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Contents

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Lamb survival is improved by reducing mob size and stocking rate at lambing: Part 2

This is the second of a two part report investigating the impact of mob size and stocking rate on lamb survival. Part one was published in the December 2016 edition of the Ovine Observer.

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Introduction

Improving reproductive performance is a priority for the Australian sheep industry.

Industry-level analysis has identified that increasing the survival of twin-born lambs is likely to have the greatest economic pay-off when compared to other components of the reproductive process.

Survey data presented in Part One of this report showed that lamb survival decreased when mob sizes and stocking rates were increased.

The effect of mob size on the survival of twin-born lambs was more than double the effect in singles, with lamb losses of 3.5% and 1.4% per additional 100 ewes in the mob.

These losses are expected to be related to the greater number of lambs born per day and thus a greater risk of mismothering.

The current study aims to validate the effects of mob size and stocking rate on lamb survival at commercial farms across Australia. It will also provide knowledge on the relative effects of mob size and stocking rate across different breeds, environments and management conditions.

The study will test the hypotheses that (i) decreasing the mob size or stocking rate of twin-bearing ewes will increase the survival of their lambs and (ii) that when implemented together these effects will be additive.

Methods

A total of 70 demonstration sites will be conducted at commercial farms across Western Australia, South Australia, Victoria and New South Wales during 2016 and 2017.

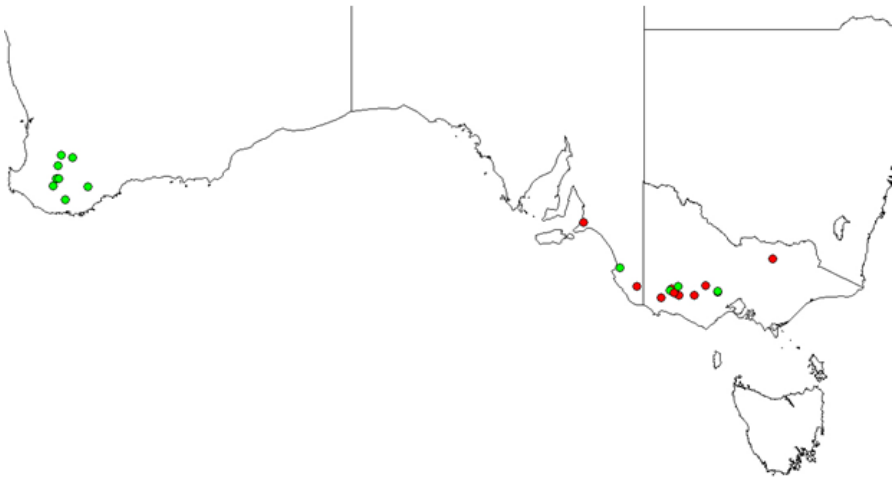

Figure 1 Locations of demonstration sites completed across Australia during 2016. Merino sites are shown in green and Maternal sites are shown in red

This report presents the preliminary findings from analysis of data collected from 22 sites which were conducted during 2016 (Figure 1).

Twin-bearing Merino or maternal ewes were allocated to one of four treatment groups at day 140 of pregnancy; high or low mob size and high or low stocking rate.

Pasture availability in each paddock and ewe condition scores (*n*=50/treatment) were assessed at day 140 of pregnancy and again at lamb marking.

Lamb survival was calculated using the number of foetuses identified at pregnancy scanning and the number of lambs alive at marking.

Data was statistically analysed using ANOVA in GenStat (VSN International 2012). The factorial combination of mob size and stocking rate along with breed were fitted as treatments, while state and farmer were fitted as blocking effects.

Results

Survival of lambs of maternal breed was greater than that of Merinos (82.4% vs 68.0%; P<0.001).

Lamb survival was poorer where ewes lambed at a higher mob size (P<0.01). Average survival was 72.4% for the high mob size and 75.4% for the low mob size .

