INVESTIGATION INTO CARCASS TRAITS AND SALEABLE MEAT YIELD OF AUSTRALIAN ALPACAS (*Vicugna pacos*)

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Abstract – This study investigated carcass traits and saleable meat yield of female and castrated male Australian alpacas at 18, 24 and 36 months of age. Fifty huacaya alpacas, evenly distributed across three ages (14, 20, 32 months) and two genders (females and castrated males), were grazed on coastal summer pastures of NSW, Australia, for four months. Carcass traits including dressing percentage and carcass length were collected at slaughter. At 24 hours post-mortem the carcasses were prepared into a range of cuts. Four saleable meat yield (SMY) combinations were collated and analysed. Older, 36 month animals had heavier hot carcass weights (33.7 ± 1 kg, mean ± s.e.) and the longest carcasses (81.2 ± 0.7 cm) as expected. Determination of whole carcass yield established the percentage of total carcass bone (17.5 ± 0.2 %), fat trim (1.4 ± 0.1 %) and meat trim (7.8 ± 0.4 %) as a proportion of cold carcass weight. The proportion of fat in carcasses increased with age and the proportion of bone decreased with age. Females had greater amounts of trim compared to males. SMY decreased in females and increased in males with age across all combinations. The higher SMY and lower trim values for male alpacas suggest they are preferable for meat production.

Key Words –alpaca, carcass, yield, meat.

I. INTRODUCTION

Strong growth in the Australian alpaca industry over the past 20 years has seen the industry improve its commercial standing. To improve commercial returns and ensure continued long term success, diversification is required into alternative products such as alpaca meat and hides, away from the traditional reliance on fibre.

Although key production traits, including animal growth, development and carcass traits, have been well established in common meat producing species, to form the basis of meat production [1, 2, 3, 4], limited information is available on the best practice for producing alpaca meat [5, 6]. This is due to the majority of available information being focused on llama meat in South America due to their larger carcasses [5, 6, 7, 8]. To establish an alpaca meat industry in Australia, where the llama population is very small, key carcass composition traits and production guidelines showing the influence of age and gender are required. The implementation of this information will be fundamental in improving productivity of the alpaca meat industry. This will provide producers and processors the ability to make informed decisions on carcass traits to enhance performance by targeting product weights, and reducing losses in the form of addition labour and trimmings to enhance overall carcass utilisation.

This paper reports on the carcass traits and saleable meat yield of 18, 24 and 36 month old, castrated male and female alpacas run under Australian conditions. This will provide alpaca meat producers with important information to enable the production of high quality meat.

II. MATERIALS AND METHODS

A total of 50 huacaya alpacas, evenly distributed across three age groups (14, 20, 32 months) and two genders (females and castrated males), were grazed on coastal summer pastures (primarily kikuyu) on the South Coast of NSW, Australia, for four months. Liveweight was monitored fortnightly and prior to the animals entering lairage.

Animals were slaughtered at a camelid certified mixed species abattoir. Necks were removed at the junction of the 5th and 6th cervical vertebrae, tagged and weighed, prior to the carcass being split in half down the vertebral column using a cattle brisket saw. Before entering the chillers, each carcass half was tagged before the hot carcass weight (HCW) for each carcass half was recorded, from which the dressing percentage was calculated.

Within two hours of carcass entering the chillers, carcass length was measured from inside the left side from the first rib to the caudal ischiatic tuber of the pelvis with a tape measure. Carcasses and necks remained in the chillers for 24 hours at an average temperature of 4˚C and humidity of 90 % before being transported (at an average temperature of 2.0˚C and humidity of 88 %) 66 km to a commercial butchery for yield analysis. Cold carcass weights were recorded for each half and whole necks. Carcass yield analysis was determined on the right side of the split carcass and all cuts prepared by the same experienced butcher according to AUS-MEAT sheep specifications and product identification numbers as indicated in brackets in the following paragraphs [9]. Any modifications have been mentioned. All cuts were weighed before and after trimming at each stage of the yield breakdown. All trimmings, bone and fat for each primal section were also recorded. Data generated was then doubled to reflect whole carcass yield.

