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Assessment of the Use of Probiotics and Growth Promoters in Poultry Feed and Its Impact on Poultry of Tangail District, Bangladesh

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ABSTRACT

Recent advancements in poultry farming have significantly increased the use of antibiotics for disease prevention and growth promotion, a trend that has raised urgent concerns about antibiotic resistance (AR) stemming from overuse. In contrast, probiotics and vitamin supplements commonly added to poultry feed or drinking water provide robust natural alternatives that effectively enhance poultry health and productivity without contributing to AR. This cross-sectional study, conducted between January 2020 to July 2022, thoroughly assessed the knowledge and usage patterns of antibiotics, probiotics, and vitamin supplements among poultry farmers in 25 commercial farms across Tangail District, Bangladesh.

Among the 25 broiler farms surveyed, a clear trend emerged: 72% of farmers relied solely on antibiotics, 8% used only probiotics, and 20% utilised a combination of both. Notably, among the probiotic users (n = 7), an impressive 71% employed probiotics as growth promoters, while 29% leveraged them for disease prevention. The study identified six commonly used probiotics: Biogut, Enprovin-Plus, Probios, Fra-C-12, Prozime, and Avi-Bac. Additionally, five effective vitamin supplements, Megavit, UK-GP-Plus, Vitamin AD-3-E, Eskavit AD-E, and AD-3-E-Super were frequently utilised, especially for promoting growth.

Statistical analysis demonstrated a substantial reduction in disease prevalence among probiotic users compared to their non-user counterparts. For instance, the incidence of blood dysentery was only 13.3% among probiotic users, in stark contrast to 86.7% among non-users. Similarly, Ranikhet virus infections affected 22.2% of probiotic users compared to 78.8% of non-users, while E. coli infections were reported at just 25.0% in probiotic users versus 75.0% in non-users. These compelling differences reinforce the strong association between probiotics and improved flock health in commercial poultry farming, confirming their potential as a safe, effective alternative to antibiotics. The benefits of probiotics extend beyond just disease prevention; they also enhance growth performance and improve meat quality in broilers.

INTRODUCTION

Poultry farming, which involves the domestication of birds for their eggs, meat, or feathers, is a critical aspect of agricultural systems worldwide. These birds are predominantly members of the super-order Galloanserae, specifically the order Galliformes (Oladayo, O. T., 2019). Poultry farming is integrated into various agricultural systems globally, offering mutual benefits such as the efficient conversion of feed sources such as agricultural by-products, household waste, and food industry residuals into valuable animal products and protein sources (Agyare et al., 2018).

This makes poultry farming more efficient than many other livestock systems. Furthermore, the contribution of poultry to food security, protein supply, and economic livelihood has made them invaluable globally, with urban and peri-urban areas benefiting significantly from poultry production (Lee et al., 2019). Additionally, poultry farming has become a vital income generator for women in many parts of the world, contributing to gender equality and supporting Millennium Development Goals (Ahmed et al., 2021).

In recent years, there has been a growing interest in alternative supplements to antibiotics, particularly probiotics and vitamins, in poultry farming. These supplements are employed to support poultry during physiological stress, reduce technological strain, and combat diseases (Hill et al., 2014). Probiotics, as live microorganisms, have become increasingly recognised for their potential benefits in maintaining a healthy gastrointestinal tract (GIT) and improving poultry health without the harmful side effects of antibiotics (Vuong et al., 2016). Research has shown that probiotics can help maintain a balance between beneficial and pathogenic bacteria in the GIT, thereby enhancing overall poultry health (Shini et al., 2021). Although the initial costs of using probiotics may be high, they prove to be cost-effective in the long run by reducing disease rates and improving productivity (Van et al., 2020).

The mechanism of probiotics was first defined by Gibson and Roberfroid (1995), who described them as indigestible food supplements that stimulate beneficial microorganisms in the intestines (Sarita et al., 2023). Probiotics are not absorbed in the GIT but serve as substrates for beneficial bacteria, including indigestible fructo-oligosaccharides (Wilson & Whelan, 2017). They help combat digestive disorders and maintain gut health by stimulating immune responses through secretions, such as bacteriocins, and by excluding pathogens, including Salmonella and E. coli (Chaucheyras-Durand et al., 2010). Vitamin supplements also play a vital role in poultry, aiding energy conversion, cellular repair, and immune boost (Zaman et al., 2021). Together, probiotics and vitamins enhance poultry health, feed efficiency, and immunity (Shini et al., 2021), also support probiotics' positive effects on feed efficiency and overall health of poultry.

