Research Article

Improving Slaughtering Efficiency and Sacrificial Cattle's Welfare Through the Use of Portable Restraining Box

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Abstract | Generally, slaughtering the sacrificial cattle on Eid al-Adha is conducted traditionally, conventionally, and tends to be rough so that the cattle experience torture. Restrain is important in the slaughtering process by using equipment in the form of a restraining box. This study aimed to examine and identify the effect of using the portable restraining boxes (PRB) on the slaughtering efficiency and the level of animal welfare in the slaughtering process of sacrificial cattle during the Eid al-Adha. The study was conducted at Al-Ishlaah Mosque, Yogyakarta, by using ten sacrificial cattle slaughtered conventionally and six slaughtered by using PRB. The parameters observed included the number of people involved, the handling time, and the stress response of the cattle. The data were statistically analyzed using an independent sample T-test. The use of PRB could reduce ($P<0.01$) the number of people (5.17±0.41 people) compared to conventional slaughter (7.70±1.16 people). The use of PRB can accelerate ($P<0.01$) the time of herding, crushing and the total time required for handling sacrificial cattle compared to conventional slaughter, namely 0.84±0.22 vs. 1.90±1.21 minutes; 4.75±6.79 vs. 2.87±1.33 minutes; and 3.22±0.57 vs. 6.78±1.48 minutes. Meanwhile, related to animal welfare, the use of PRB can reduce ($P<0.01$) the number of cattle moans during handling (0.33±0.52 times) compared to conventional slaughter (18.50±16.16 times). The duration of bleeding and the death of cattle slaughtered with PRB was faster ($P<0.01$) than conventional slaughter, namely 1.41±0.55 vs. 3.64±1.18 minutes and 2.53±1.10 vs. 4.99±2.19 minutes. It can be concluded that the use of a portable restraining box can increase the efficiency of slaughtering sacrificial cattle by reducing the number of people involved and speeding up handling time. The use of a portable restraining box can improve the welfare of the sacrificial cattle by reducing the number of moans, the duration of bleeding, and death.

Keywords | Animal welfare, Bleeding process, Eid al-Adha, Portable restrain box, Slaughtering process

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INTRODUCTION

Indonesia is a country with the Muslim population as a majority. Based on the 2020 population census, the Muslim population in Indonesia is more than 87.2% of the total population of 270 million people (Badan Pusat Statistik, 2020). Eid al-Adha for Muslims is identical to the pilgrimage and sacrifice, sacrificial worship is buying a sacrificial animal and then slaughtering it to be distributed to other communities (Ibrahim et al., 2019). Amanda et al. (2017) stated that the slaughtering of the sacrificial animals is usually conducted after Eid prayers in mosques, schools, or other institutions, not at the slaughterhouse. Added by Winarso et al. (2017), the implementation of the slaughtering sacrificial animals outside the slaughterhouse is of course not equipped with

sufficient infrastructure. In addition, human resources who handle animals and meat are generally not professionals. This condition has the potential to cause several problems in the slaughtering process that is not standardized, low animal welfare, sanitation, hygiene and decreased meat quality. Slaughtering the sacrificial animals in Indonesia is generally still carried out traditionally, less preparation, and does not pay attention to hygiene-sanitation aspects, animal welfare and environmental health as well as zoonotic aspects (Yulianto et al., 2019).

As is common in mosques, slaughtering sacrificial animals, especially cows, is carried out in a traditional and conventional manner and even tends to be rough so that the cattle experience physical and psychological torture. This results in a low level of welfare for the sacrificial cattle, a high risk of accidents for the slaughterer, and a low quality of the meat produced. Alternative methods of slaughtering sacrificial cattle need to be sought to improve animal welfare and reduce the risk of accidents in the slaughtering process (Jones, 2011). The slaughtering process of cattle is a critical point in the context of animal welfare. In the process of slaughtering cattle, there is a killing aspect, so it is important to keep the cattle from suffering when it is slaughtered (Grandin, 2010).

