

Article

Utilization of slaughterhouse by-products: a current scenario in Dhaka city

Md. Shefath Abdulla, Md. Saiful Islam*, Md. Enayet Kabir, Falguni Dadok, Md. Abdullah Al Zaber and Shikha Sarkar

Department of Animal Production and Management, Faculty of Animal Science and Veterinary Medicine, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

*Corresponding author: Md. Saiful Islam, Department of Animal Production and Management, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh. Phone: +88-01725-434279; E-mail: saiful.apma@sau.edu.bd

Received: 07 December 2020/Accepted: 24 December 2020/ Published: 31 December 2020

Abstract: Slaughter-houses are the places from where people get the meat for consumption, but the time is to utilize the by-products to increase the GDP's rate from livestock. A field survey was conducted regarding usage of the by-products of slaughterhouses and/or meat selling centers in Dhaka city of Bangladesh. Data were collected from total 60 slaughterhouses and/or meat selling centers randomly from different part of Dhaka city consisting 20 large animal (cattle, buffalo), 20 small animal (goat, sheep) and 20 poultry bird (chicken, duck) slaughterhouses and/or meat selling centers. Following slaughtering process huge amount of different by-products are also produced that have good economic and nutritive value. The results revealed that edible by-products such as head trimmings, brain, tongue, heart, stomach, lungs, liver, pancreas, spleen, kidney and tail were used by 100% as human food. Inedible by-products had diversified uses but to some extent they were also rejected. However, no one of the inedible by-products was fully rejected. Among the inedible by-products the hides had a great industrial value. Poultry by-products like blood, intestines and feather wastes were generally found to utilize as fish feed. Most slaughterhouses were found to maintain moderate to poor hygienic conditions where very few maintained good condition. Almost two-third (61.67%) slaughterhouses were used water container as water supply followed by hose pipe (33.33%) and tape water (5%) for cleaning purpose. It can be concluded that by-products are valuable materials but due to lack of management and industrial mind slaughterhouses of the Dhaka city cannot utilize those materials. Therefore, proper usages of by-products can run a new prospective business in Bangladesh.

Keywords: slaughterhouse; by-products; usage; hygiene practices

1. Introduction

Slaughterhouse or abattoir is defined as scientifically designed any premises approved and registered by the controlling authority in which animals are slaughtered and dressed for human consumption (Codex Alimentarius, 1993). The purpose of an abattoir is to produce edible meat by humane handling of the animals using hygienic techniques for slaughtering and dressing (FAO, 1992). By-products of slaughterhouse may be defined as everything from the abattoir or normal butcher's shop that is not sold directly as food (Gracey, 1986). The slaughterhouse by-products may be divided into edible and inedible, but this distinction is not rigid. Examples of edible by-products are offal's such as liver, heart, kidney, thymus, pancreas, spleen, lungs and edible fat, while inedible by-products include feet, inedible raw bone, horns, hooves, bile, blood and inedible fat (Aberle *et al.*, 2001). All parts of dead animal or condemned meat and organs also come in inedible category. The basic criterion of division between edible and inedible by-products depends upon the purchasing power, custom, tradition, food habits, religious outlook etc.

Commercial uses of by-products are described by different scientists (Ensminger, 1969; Gracey, 1986). A major part of the waste generated from the slaughterhouses constitutes the by-products which are handled by the

animal by-products industries to produce many valuable products such as leather, bone meal, meat meal, meat offal, blood meal, gelatin, casings, catgut, ornamental items etc. (Malav *et al.*, 2018).

The livestock sector of Bangladesh contributes nearly 13.62% of total agricultural sector and 1.54% of GDP (DLS, 2018). This contribution would have been much greater if the slaughterhouses by-products been efficiently utilized. Efficient utilization of by-products has direct impact on the economy and environmental pollution of the country, the former being an asset and the latter is a responsibility. Non-utilization or under-utilization of by-products not only lead to loss of potential revenues but also added and increasing cost of disposal of these products. Non-utilization of animal by-products may create major aesthetic and catastrophic health hazards. The cost of live animals often exceeds the selling price of their carcasses and the value of the by-products must pay the expense of slaughter and generate the profit for the meat-slaughtering operation. Bengtsson and Holmqvist (1984) have suggested that 7% to 12% of the income from slaughter results from the sale of by-products. If the by-products are processed, then the returns will be almost equal to the value of the meat derived from an animal. Therefore, the potential and scope of by-products utilization is really great which will result in industrial development, employment generation, environmental management and better returns to the farmers.

