

Knife Sharpening Part A

A systematic and collaborative approach with processing plants to improve knife safety and analysing IOT technology in the red meat industry at a plant level – Part A

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1.0 Executive Summary

The aim of this project was to reduce laceration and soft tissue injuries in a meat processor through knife sharpening training and assessment. Practical demonstrations and recommendations were provided to 158 employees to help improve the employees' overall understanding of knife use and reduce musculoskeletal disorders and lacerations. Knife sharpness was quantitatively analysed on 255 knives using a Anago Analyzer and the scores recorded. Only 133 knives (52%) met the minimum criteria (a score of 8 or above). Significant variation in knife sharpness was noted. A widespread and enduring focus on the importance of knife sharpness to a productive and safe workplace is required to ensure that new entrants to the industry are trained, and a focus on knife safety and training is maintained in experienced employees.

Benefit for Industry

Maintaining knife sharpness is a long standing problem in the meat processing industry. A widespread and enduring response is required to ensure that new entrants to the industry are trained and a focus on knife safety and training is maintained in experienced employees. Every employee in the plant can play a role in maintaining focus on the importance of knife sharpness to safe work practices and experienced individuals should be encouraged to help others where possible.

2.0 Introduction

A common cause of knife-related musculoskeletal disorders (MSDs) is the use of knives that are not sharp or effectively maintained. A sharp knife requires 30 per cent less force to cut than a dull knife. Repetitively applying extra force with a blunt knife can lead to a range of MSDs that include overuse injuries of the upper limb, elbow and shoulder, and muscular sprains and strains including the neck and lower back areas. Using dull knives can also cause a worker to lose their grip and sustain cuts and lacerations to parts of their body.

3.0 Project Objectives

1. Reduce laceration and soft tissue injuries through maintaining a sharp edge
2. Provide a dedicated resources for a 12 month period to processing plants involved on an agreed basis to provide support and training to upskill their workforce in knife safety and sharpness
3. Allow plants to have the equipment required to undertake analysis when an injury arises to help determine in knife sharpness could have been a contributing factor to the injury and at a minimum test all employees that use knives on an annual basis
4. Analyse data over a 2-year pre-trial on a 2-year post-trial to evaluate the effectiveness of the project
5. Review the current cut resistance levels of gloves on the market and make recommendations on the best level of protection required for different applications

4.0 Methodology

1. Engage with the provider to deliver knife sharpness training to plants on an agreed schedule for a 12 month period
2. Review injury data for the past 2 years to determine general trends in types of injuries occurring at The Abattoir
3. Undertake upskilling of staff to ensure there is enough qualified staff to continue ongoing training and assessment of employees for the long term
4. Assess all employees' knives on an annual basis for the duration of the project

5.0 Project Outcomes and Discussion

Training

The trainers (Jeff O'Malley and Scott Robinson) conducted a large amount of work to implement targeted, on and off the job training in knife sharpening. Sharpening on a stone is an inaccurate science. Inexperienced employees look to more experienced employees for help. Learning how to sharpen on a stone may take 6 -12 months to perfect and sometimes a lot longer. Response were aware that experienced operators may not require additional training and these individuals were encouraged to help others where possible. Employees who had knife injuries were flagged for further training and particular attention was invested in training a Vietnamese interpreter so they could support new starters who spoke Vietnamese as their first language.

A sharper knife edge can be achieved using a hollow grinder or a finishing machine. These pieces of equipment can be used to thin out broad shoulders to reduce cutting resistance and restore worn knives but specialist training is required for their use. The trainers implemented a hollow grinder and upskilled 1-2 operators from the boning room and slaughter floor in the use of this machines. Significant attention was also invested in ensuring employees had the correct PPE for knife sharpening (see separate Knife Sharpening Work Instruction) and new trainees had the correct knives and knife sharpening equipment.

In this program practical demonstrations and recommendations were provided to 158 employees to help improve the employees' overall understanding of knife use and reduce musculoskeletal disorders and lacerations from the use of dull knives.

Knife sharpening assessment and analysis

Knife sharpness was monitored across the various departments of the The Abattoir. An Anago Analyzer and the Angle Me app (which is available through the App store & Google Play) were used to quantitatively analyse knife sharpness and correct straightening of the edge technique (steeling angles). A number of other factors were also recorded. These included the types of steel used, knife length and the job specific details (department, task performed, operator name).