One of the important points of the slaughtering process is restraint. It is necessary to observe cattle restraint before it is slaughtered. If the restraint is running well, then the slaughtering process can take place easily and quickly so that the stress level of the animal is low. Jones (2011) stated that restraint is needed to control the cattle before it is slaughtered so that their stress level is reduced. In principle, the stress level can be reduced because restraint makes the cow calmer and copes with sudden rebellious movements and the pressure of the tool on the cow is painless and takes place quickly. Restraint aids that can be used in the process of slaughtering cattle are restraining boxes, which was required for cattle slaughterhouse in Indonesia (Jones, 2011; Whittington and Hewitt, 2009; Stark, 2010; Schipp, 2011).

The high awareness and intention to sacrifice of the Muslim population in Indonesia causes the rate of slaughtering sacrificial animals to increase during Eid al-Adha and is also followed by the emergence of emergency places for slaughtering sacrificial animals such as in mosque yards, school yards, office yards, roadsides, fields and other open places (Yulianto et al., 2019). One alternative method is to use a portable restraining box. The use of this portable restraining box can be an alternative tool to facilitate cattle handling. Another advantage of the portable restraining box is that it is designed to be easily moved from one place to another so that it is expected to be a solution for slaughtering animals in various places that conduct slaughtering throughout the year. This is in accordance with the Regulation of the Minister of Agriculture of the Republic of Indonesia No. 114/Permentan/PD/410/9/2014 concerning the Slaughtering the Sacrificial Animals Article 16, which requires that the place for slaughtering the sacrificial animal must be provided with an animal restraint facility (restrainer) to lie them down shortly before being slaughtered. With the application and use of portable restraining boxes in the process of slaughtering sacrificial cattle for Eid al-Adha, it is necessary to study the effects and impacts for both the sacrificial committee and for the implementation of animal welfare being slaughtered. Recently, there is no information regarding the use of portable restraining boxes for technical implementation and animal welfare implementation.

This study was conducted with the aim of assessing and identifying the effect of the application and use of portable restraining boxes toward the slaughtering efficiency and the level of animal welfare in the implementation during the slaughtering process of sacrificial cattle during Eid al-Adha. The results of the study are expected to be used as a reference in the development of slaughtering methods, especially related to the efficiency of slaughtering cattle by paying attention to safety and animal welfare rules.

MATERIALS AND METHODS

Ethical clearance

This research has obtained approval from the research ethics committee of the Faculty of Veterinary Medicine, Universitas Gadjah Mada, Yogyakarta, with a certificate of ethical feasibility No: 0047/ECFKH/EKs/2020.

Portable retraining box design and specification

The Portable Retraining Box used in this study is a prototype tool that has been developed for two years and following the design of (Whittington and Hewitt, 2009; Stark, 2010; Schipp, 2011; MLA, 2012). This tool has been patented at the Directorate General of Intellectual Property, Ministry of Law and Human Rights, the Republic of Indonesia with application number P00202101489 with the invention title "*Kandang Jepit Portable untuk Merobohkan dan Menyembelih Sapi*". The design and specifications of the portable restraining box are presented in Figure 1.

Specification of the portable restraining box is a portable clamp cage for knocking down and slaughtering cattle characterized by a cage consisting of 2 parts, namely a clamp cage and an outer frame cage. The tool has dimensions for the clamping cage section: height (A) 1.50 m; length (B) 1.95 m; width (C) 0.70 m, while the outer frame cage has dimensions: height (D) 1.55 m; length (E) 1.95 m; width (F) 0.79 m. It is Rectangular in shape with both front and rear sides in the form of a circular plane with a diameter

(G) of 1.80 m to rotate the axis of the frame cage to the side by 90°. The outer frame is equipped with doors on both the front and back sides for entry and exit routes and keeping the cattle inside. There is an additional square area as a place for headrests and to tie the cattle head for an easier slaughtering process with a length (H) of 0.80 m and a width (I) of 0.50 m. The portable clamp cage is above ground level with a height (J) of 0.30 m and is equipped with a drive system in the form of 1 wheel in the front with a diameter of (K) 0.65 m and two wheels at the rear with a diameter of (L) 0.60 m and lever puller cage with a length of (M) 1 m to carry or move from one place to another, so it is portable.

