

4 **CONSUMERS' AWARENESS REGARDING THE EFFECT OF**
5 **ANTIBIOTIC USED IN ANIMAL FEED ON HUMAN HEALTH**
6

7
8 **ABSTRACT**

9 The main objectives of the study were to determine the consumers' awareness regarding the
10 effect of antibiotics used in animal feed on human health and to explore relationship between the
11 selected characteristics of the respondent consumers and their awareness. The study was
12 conducted at Mohammad Nagar residential area under Batiaghata upazila of Khulna district and
13 Nirala residential area of Khulna City Corporation, Khulna, Bangladesh following descriptive
14 and diagnostic type of research design. Forty respondents from each of the residential areas were
15 interviewed as the sample of the study and data were collected through personal interview
16 method using an interview schedule by the researcher between January–February, 2019. Most
17 (80%) of the respondents were highly aware while only one fifth (20%) of the respondents had
18 medium awareness about the effect of antibiotics used in animal feed on human health.
19 Consumers were highly aware that resistance is grown in pathogenic organisms causing diseases
20 in human body against antibiotics that were used in patient treatment; thus, resulting in treatment
21 failure. However, consumers were less aware about allergic reaction and painful rash, which are
22 possible with many antibiotics. The mean awareness score of the consumers residing at Nirala
23 was higher than that of Mohammad Nagar residential area but it did not differ significantly. This
24 might be due to proximity of the two residential areas. Among ten selected characteristics of the
25 respondents; education, family education, annual family income, exposure to communication
26 media, nutritional knowledge, animal protein consumption behavior and attitude showed positive
27 significant relationship with their awareness regarding the effect of antibiotic used in animal feed
28 on human health. Consumers in the study area are concerned about the effect of antibiotics used
29 in animal feed on human health.
30

31 **Key Words:** Consumers' awareness, antibiotic, animal feed, human health.
32

33 **1. INTRODUCTION**

34 This is an established truth that human health is directly related to the surrounding environment
35 and in particular to the nature and quality of food. Quality of food from animal products is
36 gaining concern from public health agencies around the world since antibiotics and veterinary
37 drugs have played an important role in the field of animal husbandry and agro-industry. At
38 present, the occurrences of veterinary drug residues are increasing and resistance of pathogens
39 against the drugs have become burning issues [1].

40 Antibiotics and veterinary medicinal products (VMPs) are crucial to meet the challenges of
41 supplying sufficient quantity of food for the vast and **fast-growing** world population as drugs
42 improve the rate of weight gain, improve feed efficiency, prevent and treat diseases in food
43 producing animals [2]. The safe and effective use of antibiotics in animal production has
44 received considerable attention in most of the countries in the world [3]. Human health can either
45 be affected by the residues of drugs in food of animal origin, which may cause direct side effects
46 or indirectly through selection of antibiotic resistance bacteria that may spread to human [4,5,6].
47 Resistant microorganism can get access to human either by direct contact or indirectly through
48 milk, meat, and egg. It is documented that drug resistant bacteria such as *Salmonella*,
49 *Campylobacter* and *Staphylococcus* from food of animal origin were developed by human beings
50 [5, 6].

51 In general, antibiotics and drugs residues have harmful effects on human health, which may be
52 mutagenic, carcinogenic, reduction in reproductive performance, drug allergy and acute toxicity
53 or poisoning. [1, 7, 8]. **Low-level** contamination of drug generally may not generate a violating
54 problem on human health. However, extensive use of drugs may increase the risk of an adverse
55 effect of residues on the consumer including the occurrence of antibiotic resistance. In this study
56 an attempt has been made to find out the effects of antibiotics used in animal feed on human
57 health and how far the consumers are aware of this issue in the selected areas of Khulna district.