Despite the known drawbacks of antibiotic dependency, awareness and adoption of safer alternatives like probiotics remain limited among Bangladeshi poultry farmers. Probiotics, live microorganisms that support gut health and immune function, offer a promising, natural approach to improving poultry performance without contributing to antimicrobial resistance. However, a lack of farmer education, minimal veterinary guidance, and weak policy frameworks hinder their widespread implementation.

Building on these advancements, this study investigates the role of probiotics and vitamins as growth promoters in poultry farming, focusing on their effects on poultry health and productivity (Alders & Pym, 2009). It seeks to fill an important knowledge gap by examining how antibiotics, probiotics, and vitamin supplements are used and understood in poultry farms across Tangail District, Bangladesh. The research aims to identify common practices, analyse disease rates to feed supplements, and generate evidence to support policy development for more sustainable poultry health management.

METHODOLOGY

Study Area

To obtain information, this study was conducted among poultry farms selected from various areas under Tangail Sadar Upazila.

Sample size

During data collection, participants were well-informed about the objective of the research and their verbal consent was taken. The target population of this study was males and females aged between ≥ 18 years and ≤ 65 years. Individuals who were institutionalized, including people residing in hospitals, prisons, nursing homes, etc. were excluded from this study. Additionally, we put a conscious effort to include a variety of participants from different socio-economic backgrounds in this urban community, helping to reduce selection bias. To ensure our questionnaire resonated with the people of Dhaka, we made several cultural adaptations. We translated the questionnaire into Bengali, allowing participants to express themselves comfortably in their native language. By including familiar examples, we aimed to make the questions relevant to their daily lives. When addressing sensitive topics, we approached them with care, considering local beliefs and potential stigmas.

Sample Size calculation:

$$n = \frac{Z^2 \times p(1-P)}{E^2}$$

n is the required sample size

p is the percentage occurrence of a state or condition

E is the percentage maximum error required

Z is the value corresponding to the level of confidence required

According to a study prevalence of diabetes in Dhaka was 15.8% (M. Ali et al., 2024). With the precision/absolute error of 5% and at type 1 error of 5%, and confidence interval at 95% (standard value of 1.96), the sample size was calculated at 204.428 ≈ 204. Data from 205 participants were collected, but following the removal of incomplete questionnaires, 200 were retained for final analysis. Of these 107 were male and mean age was 33.65 years (SD±13.45). Just over half of the population was students (52%). 78% of the participants completed their graduation and majority participants were following Islam comprising 93%. Besides, 106 respondents were unmarried.

Measurements

To determine participants' BMI, height and weight were taken. Weight was measured using a dial scale (OSAKA model), and height was measured with a standard strip meter while the participants stood up straight in bare feet. Body Mass Index (BMI) was then calculated by dividing the weight (in kilograms) by the square of the height (in meters), using the formula BMI = kg/m². BMI was categorized according to the Asian cutoff points into four classifications: individuals with a BMI below 18.5 were classified as underweight; those with a BMI between 18.5 and 22.9 were considered normal weight; individuals with a BMI between 23 and 24.9 were classified as overweight; & those with body mass index greater than or equal of 25 or above were categorized to heavy.

Similarly, WHO classification BMI also includes four categories: individuals with a BMI below 18.5 are classified as underweight; those with a BMI between 18.5 and 24.9 are considered normal weight; individuals with a BMI of 25 and 29.9 are classified as overweight; and those with a BMI of 30 or above are categorized as obese. In this study, the household income of the participants was classified into five categories based on Bangladeshi currencies: poorest (< BDT 10,000/month), poor (BDT 10,000–19,999/month), moderate (BDT 20,000–49,999/month), rich (BDT 50,000–99,999/month), and richest (≥ BDT 1,00,000/month).

Data analysis

The SPSS program (SPSS 26 version) was used to gather the data and conduct statistical analysis. The SPSS program was used to compute descriptive statistics, such as the percentages and frequency of demographic information. Furthermore, chi-square test was run to identify the association between the prevalence of cardiometabolic diseases and participants' demographic status.

