteriales). Pulmonary endema and swelling of the spleen has been observed in both animals.

Microscopic pathological examination is the next step in this investigation. This was done by examination of tissue samples from the truncus cerebri, medulla oblongata, cerebellum, lymphonodi mesenteriales and the femoral nerve. Tissue sections (4µ) are made out of the tissue (conservated in 10% buffered formalin and then imbedded in paraffin). The sections are stained with haematoxyline-eosine (which shows basophilic nuclei and eosinophilic cytoplasm) and examined with the use of a light microscope (Olympus) by a veterinary pathologist. No abnormalities were found in these samples. In the tissue sample, taken from the musculus semimembranosus, degeneration of a single solitary muscle fiber was detected. The tarsus of the three year old buck contained activated synovial cells and some fibrinous proteins. Also some perivascular infiltrate (with circle-shaped nuclei) was found in the spinal cord and cerebrum of this buck.

DISCUSSION

Farmers with more than 100 goats are selected to participate in the survey about bilateral spastic paresis posterior and rectal and vaginal prolapse in dairy goats. The selection has been made to specifically approach the professional farmers and exclude those who keep dairy goats as a hobby. The reason is the difference in approach of the individual animal by hobbyists. Relatively much attention is paid to the individual animal when they are kept for hobby (in small numbers), so small problems (for instance one lame animal) can be biased. The professional farmers, in contrast, only report something as a problem when a significant part of their herd is affected. Therefore their answers to the survey are much more likely a reflection of the problem within the whole (professional) sector. Besides this argumentation, this investigation focusses primarily on the professional sector were the economic aspects is also implied.

Another, different survey has been sent out to the visitors (i.e. veterinarians and feed advisors) of the dairy goat farms (with more than 100 goats). Due

to their broader view of the sector, they can provide valuable information about the occurrence of a disorder within the dairy goat industry. However, the answers given by the farm visitors should be interpreted with caution. Since visitors like feed advisors are working for commercial companies, their response may be affected by commercial interests within the sector. A possible cause of the syndrome which is financially undesirable for the visitor could be a reason to exclude some answers to the survey or even adjust them in their benefit. This can lead to a misleading result.

The survey includes a wide range of questions and care had been taken to prevent guidance in a particular direction (for instance about the cause of the disease) by the manner of questioning. As a result, the respondent is invited to provide actual facts, without influence due to the way of questioning. Since none of the questions in the survey is mandatory (to prevent early drop out), respondents may have possibly passed some certain questions without answering (whether or not due to the character of the question).

It should also be mentioned that the response of farmers (and possibly farm visitors) is closely related to the motivation of the respondent regarding to the specific problem. For instance farmers who have seen the disease on their farm are generally more motivated to participate in the survey[11]. Therefore the rate of case farms within the response can probably be distorted. On the other hand, the amount of case farms, specified by the survey, is an actual reflection of the amount of case farms whitin the Dutch dairy goat industry. Initially, the survey had been established to gain insight into the occurrence of the syndrome within the dairy goat farming in the Netherlands. Aimed is at the highest possible response, but no specific frames are drawn.

The non-response is partly due to an administrative error by providing the data of the respondents. The data should be up to date (September 2013) but after publishing the survey, it turned out the data was outdated (2009). Some farmers quickly responded saying they’re no longer active in the professional goat farming business. Most likely more of such cases exist, but no response has come from their side so far. It is also a painful fact that farmers are approached to participate in the survey when their complete herd had been culled due to Q-fever. Besides these non-respondents, farmers who aren’t familiar with the presence of the disease on their farm, are much likely less motivated to fill the survey. Also, specific questions about detailed information can be a reason for early drop out. In contrast, the survey aimed to increase the response with relatively a few, open questions with ensuring the anonymity of the respondents.

The different percentages of conventional and organic farms within the case farms seems to be an adequate reflection of the general rate differences. The percentage of case farms who had chosen to perform further investigation (i.e. blood testing or post-mortem examination) was slightly higher (+5.1%) than the percentage of case farms who had consulted their veterinarian. Submitting material (blood, organs, carcasses) for further investigation by the farmer himself (without intervention of their veterinarian) could be a possible explanation for this difference.

The course of the disease seems to be stable (no alterations) up to progressive in almost half of the cases. When compared to the conducted farm visits, this seems to be confirmed. The left percentage showed (spontaneous) recovery in the development of the disease or wide variations between individual animals. This can be explained by the fact that the evaluation of the course is a subjective observation and other diseases (lameness, stiffness, etc., with different courses) are possible mistaken for spastic paresis. Occurrence of rectal or vaginal prolapse is mentioned much more often in the survey, this is perhaps an isolated phenomenon, which is most likely not connected to spastic paresis. The rectal/vaginal prolapse seems to occur passively, without dyschezia. Distinction between prolapse due to dyschezia or due to denervation must be made, to make a relation with paresis more plausible. Hypotonia of the pelvic area seems to be present in both spastic paresis and prolapse.

The bedding of the case and control animals concerned in the vast majority straw, so an influence of litter on the disease seems most unlikely. The survey also shows a variability in farm size between case farms and control farms. At this point it should be considered that in a larger stock, occurrence ánd recognition of a disease (in one or more animals) is much more likely than in a smaller stock. The farm size therefore does not seem an immediate cause of the problem, but may contribute to the frequency of noted cases. Besides this fact, it is questionable if there is a real difference between farms with 500 and 772 goats (in terms of labor). Above 1.000 goats, it seems more likely that the company can not run without additional employee(s) and this may contribute in the number of animals detected with paresis or prolapse (either positive or negative). Beneath 1.000 goats, this appears to be less the influence.

The influence on the disease of geological location (regional differences in climate, ration, etc.) is neutralized by selecting the farm visits in such a way, that a dispersion of case and control farms over the whole country has been established. Since the southern part of the country contains a higher number of farms in comparison to the northern part, relatively more farms are visited in the southern area. This is, therefore, a good reflection of the density of dairy goat farms in the Netherlands.

Besides regional differences, the case farms selected for a visit are also linked to an audit farm in the neighboring area. This allows comparison of results between these two farms without the effect of regional differences. Therefore regional differences could be minimized or excluded as a cause of the disease. Opposite, their influence could also be confirmed.