58 **The study was conducted to fulfill the following specific objectives:**

- 59 i. To analyze the selected characteristics of the consumers.
- 60 ii. To determine consumers' awareness regarding the effect of antibiotics used in animal
61 feed on human health.
- 62 iii. To explore relationships between the selected characteristics of the consumers and their
63 extent of awareness regarding the effect of antibiotics used in animal feed on human
64 health.

65 **2. METHODOLOGY**

66 **2.1 Design and Locale of the Study**

67 The present study was a descriptive and diagnostic type of research. It was designed to study
68 consumers' awareness regarding the effect of antibiotics used in animal feed on human health.
69 The study was conducted at Mohammad Nagar residential area under Batiaghata upazila of
70 Khulna district and Nirala residential area of Khulna City Corporation, Khulna, Bangladesh.

71 **2.2 Population and Sampling**

72 All the household heads of Mohammed Nagar and Nirala residential areas of Khulna were
73 considered as the population of the study. Forty family heads from each of the residential areas
74 were interviewed purposively as the sample of the study. Thus, the sampling technique was
75 purposive and sample size stood 80.

76 **2.3 Data Collection and Processing**

77 The primary data were collected through face-to-face interview between January-February, 2019.
78 Reviewing related studies, the authors considered some of the selected characters of the
79 respondents as independent variables for the study. The characteristics were age, educational
80 qualification, family size, family education, annual income, exposure to communication media,

81 nutritional knowledge, animal protein consumption behavior, training exposure and attitude
 82 towards antibiotics used in animal feed. Consumers' awareness regarding the effect of antibiotics
 83 used in animal feed on human health was considered as dependent variable in this study.

84 All qualitative data were converted into quantitative form by means of applying some
 85 appropriate scoring technique (Table 1). In several instances, indices and scales were constructed
 86 through the simple accumulation of score assigned to individual or pattern of attributes.

87
 88 **2.3.1 Measurement of Selected Characteristics (Independent Variables)**

89 The measurement of selected characteristics (independent variables) is shown in Table 1.

90 **Table 1. Measurement of selected characteristics (independent variables)**
 91

Selected characteristics (independent variables)	Measuring Unit
Age	Actual year
Educational qualification	Score 1 was given for a complete schooling year
Family size	Number
Family education	As above
Annual income	'000'BDT
Exposure to communication media	Score
Nutritional knowledge	Score
Animal protein consumption behavior	Score
Training exposure	Score
Attitude	Score (following Likert scale)

92
 93 **2.3.2 Measurement of Consumers' Awareness (dependent variable)**

94 To determine consumers' awareness, five statements related to the effects of antibiotics used in
 95 animal feed on human health were incorporated in the interview schedule. To determine the
 96 awareness score of the respondents a five-point rating scale such as strongly agree, agree,
 97 undecided, disagree and strongly disagree were employed against the five statements and a score
 98 of 5, 4, 3, 2 and 1 was employed against the scales respectively. The awareness score of a
 99 respondent would range from 5 to 25, where '5' indicate low awareness and '25' indicate high
 100 awareness. Based on awareness score, the respondents were categorized into three groups as low
 101 awareness (≤ 8), medium awareness (9-16) and high awareness (>16). To compare among
 102 statements, an awareness index (AI) was calculated using following formula:

103 $AI = N_{sag} \times 5 + N_{ag} \times 4 + N_{ud} \times 3 + N_{da} \times 2 + N_{sda} \times 1$

104 Where,

105 AI = Awareness Index

106 N_{sag} = Number of respondents rated the impact as strongly agree

107 N_{ag} = Number of respondents rated the impact as agree

108 N_{ud} = Number of respondents rated the impact as undecided

109 N_{da} = Number of respondents rated the impact as disagree

110 N_{sda} = Number of respondents rated the impact as strongly disagree

111 The awareness index (AI) score would range from 80-400 where 80 indicates low awareness and
 112 400 indicates high awareness on a particular statement regarding the effect of antibiotics used in
 113 animal feed on human health.