Ethical Considerations

This research was performed in accordance with the Declaration of Helsinki. Ethical approval was obtained before the study from the Institutional Review Board (IRB) of Daffodil International University, IRB number Ref: FAHSREC/DIU/2024/SMIG-29. No one had access to the data except for the first and corresponding authors. The data was already anonymized, and the respondents were not identified in any way.

RESULTS

According to Table 1, 53.5% of the respondents were men. Among the participants 52.5% were students while 78% were completing their graduation. Among the sample 63.5% belonged to age group of 18-35 years. Besides, 93% population were following Islam religion and 53% were unmarried. 36% of the study population's monthly household income was < BDT 10,000 while only 4% had monthly income over BDT 1 lac. According to WHO classification of BMI, 61% participants belonged to normal category but following the Asian cutoff this value was 37.5% while the prevalence of overweight was same. Surprisingly, in accordance with WHO classification and Asian cutoff, obese people were of 5.5% and 28.5% respectively.

Table 1. Background characteristics of the study population

Background Characteristics	N	(%)
Sex		
Male	107	**53.5**
Female	93	**46.5**
Age in years		
Young age (18-35)	127	**63.5**
Middle age (36-50)	36	**18**
Older age (51-65)	37	**18.5**

Occupation		
Student	105	**52.5**
Business	18	**9**
Job holder	77	**38.5**
Education		
Higher Secondary	6	**3**
Graduate	156	**78**
Postgraduate	38	**19**
Household income rank		
Poorest (≤ BDT 10,000)	72	**36**
Poor (BDT 10,000 – 19,999)	51	**25.5**
Moderate (BDT 20,000 – 49,999)	56	**28**
Rich (BDT 50,000 – 99,999)	13	**6.5**
Richest (≥ BDT 1,00,000)	8	**4**
Religion		
Muslim	186	**93**
Hindu	14	**7**
Marital status		
Unmarried	106	**53**
Married	92	**46**
Widow	2	**1**
BMI WHO Classification		
Underweight	15	**7.5**
Normal	122	**61**
Overweight	52	**26**
Obese	11	**5.5**
BMI Asian Cutoff		
Underweight	76	**8**
Normal	75	**37.5**

Overweight	52	**26**
Obese	**57**	**28.5**

Table 2 revealed that the prevalence of high blood pressure among the study participants was 27.1% in men and 18.4% in women, but the difference was not statistically significant (p = 0.925). Age was a significant factor, with a striking 81.1% prevalence among individuals aged 51-65 years, compared to only 6.3% in those aged 18-35 years (p = 0.000). Occupational status also revealed notable associations; 60% of large business owners had high blood pressure. Additionally, individuals with lower educational levels exhibited higher rates of hypertension, indicating that education may play a role in health awareness and lifestyle choices (p = 0.000).

Besides, diabetes prevalence was higher in men (17.8%) compared to women (6.1%), with a significant association to age (p = 0.008). Among those aged 51-65 years, the prevalence was 59.5%, while only 0.8% was reported in the 18-35 age group. Income levels were also significant; individuals in the wealthiest income bracket had a notably higher prevalence of diabetes. Educational attainment was inversely related to diabetes prevalence, as lower educational levels were associated with higher rates of the disease (p = 0.000).

Additionally, the prevalence of cardiovascular disease was observed at 11.2% for men and 2.1% for women, with no significant gender association (p = 0.191). Age was again a critical factor, with 32.4% of individuals aged 51-65 years affected, compared to 0% in the younger age group (p = 0.009). Occupational factors were significant, as 40% of large business owners reported cardiovascular disease. Marital status also showed a significant association, with married individuals exhibiting higher rates of CVD (p = 0.000)

Table 2: Association of high blood pressure, diabetes mellitus & cardiovascular disease of study participants with their background characteristics