Animal by-products utilization has been a remarkable economic and public health phenomenon but published information in this area is scanty. Moreover, because of lack of awareness about the significant economic benefits, wastage or under-utilization of animal by-products are common in several developing countries like Bangladesh. It has become a basic need to promote animal by-products utilization through publications, conducting workshops, seminars and giving publicity through mass media. This will not only help to solve pollution problems and energy crisis but also meet the challenges of the carcass by-products industries through innovations and find better opportunities in future. It is therefore felt that there is an urgent need for organized collection of by-products and processing them into value-added products.

Presently the slaughterhouses and/or meat selling centers of Dhaka city are being used in such a way that the by-products come from these are not using properly and wastes are polluting the surrounding environment such as river water, solid surface, air etc. Proper use of by-products are hampered in Bangladesh due to ignorance of government rules and regulations, lack of facilities to collect, process and preserve and lack of transport. However, there is no research work related to the scenario of using slaughterhouses and/or meat selling centers by-products in Dhaka city of Bangladesh. Therefore, the present research work was carried out to explore the existing uses of slaughterhouse and/or meat selling centers by-products along with the hygiene practices in slaughterhouses and/or meat selling centers.

2. Materials and Methods

2.1. Study area and respondents' selection

The study was carried out in sixty (60) slaughterhouses and/or meat selling centers of different markets of Dhaka city of Bangladesh (Figure 1). A total of 60 respondents' were selected, 20 for large animal (cattle, buffalo), 20 for small animal (goat, sheep) and 20 for poultry (chicken, duck) adopting PPRS (Proportional Probability Random Sampling) techniques of Lahiri (Snedecor and Cochran, 1989).

2.2. Development of interview schedule

An interview schedule were carefully prepared that contained both open and closed form of structured questions keeping in mind the objectives of the study. These questions were set chronologically so that the slaughterhouse and/or meat selling centers personnel (operator/worker/butcher/sellers/owner) can provide data in a systematic manner. The draft interview schedule was pre-tested and necessary correction, additions and rearrangements were made before being used it for final data collection.

2.3. Period and procedure of data collection

The data were collected during the period from December 2019 to March 2020 through personal interview. Desired rapport was established to each respondent, so any respondent failing to understand any question, care was taken by the researcher to explain the situation.

2.4. Variables and their measurements

The selection of variables and their measurements constitute an important task in research work. The researcher selected some characteristics of by-products from slaughterhouses and/or meat selling centers as the variables of this study. The characteristics are as follows: edible and inedible by-products from large, small animal and

poultry slaughterhouses and/or meat selling centers, and hygiene practices followed in slaughterhouses and/or meat selling centers.

2.5. Statistical analysis of data

All the data collected were checked and cross checked before transferring to master sheets. The data was analyzed with the help of SPSS-v-16 computer package program.

3. Results and Discussion

3.1. Utilization of edible by-products

3.1.1. Large animal slaughterhouse by-products

Large animal slaughterhouse and/or meat selling centers by-products such as head trimmings, brain, tongue, heart, stomach, lung, liver, pancreas, spleen, kidney and tail were found to use as human food by all the respondents (100%) (Table 1). Ockerman and Hansen (2000) reported that by-products like brain, other head trimmings, tongue, heart, kidney, liver, pancreas, spleen, lung, stomach and tail can be used as human food by cooking and grilling etc.

3.1.2. Small animal slaughterhouse by-products

The respondents (100%) reported that the small animal slaughterhouse edible by-products such as head trimmings, brain, tongue, heart, stomach, lungs, liver, pancreas, spleen, kidney and tail were consumed by human (Table 1). Liu (2002) reported that small animals head trimmings, brain, tongue, heart, stomach, lung, liver, pancreas, spleen, kidney and tail etc. can be used as human food by cooking, grilling etc.