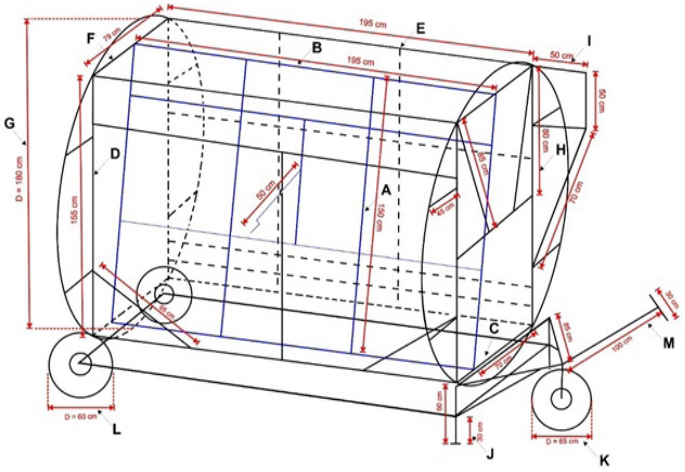

Figure 1: A. The height of the clamping cage section (1.50 m); **B**. The length of the clamping cage section (1.95 m); **C**. The width of the clamping cage section (0.70 m); **D**. The height of the outer frame cage (1.55 m); **E**. The length of the outer frame cage (1.95 m); **F**. The width of the outer frame cage (0.79 m); **G**. The diameter of a circular plane in the front and rear sides (1.80 m); **H**. The length of an additional square area as a place for headrests and slaughtering process (0.80 m); **I**. The width of an additional square area as a place for headrests and slaughtering process (0.50 m); **J**. The height above ground level (0.30 m); **K.** The diameter of the front wheel (0.65 m); **L**. The diameter of the rear wheel (0.60 m); **M**. The length of lever puller (1.00 m)

Research methods

This research was conducted during the sacrificial feast of Eid al-Adha on July 31, 2020, located at the Al-Ishlaah Mosque, Nitikan Village, Umbulharjo, Yogyakarta. This study used a total of 16 cattle that met the criteria for sacrificial cattle, namely healthy, not disabled, male, more than 1.5 years old (incisors have changed), and body weight ranging from 350-500 kg. There were ten cattle slaughtered conventionally as a control group and six cattle that were slaughtered by using a portable restraining box as a treatment group. The number of samples adjusts to the number of cattle slaughtered for sacrificial during Eid al-Adha and has obtained approval from the committee of the Al-Ishlaah Mosque (one location).

The process of handling and slaughtering cattle conventionally started from the cattle being led into the slaughter area. The cattle that have arrived at the slaughter area, their head are tied to an iron pole. Then the cattle were knocked down in the following way: A rope of 6 m long was tied to the cattle. The rope's end was pulled back on the front back and looped. The rope's end was pulled back again and looped around the abdomen, aligning the top rope at the balance point of the cattle. The rope was pulled slowly towards the back until the cattle collapsed. Cattle that have been knocked down, the front and hind legs were tied with ropes. The cattle's legs, body, and head were retained, and the cattle were ready to be slaughtered.

For the slaughtering process, by using the portable restraining box, the cattle that had been put in the box was then clamped by turning the pedal on the right side of the tool. The cattle should be firmly clamped, then the front and rear legs were tied to the side posts of the portable restraining box. The portable restraining box was then being rotated 90° clockwise and locked to prevent it from turning. The cattle were ready to be slaughtered.

Parameters observed in this study included the number of people involved, handling time, and the stress response of cattle in the process of handling and slaughtering either using conventional methods or portable restraining boxes (Grandin, 2010; Pnuela et al., 2012; Losada-Espinosa et al., 2018; Imlan et al., 2021). The number of people involved was counted by the number of people at the time of carrying from the mooring place to the slaughtering location and handling the cattle before being slaughtered. The handling time in the conventional method was calculated when the cattle began to enter the slaughter area until the cow was ready to be slaughtered. Meanwhile, the handling time with the portable restraining box was calculated from the cattle was about to climb into the portable restraining box until the cow was ready to be slaughtered. Handling time was calculated at the time of herding, at the time of binding and clamping, at the time of tearing and the total time required during the handling process before slaughtering. The stress response of cattle as an animal welfare parameter was the occurrence of kicking and mooing during handling and slaughtering. The calculated slaughtering time was the length of the slaughtering process, the length of the bleeding process and the duration of death. Statistical analysis used in this study was an independent sample T-test supported by IBM SPSS Statistics 25.

