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CAN INFRARED THERMOGRAPHY BE USED TO PREDICT EAR TAGS INFECTIONS IN LAMBS?

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Abstract

Ear tagging is one of the common husbandry procedures that cause not only pain and stress but also tissue reaction and infection. Reliable and non-invasive tools are needed to determine the stress and/or pain resulting from routine husbandry procedures commonly performed in farms. Thermal imaging is a non-invasive diagnostic method used in veterinary medicine. The aim of the study was to determine the usability of infrared thermography in prediction of infections caused by electronic and visual ear tags in lambs. We hypothesized that reactive temperature increase within the first hour in the ear tissue in response to the ear tags would trigger the formation of infection. The study was carried out on Akkaraman lambs (n=60) reared under rural farm conditions. All lambs at two weeks of age were identified with an electronic ear tag (FDX-B, Allflex) on the left ear and an official plastic ear tag on the right ear. Before tagging, infrared images of the ear region were collected at a consistent distance from the left ear of the animal using an infrared camera (FLIR E50) in the barn. Tag insertion was performed by two practitioners at the same time. An hour after tagging, the thermal measurements of both ears were carried out again with infrared camera. The ears of lambs were individually checked in the week after tagging. The status of ear lesions was monitored until healing (about 8 weeks). Before tagging, the average thermal temperature of the left ear was measured as 16.68˚C. Electronic ear tags caused more problems than official ear tags. Infected ear rate in electronic and official ear tags was 80% and 50% respectively. Significant temperature differences existed between infected and non-infected ears (P<0.05). All ear tags that caused further increase *in reactive* temperature *resulted in an inflammatory reaction. As a result, early detection of inflammation is very crucial in terms of implementation of treatment and animal welfare. Ear lesions caused by ear tags in lambs can be early identified using infrared thermography. The preliminary findings of this study should be supported in subsequent studies.*

Key words*: infrared thermography, ear tags, lamb.*

INTRODUCTION

Ear tagging is one of the identification procedures most commonly performed on livestock for routine on-farm management. Retention rate of ear tags vary from 60-98% depending on the factors such as age at tagging, tag features, healing of the tagging site, species, breeds and environmental conditions. Due to the great variability in losses and external damages, minimum retention rate of 98% recommended by the International Committee for Animal Recording (ICAR) for official identification devices at 1 year after tagging in animals is not fully achieved in many cases (Caja et al., 2004; Carne, 2010).

The ear tags in ewes and lambs were illegible or difficulty legible for reasons such as wear and tear, breakage and fouling. Tag loss rate caused by tearing of the animal's ear were reported to be up to 5% in sheep (Gonzales-Barron et al., 2009). Electronic ear tags are plastic-encapsulated transponders designed to be fixed to the animal's ear using specially designed pliers with the same principle of application as for conventional plastic ear tag (EC, 2006). Losses and damages caused by events such as tissue reaction, infection or ear splitting should also be a reason for the consideration for electronic ear tags similar to conventional ear tags (Carne, 2010).

The measurement and alleviation of fear, pain and stress during routine husbandry procedures

commonly used on farms (e.g. ear-tagging, dehorning, and castration) has crucial importance in terms of animal welfare. Because reliable and non-invasive tools are needed to measure stress or pain, infrared thermography (IRT) can be used as a useful tool for this purpose (Stewart, 2008).

Thermal imaging is a non-invasive diagnostic method used in veterinary medicine. Diseased area can be determined by this method indicating different heat than normal emitted from damaged tissue and organs of animals (Düzgün and Or, 2009). The fact that measurements can be made without touching the animal at close (<1 m) or large distances (>1000 m) and compromising their welfare is the main advantage of IRT in animal research (Church et al., 2009). IRT has been used to determine lameness, injuries, and inflammations (Martins et al., 2013; Renn et al., 2014); to diagnose infectious diseases (Schaefer et al., 2007; Gloster et al., 2011); to detect estrus, ovulation, and male fertility (Scolari, 2010; Menegassi et al., 2014); to control of stress and pain levels for evaluation of animal welfare (Stewart, 2008; Stubsjoen et al., 2009); and to assess thermal comfort (Paim et al., 2012; 2014) in livestock.

The aim of the study was to determine the usability of infrared thermography in prediction of infections caused by electronic and visual ear tags in lambs. The main approach was to measure the thermal responses of tissue to the ear tags. We hypothesized that reactive temperature increase within the first hour in the ear tissue in response to the ear tags would trigger the formation of infection. So that, it would be feasible to determine and follow as early as possible the risk of infected ears from tagging in terms of retention rate of ear tag and animal welfare, as well as time and labor saving.