3.2. Utilization of inedible by-products

3.2.1. Large animal slaughterhouse by-products

Large animal inedible slaughterhouse and/or meat selling centers by-products were being utilized in various ways (Table 2). All the respondents (100%) opined that hides and skin were sold to middlemen who after curing sent them to the tannery for making leather. Different types of goods were being produced from horns like combs, buttons etc. Blood was used as fish and/or animal feed (80%) while 70% of the respondents left blood in the place where animals were slaughtered. It diminishes automatically but creates environmental pollution. Liu (2002) reported that blood can be used for black pudding, sausage, blood and barley loaf products which are used as human food. Hossain *et al.* (2002) reported that 88.56% of the surveyed respondents left blood. About 20% respondents observed to use intestines as human food where 25% as fish feed, 50% in pharmaceutical industry (catgut production) but 70% opined exporting intestines in China. Liu (2002) reported that intestines were used for sausages casings in case of human consumption. Approximately 70% respondents informed that stomach contents were used as fertilizer where 95% of respondents reported about its disposal. Malav *et al.* (2018) reported that stomach contents can produce very good quality bio-manure which may be utilized as fertilizers for the agricultural land and gardens. In case of gall bladder, 65% respondents reported that pharmaceutical industry uses gall bladder where 75% opined about its export, 40% of total respondents mentioned its disposal and a few of respondents (10%) reported its use in research purposes. Jayathilakan *et al.* (2012) observed that bile consists of acids, pigments, proteins, cholesterol etc., and can be obtained from the gall bladder. Some ingredients of bile, such as prednisone and cortisone, can be extracted separately, and used as medicine. All the respondent (100%) reported using of fats in soap industry followed by as human food (75%) and in condensed milk industry (50%). Ghotra *et al.* (2002) reported that tallow and lard were also used for margarine and shortening as cosmetic industry. All (100%) respondents reported that the large animal's feet and hooves were used as human food but there were other uses also such as pharmaceuticals industry (gelatin production), research. Ockerman and Hansen (2000) observed that feet and hooves can be utilized as human food by processing into jelly, pickled, cooked in liquid, boiled and fried. All (100%) respondents observed that bones were used in melamine industry, whereas one-fourth of them (25%) also reported its uses in pharmaceutical industry and 15% of total respondents mentioned its disposal. Ockerman and Hansen (2000) observed that bones can be used in gelatin, soup, jellied products production. The 40% of respondents informed that urinary bladder with content were used in cleaner production, where 20% of respondents opined about its export, but 85% of them opined about disposal and 30% reported its uses in research purpose. Around 30% of respondents reported that genital organs (especially penis) were used in pharmaceutical industry, 85% of them reported about its export, but a few respondents (5%) mentioned about its disposal and another 5% of them observed its research purpose use. Liu (2002) reported that testes and penis can be used as a human food in some countries and female genitalia was used in hormone production in pharmaceuticals.

3.2.2. Small animal slaughterhouse by-products

The results of the present study revealed (Table 3) that all the skins (100%) after collection were sent to tanneries of Savar or Hajaribag. Around 40% of respondents mentioned that small animal horn (especially goat) was used in musical instrument producing industry and almost 95% of total respondents reported its disposal. Blood was used as fish feed which was opined by 95% of the respondents whereas 40% and 30% respondents reported its disposal and use in research field, respectively. Silva and Silvestre (2003) reported that blood can be used in food as an emulsifier, a stabilizer, a clarifier, a color additive, and as a nutritional component of animal feed. Highest percentage (90%) of respondents reported the use of small animal intestines in pharmaceutical industry (catgut production) followed by export in china (60%). Liu (2002) reported that intestines can be used for sausages casings in case of human consumption. Around three-fourth (75%) of respondents reported that stomach contents of small animals was used as fertilizer followed by its disposal (85%). With regard to small animal's gall bladder, it was mainly used in pharmaceutical industry (85%) followed by its export in India (75%). Small animals' fat was used as human food and in soap industry (100%). Weiss (1983) reported that traditionally tallow and lard were used for deep frying. Around 100% of respondents informed that feet and hooves were used as human food, whereas 30% of them opined its use in melamine industry, 45% in pharmaceuticals industry (gelatin production) and a few (5%) informed its disposal. The similar findings were also noticed by Liu (2002) who reported that feet of small animals can be used for producing jelly which is used as human food and gelatin in pharmaceuticals. Bones were used in melamine industry and pharmaceutical industry (gelatin production) that was opined by 85% and 60% of the respondents, respectively. These findings are in line with the observation of Liu (2002) who observed that small animal's bones were used in gelatin, soup, jelly, mechanically deboned tissue production. Urinary bladder mainly its contents were used in cleaner production (50%) followed by export in china (40%) and in doing research (30%). Almost 95% of total respondents reported that genital organs (especially penis) were exported where 30% of total respondents also reported its disposal. Liu (2002) reported that testes and penis can be used as a human food in some countries and female genitalia is used in hormone production in pharmaceuticals.