Table 1 Average survival of lambs born in the high and low mob size and stocking rate treatments in Western Australia, South Australia and Victoria during 2016

		Mob size	
		High	Low
Stocking rate	High	71.5	74.5
	Low	73.4	76.2

At the 22 sites analysed, stocking rate did not impact lamb survival (P=0.120). There was also no effect of mob size within the two different stocking rates, however the average survival of lambs was lowest in the high mob size/high stocking rate group and greatest in the low mob size/low stocking rate group (Table 1). Given this trend, work at additional locations during 2017 may reveal a cumulative effect of stocking rate and mob size on lamb survival.

Discussion

This preliminary analysis suggests that increasing mob size will decrease lamb survival.

Whilst there is currently no significant effect of stocking rate, lamb survival was poorest in the high mob size/high stocking rate treatment. This indicates that stocking rate does impact on survival and there was a trend suggesting that the effects of mob size and stocking rate may be additive. However, conclusions cannot be drawn until all data has been collected.

Further data analysis will also investigate interactions between mob size, stocking rate and breed, ewe condition score, pasture availability and characteristics of the lambing paddocks to assess their impact on lamb survival.

The average mob sizes for the high and low treatments during 2016 were 231 and 92. During 2017, the aim is to sample mob sizes up to 400 ewes in order to assess the effects of a mob size and stocking rate on lamb survival within the range of mob sizes and paddock sizes on commercial farms. Along with research investigating the impacts of lambing density on ewe-lamb and flock behaviour, the findings from this research will aid in the development of guidelines for producers on the mob size and stocking rates of ewes at lambing in order to optimise lamb survival.

Further information

If you are a producer interested in being involved in this project during 2017, please contact Serina Hancock or Amy Lockwood at Murdoch University for further information. The project is also seeking producers who scan for multiples that are interested in participating in a producer network. The network aims to collect survey data related to the effects of mob size and stocking rate on lamb survival from a range of producers throughout the nation.

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Dual Energy X-ray analysis of carcass fatness is similar for different sexes and sire types

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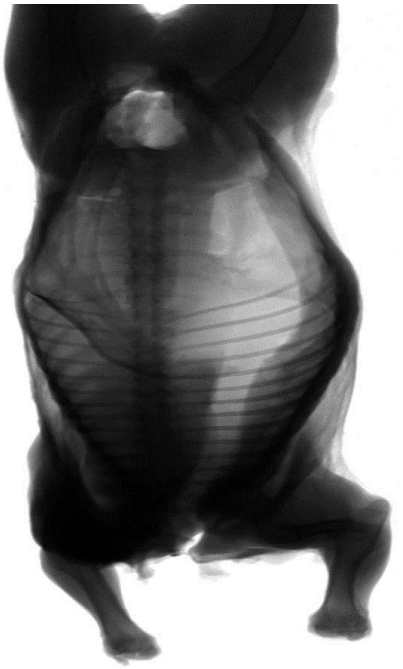
A review of the analysis to detect any bias in the data obtained from a Dual Energy X-ray Absorptiometry (DEXA) system when determining carcass composition at chain speed.

Background

The accurate determination of body composition at slaughter is important to enable the lamb industry to efficiently use carcasses in the boning room and to provide accurate feedback for producers for high quality lamb.



High Energy DEXA image of a carcass

Currently the fat component of lamb carcass composition is estimated commercially via palpation of the GR site – a point 110mm along the 12th rib when measured from the spine – to give what is known as a fat score (1-5). Direct measurements of this site can also occur, using rulers, probes, or ultrasound; however these forms of measurement are less common in processing plants.

The GR palpation technique is comparatively imprecise, being entirely subjective to the individual who is conducting the palpation. In fact, operators only palpated the correct rib around 30% of the time in a recent review of Australian abattoirs. This highlights the need for a new method of determining body composition in lambs.