114 For better understanding of the relative position of the statement, the AI score was converted to
 115 percentage using following formula:

$$116 \quad \% \text{ AI} = \frac{\text{Observed AI Score}}{\text{Highest Possible AI Score}} \times 100$$

118

119 2.4 Data Analysis

120 Data were compiled, tabulated and analyzed based on the objectives of the study. Different
 121 statistical treatments such as number, mean, standard deviation, range, minimum, maximum,
 122 rank order and percentage were used to describe the variables. To explore relationship between
 123 variables, Pearson Product and Spearman Rank Correlation Coefficients were used. Data
 124 analysis was done using the Statistical Package for Social Science (SPSS) 20.

125 3. RESULTS AND DISCUSSION

126 3.1 Facts on the Selected Characteristics of the Consumers (Respondents)

127 Data presented in Table 2 indicate that majority (51.3%) of the respondents was young and
 128 highest proportion (41.3%) of the respondents had secondary level of education. Highest
 129 proportion (45%) of the respondents' family had secondary level of education followed by
 130 higher secondary (27.5%) and graduate (25%). Majority (70%) of the respondents had small
 131 sized family, belonged to high income group (57.5%), had medium exposure to communication
 132 media (72.5%), had medium nutritional knowledge(61.3%) and consumed high amount of
 133 animal protein (62.5%). Most (90%) of the respondents did not receive any training on human
 134 health especially the effects of antibiotics used in animal feed on human health and had
 135 moderately favorable attitude(80%).

136 **Table 2. Distribution of the respondents according to their selected characteristics (N=80)**

Selected Characteristics	Categories	Score	Respondents (N=80)		Mean	SD	Range	
			Number	Percentage			Min.	Max.
Age (Years)	Young aged	≤ 35	41	51.3	38.08	12.85	16	70
	Middle aged	36-50	24	30				
	Old aged	>50	15	18.8				
Education (Years of schooling)	Illiterate	0	0	0	12.34	3.61	1	17
	Primary	1-5	3	3.8				
	Secondary	6-10	33	41.3				
	Higher Secondary	11-12	10	12.5				
	Graduate	13-16	18	22.5				
	Post graduate	>16	16	20				
Family size (No. of	Small	1-4	56	70	4.2	0.97	2	7
	Medium	5-6	22	27.5				

members)	Large	≥7	2	2.5				
Family education (Years of schooling)	Illiterate	0	0	0				
	Primary	1-5	2	2.5	10.21	2.69	3	15.5
	Secondary	6-10	36	45				
	Higher secondary	11-12	22	27.5				
	Graduate	13-16	20	25				
	Post graduate	>16						
Annual family income (BDT "000")	Low income	≤200	3	3.8				
	Medium income	201-350	31	38.8	422.93	185.07	180	960
	High income	>350	46	57.5				
Exposure to communication media (score)	No Exposure	0	0	0				
	Low exposure	1-9	10	12.5	14.63	3.94	6	23
	Medium exposure	10-18	58	72.5				
	High exposure	>18	12	15				
Nutritional knowledge (score)	No knowledge	0	0	0				
	Poor knowledge	Up to 6	20	25	8.84	3.05	2.5	16
	Medium knowledge	7-12	49	61.3				
	High knowledge	13-18	11	13.8				
Animal protein consumption behavior (score)	Low consumption	1-5	2	2.5				
	Medium consumption	6-10	28	35	10.61	2.07	4	14
	High consumption	>10	50	62.5				
Training exposure	Yes		8	10				
	No		72	90				
Attitude (score)	Less favorable	≤ 10	1	1.3				
	Moderately favorable	11-20	64	80	17.7	3.31	10	28
	High favorable	21-30	15	18.8				

137

138 **Table 3. Rank order of sources of animal protein based on animal protein consumption**
 139 **index**

Source of animal protein	APCI		Rank order
	Score	Percentage	
Egg	204	85%	2 nd
Milk	195	81.25%	3 rd
Chicken	210	87.5%	1 st
Beef	143	59.58%	4 th
Mutton	96	40%	5 th

140 **APCI= Animal protein consumption index

141 Among the sources of animal protein, chicken ranked 1st (APCI= 210, percentage= 87.5%)
 142 compared to other sources of animal protein and mutton ranked last (APCI=96,
 143 percentage=40%). This might be due to the low and high market price of chicken and mutton,
 144 respectively (Table 3).