3.3. Utilization of poultry by-products

Inedible by-products from poultry slaughterhouses and/or meat selling centres had multiple uses found in the surveyed area (Table 4). Among the various uses of blood, 45% of the respondents reported using blood of poultry as fish feed, whereas a few number of respondents (15%) observed using blood for research purpose but 80% of the respondents informed that blood was disposed. Sams (2001) reported that blood can be used to produce blood meal which is used as animal feed ingredient. About 60% of the respondents opined using intestines of poultry as fish feed followed by disposed (60%). Sams (2001) reported that meat meal was produced from intestines of poultry. Almost 45% of the respondents reported that feather wastes of poultry were used as fish feed but rejected by 95%. Ockeman and Hansen (2000) observed that feathers were used for bedding, ornaments, sporting equipment and as filler in chemical fertilizer.

3.4. Hygiene practices in slaughterhouses and meat selling centers

Highest numbers (53.33%) of the slaughterhouses and/or meat selling centres were found to maintain moderate level of cleanliness followed by poor (45%) and good (1.67%) (Table 5). In case of drainage condition, 55% of the slaughterhouses had moderate drainage condition followed by poor (43.33%) and good (1.67%) drainage condition. About 61.67% of the slaughterhouses used container whereas 33.33% and 5% used hose pipe and tap water as a source of water supply. These findings are in line with the observations of Alam *et al.* (2020) in slaughterhouses and/or meat selling centers at Mymensingh and Gazipur district of Bangladesh. Alam *et al.* (2009) reported that 50% of the slaughterhouses and/or meat selling centers of Gazipur district had adequate drainage system and water supply. The lack of sufficient water source was observed, and similar conditions were found by Cook *et al.* (2017) in slaughterhouses of western Kenya.

Table 1. Existing uses of edible slaughterhouse by-products.

Category	By-products	Uses	Frequency	Percentage
Large animal slaughterhouse	Head trimmings	Human food	20	100
	Brain	Human food	20	100
	Tongue	Human food	20	100
	Heart	Human food	20	100
	Empty stomach	Human food	20	100
	Lung	Human food	20	100
	Liver	Human food	20	100
	Pancreas	Human food	20	100
	Spleen	Human food	20	100
	Kidney	Human food	20	100
	Tail	Human food	20	100
Small animal slaughterhouse	Head trimmings	Human food	20	100
	Brain	Human food	20	100
	Tongue	Human food	20	100
	Heart	Human food	20	100
	Stomach	Human food	20	100
	Lung	Human food	20	100
	Liver	Human food	20	100
	Pancreas	Human food	20	100
	Spleen	Human food	20	100
	Kidney	Human food	20	100
	Tail	Human food	20	100

Table 2. Existing uses of inedible slaughterhouse by-products (Large animal).

By-products	Uses	Frequency	Percentage
Hides and skin	Sold to businessman for tannery industry	20	100
Horn	Industrial use (comb, buttons etc.)	20	100
	Disposed	7	35
Blood	Fish and/or animal feed	16	80
	Disposed	14	70
	Research	3	15
Empty intestine	Human food	4	20
	Fish feed	5	25
	Pharmaceutical industry	10	50
	Export (China)	14	70
	Disposed	9	45
Stomach contents	Fertilizer	14	70
	Disposed	19	95
Gall bladder	Pharmaceutical industry	13	65
	Export (India)	15	75
	Disposed	8	40
Fats	Research	2	10
	Human food	15	75
	Soap industry	20	100
	Condensed milk industry	10	50
Feet and hooves	Disposed	1	5
	Human food	20	100
	Pharmaceutical industry	13	65
	Research	1	5
Bones	Disposed	1	5
	Melamine industry	20	100
	Pharmaceutical industry	5	25
Urinary bladder with contents	Disposed	3	15
	Cleaner production	8	40
	Export	4	20
	Disposed	17	85

By-products	Uses	Frequency	Percentage
Genital organs	Research	6	30
	Pharmaceutical industry	6	30
	Export (China)	17	85
	Disposed	1	5
	Research	1	5

Multiple response

Table 3. Existing uses of non-edible slaughterhouse by-products (Small animal).