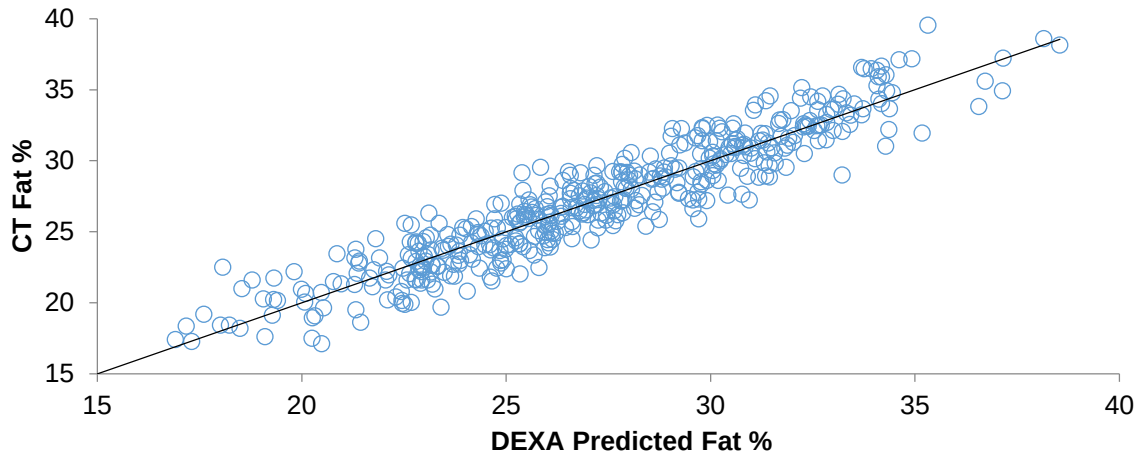
Recent work has identified a specialized form of x-ray technology called DEXA as a possible method for determining body composition in lambs. DEXA technology has the advantage of being objective, reliable and consistent. DEXA utilizes x-rays of differing energies to determine the proportions of fat and lean muscle across the entire carcass; and can achieve these measurements at chain speed in the abattoir. Multiple tests have revealed consistently high correlations between body condition estimates from the DEXA and Computed Tomography (CT), which is considered to be the gold standard.

While DEXA produced good estimates of body composition, in this report we have further examined DEXA data to quantify any measurement biases that may exist between different sexes or sire types.

Materials and methods

To determine the accuracy of the DEXA measurements, the fat percentage of 468 carcasses were calculated by both the DEXA and by computed tomography (CT). The difference between the DEXA fat percentage and the CT fat percentage was calculated for each lamb, and is called the residual.

The residuals help determine the accuracy of the DEXA system; regardless of the sex of each lamb, or the sire breed. Figure 1 shows the relationship between DEXA and CT fat % readings. The residual is the distance of the marker from the black line.



Points to note

1. Fat % predicted by DEXA is very similar to the fat % recorded by the computed tomography
2. There is a wide range of fat % across the different carcasses

Results and take home messages

Of the 468 carcasses assessed, 217 were female and 251 were male. The percentage of fat was under predicted for female carcasses by 0.4% and over predicted for male carcasses by 0.1%. When the average residual of the male and female lambs is compared (Figure 2), there is only a very small sex bias, with the average of both the male and female residuals below 0.5%. This figure is remarkably small, particularly given the large range in carcass fatness used in the study.