145 **3.2 Consumers' Awareness regarding the Effect of Antibiotics Used in Animal Feed on**
 146 **Human Health**

147 The computed scores of awareness of the respondents ranged from 14 to 24 with mean and
 148 standard deviation of 18.93 and 2.63 respectively. According to the scores on awareness, the
 149 respondents were distributed into three groups as shown in Table 4.

150

151

152 **Table 4. Distribution of the respondents according to their awareness**

Categories	Score	Respondents (N=80)		Mean	Standard Deviation	Range	
		Number	Percentage			Min.	Max.
Low awareness	≤ 8	0	0	18.93	2.63	14	24
Medium awareness	9-16	16	20.0				
High awareness	> 16	64	80.0				

153 Most (80%) of the respondents were highly aware about the effect of antibiotics used in animal
 154 feed on human health. Only one-fifth (20%) of the respondents had medium awareness about the
 155 effect of antibiotics used in animal feed on human health (Table 4). Therefore, it is clear that, all
 156 the respondents were more or less aware about the effect of antibiotics used in animal feed on
 157 human health. The findings of the present study have harmony with the findings of Mallick and
 158 Mondol [9]. They conducted a study on farmers' awareness regarding deforestation at Jalma
 159 union of Batiaghata upazila under Khulna district of Bangladesh. Human health is directly
 160 related to the surrounding environment and in particular to the nature and quality of food [16].
 161 Thus, the human being must remain aware of the consumed foods regarding high antibiotic
 162 contamination and so on.

163 **Table 5. Rank order of the statements related to antibiotics used in animal feed and their**
 164 **effect on human health based on Awareness Index (AI)**

165

Sl. No.	Statements	AI*		Rank Order
		Score	Percentage	
1.	Resistance grow against the antibiotics which are used in patient treatment	327	81.75%	1 st
2.	Some antibiotics can cause stomach upset and other gastrointestinal side effect	286	71.5%	4 th
3.	Allergic reaction and painful rash are possible with many antibiotics	271	67.75%	5 th
4.	Some antibiotics may cause cancer.	320	80.00%	2 nd
5.	Many antibiotics may adversely affect human fertility	307	76.75%	3 rd

166 ** AI= Awareness Index

167 Data presented in Table 5 indicate that consumers were highly aware about the resistance that is
 168 grown against antibiotics which are used in patient treatment (AI=327, rank= 1st). However,

169 consumers were less aware that allergic reaction and painful rash are possible with many
 170 antibiotics (AI=271, rank= 5th).

171 The mean awareness score of the consumers residing at Nirala residential area (x=19.65) was
 172 higher than that of the Mohammad Nagar residential area (x=18.2). Nevertheless, it did not differ
 173 significantly (t=1.99). This might be due to proximity of the two residential areas.

174 **3.3 Relationship between the Selected Characteristics of the Respondents and Their**
 175 **Awareness Regarding the Effect of Antibiotic Used in Animal Feed on Human Health**

176 The purpose of this section is to determine the relationships of the selected characteristics of the
 177 respondents with their awareness regarding the effect of antibiotics used in animal feed on
 178 human health. The selected characteristics of the farmers included: age, educational
 179 qualification, family size, family education, exposure to communication media, nutritional
 180 knowledge, animal protein consumption behavior and attitude towards antibiotic used in animal
 181 feed. Each of the above characteristics constituted an independent variable while consumers’
 182 awareness regarding the effect of antibiotic used in animal feed on human health was the only
 183 dependent variable in this study. Relationships of the nine selected characteristics of the
 184 respondents with their awareness have been presented in the Table 6.