The first blood parameter, **calcium**, is responsible for the acetylcholine release in the synaptic cleft. Hypocalcaemia causes a reduction of acetylcholine release by the motor neuron, which results in a less powerful muscle contraction[12], clinically visible as paresis. Calcium also plays an important role in the maintenance of the rest potential across the cell membrane. In the case of hypocalcaemia, the rest potential changes in such a way, that it approaches the threshold value for an action potential. In that way a small stimulus could cause muscle contraction. This stage is called hyperexcitability. The reference value of calcium for goats is between 2.2 to 3.6 mmol/L. The blood results showed normal calcium levels in both case and control animals.

Potassium is very important for the maintenance of a normal resting potential. Hypokalemia causes a reduced resting potential, whereby a much stronger stimulus is needed for an action potential, also called hyposensitivity[13]. The reference value for potassium in goats is between 4-7 mmol/L. The blood results of the case animals (7.65 ± 2.71 mmol/L) were 9.29% higher than the reference range. One goat showed a potassium level of 13.8 mmol/L, which is extremely high in comparison to the other goats. When this goat is excluded from analysis, the average potassium level from the case animals (6.77 ± 1.17 mmol/L) fits perfectly in the normal reference range.

Magnesium is essential for stimulus conduction and muscle contractions. In contrast to calcium, magnesium can only be absorbed through the ration, it can not be released from body tissues such as bone. A reduced magnesium can cause muscle cramps due to hyperexcitability[14]. In addition, bone formation is also partially dependent on magnesium[13]. The reference range of magnesium for goats is between 0.9 to 1.7 mmol/L. The blood test results of both the case and the control animals were within the normal reference range.

Vitamin B12 or cyanocobalamin is formed in the rumen by ruminants, if the ration contains sufficient cobalt. It is important for growth, myelination of the nerves and it plays a role in fertility and productivity[13]. Hypovitaminosis B12 can cause nerve damage, with associated neurological disorders and muscle weakness[15-17]. The reference range of vitamin B12 for goats is >221 pmol/L. The blood test results of both the case and the control animals were within the normal reference range.

The enzyme **creatine phosphokinase (CPK)** catalyzes the reaction between ADP (adenosine di-phosphate) and ATP (adenosine tri-phosphate). This is the formation of ADP and organic phosphate out of ATP but also the reversible reaction involving the formation of ATP out of ADP and organic phosphate[18]. When muscles are damaged, the CPK value in serum is increased[19]. The reference range of CPK for goats is between 13-210 IU/L. The blood results showed elevated levels of CPK in both case (331.58 ± 146.96 IU/L) and control animals (233.50 ± 148.38 IU/L). Literature mentions elevated CPK levels in animals that are laying a lot[20]. The system in which the dairy goats in the Netherlands are kept (always inside, relatively little distraction and a lot of feed intake) ensures that the goats spend a large part of their time lying and ruminating. This could cause an elevated CPK level (in the control animals). Pain or unpleasantness while standing could result in an increase of the time spent lying, which could cause high values of CPK in case animals (besides muscle damage).

The working mechanism of **GSH-Px** is based on the scavenging of free radicals (OH^-, H_2O_2 en O_2^-) in tissues. This will prevent tissue damage, which would occur in the absence of GSH-Px during catabolic reactions[13,21]. Selenium is an important component of the enzyme and it is fed richly in all kinds of additions to the (Dutch) dairy goats. In the standard feed, selenium is present only in a low level (with the exception of alfalfa, grass pellets and some silages[22]) causing many farmers or feed manufacturers into adding extra selenium to their products or by feeding extra supplements with selenium. This is done for the positive effects of selenium on the immune system and fertility[23]. Furthermore, it is known that goats can use the present selenium in the ration far more effective than cows. Therefore blood values generally found in goats (up to 1000 U GHS-Px/g Hb) lie much higher than the reference values[22]. Dercksen et al (2007) suggested a maintaining of the reference value for cattle (120-600 U GSH-Px/g Hb) in goats[24], but given the majority of studies which consider values up to 1000 U GHS-Px/g Hb not deviant, this seems much more likely a range to maintain (although it stays as a point of discussion). Chronically elevated levels of GSH-Px/selenium could cause stiffness, lameness, a reduced resistance and alopecia[13,22].

Phosphorus in the body is associated with oxygen and as such available as phosphate. In this form, it is present in almost every cell in the body (cell membranes, nucleic acids, ATP, etc.). Moreover, it is one of the major components of bone tissue. Hypophosphatemia may cause paresis. This phenomenon is described in cattle as Downer Cow Syndrome[13,25]. The reference values of inorganic phosphorus in goats is between 1.1 – 2.4 mmol/L. The average values in blood from both case and control animals lies within this frame (even though sometimes high normal).

Copper is a very important mineral in the body. Many enzymes contain copper and its influence on metabolism is enormous. For example, it is part of cytochrome oxidase (electron transport chain) and lysyl oxidase (bone formation). Osteoporosis is one of the symptoms during copper deficiency[13]. Copper deficiency can also result in a disease named Swayback[26]. The reference range of copper lies between 14 – 24 µmol/L. The average blood results of both case and control animals showed no deviation outside the reference range.

90% of bone tissue consists of collagen type I. During bone resorption, this collagen is degraded by osteoclasts[27]. Here, the collagen type I is degraded into different fragments. One of these fragments is **CTx**[28]. Measurement of CTx is possible in serum with an ELISA-assay (EIA, available at GD Animal Health Service, Deventer) and it gives information about bone resorption. Besides CTx, there are few more collagen fragments which could be measured in serum or urine, but a study performed by Rosen et al. showed CTx as the most appropriate marker of bone resorption[29]. This marker has been evaluated for goats[30]. The reference range for CTx, which is normally used for pigs, also seems useful for goats and lies between 0.2 – 0,8 µg/L[31,32]. The values for case animals (0.91 ± 0.45 µg/L) are slightly above the reference values, but there is a large standard deviation. Also, increased bone resorption seems a logical effect

in animals which do not pile their hind legs (secondary osteoporosis) which is the case in animals affected with bilateral spastic paresis.

Osteocalcin is released by osteoblasts and is a marker for bone formation. Besides bone formation, it also affects glucose metabolism by the hormonal stimulation of the beta cells in the pancreas (increased insulin production) and fat cells (increased insulin sensitivity)[33]. The amount of present osteocalcine is regulated by 1,25-dihydroxycholecalciferol[34]. 1,25-dihydroxycholecalciferol is formed in the kidneys during hypocalcaemia or hypophosphatemia (stimulated by PTH) out of vitamin D (25-hydroxyvitamin D) which is present in the blood[35]. Osteocalcin can be measured as well as CTx in serum using an ELISA assay. Lowered levels of osteocalcine are found during decreased bone formation en could (in combination with normal to high levels of CTx) cause osteoporosis[36]. The reference range for osteocalcine used in pigs seems useful for goats at first perspective and lies between 15 – 25 µg/L[32,37]. But, the assays revealed extremely low values in both case and control animals, which were all (except one, 5.10 µg/L) beneath the threshold level for detection (5.0 µg/L). Therefore it seems likely this ELISA-assay must be questioned when used in goats. During further investigations, blood could for example be tested for osteocalcin using a different ELISA-assay, which could possibly provide better results.