RESULTS AND DISCUSSION

The efficiency of slaughtering sacrificial cattle

The efficiency parameters of slaughtering sacrificial cattle

using a portable restraining box compared to slaughtering using conventional methods in this study are presented in Table 1.

Based on the analysis of the result in Table 1, it can be seen that the number of people involved in handling sacrificial cattle by using a portable restraining box was fewer person (P<0.01), namely 5.17±0.41 people compared to the conventional methods, 7.70±1.16 people. This shows that portable restraining boxes require fewer human resources than conventional methods. The involvement of a person in handling cattle using a portable restraining box can be minimized by up to half (50%) than the conventional method because handling cattle from tying and knocking down the cattle can be done mechanically with a portable restraining box. Based on Table 1, handling cattle using a portable restraining box is easier and faster. This can be seen in the difference in the total time required from herding, knocking down and until the cattle were ready to be slaughtered was 1.06; 2.77 and 3.56 minutes faster (P<0.01) compared with the conventional method. The time required for herding, knocking down and handling time until the cattle are ready to be slaughtered can be minimized by 50%, which makes it more efficient in slaughtering sacrificial cattle. Thus, the total time for handling cattle until they were ready to be slaughtered was twice faster (P<0.01) of 3.22±0.57 minutes than the conventional method, which was 6.78±1.48 minutes.

The welfare level of the sacrificial cattle

The welfare parameters of the sacrificial cattle with the use of a portable restraining box compared to conventional methods are presented in Table 2.

The stress response in the form of kicks during the handling process and moans during the slaughtering process were not significantly different. The number of cattle kicks when using a portable restraining box was 46.50±15.98 times and was higher (P<0.05) than the conventional method, which was 25.20±3.67 times. On the other hand, the use of a portable restraining box could reduce (P<0.01) the number of cattle moans during handling, which almost did not appear (0.33±0.52 times) compared to the conventional method, which reached 18.50±16.16 times. The length of time for slaughtering sacrificial cattle with the use of portable restraining boxes and conventional methods was not significantly different, which was around 20 seconds. The relative length of time for slaughtering required the same amount of time for the two slaughtering groups because both were carried out by experienced and skilled butchers. However, there was a significant difference (P<0.01) between the length of bleeding and the time of death because both processes were influenced by the condition of the cattle before being slaughtered. The duration of bleeding and the death of the sacrificial cattle being slaughtered by using a portable restraining box was faster (P<0.01), namely 1.41±0.55 and 2.53±1.10 minutes compared to the conventional method, in which 3. 64±1.18 and 4.99±2.19 minutes. The use of a portable restraining box made the time of bleeding and death two times faster compared to the conventional methods.

Tabel 1: Parameters of the slaughtering efficiency of sacrificial cattle through the use of portable restraining boxes (PRB).

Variables	Control (N=10)	PRB Treatment (N=6)
Number of escort (person)**	2.20±0.42[a]	3.17±0.41[b]
Number of handlers (person)**	7.70±1.16[b]	5.17±0.41[a]
Herding time (minutes)**	1.90±1.21[b]	0.84±0.22[a]
Fastening and clamping time (minutes)	2.22±0.98	4.75±6.79
Laying time (minutes)**	2.87±1.33[b]	0.10±0.02[a]
Total hour (minutes)**	6.78±1.48[b]	3.22±0.57[a]

Note: [a, b] different superscript denote a significant differences between rows *(P < 0.05); **(P < 0.01). PRB, portable restraining boxes.

Development of restraining box for slaughtering cattle

Since 1998, the Australian livestock export industry has developed cattle restraint boxes, especially in Indonesia, for the halal slaughtering of cattle. A design had been

Table 2: Welfare parameters of sacrificial cattle through the use of portable restraining box (PRB).