The tenderloin (HAM No 5080), was separated by removing the m. *psoas major* and the m. *psoas minor* from the ventral surface of the lumbar vertebrae and lateral surface of the illium. The forequarter (HAM No 4972 minus the neck) was cut along the contour of the 6th and 7th rib to the ventral edge and through the thoracic vertebrae. This primal was weighed before the foreshank (HAM No 5030) was removed by cutting proximal to the breast and at the distal end of the humerus bone. The foreshank was weighed as a whole, before being tipped and frenched (HAM No 5029) and all components weighed again. The remaining forequarter was then de-boned (HAM No 5050) prior to all muscle, bone, fat and trim components being weighed. The loin region was divided with a bandsaw at the 12/13th rib into two primals; rack (HAM No 4932) and shortloin (HAM No 4880). The flap (HAM No 5011) was prepared by a straight cut from ventral section of the 5th and 6th ribs and a secondary cut parallel to the to the 6th lumbar vertebrae. The rack (eight rib) was prepared by removing the forequarter at the 5th and 6th rib and by a cut through the thoracic vertebrae severing the backbone. The spare rib cut (consisting of eight ribs, intercostal muscles and overlying muscles) was prepared by cutting the rib cage parallel to the backbone. After recording the weight of the whole rack, the frenched rack cap on (HAM No 4748) was produced by cutting off the upper portion of the cap muscle, approximately one and a half inches from the rack eye muscle, exposing the ribs. Once weighed, the remaining cap muscle covering the ribs was removed to produce a frenched rack cap off (HAM No 4764). The m. *longissimus et lumborum* (LL) and silverskin was then removed off the spinosus processes and transverse processes of the 6th thoracic vertebrae through to the 12th thoracic vertebrae, and weighed along with all rack components (muscle, bone, trim and fat). The shortloin (posterior section of the loin) was prepared by a cut between the 12th and 13th ribs and the secondary cut through the junction of the 6th lumbar and 1st sacral vertebrae. After weighing, the shortloin flap was removed by cutting parallel to the lumbar vertebrae and weighed separately. The remaining shortloin was then deboned (removal of the lumbar vertebrae, remaining ribs, and all silverskin) to produce an eye of shortloin (HAM No 5150).

An outline tracing of the eye of shortloin muscle (LL), was taken using transparent acetate paper to measure area, width and depth for eye muscle area (EMA) data for each carcass between the 12th/13th rib. A 10 cm scale was then measured and written next to each tracing to ensure that the image was not distorted whilst the tracings were photocopied, scanned and turned into a compatible file to be measured using the Universal Desktop Ruler (UDR) program [10]. The scale bar next to each tracing was used to calibrate the UDR before the width, depth; area and perimeter measurements were recorded and tabulated.

The whole hind leg, referred to as leg chump on (HAM No 4800), was prepared by cutting through the 6th lumbar vertebrae and the 1st sacral vertebrae, just next to the ilium bone, and ventral to the flank. The hindshank (HAM No 5031) was then cut off with a band saw through the stifle joint and weighed before being tipped and frenched (HAM

No 5029). The chump was then removed and prepared into the rump (HAM No 5074) and D-rump. The remaining leg (HAM No 5070) was then de-boned resulting in the silverside (HAM No 5071), outside (HAM No 5075), knuckle (HAM No 5072), and topside (HAM No 5073).

During data analysis primals were combined into four saleable meat yield (SMY) end point combinations. Each combination had a different retail cut combination for the popular high value rack and hind-leg products to reflect commercial retail products. All four combinations comprised: the neck (HAM No 5020), deboned-forequarter (HAM No 4972), fore-shank (HAM No 5030), tenderloin (HAM No 5080), eye of shortloin (HAM No 5150), and spare ribs (HAM No 5015). In addition, Combination A contained: frenched rack cap on (HAM No 4748) and leg chump on (HAM No 4800). Combination B contained: frenched rack cap on (HAM No 4748), deboned hindleg, minus the rump (HAM No 5065) and hindshank (HAM No 5031). Combination C contained: frenched rack-cap off (HAM No 4764), and leg chump on (HAM No 4800). Combination D contained: frenched rack-cap off (HAM No 4764), deboned hindleg, minus the rump (HAM No 5065) and hindshank (HAM No 5031). Values for trim, bone and fat for each combination were not calculated as combinations were obtained from combined retail cut data which did not have individual trim, bone and fat values. Whole carcass bone, fat and trim portions were totaled by combining all bone, fat and trim data throughout the yield breakdown procedure.

Once whole carcass yield data was calculated, it was then converted into a proportion of cold carcass weight (CCW) for data analysis. Linear mixed models were fitted using GenStat 14th Edition [11] with the factors age and gender as fixed effects and kill day as a random effect.

