Asian J. Med. Biol. Res. 2020, 6 (3), 507-513; doi: 10.3329/ajmbr.v6i3.49801

Asian Journal of Medical and Biological Research
ISSN 2411-4472 (Print) 2412-5571 (Online)
www.ebupress.com/journal/ajmbr

Article

Socioeconomic condition and problem confrontation by the chicken farmers in the southwestern region of Bangladesh

Md. Abdul Hannan[1*], Mohammad Bashir Ahmed[2] and Sarder Safiqul Islam[2]

[1]Senior Instructor (Livestock), Youth Training Center, Bagerhat, Department of Youth Development, Ministry of Youth and Sports, Bangladesh
[2]Agrotechnology Discipline, Khulna University, Khulna, Bangladesh

*Corresponding author: Dr. Md. Abdul Hannan, Senior Instructor (Livestock), Youth Training Center, Bagerhat, Department of Youth Development, Ministry of Youth and Sports, Bangladesh. Phone: +88 01718704933; E-mail: mahannan1971@gmail.com

Received: 25 August 2020/Accepted: 23 September 2020/ Published: 30 September 2020

Abstract: A survey was conducted in the three district of south western region of Bangladesh like Khulna, Satkhira and Bagerhat, to observe the socioeconomic condition and problems facing by the chicken farmers under the existing management practices. Five hundred commercial chicken farms were considered in the present study. Data were collected using a pretested questionnaire by interview of the farmers. To observe the socioeconomic conditions, the age of selected farmers, their gender, occupation, education level, land size, annual income from chicken farms, experience, training exposure and bio-security score were considered. There are two problems are categorized like diseases outbreaks and socioeconomic problems. Among the respondents, maximum percentage of farmers were male groups within 31 to 40 years age had conjugated with the occupation of poultry and agriculture and belonged to HSC level of education. Highest percentage of medium land size farmer earned 01-03 lac BDT per year only from the chicken farms. Newcastle or Ranikhet disease was highly severed followed by Fowl cholera, Gumboro and Coccidiosis. Irregular fluctuation of market price was the major problem facing by the chicken farmer in the study area. Bio-security practice and proper marketing system should enhance the profitability of the chicken farms.

Keywords: disease; bio-security; market price; income

1. Introduction

The poultry industry of Bangladesh primarily produces chicken although a few other species like duck, pigeon, quail, goose, turkey, and guinea fowl are available throughout the year. Chicken meat and eggs are the cheapest source of animal protein and it is well accepted by all religious, economic, social, and demographic groups (Sarker *et al*., 2009; Simon, 2009). Since the beginning of 21st century, the poultry industry has become an unparalleled platform for a quick profit, the generation of local employment and the production of cheaper animal proteins. In recent years, the poultry sector in Bangladesh has gained sufficiency against the current market demand (Raha, 2013), but not against the standard nutritional requirement (DLS, 2016). Starting from the 1980s the industrial poultry sector gained massive momentum towards the industrial phase. After that, it gained a significant annual average growth rate, approximately 15 - 20% annually, until the outbreak of avian flu in 2007. After 2015, this industry again attained the capacity to fulfill the domestic demand for broiler, edible eggs, parent stocks, and precooked poultry products. According to the demand, production, availability, and deficiency of meat and eggs in the years 2015 and 2016 shows that production of meat and egg was found to be lacking 0.9 million metric ton (MMT) and 4,831.6 million (Khaled, 2015; DLS, 2016). The chicken meat consumption in Pakistan, Sri Lanka, Indonesia and Malaysia, is 5.5, 5.7, 7, and 38 kg per capita per year and chicken egg consumption is 60, 54, 87, and 320 eggs per capita per year, respectively, where Bangladesh is only consume 3.2 kg broiler meat and 41 eggs per capita per year (Kaiser Kabir, 2015). According to the national health strategy, an adult people need120g of meat everyday and 104 pieces of eggs per year. However,

presently the availability is only 67.17 and 63.65%, respectively (DLS, 2015). Although meat production has been increasing over time in the country but the per capita availability is far below the minimum requirement (Begum, 2008). Recently, the demand for poultry and livestock products has been increased significantly that leads most poultry-related development intervention is promoting intensification of traditional poultry systems (FAO, 2009). Under these circumstances to meet up the deficiency of meat and eggs, the government and private organizations are putting efforts together to produce commercial chicken farming to enhance the present meat and egg production status.