185 **Table 6. Correlation between the selected characteristics of the respondents and their**
 186 **awareness regarding the effect of antibiotic used in animal feed on human health**

Independent variable (selected characteristics)	Dependent variable (focus variable)	Correlation coefficient	Remark
Age		0.055 NS	PPCC
Education		0.520**	PPCC
Family size	Consumers’ awareness regarding the effect of antibiotic used in animal feed on human health	-0.147 NS	PPCC
Family education		0.419**	PPCC
Annual family income		0.426**	PPCC
Communication media exposure		0.619**	SRCC
Nutritional knowledge		0.725**	PPCC
Animal protein consumption behavior		0.310**	SRCC
Attitude		0.663**	SRCC

187 NS= Non-significant, **Correlation highly significant at 1% level of probability and *Correlation highly significant
 188 at 5% level of probability, PPCC = Pearson’s Product Moment co-efficient of correlation, SRCC = Spearman Rank
 189 Correlation Coefficient.

190
 191 Among the selected characteristics of the respondents; education, family education, annual
 192 family income, exposure to communication media, nutritional knowledge, animal protein
 193 consumption behavior and attitude showed positive significant relationship with their awareness
 194 regarding the effect of antibiotics used in animal feed on human health. It means that education,

195 family education, annual family income, exposure to communication media, nutritional
196 knowledge, animal protein consumption behavior and attitude increase awareness of consumers.
197 Sultana et al. [10] also found similar results regarding age. The findings of the studies conducted
198 by Hasan, Shanto and Khatun [11,12,13] have harmony with the present study regarding
199 educational qualification. Similar result was described by Mallick and Mondol, Hasan and
200 Hoque [9,11,14] regarding family size. The findings of the studies conducted by Hasan, Shanto
201 and Khatun [11,12,13] have similarity with the present study regarding annual family income.
202 Hasan, Shanto [11,12] observed similar result regarding exposure to communication media. The
203 findings of the studies conducted by Hasan, Hoque and Jalal [11,14,15] have harmony with the
204 present study regarding knowledge.

205 4. DISCUSSION

206 According to [17], in Bangladesh, various types of antimicrobial drugs are available in the
207 market. Only a few companies mention the withdrawal period of their product in packet. Our
208 farmers are not so much literate that they can think about the residual effect of antibiotics which
209 have been developed due to continuous use of these antimicrobial drugs. Livestock producers in
210 all parts of the world will increasingly face legislative and consumer pressures to reduce the use
211 of antimicrobial drugs which are chemically related to antibiotics used to treat human disease.

212 According to [18], a cross-sectional study on the use of antibiotics in pig and poultry production
213 as well as the farmer's knowledge on the danger of the antibiotic use in three different animal
214 production systems (farm household, semi-industrial and industrial) on 270 entities, in 3
215 representative localities of the Red River Delta (RRD) region was conducted in Vietnam. The
216 researchers found that a large volume of antibiotics was used in all animal production systems.
217 Animals were not only treated for acute diseases, but also for disease prevention and for growth
218 promotion. At least 45 antibiotics of more than 10 classes were used. Fifteen antibiotics were
219 used in pig and poultry feed. For diseases treatment and prevention, antibiotics were used
220 abusively and even illegally (e.g. chloramphenicol) by both farmers and veterinarians.

221 [19] carried out a study to investigate antibiotic usage in livestock management by farmers in
222 northeast Nigeria and found that majority of the farmers administered antibiotics on their animals
223 yearly (21%) and monthly (16%), and tetracycline (25%) and penicillin (19.5%) appeared to be
224 the most commonly patronized antibiotics by farmers in this region. Majority of the farmers
225 indicated sourcing their antibiotics from veterinary pharmacy shops (31%) and veterinary clinics
226 (27.5%), and most of the farmers indicated relying on veterinary doctors for recommendation for
227 antibiotic use (29.7%), dosage (27%) and withdrawal time (29.7%).The pattern of antibiotics use
228 and administration observed in this survey revealed potential misuse of antimicrobials, despite
229 the fact that more farmers relied on antibiotic prescriptions.