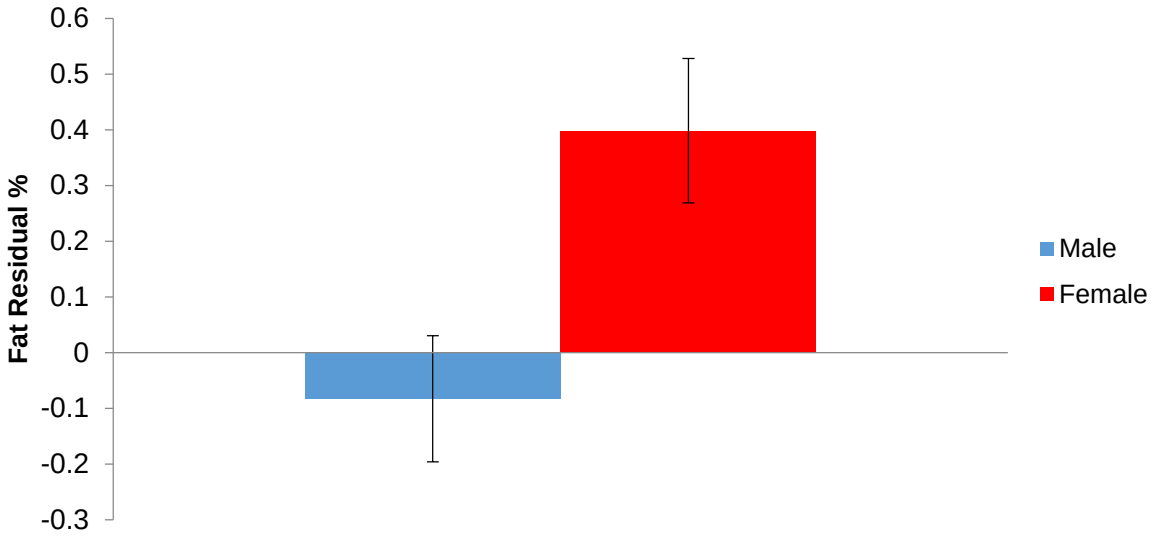


Figure 1 Average of the residual values (DEXA fat % minus the Computed Tomography fat %) for the male and female carcasses

Points to note

1. There was a small bias in the estimation of fat % by the DEXA between the sexes
2. The bias was very small, less than 0.5%

The breed of the sire of the lamb was also investigated, with a total of 9 sire breeds examined within the dataset. There was slightly greater variation in the average residuals between the sire breeds, than for the sexes. The percentage of fat was under predicted by about 0.7% for the merino sire types (merino and poll merino) and over predicted by about 0.7%, and the terminal sire types (Poll dorset, Texel, Suffolk and White Suffolk) were under predicted by about 0.5% (1% for Texel). However, as with the sexes, the difference was still very small and the average residuals for the DEXA fat compared with the CT fat were 1.1% or less (Figure 3).

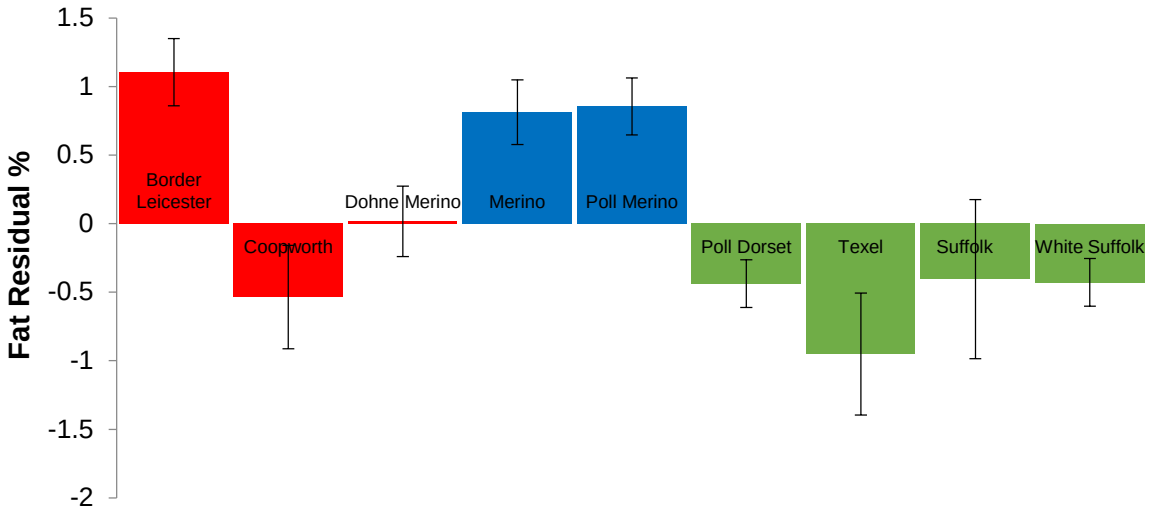


Figure 3 Average fat prediction residual % of each sire breed, separated in to their respective sire types of Maternal (red), Merino (blue) and Terminal (green)

Points to note

1. There was a small bias in the estimation of fat % by the DEXA between the sire breeds
2. The bias was consistent for merino sire breeds and terminal sire breeds but varied for maternals
3. The bias was very small, less than 1.1%

Conclusion

These results demonstrate that the DEXA system of predicting carcass fat is both precise and robust, maintaining accuracy over a variety of phenotypic variables including sex, and sire breed. These results give the supply chain significant confidence in the carcass information that can be generated from this DEXA system. This robust information can then be used to optimize multiple points of production – including the selection of flock genetics, farm management, carcass market determination, boning room efficiency and carcass consistency.