The most severe challenge facing the commercial poultry sector over the last few years has been the widespread and recurring onset of avian influenza (Al) and other infectious diseases like Newcastle, Gumboro, fowl cholera, Coccidiosis and so on. The subtype H_5N_1 of highly Pathogenic Avian Influenza (HPAI) was first reported in Southeast Asia in late 2003. The outbreaks have had serious economic impact to the affected countries, with millions of birds either killed by the disease or mandatory culled in an effort to limit the spread of virus (Rushton *et al.,* 2005; Alders *et al.,* 2014). One of the factors responsible for outbreaks and the persistence of the virus in domestic poultry populations are cited to be the widespread practice of small holder backyard poultry farming and associated live bird markets (Alders *et al.,* 2014; Henning *et al.,* 2009). This is mainly because basic bio-security measures are rarely implemented in backyard poultry farming systems allowing HPAI to circulate within poultry populations resulting in a perpetual virus source to other poultry flocks (Paul *et al.,* 2011; FAO, 2016). Therefore, one of the most effective forms of protection against HPAI and other poultry diseases is bio-security, which is principally the implementation of measures to prevent the introduction of infectious agents into the farm/environment. Bio-exclusion or containment measures to prevent spread of infectious agents from existing in the event of outbreaks (FAO, 2016).

Sometimes, chicken farmer fail to manage their farms efficiently because of their limited resources, lack of knowledge, training, advisor and capital (Rahman et al., 2002). As a result, their net profit is not in a static condition. Sometimes, they earn profit and other times they incur loss. A sharp rises in the price of chick and feed, and failure to obtain remunerative price of their products. Besides, some farmers are illiterate and they do not have adequate knowledge about the nature of input for having maximum profit. They do not have any financial analysis of their production units for further expansion of chicken farming considering net return. Therefore, it is essential to consider all essential socioeconomic factors and overcome all problems facing by the chicken farmers for successful farming. Considering the view in mind, the present study was undertaken to study the socioeconomic condition and problem confrontation by the chicken farmers in the southwestern region of Bangladesh.

2. Materials and Methods

Data were collected from Khulna, Bagerhat and Satkhira district during the period from January to Dcember, 2013. A total number of 500 chicken farms were selected randomly for data collection. The questionnaire was prepared keeping in view the objectives of the study. It was designed in a simple manner to get accurate information from the farmers. In order to obtain reliable information door to door survey was performed and data were collected through direct interviewing heads of the farm. Information given by the farmers was recorded and kept for analysis. Age of the respondents was categorized into 3 groups, i.e. up to 30 years (young age), 31 to 40 years (middle age), and >41 years (old age) with male and female gender. Education levels of the poultry farmers were categorized into 5 groups, <SSC, SSC, HSC, Bachelor and Masters. Occupation of the farmers was categorized into 4, only poultry, poultry plus agriculture, poultry plus service and poultry plus business. Respondents were categorized into 5 according to their land size, landless (<0.02 ha), marginal (0.02 to 0.20 ha), small (0.21 to 1.0 ha), medium (1.01 to 3.0 ha) and large (>3.0 ha). On the basis of their annual income from poultry farmers were categorized into 3 groups, low income (<1 lac), medium (1 to 3 lac) and high income (>3 lac). Farming experience, training exposure and biosecurity score of the poultry farmers were also considered. Disease incidence like Gumboro, Coccidiosis, Newcastle, Fowl pox, Fowl Typhoid, Fowl cholera, CRD, Bird flu, Unknown and other socioeconomic problems like inadequate availability of quality feed, inadequate availability of quality chick, social security and political unrest, irregular fluctuation of market price, load shedding of electricity, monopoly business syndicate, natural disaster, inadequate availability of technical advisor and unscrupulous middleman were also considered in this study.

Collected data were compiled, coded, tabulated for processing and analysis in accordance with the objectives of the study. To draw a meaningful conclusion, tabular presentation of data was intensively used. The SAS 9.0 (2009) computer program was used to analyze the data. Descriptive statistics like number, percentage, mean, and standard error were used in describing the selected independent and dependent variables of the study.