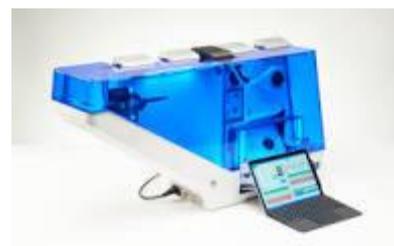
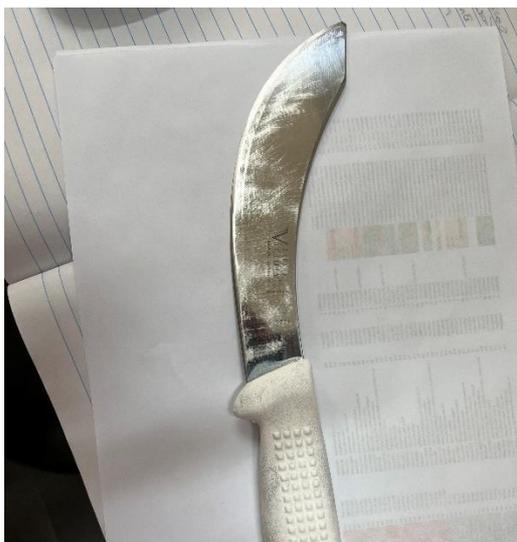


Figure 1: The Anago Analyzer

Many knives presented by the trainees were poorly sharpened. Common problems included:

- variations in sharpening angles
- no defined cutting edge (as knives were rounded from rubbing back on bench stones)
- thick shoulders.

In addition, 35 knives were detected that were severely worn and/or chipped knives that were unable to be sharpened effectively (an example is shown below). These knives were replaced.



Knives were analysed in the Anago Analyzer and the scores were recorded. The trainers recorded the employees' steeling and slowed down the play back to analyse their technique using the Angle Me App. Steeling technique training was then provided to explain the importance of angles and pressure when straightening a dulled edge. Technique was corrected and trainees were taught how to read a knife so they can steel accordingly.

All knives used in a meat processing environment should receive a score of 8.0 or above to effectively perform their intended job and avoid employee over-exertion. The manufacturer provided sharpness zones are shown below (Table 1).

Table 1: Manufacturer provided sharpness zones and knife sharpness zones at The Abattoir

Broad level	Detailed level	Score	Knives in category (%)	Knives in category (number)
Unsatisfactory	Below the recommended minimum level	< 8.00	52%	133
Satisfactory	Sharp	8.00 - 8.99	48%	122
	Very Sharp	9.00 - 9.49	0	0
	Extremely Sharp	>9.50	0	0

Table 1 shows that of the 255 knives analysed, only 133 of them met the minimum criteria (52%). The remaining knives (48%) were characterised as Sharp with no knives reaching a score level of Very Sharp or Extremely Sharp (Table 1). The average score was 7.76 with a minimum score of 3.81 and a maximum knife sharpness score of 8.85. This average score is slightly lower than the average score of 7.89 that was reported in a previous knife sharpness study that analysed 1,727 knives from 13 abattoirs [1].

The slaughter floor employees stated that they deliberately dulled the tip of their knives to prevent from cutting through hide unintentionally and this minimises safety risks of being stabbed by the knife coming loose. This practise is consistent with slaughterman in all sheds Response's knife trainer (Jeff O'Malley) has been to. Doing this will reduce the scores by 0.5 compared to boning knives.

Significant variation in knife sharpness was noted across staff members, tasks, steeling methods, species, job, department and blade used and factors affecting knife sharpness will be discussed below.

Table 2: The relationship between knife sharpness and species or steeling method

Characteristic	Mean Score	Standard error mean (SEM)	Number of records
Species ($p < 0.05$)			
Bovine	7.90	0.06	110
Ovine	7.66	0.08	145
Steeling method ($p < 0.05$)			
Ergo	7.05	0.64	7
Rod	7.78	0.05	248

Steeling a knife with a Rod was associated with higher knife scores, compared to Ergo, and was the predominant (used 97% of the time) method by which steeling occurred (Table 2). In addition, knives used on cattle (bovine) received higher knife sharpness score in this study than knives used on sheep (ovine; Table 2).

The relationship between individual knife sharpness and round

Highly significant differences in knife sharpness were found across individuals ($P > 0.001$) and there was a significant interaction between Round and Individual ($P > 0.001$). This indicates that individuals knife scores changed between subsequent analysis rounds. Assessment of these results showed that of the 158 employees who underwent knife training 41 were analysed in both Round 1 and Round 2. Of these, 73% increased their knife sharpness scores from Round 1 to Round 2. In this group, the average score in Round 1 was 7.55 and the average score in Round 2 was 8.05. Thus, knife training and assessment increased knife sharpness scores from a unsatisfactory level to a satisfactory level. Details of the employee's individual knife scores in each round are provided in Table 6 in the Appendix.

Getting access to employees for training was, at times difficult, especially when they were required to work on the line. Priority was given to training those most in need and not on generating repeat knife testing results. Training in one room was also cut-short due to a trainer developing COVID-19.