Currently, other variables are also being investigated in a similar fashion, to ensure continued confidence in DEXA technology. In addition, further experiments are also being conducted to take advantage of new innovations in the software and hardware in order to guarantee the most accurate information possible.

Acknowledgements

Contributors to this project include MLA, Sheep CRC, JBS, AMPC, Scott's Automation and Robotics, and Murdoch University.

Body condition score as a selection tool for worm control using Targeted Selective Treatment

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Introduction

The effectiveness of worm control is increasingly compromised because of increasing and widespread resistance to anthelmintics (drenches). On-going investigations into sustainable worm control have focused on the "refugia" strategy. This technique works by ensuring the survival of sufficient worms with genotypes susceptible to anthelmintics within in the total population on a property, to dilute resistant individuals surviving anthelmintic treatment.

'Targeted selective treatment' (TST) is a type of refugia-based strategy by which anthelmintic treatments are restricted to animals judged likely to suffer significant production loss or health effects if not treated, while treatment to others in the group is withheld. It is based on the theory that the individual animals who exhibit greater resilience to parasites, seen as fewer signs of ill-health or increased efficiency, can be exploited by TST strategies to ensure that a proportion of a worm population remains in refugia from anthelmintic exposure.

A key factor that has delayed utilization of TST for trichostrongylid worms other than *H. contortus* (barbers pole), is the absence of a convenient and accurate method for identifying animals that would benefit most from treatment. Approaches used in other investigations have been based on repeated measurements of production indices (for example body weight, worm egg count, ocular membrane inspection) in animals under parasite challenge as an indicator of resilience. However these require investment in labour and/or equipment that may limit their application on a large scale.

Body condition score (BCS) is a commonly used on-farm measure, requiring no technological investment. BCS is accepted as an indicator of general condition and body reserves, and therefore may act as an indicator of resilience to worm infections. This report summarises the findings of a paper investigating the relationship between BCS and worm burdens, and the practical use of BCS in TST programs on farm.

Differences in body condition score for treated and untreated ewes

In order to evaluate the usefulness of BCS in on-farm TST programs, an investigation was conducted to determine the relationship between BCS and production losses due to worm burdens. We hypothesised that mature sheep in poorer body condition would suffer greater production loss due to worm infections than sheep with higher body condition, and therefore BCS would provide a suitable selection tool.

Materials and Methods

Adult merino ewes at two sites were separated in to four different groups on the basis of their body condition score prior to lambing. Ewes from each of these groups were then separated into two equal sub-groups and either treated for worms (treated) or not (untreated). The body condition score and WEC's of all ewes were monitored from 3 weeks pre-lambing until 28 weeks post lambing. The predominant worm species found in this experiment were *Trichostrongylus* spp., *Teladorsagia circumcincta* and *Chabertia ovina*.

Results

In general, ewes in poorer starting body condition showed a greater relative BCS response to treatment than those of higher starting BCS. The untreated ewes lost more condition than the treated ewes in the two lowest BCS groups; ≤2.5 and 2.7 compared to the two higher BCS groups; 3.0 and >3.0 (Table 1).

This suggests that pre-lambing BCS does offer promise as a selection index for identifying Merino ewes most likely to benefit from anthelmintic treatment in TST-based worm control programs.

The response was found to be more consistent at Farm A, which was characterised by poorer nutritional conditions (pasture availability), lower average flock body condition and higher average flock worm egg counts (WEC) in untreated ewes, compared with the same measures at Farm B.