Variable	Control (N=10)	PRB Treatment (N=6)
Number of kicks during handling process (times)	8.40±6.71	10.67±9.97
Number of kicks during slaughtering process (times)*	25.20±3.67[a]	46.50±15.98[b]
Number of moans during handling process (times)**	18.50±16.16[b]	0.33±0.52[a]
Number of moans during slaughtering process (times)	24.10±8.97	21.33±8.11
Slaughtering period (second)	20.20±6.07	21.00±5.69
Blood extraction period (minute)**	3.64±1.18[b]	1.41±0.55[a]
Death period (minute)*	4.99±2.19[b]	2.53±1.10[a]

Note: [a, b] different superscript denote a significant differences between rows *(P < 0.05); **(P < 0.01). PRB, portable restraining boxes.

developed using springs and levers and did not use pneumatics, hydraulics, or electricity. This was conducted to improve traditional cattle slaughtering methods through the development of tools that were cost-effective, easy to install, compatible with skills and processes, can be serviced regularly, and did not require an electricity supply. Until this day, the device was known as the Mark I, Mark II, Mark III, and Mark IV restraint box. (Whittington and Hewitt, 2009; Stark, 2010; Schipp, 2011; MLA, 2012; Imlan et al., 2021).

The use of Mark restraint boxes in several countries in the Middle East and Southeast Asia has the following benefits: (1) Improved handling of animals before and during the slaughtering process as it eliminates the need to immobilize cattle in an effort to effectively restrain them. (2) Improved process efficiency and safety during slaughtering. (3) Increased commitment to improving animal welfare standards in the supply chain and beef production (Whittington and Hewitt, 2009; Stark, 2010; Imlan et al., 2021). Sarmin et al. (2014), reported that the use of Mark 1 restrain box in the slaughterhouse Yogyakarta was sufficient to ensure animal welfare.

The Australian Chief Veterinary Officer (ACVO) assessment found that the use of Mark IV restraint box was appropriate and complied with Office International des Epizooties/OIE (World Organization for Animal Health) requirements related to animal slaughter and could be developed sustainably (Whittington and Hewitt, 2009; Stark, 2010; Schipp, 2011). According to the OIE guidelines, the process of slaughtering without stunning should not be excluded from operational standards, so the restraint method must meet the following basic requirements: providing an anti-slip floor, ensuring that the restraining equipment does not apply excessive pressure to cause the animal to struggle and make noises, reduce the clattering sound on restraint materials, equipment that does not have sharp surfaces that can injure the animal, restraint equipment that does not cause the cow to move suddenly or startle, and is operated by skilled, experienced and knowledgeable personnel so that animal welfare standards can be achieved (OIE, 2010).

Principally, the development of the portable restraining box in this study refers to the restrain box that has been widely developed in the slaughterhouse in Indonesia, especially Mark IV, with various modifications to the portable characteristic that can be moved from one location to another or are easily operated by the committee for slaughtering sacrificial cattle. Some specific aspects of the portable restraining box with Mark IV include non-slip floor by using "bordes" patterned iron plate, consisting of an outer frame and clamping cage/restraints with tough materials, and having a circular area of 1.80 m in diameter at the front and rear to rotate the axis of the skeleton cage until 90° to the side by so that it can lay down the cattle in a ready position to be slaughtered and optimize blood loss. Moreover, there is an additional square area as a place to rest and tie the cattle's head for easy slaughter. It is also equipped with a drive system in the form of 1 front wheel 0.65 m diameter, and 2 wheels at the rear with a diameter of 0.60 m, as well as cage pull lever with a length of 1 m to carry or move the box from one place to another so that it is portable.

The efficiency of slaughtering sacrificial cows

Conventional animal slaughtering is the process of slaughtering cattle using traditional equipment, mostly conducted at the time of sacrificial feast. In accordance with the Regulation of the Minister of Agriculture of the Republic of Indonesia No.114/Permentan/PD/410/9/2014 concerning the Slaughtering Sacrificial Animal, required the place where the sacrificial animal was slaughtered must have available animal restraint facilities (restrainer) to knock it down shortly by using a restraining box. If it is not available, knocking down the cattle should use the rope method in accordance with OIE (2010) recommendations in a good way, smooth, not being slammed, stepped on or pulled. In these situations, the use of restraining boxes can improve slaughtering efficiency.