Table 3: The relationship between knife sharpness and job title or task

Characteristic	Mean Score	Standard error mean (SEM)	Number of records
Job title ($p < 0.001$)			
AAO	6.97	0.31	20
Muslim Slaughterman	7.51	0.06	25
QC	7.57	0.13	59
Knife Hand	7.63	0.26	11

Labourer	7.69	0.17	7
Supervisor	7.85	0.16	6
Trimmer	7.85	0.54	8
Slaughterman	7.92	0.06	81
Slicer	7.92	0.07	32
Boner	8.05	0.2	5
QA	8.17	0	1
Job task (p < 0.05)			
AAO	6.85	0.44	10
Boning	8.05	0.07	23
Breakdown	8.11	0.15	2
Buggies	8.48	0.00	1
Change over	8.01	0.00	1
Drop Tongues	8.09	0.00	1
Evisceration	7.63	0.22	6
First Leg	7.94	0.00	1
Flanking	7.89	0.15	10
Forequartering	7.97	0.09	19
Gutting	7.81	0.18	12
Head Inspection	7.99	0.00	1
Hide Puller	7.95	0.04	4
Hock Cutter	7.98	0.25	3
Horns	7.58	0.00	1
Legging	8.40	0.12	6
Necks	7.44	0.77	2
Offal chain	7.41	0.44	7
Offal Table	6.19	2.17	2
Open Paunch	7.59	0.11	4
Pelting	7.98	0.15	11
Pluck	8.20	0.00	1
QA	8.17	0.16	6
Ring Bung	7.58	0.40	4
Scales	7.90	0.06	2
Skins	8.23	0.10	3
Slicing	7.93	0.06	34
Split Saw	8.15	0.00	1
Stick and Bleed	7.50	0.15	12
Supervisor	7.85	0.20	5
Tongues	7.99	0.00	1
Trimming	7.51	0.15	56
Weasand	8.31	0.17	3

These differences in task and job title require further assessment. Some postulations from the results in Table 3 include:

- The low score found in AAO for both job task and job title may be caused for the minimal use of knives in this task which makes knife sharpening a low priority
- Muslim Slaughterman cut through skin. This is hard to do and may dull the knife blade. Extra attention should be placed on knife sharpening in this area to reduce injuries due to dull knives.

- Boners need the highest scores as they are using their knives often and should aim to be in the very sharp category. Whilst it is encouraging that this group is over 8 continual effort is needed to maintain and improve knife sharpness in boners.

Knife injuries at The Abattoir

Please note that the injury results from 2022 reflect the period January-July 2022. The figures from this period have been doubled to allow easy comparison with previous years. Comparison across years is complicated by changes in production from the covid-19 pandemic and changes to the way injuries are categorised. It is promising that many “major injury” categories such as major laceration, pain, puncture, soreness and swollen have decreased over the years. The inclusion of additional minor categories in 2022, such as headache or tingling, also shows the importance the The Abattoir health and safety team place on injury recording.

Table 4: Injury categories

Year	Abrasion	Amputation	Bleeding	Major Laceration	Minor Laceration
2018	7			4	57
2019	6			1	47
2020	16			3	53
2021	2	1			16
2022	6		2		46

Table 5: Injury location

Year	Beef Kill	Boning	Chillers	Cleaning	Cutting	Maintenance	Offal	Other	Rendering	Skills	Skins	Smallstock Kill	Stockyards	Total
2018	22	22	15		20		34	23	1		4	47	18	206
2019	22	25	23		27		16	22	1		6	27	29	198
2020	28	22	30		25		23	26	4		15	71	24	268
2021	5	11	12		12		8	6	1	1	9	25	2	92
2022	52	32		10	8	18	16	6	6			18	10	176
Total	129	112	80	10	92	18	97	83	13	1	34	188	83	940

6.0 Conclusions / Recommendations

An initial low level of knife sharpness was found at The abattoir. This is consistent with previously reported industry-wide knife sharpness levels [1]. Regular knife testing and training improved knife sharpness in 73% of employees who underwent multiple testing rounds. The score in this cohort increased from an average score in the unsatisfactory category (7.55) to an average score in the satisfactory knife sharpness category (8.05). Despite these positive findings it is recommended that regular knife testing and training practices are implemented to train new staff and maintain focus on the importance of knife sharpness to safe work practices. On-site recommendations to further improve knife sharpness include:

- Training team leaders to provide on-site trainers.
- Replacement of all worn or damaged knives
- Continued training of new personnel
- Employees requiring help to be identified and released for training when Response trainer on-site
- Repair and maintenance of hollow-grinder (and other equipment as necessary)
- Training two operators in the use of the hollow-grinder so they can grind knives in the mornings before production.

A detailed work instruction has been provided for use by the industry to demonstrate proper knife sharpening techniques.

7.0 Bibliography

1. Roberts, S., Sharpness of workers' knives: a case study of thirteen Australian abattoirs Meat and Livestock, 2009. https://www.mla.com.au/contentassets/985518bf002f4e269116b7647a65bf9f/a.min.0083_final_report.pdf