A SURVEY ON WATER FOOTPRINT OF SMALL-SCALE SHEEP AND GOAT SLAUGHTER AND CARCASS PROCESSING IN SOME KANO METROPOLITAN ABATTOIRS

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ABSTRACT
A survey was conducted to quantify the amount of water used in sheep and goat slaughtered and carcass processed in some Kano metropolitan abattoirs. The data were collected from a total of 100 respondents through interview using structured questionnaires in five selected slaughter houses at Kumbotso, Tarauni, Fagge, Ungogo and Nassarawa local government areas. The data generated were subjected to statistical analysis using simple descriptive statistics of SPSS Version 20.0. The findings revealed that sheep and goat slaughtering in Kano metropolitan abattoirs was dominated by men (100%), married (73%), of between 21 – 40 years old (70%) and majority possessed between 6 – 10 family members (41%). Most butchers (51%) were involved in both sheep and goat slaughtering and majority (46%) processed between 11 to 50 animals per day. The results also indicated that evisceration consumed the highest quantity of water (22.7 L per 30 – 40 kg animal), followed by general cleaning (6.6 L/head). The finding also showed that majority (62%) of butchers sourced their water from vendors at an average cost of ₦100 per 25 litres. It was concluded that large volume of freshwater was used in small ruminants slaughtering and carcass processing in Kano metropolitan abattoirs, sourced mostly from water vendors at exorbitant prices. It is therefore recommended that government should provide additional source of freshwater particularly borehole to mitigate water scarcity and reduce the cost experienced by the butchers in Kano metropolitan slaughter houses. Water recycling could be encouraged without compromising the hygienic aspect of the meat.
Keywords: Water footprint, Sheep, Goats, Slaughter, Carcass

Introduction

Slaughterhouses and red meat processing plants are known for being the big consumers of water (Valta *et al*., 2014), with intense wastewater production (Apatie *et al*., 2016). The term "water footprint" was coined in the early 2000s as an indicator of the volume of freshwater used to produce food (e.g., meat, milk) or an industrial product (Hoekstra and Hung, 2002). Among the food industries, the meat processing plants constitutes 24% which is the highest in terms of fresh water demand, followed by the beverages industry with 13% and dairy industry with 12% (Bustillo-Lecompte *et al*., 2015; Compton *et al*., 2018). The average water requirement for the production of one kilogramme of meat is 15.5 litres for cattle, 6.1 litres for sheep and goats, 4.8 litres for pigs and 4.0 litres for poultry (Hoekstra *et al*., 2011). The quantity of water used in red meat abattoirs is linked to the number of animals slaughtered. Water is used in practically all the processing areas, either for washing down, cleansing or sterilizing purposes (Hoekstra, 2012).

Interest in water footprint of animal products has grown recently in response to consumer concerns about the environmental impacts of food production (Chapagain and Hoekstra, 2003; Ridoutt *et al*., 2012). An estimated two-thirds of the current global population live under conditions of severe water scarcity at least 1 month of the year, and half a billion people face severe water scarcity all year round (Mekonnen and Hoekstra, 2016). In Nigeria, the proportion of people living in water stressed regions is expected to rise significantly (Wada *et al*., 2014). In order to reduce water scarcity issues in urban and industrial locations, water conservation and reuse are crucial methods (Matsumura and Mierzwa, 2008). However, there is little or no information on the water footprint of small ruminant slaughter and carcass processing in dryland Nigeria. Thus, the present survey aimed at estimating the quantity of water utilized during slaughter and carcass processing of small-scale sheep and goat in Kano metropolitan abattoirs.

MATERIALS AND METHODS

Study area

The study was conducted at Department of Animal Science, Bayero University, Kano. The State lies between Latitude 10° 33' to 12° 27' N and Longitude 7° 34' to 9° 29' E with a rainfall distribution ranging from 800 to 1200 mm and an ambient temperature of between 19.6^{0}C to 40^{0}C (Olofin, 2008). The State is located in the semi-arid area of North-western Nigeria. It has a human population of 9,383,682 (NPC, 2006). The State is the commercial nerve center of Northern Nigeria.

Methodology

A total of one hundred well-structured questionnaires were used to collect information on water used in sheep and goats slaughter and carcass processing at five Kano metropolitan abattoirs located in Fagge, Ungogo, Tarauni, Kumbotso and Nassarawa local government areas. The abattoirs were selected based on high concentration of small ruminant slaughtering and meat processing. In addition to interviews, physical observations on some of the reservoirs used for water storage were made to ease estimation of water volume.

Data analysis

The data generated were subjected to statistical analysis using simple descriptive statistics of SPSS Version 20.0.