Portable restraining boxes require fewer human resources than conventional methods. The person's involvement in handling cattle using a portable restraining box can be minimized by up to 50% than the conventional method because handling cattle from tying and knocking down the cattle can be done mechanically with a portable restraining box. The tightly bound cattle in a portable restraining box can reduce as much as two workers compared to conventional methods. This is in accordance with (Stark, 2010), which stated that the use of restraining boxes minimizes the number of workers involved in handling cattle. The handling process can be done quickly and efficiently, minimizing labor and easy operation. Whittington and Hewitt (2009) added that the use of restraining boxes impacts slaughtering efficiency and increases the safety of cattle and workers by using sturdy iron materials that ensure safety.

Handling cattle using a portable restraining box is easier and faster. The time required for herding, knocking down, and handling time until the cattle are ready to be slaughtered can be minimized by 50%, which makes it more efficient in slaughtering sacrificial cattle. Handling cattle with a portable restraining box can run efficiently because it did not take time to hold the cattle when they were about to be tied up and the process of knocking them

down was faster. Whittington and Hewitt (2009) stated that the use of restraining boxes speeded up and made the process of knocking down the cattle, as well as providing treatment to the cattle before the slaughtering process. According to Yulianto et al. (2019), conventionally, it is recommended to use the Burley and/or Reef (Rope squeeze) method and as long as it caused minimum pain to the cattle in accordance with the Regulation of the Minister of Agriculture of the Republic of Indonesia No. 114/Permentan/PD/410 /9/2014 concerning Slaughtering Sacrificial Animals. Therefore, it takes expertise and skills to carry out the restraining method and the impact on the time required is different. In addition to the slaughtering process, the use of a restraining box plays an important role in facilitating the implementation of animal breeding. As reported by Carrell et al. (2021), the use of a breeding box can facilitate handling, facilitate the lust synchronization implementation program, increase the timeliness of the artificial insemination program and pregnancy rates.

The welfare level of the sacrificial cattle

Lasada-Espinosa et al. (2018) identified animal welfare parameters of the slaughtering process in the form of behavior that is an expression of fear and stress, namely the occurrence of kicks and moans (vocalization) occur during the handling and slaughtering process. The stress response was in the form of moaning because the treatment using a portable restraining box was smooth when inserting and knocking down the cattle. The use of a portable restraining box minimized the occurrence of injury and did not hurt the cattle during the knocking process. The portable restraining box was designed to follow the restraint box designed by Whittington and Hewitt (2009), Stark (2010), Schipp (2011), MLA (2012), and the OIE (2010) standard that in which there were no sharp parts that can injure the cattle. The box was clamping the cattle without causing pain or injury. The process of knocking down the cattle ran smoothly and did not slam them because it was done mechanically.

As reported by Wenno et al. (2015), the slaughtering process in the slaughtering house in Denpasar, Bali, in which using a restrains box, had met the principles of animal welfare in the process of herding and slaughtering preparation in the restrains box, 93.29% of the cows did not slip, the tail was pulled, slamming and thrashing. Nielsen et al. (2020) stated that animal welfare when handling cattle is in the restraining process, whether the rebellious response of the cattle exist or not. Handling such as pulling the cattle's tail, slamming and kicking the cattle can be minimized when the cattle did not di rebellious action. Whittington and Hewitt (2009) stated that the use of a restraining box was to prevent the cattle from being tortured. Cattle stress responses such as kicking can be minimized. The cattle also did not knock over or hit by hard objects during the restraining process, so bruising can be avoided. Cattle that were handled by using a portable restraining box did not force themselves out of the restraining box. Handling in the form of clamping the body of the cattle, tying the legs, and turning the cattle did not make them rebel and remain calm. Cattle that were not rebellious and calm will make the handling process easier. Stark (2010) stated that the cattle handled with a restraining box were calmer, making it easier to give treatment while in a restraining box. The process of gripping the cattle when it is in the restraining box happened tightly without making them suffer. Restraining cattle run smoothly without any jerking motion on the tool that causes them to panic.