MATERIALS AND METHODS

The study was carried out on Akkaraman lambs (n=60) reared under rural farm conditions. All lambs at two weeks of age were identified with an electronic ear tag (FDX-B, Allflex) on the left ear and an official plastic ear tag on the right ear. Before tagging, infrared images of the ear region were collected at a consistent distance from the left ear of the animal using an infrared camera (FLIR E50) in the barn. The tags were immersed in a disinfectant before insertion. Tag insertion was performed by two practitioners at the same time. The behavior of the lambs was observed at tagging. An hour after tagging, the thermal measurements of both ears were carried out again with infrared camera. The ears of lambs were individually checked for signs of infection associated with the ear tag in the week after tagging. The status of ear lesions was monitored until healing (about 8 weeks). Statistical analysis was performed using t test.

RESULTS AND DISCUSSIONS

Following ear tagging, all lambs showed characteristic signs of pain or discomfort by bleating, head-shaking and ear-scratching. Leslie et al. (2010) reported that head shakes and ear scratching were the behaviours observed most frequently following the application of ear tag in piglets.

Electronic ear tags caused more problems than official ear tags. Infected ear rate in electronic and official ear tags was 80% and 50% respectively (Figure 1). Signs of infection were observed in the form of swelling of the ear, irritation under the ear tag, inflammation, and discomfort or pain when touched. The severity of ear lesions was monitored until healing. All infected ears healed within 8 weeks of insertion of the ear tag based on lesion severity. Edwards et al. (2001) indicated that the insertion of ear tags resulted in an inflammatory response in ewes and lambs. By the 20th week after inserting the ear tag, all lesions, except those caused by the metal loop tags, were almost completely healed. Carne et al. (2009) reported 3.3% infection and 6.5% tissue reaction rates for electronic ear tags in goat kids, but 90.2% of ears were completely healed at 2 months after tagging. On the other hand, Kowalski et al. (2014) observed only bleeding in one goat during application of the big visual ear tag. It is thought that the problems in ears with e-ET may be caused by the greater weight due to the presence of a transponder.

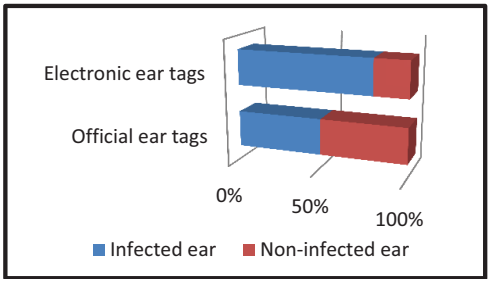

Figure 1. Infected and non-infected ear rate in electronic and official ear tags

Average ear temperatures before tagging and 60 min after insertion of electronic and official ear tags are presented in Table 1. Before tagging, the average thermal temperature of the left ear was measured as 16.68˚C. One hour after insertion of electronic and official ear tags, the average temperature of overall was 24.56˚C and 21.85˚C, respectively.

Table 1. Average ear temperatures before and 60 min after tagging (degree C)

	Before tagging		After tagging			
	n		n	Electronic ear tags	n	Official ear tags
Overall	60	16.68±1.46	60	24.56±4.68 *	60	21.85±5.21 *
Infected ear	48	16.58±1.34	48	25.95±4.05	30	26.18±3.41
Non-infected ear	12	17.09±1.89	12	19.00±2.28	30	17.52±2.22

*: P<0.05

Significant temperature differences existed between infected and non-infected ears. The average temperature of infected ears caused by electronic ear tags was measured as 25.95˚C while the temperature of non-infected ears was 19.00˚C (P<0.05). On the other hand, the average temperature in ears with official tag resulted in an inflammatory reaction was 26.18˚C while the temperature of non-infected ears was 17.52˚C (P<0.05). Temperature increase is a good predictor for the early phase of inflammation development. All ear tags that caused further increase in reactive temperature resulted in an inflammatory reaction.

CONCLUSIONS

Ear tags may result in an inflammatory response due to the wound created when they were inserted into the ear. Ear wounds should be considered in terms of ear tag losses and welfare implications, since re-tagging of an animal result in increased cost and animal stress. Therefore, early detection and treatment of inflammation or ear tissue reaction is economically and strategically advantageous. As a result, infrared thermography as a non-invasive diagnostic tool can be used to identify lambs with inflammations caused by ear tags. However, the preliminary findings of this study should be supported in subsequent studies.

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