During the standard **macroscopic pathological examination**, all organs are judged on the existence of any abnormalities. If no abnormalities are found, it is not standard to take samples from specific organs (such as the kidneys), for further microscopic examination. There lies a great risk, because microscopic abnormalities could be missed during macroscopic examination. High levels of phosphate during blood analysis could for instance be caused by interstitial nephritis. The presence of interstitial nephritis could be missed during macroscopic pathological examination, so microscopic examination of some structures need to be added to the dissection protocol. Besides the kidneys in the possible case of interstitial nephritis, samples of bone in the hind legs are also added to the dissection protocol. This is done due to the elevated levels of CTx in combination with the lowered levels/absence of osteocalcin during blood analysis. Microscopic analysis of this bone samples could tell something about the bone density in the hind legs.

Tissue samples of liver and the central nervous system are conserved for further analysis, if this seems necessary on a later date.

In the introduction, the clinical signs are named as seen in the case animals in this study. Some diseases are mentioned which showed somewhat equal clinical symptoms. In literature, the problem **spastic paresis** has been described in pygmy goats[4] and cattle[5-9].

The constant contraction of the musculus gastrocnemius, the m. flexor digitalis superficialis[4,5] or the m. quadriceps[38] seems to be the main cause of the excessive stretching of one (or in some cases both) hind legs in pygmy goats and cattle at the defined condition of spastic paresis. Other muscles such as the musculus biceps femoris, m. semitendinosus, m. semimembranosus and m. adductor may also play a role in this process. All studies in this area show that the hyperextension of the hind leg is caused by hyperactivity of the myotatic reflex (stretch reflex)[39]. Hyperactivity of muscles may be caused by excessive stimulation of the muscle. Excessive stimulation could occur (under normal circumstances) by hypersensitivity of the muscle spindle. Gamma motor neurons provide the sensitivity of the muscle spindle and are therefore accountable for the response of the muscle to stimuli. If this gamma pathway is disturbed, the muscles are hypersensitive and the slightest stimuli could cause hypercontractability in the corresponding muscle[40]. Abnormal performances of the gamma motor neurons in the cases of spastic paresis seems to be the origin of hyperactivity (from for instance the musculus gastrocnemius)[39]. The reasons for this may lie in the gamma motor neurons themselves or in the central nervous system[40] and may have various backgrounds. The image of spastic paresis in pygmy goats and cattle is very similar to the image seen in the dairy goats. The only difference lies in the fact that the hind legs are mostly bilateral

affected in dairy goats, in contrast to the (mostly) unilateral problems in pygmy goats and cattle. Spastic paresis in cattle is treated in different ways. Those treatments can be called symptomatic, since the cause is still not clarified. Neurectomy of the tibial nerve is the most common treatment. The n. tibialis innervates the m. gastrocnemius and seems therefore responsible for the largest part of the disease. This treatment appears to have good results and strongly reduces the symptoms but complete recovery is still unseen[39]. Tenotomy or partial tenotomy of the tendon of the m. gastrocnemius is also used as a therapy, but besides the positive results, full recovery is not achieved. Since the susceptibility exist of a hereditary factor affecting this disease (and this can not be excluded), the advice remains (in cattle) to exclude affected animals for breeding purposes[41].

Severe, bilateral pododermatitis circumscripta is described in literature for showing symptoms, similar to those seen in the dairy goats (caudal stretching hind legs). Pododermatitis circumscripta (sole ulcer) is a claw disorder caused by trauma to the feet[42]. It can be exacerbated by infection with Dichelobacter nodosus and Fusobacterium necrophorum. If there is a sole ulcer on both hind legs, the animal could replace its hind legs more caudally in a hyperextensive stance to alleviate the pain[43]. This is similar to the symptoms that are seen in dairy goats, except the difference between a somehow forced hyperextension of the joints (in bilateral spastic paresis) and a voluntary hyperextension (in pododermatitis circumpscripta, only to relieve the pain).

The phenomenon **periodic spasticity or cramping** in cattle of different breeds is known since a long time[44]. The disease has some similarities with the problem in the dairy goats. Periodic spasticity is characterized by short-term occurrence of paroxysmal strokes in which the hind legs are stretched and muscle vibration occurs. Initially such attacks take a few seconds, but after a few months to years these attacks last significantly longer (sometimes up to 30 minutes). The condition is strongly progressive, whereby more cranially parts become also affected after a period of time, involving the neck, front legs and back. The symptoms usually occur after a period of inactivity (for example, when standing up). In addition to pain and additional trauma (e.g. through falling), the body condition score and the milk yield drop dramatically[9]. Similar symptoms are seen in dairy goats, as well as a progressive course of the disease. However, progressivity to cranial body parts were not observed in dairy goats.

Intoxication with organophosphates may lead to spasms and hypercontractility/hyperactivity of the muscles. The working mechanism of the organophosphate pesticide is based on the inhibition of the enzyme acetylcholinesterase (AChE)[45]. AChE ensures (under normal conditions) the breakdown of the excitatory neurotransmitter acetylcholine (ACh) in the synaptic cleft. If this enzyme is inhibited, there will be an accumulation of acetylcholine and thereby an hyperstimulation of the muscles[46]. In the European Union, the use of organophosphate pesticides (e.g. chlorpyrifos) is allowed by the Board for the authorization of plant protection products and biocides (College voor de toelating van gewasbeschermingsmiddelen en biociden, Ctgb[47]) as described in the Pesticides Directive (Pesticiden Richtlijn[48]). An organophosphate intoxication as such can not be excluded as a possible cause of the symptoms in dairy goat, but affection of a greater proportion of animals in a flock would hereby be suspected.

Rectal and/or vaginal prolapses could have different causes. **Dyschezia** is one of them. Coccidiosis[49], clostridial infections[50] and salmonellosis[51] are examples of infections which could lead to diarrhea and irritation of the intestinal wall by damage to the gastro-intestinal tract (at a sufficiently severe infection)[52]. No evidence had been found for an infection with coccidia, clostridial species, salmonella species or other bacterial infections during macroscopic inspection of the gastrointestinal tract. No abnormalities were found in rumen, abomasum and intestines (small and large intestines). The manure was not abnormal.