RESULTS AND DISCUSSION

Table 1 shows the socio-economic background of small ruminants' butchers in Kano metropolitan abattoirs. The respondents were found to be all male and majority were married and at their youthful age. This could be connected to religious or cultural reasons in northern Nigeria where most women and old people do not engage in laborious work like butchering compared with men. The present result is in conformity with that of Muhammad *et al*. (2007), who reported 100% male butchers and 76.6% of them were married at productive age (55%) in Kano metropolitan abattoir.

Table 1: Socio-economic Background of the Butchers in Kano Metropolitan Abattoirs

Parameters	Frequency	Percentage
Gender		
Male	100	100
Female	0	0
Age (years)		
< 20	3	3
21 – 40	70	70
41 – 60	25	25
> 60	2	2
Marital status		
Single	27	27
Married	73	73
Household size		
< 5 Persons	25	25
5 – 10 Persons	41	41
> 10 persons	34	10

The study revealed that most butchers (51%) were involved in both sheep and goat slaughter and majority (46%) processed between 11 to 50 animals per day. This could be traced to some common features shared by the sheep and goat in terms of size and easy handling during slaughter as well as meat demands due to the human population in the study area. Evisceration (76%) and general cleaning (22%) consumed the highest (27.7 and 6.6 liters/head/day, respectively) amount of freshwater during small ruminants slaughtering. This could be attributed to the huge waste in terms of rumen contents, intestinal components, blood and other internal organs as well as killing floor and containers which need to be thoroughly cleaned for a hygienic meat and environment. Generally, sheep and goat slaughtering and meat processing consumed approximately 30 litres of water per 30 to 40 kg animal per day. In concurrence with the findings, the United Nations Environment Program, Cleaner Production Assessment in Meat Processing (2000), estimated that 4.1 to 16.6 m^3 of water was used per tonne of carcass in the United States. While, between 44-60% of water was utilized during slaughter, evisceration and boning stages (MRC, 1995).

The butchers sourced water from vendors at an exorbitant price (₦100 per 25 liters) and stored in drums for their use during slaughtering and meat processing without water re-use at some points to reduce the volume of fresh water conversion to wastewater and cost. This could be responsible for the water scarcity and the government inability to meet the required amount of water supply to the Metropolitan inhabitants. In concurrence with this

finding, Nura and Ibrahim (2014), reported that the total water demands in Kano metropolis and environment is 550 million litres daily, however, water treatment plants in the whole Kano State can only supply 200 million litres per day.