By-products	Uses	Frequency	Percentage
Hides and skin	Sold to businessman for tannery industry	20	100
Horn	Musical instrument industry	8	40
	Disposed	19	95
Blood	Fish feed	19	95
	Disposed	8	40
	Research	6	30
Intestine	Fish feed	3	15
	Pharmaceutical industry	18	90
	Export (China)	12	60
Stomach contents	Disposed	12	60
	Fertilizer	15	75
Gall bladder	Disposed	17	85
	Pharmaceutical industry	17	85
Fats	Export (India)	15	75
	Disposed	10	50
	Human food	20	100
Feet and hooves	Soap industry	20	100
	Human food	20	100
	Melamine industry	6	30
Bones	Pharmaceutical industry	9	45
	Disposed	1	5
	Melamine industry	17	85
Urinary bladder with contents	Pharmaceutical industry	12	60
	Disposed	6	30
	Cleaner production	10	50
	Disposed	13	65
Genital organs	Export (China)	8	40
	Research	6	30
	Export	19	95
	Disposed	6	30

Multiple response

Table 4. Existing uses of poultry slaughterhouse by-products.

By-products	Uses	Frequency	Percentage
Blood	Fish feed	9	45
	Disposed	16	80
	Research	3	15
Intestines	Fish feed	12	60
	Disposed	12	60
Feather wastes	Fish feed	9	45
	Disposed	19	95

Multiple response

Table 5. Hygiene practices in slaughterhouses (n=60).

Parameters	Category	Frequency	Percentage
Cleanliness	Good	1	1.67
	Moderate	32	53.33
	Poor	27	45
Drainage condition	Good	1	1.67
	Moderate	33	55
	Poor	26	43.33
Water supply	Hose pipe	20	33.33
	Tape water	3	5
	Container	37	61.67

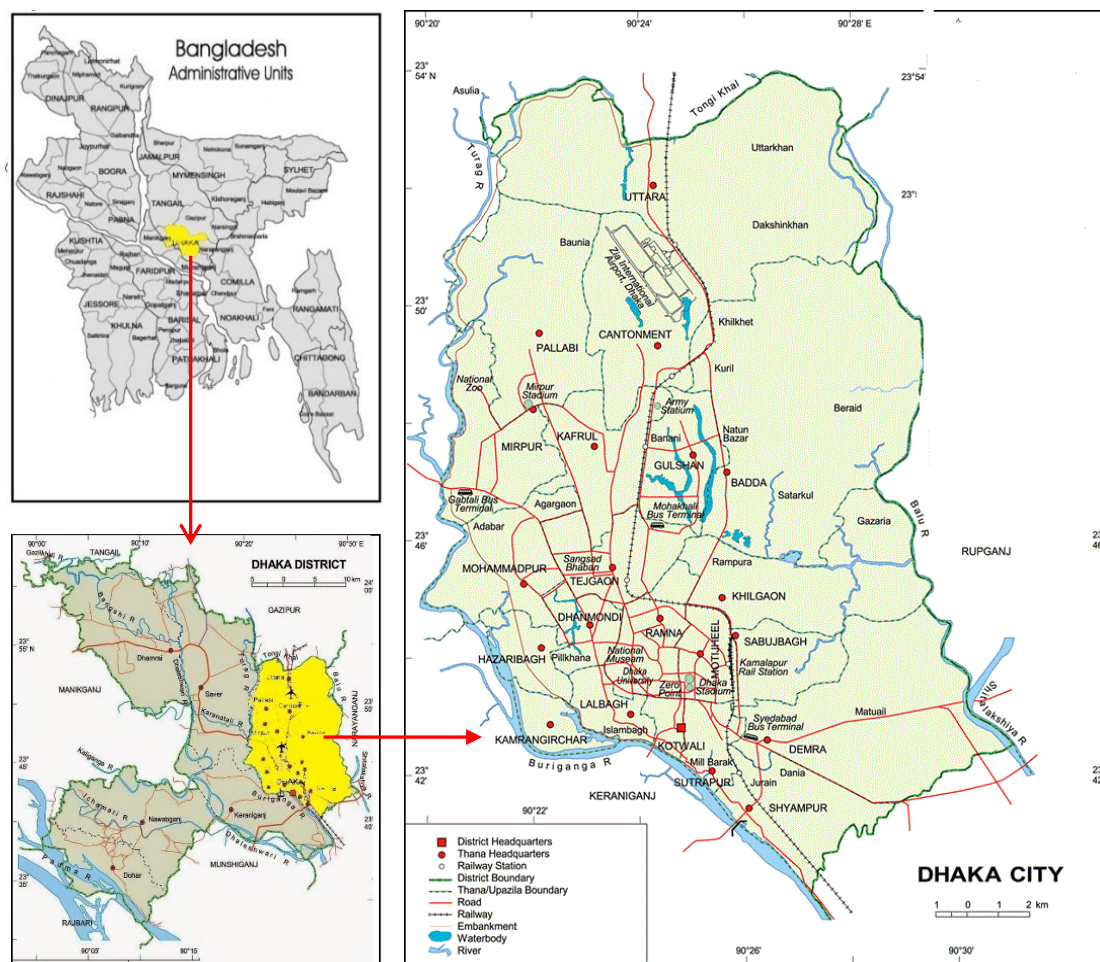


Figure 1. Location map of study area.