3. Results and Discussion

3.1. Socioeconomic condition of the poultry farmers

Socio-economic conditions of poultry farmers are presented in Table 1. Age, gender, education status, occupation, land size and yearly income from poultry farms were considered as farmer's criteria and every criterion was divided into different categories. Among the respondents, highest number of farmers (45.6%) was found within the 31 to 40 years age group, followed by less than 30 years (34.0%) and above 41 years (20.4%). This trend was similar to the findings of Islam *et al*. (2013). In a study Eva (2013) reported that the majority of the farmers (43.3%) belonged to 41 to 50 years age group which is differ with the present study. In case of gender issue 86.8% male had involved in poultry farming at against of only 13.2% female. A wide variation of male and female was found in this study.

Maximum percentage of farmers belonged to HSC level of education (31.8%) followed by SSC (24.2%), bellow SSC (22%), Bachelor (13.4%) and Masters (8.6%). This result was inconsistent to the findings of Islam *et al.* (2013), they were found maximum percent of respondent belonged to >SSC level. However, Eva (2013) was reported similar result of our study. Considering the occupation of the respondents, maximum percentage of respondents had a conjugated occupation of poultry and agriculture 48.6% followed by exclusive poultry farming 20%, poultry and business 19.6 %, poultry and service 11.8% only. According to land size poultry farmers were categorized into landless (<0.02 ha), marginal (0.02 to 0.20 ha), small (0.21 to 1.0 ha) and large (>3.0 ha) farmers. In the present study, maximum percentage of poultry farmers belonged to medium land size category (35.6%) followed by small (30.2%), marginal (27.8%) and large (6.4%) categories. Annual income from poultry farm showed that maximum percentage of farmers belonged to medium income group (43.6%), followed by low (39%) and high income group (17.4%). Rahman *et al*. (1997) conducted a socio economic study of livestock farmers and found the similar findings regarding education, occupation and land size of the farmers.

Table 1. Socio-economic condition of the poultry farmers in the study area.

Criteria and Category	Khulna		Satkhira		Bagerhat		Respondent	
	Meat farms	Egg farms	Meat farms	Egg farms	Meat farms	Egg farms	Number	Percentage
Age group:								
< 30 yrs	40	26	30	17	35	22	170	34.0
31-40 yr	55	38	42	29	36	28	228	45.6
> 41 yrs	25	16	18	14	19	10	102	20.4
Total	**120**	**80**	**90**	**60**	**90**	**60**	**500**	**100.0**
Gender:								
Male	115	70	78	45	77	49	434	86.8
Female	05	10	12	15	13	11	66	13.2
Total	**120**	**80**	**90**	**60**	**90**	**60**	**500**	**100.0**
Education:								
< SSC	19	18	24	16	21	12	110	22
SSC	37	22	17	12	22	11	121	24.2
HSC	46	27	21	20	30	15	159	31.8
Bachelor	11	08	16	08	10	14	67	13.4
Masters	07	05	12	04	07	08	43	8.6
Total	**120**	**80**	**90**	**60**	**90**	**60**	**500**	**100.0**
Occupation:								
Only poultry	23	17	19	10	16	15	100	20
Poultry + Agril.	54	30	47	33	51	28	243	48.6
Poultry+ Service	18	11	09	04	12	05	59	11.8
Poultry+ Business	25	22	15	13	11	12	98	19.6
Total	**120**	**80**	**90**	**60**	**90**	**60**	**500**	**100.0**
Land size:								
Landless(<0.02 ha)	0	0	0	0	0	0	00	00
Marginal(0.02-0.2ha)	38	23	24	13	25	16	139	27.8
Small(0.2-1.0ha)	30	22	27	19	32	21	151	30.2
Medium(1.01-3.0ha)	41	28	31	26	29	23	178	35.6
Large(>3ha)	11	07	08	02	04	00	32	6.4
Total	**120**	**80**	**90**	**60**	**90**	**60**	**500**	**100.0**

Income from poultry farms:								
Low, < 1lac	48	30	41	20	38	18	195	39
Medium,1to 3 lac	53	35	45	31	29	25	218	43.6
High, > 3 lac	19	15	04	09	23	17	87	17.4
Total	**120**	**80**	**90**	**60**	**90**	**60**	**500**	**100.0**