Chronic coughing is also mentioned as a cause of rectal and/or vaginal prolapse. Coughing was

not observed in goats which had symptoms of a prolapse and therefore chronic coughing can most likely be excluded as the cause of prolapses (rectal and/or vaginal).

Besides dyschezia and chronic coughing, **denervation of the pelvic region** could also cause a rectal and/or vaginal prolapse[53,54]. This initially seems an obvious cause if the occurrence of a prolapse is associated with the symptoms of spastic paresis, whereby an disturbed innervation of the muscles of the hindquarters also seems to be the problem. Normotension of the perianal and perivaginal area is absent due to the disturbance of the neural innervation. As a result, there is no counter pressure against the intra-abdominal pressure, whereby caudal protrusion of the rectum and vagina may occur (the actual prolapse). The symptoms are probably more severe in pregnant animals, because of the increased content of the abdomen during pregnancy (and therefore a higher intra-abdominal pressure). The symptoms will most likely worsen if the animals are housed on a slope underground (e.g. at the feed place), whereby gravitation will increase the caudally pointed pressure of the internal organs (and so the prolapse).

Intoxication with zearalenone is mentioned in literature as a probable cause of prolapses (rectal and/or vaginal)[55]. After ingestion, this mycotoxine can activate estrogen receptors in the body. This hyperestrogenic effect causes vulvar swelling and swelling of the mammary gland packages but also the occurrence of a rectal and/or vaginal prolapse[55,56]. Mycotoxins such as zearalenone are ingested through the ration and are commonly found in feed storage at suboptimal conditions (e.g. too moist)[57]. Affection of a large part of the flock seems likely if an intoxication with this mycotoxine is the cause of the symptoms in dairy goats. Since this isn't observed, a zearalenone intoxication seems (as well as an organophosphate intoxication) unlikely.

In addition to a zearalenone intoxication, **Atropa belladonna poisoning** could also cause rectal and/or vaginal prolapses. The anticholinergic activity of the alkaloids in the plant causes relaxation of the smooth muscle tissue in the gastrointestinal tract[58]. This could be a possible reason for the hypotension of the perianal and perivaginale region. But besides this, constipation, associated with abnormal content of the gastrointestinal tract is an often seen, secondary symptom in a belladonna intoxication. This isn't observed in case animals during macroscopic pathological examination. Besides relaxation of the smooth muscles, ataxia is a common symptom in an Atropa belladonna intoxication[59]. No signs of ataxia were seen in the dairy goats during clinical examination, so an intoxication with nightshade does not seem an obvious choice.

CONCLUSION

First of all, it seems fair to say that bilateral spastic paresis posterior and rectal/vaginal prolapses are an underestimated problem within the Dutch dairy goat industry. Because affected animals need to be culled from the farm, the economic damage of this problem is huge, since some farms reported 20% of their flock was affected.

Goats which show symptoms of paresis ánd prolapse don't strain excessively, in contrast to goats which only have a prolapse. This leads to the tentative conclusion that the prolapse (when occurring alongside paresis) is caused by hypotonia of the pelvic region and not primarily by dyschezia or excessive straining. The cause of this hypotonia, however, is still unknown. Straining is seen in those animals later in the disease, by secondary irritation of the mucosa, but doesn't seem to primarily cause the prolapse.

Concluded from the given answers to the survey, there seems to be almost no difference between the occurrence of the disease in the conventional or the organic branch of the Dutch dairy goat husbandry. There is, however, a difference between farm size in case farms and audit farms.

Based on the results of blood analysis in some animals, a few conclusion can be drawn. First of all, most of the investigated parameters do not differ between case and control animals. They also do not deviate when compared to the normal reference ranges (as far as they are defined for goats). Those parameters include calcium, potassium, magnesium, vitamin B12, phosphorus, copper and CTx. As discussed above, the reference range for CPK and GSH-Px in (dairy) goats (in the Netherlands) are most likely not useful and regarding to other studies, the values found in this investigation are not abnormal (in case and control animals).

The marker for bone formation, osteocalcin, had a measured value below the detectable limit of 5.0 µg/L in both case and control animals. Further blood analysis with this marker should probably be performed with a different ELISA-assay, since the test used in this study seems not suitable for (dairy) goats.

The abnormal, low levels of osteocalcin in combination with a normal to high CTx-value (bone degradation marker) indicates an decreased bone formation with an normal to increased bone resorption. Eventually, this process could lead to osteoporosis. However, this is seen in both case and control animals (most likely caused by the use of an unsuitable ELISA-assay), so no clear association with the specific symptoms can be defined so far.

In summary, after completion of this study, it is clear that further research is necessary to get to the cause of this underestimated problem in the Dutch dairy goat industry for more targeted action in the future.

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ANNEX I: SURVEY FARM VISITORS (IN DUTCH)

1. **In welke rol bent u betrokken bij de sector melkgeitenhouderij in Nederland?**

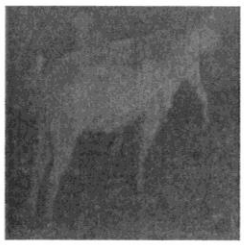
☐ Ik ben voervoorlichter
☐ Ik ben dierenarts
☐ Ik ben klauwverzorger
☐ Anders, namelijk

2. **Heeft u één of meer van de volgende verschijnselen waargenomen bij één of meerdere van uw klanten in de verschillende periodes?**

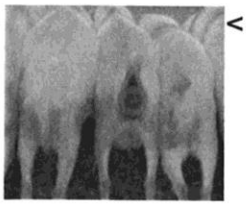
(hieronder staan voorbeelden grafisch weergegeven)

<== Voorbeeld 1: Spastische parese bij een bok, wat hierbij opvalt is een kromming van de rug en een kruising van de achterpoten.

<== Voorbeeld 2: Spastische parese bij een bok, wat opvalt is het overmatig strekken (hyperextensie) van de gewrichten in de achterpoten.



<== Voorbeeld 3: Spastische parese bij een bok, ook hierbij valt het overmatig strekken van de gewrichten in de achterpoten op.



<== Voorbeeld 4: Lijfbieden/prolaps bij een melkgeit

Aantal waargenomen dieren invullen.