Table 1 Change in body condition score (average ± standard error) in ewes in different worm treatment groups and different groups of initial condition score

Initial BCS	Farm A			Farm B		
	Treated	Untreated	P value	Treated	Untreated	P value
≤2.5	-0.42 ± 0.05	-0.71 ± 0.04	<0.001	0.31 ± 0.06	0.02 ± 0.06	0.001
2.7	-0.71 ± 0.04	-0.86 ± 0.06	0.044	0.19 ± 0.04	0.00 ± 0.06	0.014
3.0	-0.95 ± 0.05	-1.05 ± 0.04	ns	-0.05 ± 0.04	-0.10 ± 0.04	ns
>3.0	-1.18 ± 0.08	-1.24 ± 0.07	ns	-0.28 ± 0.06	-0.39 ± 0.05	ns

ns = not significant (P>0.05)

Relative risk for untreated ewes

Regardless of treatment, the risk of sheep falling below BCS 2.0 during the experiment was increased for ewes in poorer BCS before lambing.

Table 2 shows the relative risk of the different groups of ewes falling below a BCS of 2 after lambing relative to that of ewe with a BCS of 3 or greater pre-lambing. The ewes in poorer body condition (BCS <3.0) pre-lambing were more than three times more likely to fall below BCS 2.0 after lambing. Furthermore, untreated ewes in very poor condition (BCS <2.0) were over 230 times more likely to have BCS <2.0 after lambing at Farm B (P<0.001; Table 2). These results further support the notion that BCS can be used to identify sheep more likely to benefit from treatment.

Table 2 Number of times more likely that ewe BCS will fall below 2.0 after lambing relative to ewes with an initial BCS ≥3.0 pre-lambing

	All ewes		Treated ewes only		Untreated ewes only	
Pre-lambing BCS	Farm A	Farm B	Farm A	Farm B	Farm A	Farm B
<2.0	*	62.4	*	ns	*	231.0
≤2.5	9.8	18	5.6	ns	*	31.7
<3.0	4.2	9.3	3.6	ns	5.5	16.1

*All sheep fell below BCS 2.0 after lambing
ns = not significant (P>0.05)

The results of this experiment suggest that only treating ewes in a poor BCS could be a viable tactic to allow worm burdens to remain in the well-conditioned animals in the flock. This is unlikely to affect production as treating well-conditioned individuals with anthelmintics did not significantly affect the change in BCS.

Take home messages

This experiment supported the hypothesis that ewes in poorer body condition prior to lambing are more likely to benefit from anthelmintic treatment than well-conditioned ewes. Better conditioned ewes were also less likely to fall to a critically low body condition level, below BSC 2 where welfare and production are likely to be compromised. The findings from these flocks therefore suggest that under a TST strategy, pre-lambing treatments could be given to ewes in poorest BCS, leaving ewes in better body condition (BCS > 3.0) as a source of refugia.

Video footage captured in a walk-over-weigh (WoW) system can be used to assess sheep welfare

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Introduction

The general health and wellbeing of sheep is subjected to many challenges during production. These come from many different sources and along with routine husbandry practices, challenges also stem from changes in management or environmental conditions. Failure of sheep to adapt to these challenges can result in reductions in production performance and, therefore, economic losses.

The perception of animal welfare in sheep production affects the image of the sheep industry in both the global and domestic markets, and therefore affects the profitability and viability of the industry. However, for a welfare assessment tool to be useful it needs to be robust, yet also able to be applied in a practical manner for on-farm usage.

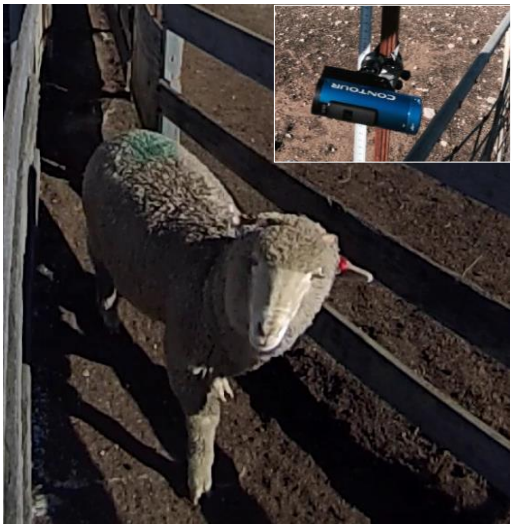
At present current assessment methodologies are cumbersome and difficult to implement, particularly with common on-farm management strategies and labour constraints. New animal farming technologies, such as electronic animal identification (Eid) and automated data capture may provide the opportunity for behaviour, health and welfare to be monitored in a practical and cost-effective manner in both intensive and extensive sheep management systems.