3.2. Common diseases faced by the poultry farmers

The common diseases confronted by the poultry farmers under the study area are shown in Table 2. The result from this study showed that Newcastle disease (ND) was the highly severe (64.2%) diseases observed by the poultry farmers. Adene and Oguntade (2006) reported ND to be endemic and the most devastating disease of rural poultry in Nigeria. This disease was transmitted via contact with the infected chickens and materials. So that contagious diseases can easily spread and become difficult to control under poor management. Bio-security should prevent the spread of contagious disease. This study also revealed that Fowl Cholera (FC) was the second highly severe (55.6%) disease followed by Gumboro (54%), Coccidiosis (46.6%), CRD (45%) Fowl pox (31.8%), Fowl typhoid (25.4%) and Bird flu (8.4%) These findings differ from the report by Adene and Oguntade (2006) of Gumboro disease to be the second most devastating disease of commercial poultry probably due to differences either in time, place or in methodology. This study was conducted in the costal saline area (Satkhira, Khulna and Bagerhat) of Bangladesh, due to deficiency of fresh water fowl cholera was the second highly severe disease observed by the poultry farmer. Generally, the findings showed these diseases commonly observed by poultry farmers to be associated with poor management, geographical position and lack of bio-security application. Rahman *et al*. (1999) stated that village people adopted some indigenous knowledge to prevent some diseases instead of vaccine and medicine.

Table 2. Common diseases confronted by the poultry farmers (500 heads) under the study area.

Disease	**Highly severe**		**Moderately severe**		**Negligible**		**Not at all**	
	N.R	**Percent**	**NR**	**Percent**	**NR**	**percent**	**NR**	**percent**
Gumboro	270	54%	87	17.4%	108	21.6%	35	7%
Coccidiosis	233	46.6%	122	24.4%	120	24%	25	5%
Newcastle	321	64.2%	94	18.8%	58	10.8%	27	5.4%
Fowl pox	159	31.8%	155	31%	67	13.45%	119	23.8%
Fowl Typhoid	127	25.4%	152	30.4%	81	16.2%	140	28%
Fowl cholera	278	55.6%	150	30%	46	9.2%	28	5.6%
CRD	225	45%	160	32%	64	12.8%	51	10.2%
Bird flu	42	8.4%	100	20%	159	31.8%	209	41.8%
Unknown	59	11.8%	58	11.6%	116	23.2%	267	53.4%

3.3. Problems confronted by the respondent in poultry farmers

More or less the respondent faced nine problems in poultry farming in the study area.

3.3.1. Overall problem confrontation

The obtained problem confrontation scores of the respondents ranged from 03-27 against the possible range 0-27 with the mean and standard deviation of 17.26 and 5.03 respectively. Based on possible problem confrontation scores, the respondents have been classified into three categories as shown in Table 3. Data in Table 3 revealed that 52.4% of the farmers had medium while 42.2% of the farmers had high problem confrontation. Only 5.4% of the farmers had low problem confrontation. There was a less variation between medium and high but a wide variation from low problem confrontation.

Table 3. Overall problem confrontation by the respondents.

Categories	**Scores**	**Respondents (N=500)**		**Mean**	**Standard Deviation**	**Min.**	**Max.**
		Number	**Percentage**				
Low	1-9	27	5.4	17.26	5.03	03	27
Medium	10-18	262	52.4				
High	19-27	211	42.2				
Total		500	100				

3.3.2. Severity of the problem related to poultry production in the study area

The farmers of the study area were asked to indicate the problems as confronted by them along with their severity. The farmers of the study area confronted 09 problems to different extent. Data presented in Table 4 indicate that irregular fluctuation of market price was the highly severe problem while inadequate availability of technical advisor was the least severe problem confronted by the poultry farmers. The second major problem was unscrupulous middleman followed by social security and political unrest, monopoly business syndicate, inadequate availability of quality feed, inadequate availability of quality chick, load shedding of electricity and natural disaster.

3.3.3. Irregular fluctuation of market price

Firstly irregular fluctuation was the major problem in the study area. Pricing of meat and egg varies with the supply and demand for poultry and poultry products. Since there were no organized marketing channels and no storage facilities in the study area, the sellers and buyers cannot bargain in fixing price. Due to perishability of eggs, increasing mortality of broiler and availability of production, seller did not go to bargain with buyer. Eggs were sold on the basis of types, species and color (exotic and indigenous chicken, duck etc.). The price of brown shell egg is about 10% higher than that of white egg and indigenous egg price is about 6% higher than farm egg price. The price of eggs is also varies in different seasons. Eggs are sold at higher price in winter than in summer. The opposite trend is true in case of broiler marketing. Rahman *et al*. (1998) stated that market price fluctuation of concentrate feed is very common in rural areas that have a great influence on meat and egg production.