	Periode **1 januari 2013 – 1 september 2013**	Periode **vóór 1 januari 2013**
Spastische parese	☐☐☐☐	☐☐☐☐
Lijfbieden/prolaps van rectum en/of vagina	☐☐☐☐	☐☐☐☐
Spastische parese én lijfbieden waargenomen bij hetzelfde dier	☐☐☐☐	☐☐☐☐

3.
Sinds wanneer ziet u deze verschijnselen? (parese en/of lijfbieden)

☐ Sinds **enkele weken tot een maand**
☐ Sinds **enkele maanden tot een half jaar**
☐ Sinds **een half jaar tot één (1) jaar**
☐ Sinds **één (1) tot vijf (5) jaar**
☐ Sinds **meer dan vijf (5) jaar**

4.
Verandert het aantal dieren dat u met deze symptomen (parese en/of lijfbieden) tegenkomt?

☐ Ja, neemt af
☐ Nee, blijft gelijk
☐ Ja, neemt toe

5.
Veranderden de symptomen (parese en/of lijfbieden) bij de aangedane dieren na verloop van tijd?

☐ Ja, het wordt minder erg/neemt af
☐ Nee, het blijft gelijk
☐ Ja, het wordt erger (progressief)
☐ Verschilt per dier

6.
Welk gemiddeld percentage van een koppel is volgens u aangedaan op een bedrijf waar eerdergenoemde symptomen (parese en/of lijfbieden) voorkomen?

☐

7.

Indien er dieren zijn onderzocht, wilt/kunt u de in uw ogen belangrijkste bevindingen met ons delen?

Kun u hier hierbij tevens vermelden welke klinische verschijnselen deze dieren vertoonden? (parese en/of lijfbieden)

8.

Wat is volgens u de oorzaak van het probleem?

9.

Indien gewenst kunt u hieronder uw persoonsgegevens invullen zodat wij u de samenvatting van ons onderzoeksrapport op kunnen sturen of zodat wij contact met u op kunnen nemen.

De gegevens worden vertrouwelijk behandeld, worden niet aan derden verstrekt en zullen nooit naar u of uw klanten te herleiden zijn.

☐ Naam

☐ Telefoon (vast of mobiel)

☐ E-mailadres

☐ Bedrijf

☐ Ik wil graag een samenvatting van het onderzoeksrapport ontvangen

10.

Heeft u naar aanleiding van deze enquête nog vragen of opmerkingen?

Deze kunt u hieronder kwijt.

11.

Wilt u dat wij nog contact met u opnemen over dit onderwerp?

U dient hiervoor uiteraard wel uw contactgegevens eerder in de enquête te hebben ingevuld.

☐ Ja
☐ Nee

ANNEX II: SURVEY DAIRY GOAT FARMERS (>100 GOATS) IN THE NETHERLANDS (IN DUTCH)

Allereerst willen wij iets te weten komen over uw bedrijf in het algemeen.

1. **Wat zijn de eerste twee (2) cijfers van uw postcode?**

   (Dit wordt enkel gebruikt om inzicht te verkrijgen in lokalisatie van het probleem)

☐☐

2. **Wat is uw bedrijfsgrootte?**

	Jonger dan één (1) jaar	Ouder dan één (1) jaar
Aantal dieren (1 januari 2011 – 31 december 2011)	☐☐☐☐	☐☐☐☐
Aantal dieren (1 januari 2012 – 31 december 2012)	☐☐☐☐	☐☐☐☐
Aantal dieren (1 januari 2013 – 1 september 2013)	☐☐☐☐	☐☐☐☐

3. **Wat is uw bedrijfssysteem?**

☐ Gangbaar
☐ Biologisch

Huisvestingssysteem lammeren

4. **Op welk type vloer staan de lammeren?**

☐ Potstal (dichte vloer)
☐ Roosters
☐ Anders, namelijk ☐

5. **Op welk type strooisel staan de lammeren voornamelijk?**

☐ Stro
☐ Vlas
☐ Zaagsel
☐ Anders, namelijk ☐
☐ Geen strooisel

Huisvestingssysteem opfok

6. **Op welk type vloer staan de opfokdieren?**

☐ Potstal (dichte vloer)
☐ Roosters
☐ Anders, namelijk

7. **Op welk type strooisel staan de opfokdieren voornamelijk?**

☐ Stro
☐ Vlas
☐ Zaagsel
☐ Anders, namelijk
☐ Geen strooisel

Huisvestingssysteem melkgeiten

8. **Op welk type vloer staan de melkgeiten?**

☐ Potstal (dichte vloer)
☐ Roosters
☐ Anders, namelijk

9. **Op welk type strooisel staan de melkgeiten voornamelijk?**

☐ Stro
☐ Vlas
☐ Zaagsel
☐ Anders, namelijk
☐ Geen strooisel

10. **Bevinden er zich andere dierensoorten op uw erf?**

Runderen	Varkens	Pluimvee (kippen, kalkoenen, etc.)	Schapen	Honden

Aantal aanwezige dieren	☐	☐	☐	☐	☐
	☐ 5–20 dieren	☐ 5–20 dieren	☐ 5–20 dieren	☐ 5–20 dieren	☐ 5–20 dieren
	☐ 20–100 dieren	☐ 20–100 dieren	☐ 20–100 dieren	☐ 20–100 dieren	☐ 20–100 dieren
	☐ >100 dieren	☐ >100 dieren	☐ >100 dieren	☐ >100 dieren	☐ >100 dieren

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11. **Heeft u (veel) last van ongedierte op uw bedrijf?**

☐ Ja ➡ Ga verder met vraag 12.
☐ Nee ➡ Ga verder met vraag 13.