4. Conclusions

Edible by-products were used as human food but inedible by-products were utilized in various ways. Slaughterhouses and/or meat selling centers still also disposed by-products in an environmentally unfriendly manner, which predisposes the public to several health epidemics. There is need for increased government regulations aimed at increasing slaughterhouses hygiene for public safety in line with confines of the law. However, the study can be widen to entire country.

Conflict of interest

None to declare.

References

- Aberle ED, JC Forrest, DE Gerrard and EW Mills, 2001. Principles of Meat Science, Fourth edition, Kendall/Hunt Publishing Co. Dubuque, IA.
- Alam MK, MM Hossain, R Islam and S Akhter, 2009. Management of slaughterhouse and meat selling center to supply quality goat meat for human consumption. *J. Bangladesh Soc. Agric. Technol.*, 6: 135-140.
- Alam MK, Y Keiko and MM Hossain, 2020. Present working conditions in slaughterhouses and meat selling centres and food safety of workers in two districts of Bangladesh. *Pertanika J. Soc. Sci. & Hum.*, 28: 867-881.
- Bengtsson O and O Holmqvist, 1984. Co-products from slaughtering, a short review. *Fleisch-wirtschaft.*, 64: 260-263 & 334-336.
- Codex Alimentarius, 1993. Code of Hygiene Practice for Meat (CAC/RCP 58-2005). http://www.codexalimentarius.net/download/standard/10196/cxp_058e Retrieved 2012-02-11.
- Cook EAJ, WAD Glanville, LF Thomas, S Kariuki, BMDC Bronsvoot and EM Fevre, 2017. Working conditions and public health risks in slaughterhouses in western Kenya. *BMC Public Health*, 17: 14.
- DLS (Department of Livestock Services), 2018. Livestock at a glance.
- Ensminger ME, 1969. Animal Science (Animal Agriculture Series), Sixth edition. The interstate printers and publishers Inc. Illinois. USA.
- FAO, 1992. Construction and operation of medium-sized abattoirs in developing countries. In: 97th Animal Production and Health Paper. pp. 1-104.
- Ghotra BS, SD Dyal and SS Narine, 2002. Lipid shortenings: a review. *Food Res. Intl.*, 35: 1015-1048.
- Gracey JF, 1986. Meat Hygiene, Eighth edition. English Language Book Society. Bailliere Tindall, UK. pp. 495-497.
- Hossain MI, MM Hossain, MA Hashim and M Ahmed, 2002. Uses of slaughterhouse by products in Bangladesh. *Bang. J. Anim. Sci.*, 31: 37-43.
- Jayathilakan K, Sultana Khudsia, K Radhakrishna and AS Bawa, 2012. Utilization of by-products and waste materials from meat, poultry and fish processing industries: A review. *J. Food Sci. Technol.*, 49: 278-293.
- Liu DC, 2002. Better utilization of by-products from the meat industry. Extension Bullet. Ins. Food and Fertilizer Technology Center for The Asian and Pacific Region (FFTC publication database).
- Malav OP, R Birla, KS Virk, HS Sandhu, N Mehta, P Kumar and RV Wagh, 2018. Safe disposal of slaughterhouse waste: Mini review. *Crimson Publishers*. ISSN: 2576-9162. pp. 1-2.
- Ockerman HW and CL Hansen, 2000. Animal By-product Processing and Utilization. Technomic Pub. Co. Lancaster, PA.
- Sams AR, 2001. Poultry Meat Processing. CRC Press, Boca Raton.
- Silva VDM and MPC Silvestre, 2003. Functional properties of bovine blood plasma intended for use as a functional ingredient in human food. *LWT- Food Sci. Technol.*, 36: 709-718.
- Snedecor GW and GW Cochran, 1989. Statistical Methods. Eighth edition. East-West Press, New Delhi, India.
- Weiss TJ, 1983. Bakery Shortenings and Frying Shortenings. In: Food Oils and Their Uses. Connecticut: The AVI Publishing Company, Inc. pp. 153-165.