3.3.4. Unscrupulous middleman

Unscrupulous middleman was the second major problem faced by the poultry stakeholder. In the study area, poultry marketing channels were traditional marketing systems where the numbers of intermediaries. Consequently, farmers were sometimes forced to sell at lower prices because of inadequate market information, transport facilities, etc. Most of the times eggs and chickens were being marketed through middlemen, as a result the farmers did not get actual price. The unscrupulous middleman was taking the advantages.

3.3.5. Social security, political unrest and monopoly business syndicate

Social security, political unrest and monopoly business syndicate was the third major problem in the study area. At the period of study the political condition of Bangladesh was very much unrest. Hartal, blocked was regular practiced by the opposition. That was directly affected to the poultry industry as well as other economic sector. In Bangladesh only four to six biggest companies were controlled the whole poultry sector. This syndicate fixed the chick and feed price that was 70 to 80% cost of a poultry farms. So, the commercial poultry farmers were mainly depended on the business syndicate.

Table 4. Rank order of problems based on problem confrontation index.

Types of problems	Severity of the problems (N=500)				PCI		Rank order
	HS	MS	LS	NAA	Score	Percent	
Inadequate availability of quality feed	210	175	90	25	1070	71.33	4th
Inadequate availability of quality chick	225	150	80	45	1055	70.33	5th
Social security and political unrest	255	125	85	35	1100	73	3nd=
Irregular fluctuation of market price	300	150	40	10	1240	82.66	1st
Load shedding of electricity	140	210	90	60	930	62	6th
Monopoly business syndicate	285	100	40	75	1095	73	3nd=
Natural disaster	60	165	85	190	595	39.66	7th
Inadequate availability of technical advisor	40	75	130	255	400	26.66	8th
Unscrupulous middleman	280	135	35	50	1145	76.33	2nd

HS= Highly severe, MS=Moderately severe, LS= Less severe, NAA=Not at all, PCI= Problem confronted index

3.4. Relationship between the selected characteristics of the respondent and their problem confrontation in poultry farming

The purpose of this section is to examine and describe the relationship between the selected characteristics of the respondents and their problem confrontation. To explore the relationship between the selected characteristics

of farmers and their problem confrontation" Pearson's Product-Moment Correlation Co-efficient "r" was used which has been shown in Table 5.

Table 5. Relationship between the selected characteristics of the respondent and their problem confrontation.

Characteristics(Independent variable	Dependent variable	Correlation coefficient
1.Age	Problem Confrontation of poultry production	-0.154^{NS}
2. Gender		0.123^{NS}
3.Level of Education		-0.114^{NS}
4.Farm experience		-0.276^{**}
5.Training exposure		-0.284^{**}
6.Bio security score		-0.289^{**}
7.Family size		-0.090^{NS}
8.Annual income		0.265^{*}
9.Cosmo politeness		-0.045^{NS}
10.Farm size		-0.085^{NS}

NS=Non significant, **=Correlation is significant at the 0.01 level,*=Correlation is significant at the 0.05 level

Among the 10 selected characteristics of the respondents, farm experience, training exposure and bio-security score showed a negative significant relationship with the problem confrontation. It means that the higher is the farm experience, training exposure and bio-security score; the lower is the problem confrontation of the poultry farming. On the other hand, the annual income showed appositive significant relationship with the problem confrontation. It means that higher is the annual income, the higher is the ability of the farmers to identify the problems in poultry farming. Age, level of education, family size, cosmopolitans' and farm size of the respondents showed a negative but non-significant relationship with the problem confrontation. Only the gender showed a positive but non-significant relationship with the problem confrontation.

4. Conclusions

Maximum percentage of farmers were male groups within middle age had conjugated with the occupation of poultry with agriculture and belonged to HSC level of education. It should encourage female entrepreneur for chicken farming because wide variation between male and female participation. Medium land size farmer earned highest money only from the chicken farms. Newcastle or Ranikhet disease was highly severe and irregular fluctuation of market price was the major problem facing by the chicken farmer. Through bio-security practice and proper marketing system should enhance the profitability and sustainability of the chicken farms.

References

Adene DF and AE Oguntade, 2006. The structure and importance of the commercial and rural based poultry industry in Nigeria. FAO (Rome) study, October, 2006. Pp. 1-70.