Qualitative Behavioural Assessment (QBA) is a method for remotely evaluating the welfare of sheep and has been proposed as way to utilise Eid and automated data capture for practical, on-farm welfare and health assessment. It is naturally suited for on-farm application, being quick, easy to implement and non-invasive. Furthermore, it is suggested that QBA can integrate with existing farm management systems, such as walk-over-weighing (WoW), and guide welfare assessments to provide a clear and meaningful picture of animal welfare.

In this application, QBA captures the body language of animals, describing *how* they are behaving using descriptive terminology such as assured, tense and wary. In doing so, QBA captures information concerning how the animal perceives and responds to its environment. Such assessments of body language or behavioural expression can provide insights into the physical and emotional or psychological health, which are relevant to welfare assessment.

This study investigates whether behavioural assessment could be used as an on-farm welfare tool in the sheep industry. It was hypothesised that QBA could be applied in a mock WoW system to identify individual sheep that were; (1) habituated to human presence; (2) lame; or (3) inappetent.

Materials and methods



A ‘habituated’ wether voluntarily traveling through the mock walk-over-weigh (WoW) system. Insert shows one of the cameras set up in the WoW system to remotely capture video footage.

Video footage was remotely collected from thirty-six Merino wethers within four treatment groups; control (n = 12), habituated (n = 8), lame (n = 8) and inappetent (n = 8) as they traversed, under their own volition, through a mock WoW system. The habituated sheep had been exposed to a low-stress handling regime for six consecutive days prior to filming. Animals were considered to be inappetent when their average feed intake was in the bottom 2.5% of the group over the six days prior to filming. A six-point lameness scoring system was employed to identify lame individuals (0 = not lame; 6 = will not stand or move; average 2.2 ± 0.3). The control animals were not habituated, lame, or inappetent.

The footage of these 36 sheep as they moved through the WoW system was compiled into a series of assessment clips, with one clip per animal. Eighteen observers evaluated the behaviour of the sheep in each of the 36 clips using a free choice profiling approach. This approach allows the observers to first generate their own unique list of descriptive terms to describe sheep behaviour, for example, assured, tense or wary. After watching each clip the observers then scored each animal for each of their own behavioural terms by making a mark on a line which represented minimum to maximum expression (i.e. 0-100).

The relationships between the behaviours scored by the observers were identified using Generalised Procrustes and Principal Component statistical analyses in GENSTAT. The behavioural expression of the four groups of sheep was compared using ANOVA (GenStat 2008, VSN International, UK).

Results and take home messages

The observers had similar assessments of the behavioural expression of the sheep in this study ($P<0.001$). In support of our hypothesis, the assessment of the control and habituated sheep, and the control and the lame sheep, were significantly different (Table 1; $P < 0.05$). No other significant differences were identified.

Table 1 Comparison of behaviour expression scores between different treatment groups. Bold values denote significant differences between compared treatment groups

Treatment groups	QBA p-values
Control vs. Habituated	**0.0136**
Control vs. Lame	**0.0096**
Control vs. Inappetent	0.0693