---

12. **Voert u maatregelen uit ter ongediertebestrijding?**

☐ Ja, namelijk ☐

☐ Nee

---

13. **Welke hygiënemaatregelen neemt u op uw bedrijf?**

☐ Geen hygiënemaatregelen
☐ Ontsmetten (voetbad o.i.d.)
☐ Bedrijfskleding
☐ Hygiënesluis
☐ Douchen
☐ Anders, namelijk ☐

De volgende vraag heeft betrekking op het rantsoen van uw melkgeiten

---

14. **Wat is de samenstelling van het rantsoen voor de verschillende leeftijdsgroepen op uw bedrijf?**

	Geen dieren van deze leeftijdsgroep op mijn bedrijf aanwezig	**Melk**	**Standaard krachtvoer (brok)**	**Maïs**	**Kuilvoer**	**Stro**	**(Natte) bijproducten**	**Anders, namelijk**
Dieren van **0 – spenen**	☐	☐	☐	☐	☐	☐	☐	☐
Dieren van **spenen tot een half jaar**	☐	☐	☐	☐	☐	☐	☐	☐
Dieren van een **half tot 1 jaar**	☐	☐	☐	☐	☐	☐	☐	☐
Dieren **ouder dan 1 jaar**	☐	☐	☐	☐	☐	☐	☐	☐

Middels de volgende vragen willen we iets meer te weten komen over de vervanging en

uitval op uw bedrijf

15. **Wat is uw jaarlijkse vervanging?** **(van 1 januari 2012 tot 31 december 2012)**

(in aantal dieren)

☐☐☐☐

16. **In het kader van vervanging, welke reden voor vervanging is voor u het belangrijkst en welke het minst belangrijk?**

(belangrijkste reden een 1 invullen; minst belangrijke reden een 6 invullen)

	Verminderde melkproductie	Kreupelheid	Gust gebleven	Teruglopende lichaamsconditie (BCS)	Lijfbieden	Andere reden
Score (1=belangrijk; 6=onbelangrijk)	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1	☐ 1
	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2	☐ 2
	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3	☐ 3
	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4	☐ 4
	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5	☐ 5
	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6	☐ 6

17. **Welke andere reden voor vervanging bevindt zich in de top 6 op uw bedrijf?**

☐

18. **Wat is uw uitval op jaarbasis onder de verschillende leeftijdsgroepen in de aangegeven periodes?**

(Aantal dieren invullen)

	0 – Spenen	Spenen – half jaar oud	Half jaar oud – 1 jaar oud	Ouder dan 1 jaar
Uitval tussen **1 januari 2011 – 31 december 2011**	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
Uitval tussen **1 januari 2012 – 31 december 2012**	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
Uitval tussen **1 januari 2013 – 1 september 2013**	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐

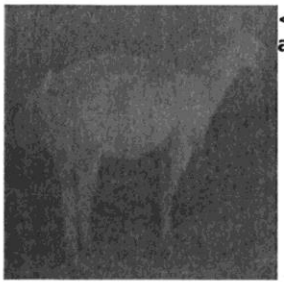
19. **Is uw uitvalspercentage de afgelopen vijf (5) jaar veranderd?**

☐ Gedaald
☐ Gelijk gebleven
☐ Gestegen
☐ Schommelingen in uitval waargenomen, namelijk ☐

De volgende vragen gaan over het specifieke ziektebeeld van dit onderzoek en de eventuele bevindingen hiervan op uw bedrijf

20. **Hoeveel dieren uit de verschillende categoriën heeft u in de periode 1 augustus 2012 – 31 augustus 2013 waargenomen met één of meer van de volgende verschijnselen?**

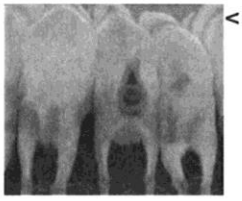
(Zoals op de voorbeelden hieronder grafisch weergegeven)



<== Voorbeeld 1: Spastische parese bij een bok, hierbij valt het kruisen van de achterpoten en een enigszinse kromming van de rug op.

<== Voorbeeld 2: Spastische parese bij een bok, hierbij valt het overmatig strekken (hyperextensie) van de gewrichten in de achterpoten op.

<== Voorbeeld 3: Spastische parese bij een bok, ook hierbij valt het overmatig strekken (hyperextensie) van de gewrichten in de achterpoten op.



<== Voorbeeld 4: Lijfbieden/prolaps bij een melkgeit

Aantal waargenomen dieren invullen

	Jonge, niet drachtige geiten/bokken (tot 1 jaar)	Drachtige geiten	Geiten in lactatie	Bokken ouder dan 1 jaar
Onvermogen om op de achterpoten te staan (parese)	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
Lijfbieden/prolaps (van rectum en/of vagina)	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐
Parese én lijfbieden (vaginaal en/of rectaal) bij hetzelfde dier	☐☐☐☐	☐☐☐☐	☐☐☐☐	☐☐☐☐

---

21. **Hieronder kunt u aanvinken of u één of meerdere van de bovengenoemde verschijnselen in het algemeen heeft waargenomen (ongeacht de leeftijdsgroepen).**

Dit is van invloed op het verdere verloop van de enquête.

☐ Ik heb de verschijnselen, zoals hierboven ingevuld, waargenomen ➡ Ga verder met vraag 24.
☐ Ik heb de verschijnselen nog nooit waargenomen ➡ Ga verder met vraag 22.

---

22. **U heeft aangegeven *géén* dieren met de genoemde verschijnselen op uw bedrijf te hebben/te hebben gehad.**

Wilt u bijdragen aan ons onderzoek door bij twee (2) van uw dieren bloed te laten tappen? Dit zijn dan de controle dieren voor ons onderzoek.

Uiteraard zijn hier voor u geen kosten aan verbonden en worden uw (bedrijfs)gegevens anoniem verwerkt.

Indien u hieraan mee wilt werken klikt u op ja en kunt u hierna uw contactgegevens invullen.

N.B. Er zijn slechts een beperkt aantal controle bedrijven nodig; indien u tot de selecte groep behoort nemen wij contact met u op.

☐ Ja ➡ Ga verder met vraag 23.
☐ Nee

---

23. **Hieronder kunt u uw naam, UBN, adres, telefoonnummer of e-mailadres invullen. Uiteraard wordt hier vertrouwelijk mee omgegaan en zijn deze gegevens nooit naar uw bedrijf te herleiden.**

Indien uw bedrijf geselecteerd wordt, nemen wij contact met u op.

Tevens kunt u hier direct aangegeven of u een samenvatting van ons onderzoeksrapport thuisgestuurd wilt krijgen.

☐ Naam
☐ UBN
☐ Adres
☐ Telefoonnummer (vast of mobiel)
☐ E-mailadres
☐ Ik wil graag een samenvatting van het onderzoeksrapport thuisgestuurd krijgen

24. **Veranderden de verschijnselen (parese en/of lijbieden) na verloop van tijd?**

☐ Ja, de dieren knapten weer op
☐ Nee, de verschijnselen bleven gelijk
☐ Ja, de verschijnselen werden erger
☐ Dit verschilde tussen de dieren

25. **Heeft u dit probleem (parese en/of lijbieden) besproken met uw begeleidende dierenarts?**

☐ Nee ➡ Ga verder met vraag 26.
☐ Ja

26. **Heeft u dieren ingestuurd voor sectie of aangedane dieren laten onderzoeken (bijvoorbeeld via bloedmonsters)?**

Wilt u hierbij ook vermelden welke verschijnselen (parese en/of lijfbieden) deze dieren vertoonden?