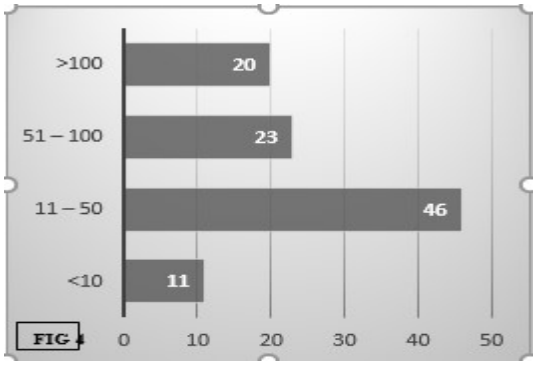

Figure 1: Type of animal slaughter

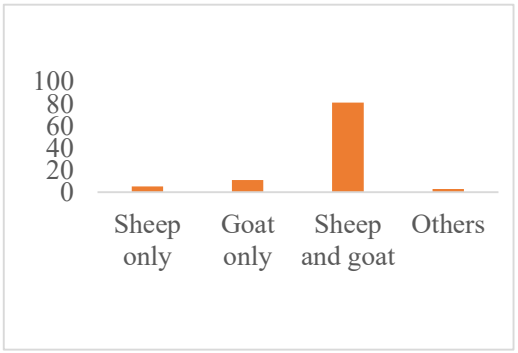

Figure 2: Number of animal slaughter per day

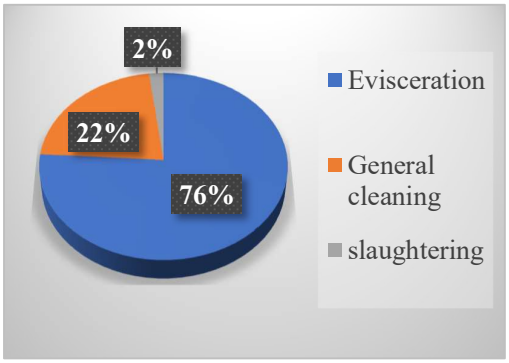

Figure 3: Volume of water used

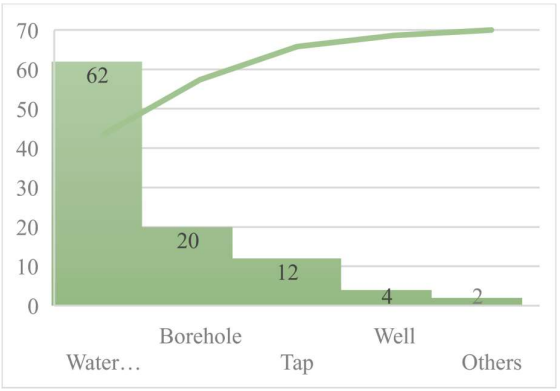

Figure 4: Source of water

CONCLUSION AND RECOMMENDATIONS

It was concluded that large amount of freshwater was used in small-scale sheep and goats slaughtering, carcass evisceration as well as cleaning of meat and slaughter floor in Kano metropolitan abattoirs. Moreover, the water was sourced mostly from water vendors at higher prices. It is therefore recommended that water re-use should be adopted at some points to reduce wastage without compromising the hygienic aspect of meat and government should provide additional source of freshwater to mitigate its scarcity and reduce the cost experienced by the butchers in Kano metropolitan slaughter houses.

REFERENCES

Apatie, N.C., Houser, D.J., Preiss, E., White, O., Fang, H. and Mesnick, L. (2016). Master of Science Thesis, Evaluation of a MBR for Treating Slaughterhouse Wastewater in Montevideo, Uruguay, Delft.

Bustillo-Lecompte, C.F and Mehrvar, M. (2015). Slaughterhouse wastewater characteristics, treatment, and management in the meat processing industry: A review on trends and advances. *Journal of Environmental Management.* 161, 287–302.

Chapagain, A. K. and Hoekstra, A. Y. (2003). Virtual water flows between nations in relation to international trade in livestock and livestock products. Value of water research report series no. 13. UNESCO-IHE, Delft, the Netherlands.

Compton, M., Willis, S., Rezaie, B. and Humes, K. (2018). Food processing industry energy and water consumption in the Pacific northwest. *Innovation Food Science Emerging Technology*. 47, 371–383.

Hoekstra, A. Y. (2012). The hidden water resource use behind meat and dairy. *Animal Frontier*. 2(2):3–8. doi:10.2527/af.2012-0038

Hoekstra, A. Y. and Hung, P. Q. (2002). Virtual water trade. A quantification of virtual water flows between nations in relation to international crop trade. Value of water research report series no. 11. UNESCO-IHE, Delft, the Netherlands.

Hoekstra, A. Y., Chapagain, A. K., Aldaya, M. M. and Mekonnen, M. M. (2011). The Water Footprint Assessment Manual: Setting the Global Standard. Earthscan, London, UK.

Matsumura, E. M. and Mierzwa, J. C. (2008). Review - Water conservation and reuse in poultry processing plants. A case study. *Resources, Conservation and Recycling*. 52 - 835–842.

MRC (1995). Meat Research Corporation. Devices and Approaches in the Meat Industry. http://wrrc.p2pays.org/p2rx/subsection.cfm.

Mekonnen, M. M. and Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. *Science Advances.* 2(2): e1500323.doi:10.1126/sciadv.1500323.

Muhammad, I.R., Ashiru, R.M. and Abdullahi, A.Y. (2007). Implication of slaughter of pregnant Ewes and Does to future Stocks in the Semi-Arid Urban Abattoir. *Medwell Journal of Animal and Veterinary Advances* 6(6): 819-822.

NPC (2006). National Population Commission, Nigerian population census. Abuja, Nigeria. Pimentel.

Nura, I.B. and Ibrahim, K.A. (2014). Water Supply Situations in Kano Metropolitant Prospects and Challenges. *International Journal of Research in Earth & Environmental Sciences,* 1(4):25-32.

Olofin, E.A. (2008). The Physical Setting. In E.A. Olofin, A.B. Nabegu and A.M. Dambazau (Eds). **Wudil Within Kano Region: A Geographical Synthesis of Kano City:** Adamu Joji Publishers. pp 5-34.

Ridoutt, B. G., Sanguansri, P., Freer, M. and Harper, G. S. (2012). Water footprint of livestock: Comparison of six geographically defined beef production systems. *International Journal of Life Cycle Assessment*. 17(2):165–175.

UNEP (2000). UN Environment Program. Cleaner Production Assessment in Meat Processing. COWI for UNEP and Danish Environmental Protection Agency. Paris: UNEP. Available at http://www.agrifood-forum.net/publications/guide/index.htm

Valta, K., Kosanovic, T., Malamis, D., Moustakas, K. and Loizidou, M. (2014). Overview of water usage and wastewater management in the food and beverage industry. Desal. *Water Treatment.* 1–13.

Wada, Y., Gleeson, T. and Esnault, L. (2014). Wedge approach to water stress. *National Geoscience*. 7(9):615–617. doi:10.1038/ngeo224.