Alders R, JA Awuni, B Bagnol, P Farrell and N de Haan, 2014. Impact of avian influenza on village poultry production globally. Ecohealth, 11: 63–72.

Begum IA, 2008 .Prospects and potentialities of vertically integrated contract farming in Bangladesh. Ph.D. Thesis, Department of Agricultural Development Economics, Hokkaido University, Japan. Benekon, Holland, 11 pp.

DLS, 2015. Annual report on livestock 2015. Division of Livestock Statistics, Ministry of Fisheries and Livestock, Farmgate, Dhaka, Bangladesh

DLS, Department of livestock services. 2016. Yearly updated report for 2015 - 2016.Government of the People's Republic of Bangladesh, Farmgate, Dhaka, Bangladesh. Accessed in http://www.dls.gov.bd.

Eva F, 2013. Use pattern of antibiotics in poultry rations of some selected farms of Khulna region. Undergraduate thesis, Agro-technology Discipline, Khulna University, Khulna.

FAO, 2009. The State of Food and Agriculture 2009: Livestock in the Balance. Food and Agriculture Organization of the United Nations, Rome, Italy, ISBN-13: 9789251062159, Pages: 166.

Food and Agriculture Organization (FAO), 2016. Bio-security for highly pathogenic avian influenza: Issues and options. FAO Animal Production and Health Paper No. 165. 2008. http://www.fao.org/3/a-i0359e.pdf. Accessed 6 Nov 2016

Henning KA, J Henning, J Morton, NT Long, NT Ha and J Meers, 2009. Farm and flocklevel risk factors assocaited with highly patahogenic avian influenza outbreaks on small holder duck and chicken farms in the Mekong Delta of Viet Nam. Prev. Vet. Med., 91: 179–88.

Islam SS, C Paul and BC Sarker A, 2013. Comparative study on the performances of layer hybrids in some selected areas of Khulna region. Bang. J. Anim. Sci., 42: 114-122.

Khaled SA, 2015. Can the commercial poultry sector play the pivotal role in building a healthy nation? Souvenir of 9th International Poultry Show & Seminar.19-21 February 2015 at Bangabandhu international Conference Centre, Dhaka, Bangladesh.

Paul M, S Wongnarkpet, P Gasqui, C Poolkhet, S Thongratsakul, C Ducrot and FO Roger, 2011. Factors for highly pathogenic avian influenza (HPAI) H5N1 infection in backyard chicken farms, Thailand. Acta Trop., 118: 209–216.

Raha SK, 2013. Poultry industry in Bangladesh: Ample opportunities for improvement. Proceedings the 8th international poultry show and seminar. pp. 13-19. World's poultry science association, Dhaka, Bangladesh Branch.

Rahman MM, S Habib MA Kadir, MN Islam and MS Islam, 2002. Participation of rural people in cattle management practices in a selected area of Bangladesh. J. Anim. Vet. Adv., 1: 196-199.

Rahman MM, S Akhter, MS Rabbani and MM Hossain, 1999. Indigenous knowledge on livestock practiced by the farmers in Mymensingh district of Bangladesh. Bangladesh J. of Anim. Sci., 28: 97-103.

Rahman MM, S Akther and MM Hossain, 1998. The availability of the livestock feeds and feeding practices followed by the farmers of some areas of Mymensingh District. Bangladesh J. of Anim. Sci., 27: 119-126.

Rahman MM, S Akther and MM Hossain, 1997. Socio Economic Aspects of the farmers for livestock keeping in Mymensingh town adjacent areas. Progressive Agriculture, 8: 153-157.

Rushton J, R Viscarra, EG Bleich and A Mcled, 2005. Impact of avian influenza outbreaks in the poultry sectors of five South East Asian countries (Cambodia, Indonesia, Lao PDR, Thailand, Viet Nam) outbreak costs, responses and potential long term control. Worlds Poult. Sci. J., 61: 491–514.

SAS, 2009. Statistical Analysis System, Computer Software, Version 9.1.3: Statistics SAS Institute Inc. Cary, NC 27513, NC27513, USA.

Sarker BC, MA Alam, MM Rahman, AFMT Islam and MGF Choudhury, 2009. Waste management of commercial poultry farms in Bangladesh. Journal of innovation and development strategy, 3: 34-37

Simon PC, 2009. Commercial egg and poultry meat production and consumption and poultry trade worldwide. Proceedings of the 6th International poultry show and seminar, Dhaka, Bangladesh.