230 [20] reported that among seven countries Norway, Belgium, Sweden, Denmark, Switzerland,
231 Austria and The Netherlands, Belgium ranked first (86%) for antimicrobial use in animals.
232 National mechanism for data collection on antibiotic use is lacking amongst many countries, as
233 pharmaceutical industries seem to treat production and sales figures as confidential business
234 information. [21] found that the maximum veterinary residue limits for tetracycline,
235 oxytetracycline, streptomycin, gentamicin, sulphonamides, quinolones, among others, to be 100,
236 100, 200, 200, 100 and 75 µg/kg respectively. Antibiotics used in livestock and poultry are
237 similar in mechanism to antibiotics used in humans and have the substantial potential to trigger
238 cross-resistance [22].

239 Commonly used antibiotics in animal feed are streptopenicillin, benzyl penicillin, enrofloxacin,
240 amoxicillin, ampicillin, sulfa-trimethoprim, tylosin, sulfamethoxazole, oxytetracycline,
241 doxycycline, colistin sulfate, neomycin, tetracycline, tylosin, enrofloxacin, ciprofloxacin,
242 amikacin and tilmicosin. Infectious zoonotic agents, as well as non-zoonotic diseases that are
243 affecting livestock, are commonly treated with antibiotics. The most used and commonly
244 reported antibiotics were tetracycline, sulphadimidines and penicillin-streptomycin [23].

245 [24] reported that the use of antimicrobial drugs in large amounts and consistently could result in
246 deposition of antimicrobial residues in muscle and organs of animal. Consumption of these
247 residues in animal products (especially through meat and meat products) may cause health risk to
248 consumers including development of antibiotic resistance and hypersensitivity reaction.
249 Approximately 4-11% of the human population are believed to be allergic to penicillin and
250 related drugs [25], therefore exposure to this drug class via food animal residues puts them at
251 risk for developing allergic reactions that may range from minor reactions such as a skin rash to
252 severe anaphylaxis. Although the true incidence/prevalence and mortality associated with drug
253 induced anaphylaxis is unknown in western countries, several epidemiological studies
254 investigating penicillin and anesthetic agents given during the perioperative period showed these
255 drugs were associated with allergic anaphylaxis [25, 26].

256 **5. CONCLUSION**

257 Based on the finding of the study and its scientific interpretation it can be concluded that most of
258 the respondents were highly aware about the effect of antibiotic used in animal feed on human
259 health. Only one-fifth of the respondents had medium awareness about the effect of antibiotic
260 used in animal feed on human health. Consumers were highly aware about that resistance is
261 grown in pathogenic organisms causing diseases in human body against antibiotics which are
262 used in patient treatment resulting in treatment failure. But consumers were less aware about
263 allergic reaction and painful rash which are possible with many antibiotics. The mean awareness
264 score of the consumers resided at Nirala residential area was higher than that of the Mohammad
265 Nagar residential area but it did not differ significantly. This might be due to proximity of the
266 two residential areas. Among the selected characteristics of the respondents; education, family
267 education, annual family income, exposure to communication media, nutritional knowledge,
268 animal protein consumption behavior and attitude showed positive significant relationship with
269 their awareness regarding the effect of antibiotic used in animal feed on human health.

270 In pursuit of the findings and observations, it is clear that the consumers in the study area are
271 concerned about the effect of antibiotic used in animal feed on human health. Government and
272 the producer should develop new strategies for a prudent use of antibiotics in food producing
273 animals to ensure food safety.

274 **Consent :**

275 As per international standard, respondent's informed written consent has been collected and preserved
276 by the author(s).

277 **Ethical :**

278 **NA**

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280

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