	Nee	Ja, ik heb het volgende aantal dieren ingestuurd voor sectie	Ja, ik heb het volgende aantal dieren laten onderzoeken door middel van bloedonderzoek
Aantal dieren	☐	☐☐☐☐	☐☐☐☐

27. **Kunt u ons iets vertellen over eventuele bevindingen van het onderzoek bij deze dieren?**

Wilt u hierbij ook aangeven welke verschijnselen (parese en/of lijfbieden) de dieren vertoonden?

(Indien u geen dieren heeft ingestuurd, klikt u op Nee)

☐ Nee
Ja, namelijk
☐

28. **Wat is uw aanpak geweest met betrekking tot de/het aangetaste dier(en) en wat wat is het resultaat hiervan?**

	Gekozen aanpak	Resultaat van de gekozen aanpak
Geen actie ondernomen	☐	
Dier(en) afgevoerd voor het aflammeren	☐	
Dier(en) afgevoerd na het aflammeren	☐	
Aanpassing van de vloer/bodembedekking, namelijk	☐	
Aanpassing van het rantsoen, namelijk	☐	
Behandeling gestart, namelijk	☐	
Anders, namelijk	☐	

29. **Wat is naar uw mening de oorzaak van het probleem?**

30. **Als laatste willen wij u vragen naar uw naam, UBN, adres, telefoonnummer of e−mailadres.**

Deze informatie zullen we eenmalig gebruiken om de I&R gegevens van uw bedrijf te koppelen aan de antwoorden gegeven in deze enquête. Vervolgens zal alle informatie die kan terugleiden tot uw bedrijf vernietigd worden.

Hiernaast willen we graag een afspraak met u maken voor een bedrijfsbezoek om meer anoniem beeldmateriaal te verkrijgen van aangetaste dieren.

Als laatste kunt u (indien u uw contactgegevens heeft ingevuld) ook aangeven of u een samenvatting van ons onderzoeksrapport wilt ontvangen.

☐ Naam

☐ UBN

☐ Adres

☐ Telefoonnummer (vast of mobiel)

☐ E–mailadres

☐ Ik wil graag een samenvatting van het onderzoeksrapport ontvangen

---

31. **Heeft u naar aanleiding van deze enquête nog vragen of opmerkingen?**

Deze kunt u hieronder kwijt.

---

32. **Wilt u dat wij nog contact met u opnemen over dit onderwerp?**

U dient hiervoor uiteraard wel uw contactgegevens eerder te hebben ingevuld.

☐ Ja
☐ Nee

ANNEX III: PROTOCOL FARM VISITS (IN DUTCH)

Bij het afleggen van een bedrijfsbezoek dien vooraf een afspraak gemaakt te worden met de veehouder zodat deze op de hoogte is van uw komst. Voor de inplanning van meerdere bedrijven op dezelfde dag dient een logische volgorde te worden bepaald. Uiteraard worden ook bij andere bedrijven de hygiënemaatregelen in acht genomen, zodat in-/uitsleep van ziektekiemen voorkomen wordt.

Bij aankomst dient u zich bij de veehouder te melden zodat u gewezen kunt worden op de hygiënesluis óf u kunt zelf de hygiënesluis betreden.

In de hygiënesluis dient u schoeisel te verwisselen voor bedrijfseigen schoeisel en dient u bedrijfskleding over uw eigen kleding of ter vervanging van uw eigen kleding aan te trekken. Afhankelijk van de hygiënemaatregelen die op het betreffende bedrijf gelden, kan er gevraagd worden om te douchen alvorens het bedrijf te betreden. Eigen, meegebrachte spullen zoals jassen, tassen, schoenen, etc. dienen aan de buitenzijde van de hygiënesluis achter te blijven. Ook dienen altijd de handen gewassen te worden voordat men verder het bedrijf opgaat.

Na de hygiënesluis dient contact te worden gezocht met de veehouder, om van hem/haar aanwijzingen te ontvangen met betrekking tot de gewenste looplijnen binnen het bedrijf (in verband met besmetting tussen verschillende diergroepen).

De veehouder kan tevens een korte rondleiding geven over het bedrijf en waar nodig uitleg geven, waarbij de bezoeker het bedrijf kan inspecteren en tegelijkertijd de veehouder kan ondervragen omtrent bepaalde zaken.

Voordat er wordt uitgereden op bedrijfsbezoek, dienen de bedrijfsparameters uitgezocht te zijn. Zo kunnen de volgende dingen alvast vooraf uitgezocht worden:

- Bedrijfsgrootte
- Bedrijfssysteem (gangbaar/biologisch)
- Aanwezigheid van andere dieren op het erf
- Mogelijke aanbieding tot het gezamenlijk bekostigen van aanvullend onderzoek in het kader van onderzoek naar parese en prolaps

Tijdens deze rondleiding, specifiek gericht op het probleem parese, kan extra aandacht worden besteed aan de volgende onderwerpen:

- Algemene indruk
    - Aandacht besteden aan pensactiviteit/herkauwen
- Onlangs nog veranderingen doorgevoerd in management (bijvoorbeeld eerder spenen, ander voer, etc.)
- Waarnemen van de specifieke verschijnselen
    - Parese posterior
    - Prolaps rectie
    - Prolaps vaginae
    - Combinaties van bovenstaande verschijnselen bij hetzelfde dier
- Vergaren van verdere informatie over aangedane dieren:

    - Betrof het een dracht met een ‘afwijkend’ aantal lammeren? (<2 of >2)
- Optreden van de verschijnselen bij de verschillende leeftijdsgroepen
    - Jonge, niet drachtige dieren
    - Opfokgeiten
        - 1e helft van de dracht
        - 2e helft van de dracht
    - Eerstejaars geiten in de lactatie
        - < 1 maand na aflammeren
        - > 1 maand na aflammeren
    - Twee- of meerderedrachts geiten
        - 1e helft van de dracht
        - 2e helft van de dracht
    - Bokken
        - 0 tot 1 jaar
        - Ouder dan 1 jaar
- Momenteel toepassen van behandelingen
- Aanpak van dieren met de symptomen (behandelen, afvoeren, etc.)
- Eventueel uitvoeren van aanvullende diagnostiek of dieren opsturen voor sectie
- Bodem waarop de geiten zijn gehuisvest
    - Tevens kijken naar vulling van de pot en daarmee de hellingshoek waarop de dieren aan het voerhek staan
    - Kijken naar kwaliteit bodem (droog/nat)
- Samenstelling van het rantsoen (voor de verschillende leeftijdsgroepen: lammeren, opfokgeiten en melkgeiten)
    - Melk (poeder)
    - Ruwvoer
    - Krachtvoer
    - (natte) Bijproducten
    - Overige additieven/supplementen
- Wat is uw jaarlijkse vervanging?
- Belangrijkste reden voor vervanging?
    - Verminderde melkproductie
    - Kreupelheid
    - Gust gebleven
    - Teruglopende lichaamsconditie (BCS)
    - Lijfbieden
- Uitvalspercentage (ook in de afgelopen jaren)
    - 0 – spenen
    - Spenen – ½ jaar
    - ½ jaar – 1 jaar
    - Ouder dan 1 jaar
- Gebruik van onkruidbestrijding/gewasbescherming?
    - Zo ja, welk(e) middel(en)?
- Nachtschade? (*incl afbeelding*)

Er kan gevraagd worden naar het inzetten van KI en indien dit toegepast wordt, welke bokken er gebruikt worden. Verder dient er, indien er dieren met parese/prolaps verschijnselen zijn, achterhaald te worden waar deze dieren vandaan komen (eigen opfok, aankoop) en of het vaderdier te traceren is. Dit in verband met een mogelijk genetische achtergrond van het probleem.

Naar aanleiding van het vooraf bepaalde beleid in het onderzoek is het mogelijk dat er op het betreffende bedrijf aanvullend onderzoek uitgevoerd kan/mag worden. Hier dient vooraf te worden bepaald hoeveel dieren er onderzocht dienen te worden (case en controle). Overleg tussen veehouder en GD moet hierover duidelijkheid geven (ook omtrent het kostenplaatje).

In overleg met de veehouder kan toestemming verkregen worden voor het maken van beeldmateriaal van de dieren. Uiteraard is dit alleen toegestaan indien de veehouder hier duidelijk toestemming voor heeft gegeven. Desondanks dient men er op te letten dat dit beeldmateriaal zo anoniem mogelijk wordt gehouden. Dit kan gebeuren door het bedrijf, de veehouder zelf, oornummers en andere bedrijfsspecifieke zaken niet in beeld vast te leggen. Ook voor het latere gebruik van dit beeldmateriaal in rapporten of andere publicaties dient toestemming te worden gevraagd aan de veehouder.

Na het bedrijfsbezoek dient de veehouder bedankt te worden voor zijn tijd en voor het bieden van de mogelijkheid tot een bedrijfsbezoek. Vervolgens dient de hygiënesluis wederom betreed te worden, ditmaal in omgekeerde richting. Bedrijfskleding en schoeisel dient te worden omgewisseld met eigen, schone kleding en schoeisel. Afhankelijk van het bedrijf en de daar geldende hygiënemaatregelen kan er gevraagd worden om te douchen alvorens men het bedrijf verlaat. Voor het verlaten van de hygiënesluis dienen altijd de handen gewassen te worden. Mogelijk (infectieus) materiaal van het bedrijf mag niet mee worden genomen tot buiten de hygiënesluis en zeer zeker niet naar andere, te bezoeken bedrijven.

ANNEX IV: PROTOCOL PATHOLOGICAL EXAMINATION (IN DUTCH)

Naast algemene sectie dient aandacht te worden besteed aan de volgende punten:

- **Body Condition Score**
  ◯ 0 ◯ 1 ◯ 2 ◯ 3 ◯ 4 ◯ 5
- **Drachtigheidsstatus**
  ◯ Gust ◯ Drachtig ◯ N.v.t.
  - **Aantal vruchten:**
  - **Duur van de dracht:**

  ◯ Eerste deel dracht (tot ongeveer 50 dagen)

  ◯ Midden dracht (vanaf ongeveer 50 dagen tot ongeveer 100 dagen)

  ◯ Einde dracht (vanaf ongeveer 100 dagen tot einde dracht)

- **Centraal Zenuwstelsel**
  - Hersenen in toto veiligstellen
  - Ruggenmerg in toto veiligstellen
  - Bij verkrijgen materiaal centrale zenuwstelsel dient de wervelkolom te worden beoordeeld op abnormaliteiten
  - Van hersenen worden van één helft cerebrum, cerebellum, hersenstam en verlengde merg microscopisch beoordeeld en het ruggemerg t.h.v. plexus brachialis en lumbalis; rest bewaren in pot.
- **Maag-darmkanaal**
  - Beoordeling van de mest**, indien afwijkend**:
    - Natief preparaat maken van duodenum, jejunum, ileum, colon en rectum; deze preparaten worden semikwantitatief beoordeeld door afd. parasitologie op aanwezigheid van coccidiën (inbrengen onder extra info); potje mest bewaren.
    - Onderzoek clostridium infectie en/of andere oorzaken voor aantasting van de darmen **<u>die (heftig) persen als gevolg kunnen hebben.</u>**
    - Histologisch onderzoek aangetaste delen darm
- **Lever**
  - Bewaren voor eventueel mineralenonderzoek
- **Nieren**
  - Sample nemen voor microscopisch onderzoek (ook indien macroscopisch niet afwijkend)
- **N. femoralis beoordelen**
  - Sample nemen voor histologisch onderzoek
- **Spieren van de achterhand (beiderzijds) beoordelen**
  - Sample nemen voor histologisch onderzoek
- **Spieren van de lendenen beoordelen**
  - Sample nemen voor histologisch onderzoek
- **Saggitale doorsnede van beide achterpoten, beoordeling van het snijvlak op abnormaliteiten** (zoals bijv. abnormale epifysair-schijven); sample nemen voor histologisch onderzoek, waarbij

gekeken moet worden naar de dichtheid van het beenweefsel (ivm mogelijke stoornis botafbraak/-opbouw).

Bij de eerste sectie wordt gekozen bij welke spieren een sample wordt genomen (in overleg met de patholoog). Bij de volgende sectie(s) wordt deze spier opnieuw gesampled om onderling te kunnen vergelijken (tenzij de patholoog aanwijzingen heeft dat de voorkeur naar een andere spier uitgaat).

Bij voorafgaand bedrijfsbezoek wordt bloed getapt van de dieren die hierna voor sectie worden aangeboden. Hiervan wordt ook serum opgeslagen voor eventueel verder onderzoek.