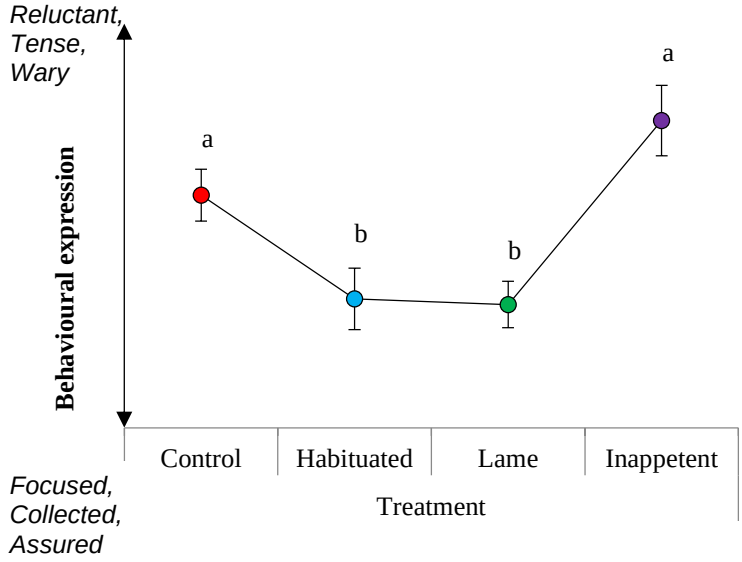


Figure 1 Average (± S.E.) observer behavioural expression scores for each of the four treatment groups. Different letters indicate treatment groups that were significantly different ($P < 0.05$)

Points to note:

1. Despite being blind to treatment groups, observers could differentiate between the control sheep and the habituated or lame sheep
2. QBA can be used on remotely captured video footage from a WoW system

The habituated and lame sheep consistently received lower scores than the other groups, being described by the observers as more *focused*/*collected*/*assured* than the control animals (Figure 1.).

In contrast, there was no significant difference between the observer scores given to the inappetent animals compared to the control. This suggests that further investigation into the sensitivity of QBA to certain disease states is necessary given the inability to distinguish the inappetent sheep from the control.

Conclusion

Our findings demonstrate that observers can use the behaviour of sheep to differentiate between sheep that were lame, or acclimated to their immediate environment (habituated), and those that were not (control animals), from film captured as they walked through a WoW system. These results suggest that differences in the way animals interact with mild stimuli in the environment (e.g. the WoW system in this experiment) can be identified using QBA. Thus, QBA represents a simple tool that could potentially be applied to video footage taken by an automatic data capture system (on farm) to provide meaningful information concerning sheep welfare.

Acknowledgements

This research was funded by the Cooperative Research Centre for Sheep Industry Innovation (Sheep CRC). The Wellard La Bergerie Feedlot is thanked for the wethers and facilities.

Sheep Industry Research Open Day

Hosted at the Department of Agriculture and Food's Katanning Research Facility (formerly GSARI) Nyabing Road, Katanning, WA
10.00am – 4.30pm (sundowner to follow)
30 March 2017

Come and join us at the Sheep Industry Research Open Day in March!
We will be showcasing the latest innovative technology and research across the WA Sheep Industry and what this means for sheep producers.
This free interactive field day is for you, for ewe, and for me!

Program

- EweTube; Let Siri do the sheepwork - Beth Paganoni, DAFWA
- Labour or Love? Labour Saving Technologies that allow a life off-farm - John Paul Collins, DAFWA & Clayton South, sheep producer, 'Tahara'
- ASBVs for traits that are expensive and difficult to measure - Johan Greeff, DAFWA
- Do I look fat in these genes? Shedding some light on why owning skinny genes doesn't guarantee their fit! - Sarah Blumer, Murdoch University
- Yardstick 2015: Driving genetic gains in the sheep industry - Bob Hall, ICON Agriculture
- Can you identify breech strike susceptible sheep BEFORE they are struck? - Tony Schlink, UWA
- DAFWA and UWA joining forces to solve the winter dag problem - Graeme Martin, UWA
- Running the ruler over lamb in 2017 – the future of Lean Meat Yield analysis - Steve Connaughton, Murdoch University
- We like our meat red! Demonstration of packaging options to optimise colour at retail & colour measurement technology - Maddison Corlett, Murdoch University
- Eat the lot - demonstrate cut by cook effect on eating quality - Rachel O'Reilly & Lis Pannier, Murdoch University
- The good gas on methane: Live demonstration of gas measures - Phil Vercoe, UWA
- Chaos on the Maternity Ward: Can optimising lambing density minimise mismothering and improve lamb survival? - Amy Lockwood, Murdoch University

RSVPs are essential. Please contact Julia Smith, DAFWA, at julia.smith@agric.wa.gov.au or Esther Jones, Sheep Alliance at esther@bluesee.com.au

The KRF Open Day is made possible by DAFWA's Sheep Industry Business Innovation project, supported by Royalties for Regions, and in partnership with the Sheep Alliance of WA

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