III. RESULTS AND DISCUSSION

Hot carcass weights increased with age ($P < 0.001$), with 18 month old animals having the smallest carcass weights as expected (Table 1). However, these carcass weights are greater than those for Peruvian alpacas [6]. There was no gender effect or age by gender interaction effect on carcass weight ($P > 0.05$). Overall dressing percentage was 54.3 ± 1.4 %, with no gender, age or gender by age interaction effects, detected ($P > 0.05$). Carcass length increased with age ($P < 0.001$), and females had longer carcasses than males ($P < 0.001$) (Table 1). The overall average eye muscle area was 32.2 ± 0.9 cm^2, with no interaction at any level ($P > 0.05$). These findings are similar to the literature [6] for Peruvian alpacas.

Determination of whole carcass yield gave the percentage of total carcass bone (17.5 ± 0.2 %), fat trim (1.4 ± 0.1 %) and meat trim (7.8 ± 0.4 %) as a proportion of CCW. Whole carcass trim increased with age ($P < 0.05$) as expected with eighteen month old animals having the smallest percentage of trim (7.1 ± 0.1 %), followed by the 24 month (8.1 ± 0.5 %) and 36 month (8.4 ± 0.5) animals. Females had higher whole carcass meat trim (8.4 ± 0.4 %), ($P < 0.05$) then males (7.3 ± 0.4 %). Whole carcass bone as a percentage of CCW decreased with age ($P < 0.05$) with 18 month animals having the largest percentage (18.3 ± 0.3 %), followed by 24 month (17.7 ± 0.3 %) and 36 month (16.5 ± 0.3 %) animals. Whole carcass fat trim (overall average 1.4 ± 0.3 % of CCW) increased with age and was greatest in 36 month old females at 2.6 ± 0.3 % of CCW ($P < 0.05$). Although there is minimal literature available to compare alpaca carcass traits, these findings follow similar trends to other livestock species which have been well documented [1, 2, 3, 4, 6].

Table 1 Alpaca age and gender carcass traits (predicted mean ± s.e.)

Trait	Age (months)			Gender	
	18	24	36	Male	Female
Hot carcass weight (kg)	22.3 ± 1.0^a	28.4 ± 1.0^b	33.7 ± 1.0^c	27.1 ± 0.8	29.2 ± 0.8
Cold carcass weight (kg)	21.7 ± 1.1^a	27.3 ± 1.0^b	32.6 ± 1.0^c	26.0 ± 0.8	28.3 ± 0.8
Carcass length (cm)	72.7 ± 0.8^a	78.4 ± 0.7^b	81.2 ± 0.7^c	76.0 ± 0.6^A	78.9 ± 0.6^B

Different letters indicate significant differences between means per trait.
Lower case letters signify age differences and upper case letters signify gender differences.

Combination A was the highest yielding at 80.0 ± 0.2 % of CCW (P < 0.01), followed by combination C, at 79.1 ± 0.2 % of CCW (P < 0.001), combination B, at 67.7 ± 0.2 % of CCW (P < 0.01) and lastly combination D at 66.8 ± 0.2 % of CCW (P < 0.05). The percentage of SMY increased in males with age, and decreased in females (Table 2).

Table 2 Saleable meat yield (SMY) combinations as a percentage of cold carcass weight according to age and gender (predicted means and s.e.).

SMY Combination	Age (month)	Female	Male
A	18	81.0 ± 0.4^{a}	80.1 ± 0.4^{ac}
	24	79.7 ± 0.4^{bc}	80.2 ± 0.4^{ac}
	36	78.7 ± 0.4^{b}	80.5 ± 0.4^{ac}
B	18	68.4 ± 0.4^{df}	67.6 ± 0.4^{de}
	24	66.9 ± 0.4^{e}	68.0 ± 0.4^{df}
	36	66.8 ± 0.4^{e}	68.7 ± 0.4^{f}
C	18	80.2 ± 0.4^{g}	79.0 ± 0.4^{de}
	24	78.9 ± 0.4^{h}	79.3 ± 0.4^{df}
	36	76.7 ± 0.4^{i}	79.6 ± 0.4^{f}
D	18	67.2 ± 0.5^{jl}	67.0 ± 0.5^{jl}
	24	66.1 ± 0.4^{jk}	67.2 ± 0.4^{jl}
	36	65.4 ± 0.5^{k}	67.9 ± 0.4^{l}

Superscripts with different letters represent significant differences between age-gender means within the same SMY combination.

IV. CONCLUSION

Desirable SMY results and reduced levels of trim in male alpacas indicate that they have more preferable carcass characteristics for meat production. Further investigations into carcass yield breakdown and the economics related to the costs of producing value added cuts would be desirable for alpaca meat producers and processors so that the optimal balance between carcass quality and quantity can be established.

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