The length of time for slaughtering sacrificial cattle with the use of portable restraining box and conventional was longer than the recommendation of Yulianto et al. (2019), in the training module for halal butchers from the Ministry of Agriculture, which was 10 seconds from the time the cattle were ready to be slaughtered until the slaughtering process was complete. Meanwhile, the length of time for slaughtering cattle at the slaughtering house in Denpasar, Bali, by using a restraint box and carried out by a trained butcher took approximately one minute (Wenno et al., 2015). The length of bleeding and the time of death were influenced by the condition of the cattle before being slaughtered. Therefore, it became a parameter for the presence or absence of stress in the sacrificial cattle. The stress level of cattle before being slaughtered will be shown at the time after the slaughtering process, which includes the time to stop blood gushing and the time of complete death. The use of a portable restraining box made the time of bleeding and death two times faster compared to the conventional methods (Rodriguez et al., 2012; Cranley, 2014; Pisetyani et al., 2015; Barrasso et al., 2020).

The observation results of the death assessment were conducted out by touching the cornea of the eye and looking at the foot reflexes and movements as mentioned in the MLA (2012) procedure, in which determination of death can be conducted by gently touching the corner of the cattle's eye using a finger, and it took approximately 2 minutes, so the next procedure could be continued for head separation and skinning. The duration of bleeding and the duration of death in sacrificial cattle slaughtering by using a portable restraining box were the same as the results of previous studies on cattle slaughtering with restrains box without stunning. The length of the process of bleeding occurred within 2 minutes after slaughtering the neck (cut-neck) (Barrasso et al., 2020). Rodriguez et al. (2012) reported that the respiratory rhythm disappeared at a mean time of 44±4.2 seconds (range 30 to 60 seconds) and corneal reflexes disappeared at 116±11.01 seconds (range 80 and 160 seconds) after being slaughtered. Cranley

(2014) reported that slaughtering cattle without stunning took 120 minutes.

The use of a portable restrain box makes the cattle's head position well tied to the provided field and the body position was in a tilt (lateral) > 90° so that it can facilitate the slaughtering process, speed up the process of bleeding and death, compared to the conventional method, where the head was raised due to the bearing on the head and its position was higher than the body lying on the floor. According to Cranley (2012), if the cattle's head was properly restrained and parallel to the cervical spine, it can expose the carotid to the exact location of the slaughtering (cut-neck) that limiting the blood supply to the brain center, resulting in ischemia to cause seizures that release glutamate or aspartate to hasten death. The purpose of phlebotomy is to bleed and ensure the animal died by stopping the oxygen supply to the brain (Gregory et al., 2010). Bleeding will cause unconsciousness, which continues with death. The death occurred due to lack of oxygen supply to the brain which has been supplied by the arterial flow. Normal blood loss can occur in healthy cattle but can be slowed if the animal experiences muscle damage (Pisetyani et al., 2015). Muscle damage can occur, one of which was due to a crash that causes damage to the capillary blood vessels in the tissue so that blood entered the muscle resulted in lower meat quality. Perfection of bleeding is a requirement for the quality of the meat produced is good. Therefore, slaughtering the cattle should be allowed to experience contraction until it died completely, after which the hanging and releasing of the skin can be carried out. Furthermore, the use of portable restraining boxes is also an effort to produce qualified sacrificial meat and to prevent damage caused by the sacrificial cattle handling before being slaughtered. This research is suitable to be developed for further research. Suggest further research, especially for stress response, for example, by observing cortisol hormone levels or animal behavior. In addition, observations related to meat quality also need to be conducted to determine the effects of the slaughtering process.

CONCLUSIONS AND RECOMMENDATIONS

Based on the study results, it can be concluded that using a portable restraining box can increase the efficiency of slaughtering sacrificial cattle because it can reduce the number of people involved and speed up the handling and slaughtering of the cattle up to 50% compared to the conventional method. The use of a portable restraining box can improve the welfare of the sacrificial cattle, shown by the smaller number of moans and twice faster-bleeding process and death than the conventional method.

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NOVELTY STATEMENT

This research is the first scientific study related to the usage of Porta-ble Restraining Box (PRB) on slaughtering efficiency and sacrifi-cial cattle's welfare during Eid al-Adha Festival in Indonesia. Im-proving slaughtering efficiency and sacrificial cattle's welfare are important due to the increasing awareness on food safety and ani-mal welfare.

AUTHOR CONTRIBUTION

Panjono designed, coordinated, and supervised the study. ET, WSN and MDEY supervised and revised the manuscript. BAA performed the experiment, analyzed the data and wrote the manuscript. The final manuscript has been read and developed in consultation with all authors. All authors read and approved the final manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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