	High Blood Pressure (HBP)		P	Diabetes Mellitus (DM)		P	Cardiovascular Disease (CVD)		P
	Yes N (%)	**No N (%)**		**Yes N (%)**	**No N (%)**		**Yes N (%)**	**No N (%)**	
Sex									
Male	29(27.1)	78(72.9)	.75	19(17.8)	88(82.2)	.434	12(11.2)	95(88.8)	.193
Female	23(24.7)	70(75.3)		12(12.9)	81(87.1)		2(2.2)	91(97.8)	
Age (years)									
18-35	8(6.3)	119(93.7)	.000	1(.8)	126(99.2)	.000	0(0.0)	127(100)	.000
36-50	14(38.9)	22(61.1)		8(22.2)	28(77.8)		2(5.6)	34(94.4)	
51-65	30(81.1)	7(18.9)		22(59.5)	15(40.5)		12(32.4)	25(67.6)	
Occupation									
Student	6(5.7)	99(94.3)	.000	0(0.0)	105(100)	.000	0(0.0)	105(100)	.000

Business	10(55.6)	8(44.4)		9(50.0)	9(50)		7(38.9)	11(61.1)	
Job holder	36(46.8)	41(53.2)		22(28.6)	55(71.4)		7(9.1)	70(90.9)	
Education									
Under-graduate	4(66.7)	2(33.3)	.000	2(33.3)	4(66.7)	.003	0(0.0)	6(100)	.532
Graduate	29(18.6)	127(81.4)		17(10.9)	139(89.1)		10(6.4)	146(93.6)	
Post-graduate	19(50)	19(50)		12(31.6)	26(68.4)		4(10.5)	34(89.5)	
Household Income									
Poorest	13(18.1)	59(81.9)	.000	5(6.9)	67(93.1)	.000	1(1.4)	71(98.6)	.000
Poor	5(9.8)	46(90.2)		1(2.0)	50(98)		0(0.0)	51(100)	
Moderate	19(33.9)	37(66.1)		17(30.4)	39(69.6)		6(10.7)	50(100)	
Rich	8(61.5)	5(38.5)		1(7.7)	12(92.3)		4(30.8)	9(69.2)	
Richest	7(87.5)	1(12.5)		7(87.5)	1(12.5)		3(37.5)	5(62.5)	
Religion									
Muslim	51(27.4)	135(72.6)	.095	31(16.7)	155(83.3)	.097	14(7.5)	172(92.5)	.287
Hindu	1(7.1)	13(92.9)		0(0.0)	14(100)		0(0.0)	14(100)	
Marital status									
Unmarried	9(8.5)	97(91.5)	.000	2(1.9)	104(98.1)	.000	1(0.9)	105(99.1)	.001
Married	41(44.6)	51(55.4)		28(30.4)	64(69.6)		13(14.1)	79(85.9)	
Widow	2(100)	0(0)		1(50)	1(50)		0(0)	2(100)	
BMI (WHO)									
Under-weight	2(13.3)	13(86.7)	.025	0(0.0)	15(100)	.150	0(0.0)	15(100)	.133
Normal	25(20.5)	97(79.5)		17(13.9)	105(86.1)		7(5.7)	115(94.3)	
Over-weight	21(40.4)	31(59.6)		12(23.1)	40(76.9)		7(13.5)	45(86.5)	
Obese	4(36.4)	7(63.6)		2(18.2)	9(81.8)		0(0.0)	11(100)	
BMI (Asian cutoff)									
Under-weight	3(18.8)	13(81.3)	.008	0(0.0)	16(100)	.012	0(0.0)	16(100)	.042
Normal	11(14.7)	64(85.3)		6(8.0)	69(92)		7(9.3)	68(90.7)	

Over-weight	15(28.8)	37(71.2)		21.2(14)	41(78.8)		0(0.0)	52(100)	
Obese	23(40.4)	34(59.6)		14(24.6)	43(75.4)		7(12.3)	50(87.7)	

Table 3 depicts that 70% reported having at least one health condition, with a notable 15% experiencing just one disease, while 11.5% faced two, and 3.5% had three. Table 4 demonstrated that gender and BMI showed no strong differences in co-morbidity (p = 0.252 & 0.040). However, marital status played a significant role—91.5% of those with any diseases were unmarried. But in comorbidity, it was only 0.9% for unmarried while 22.8% and 6.5% of married people were with 2 diseases and 3 diseases respectively (p = 0.000). Age was another critical factor, with a striking 18.9% of co-morbid cases of more than 2 diseases occurring in individuals aged 51-65 years, while none was found in other 2 groups (p = 0.000). According to education levels, prevalence of 2 diseases was highest among undergraduate level whereas it was highest in graduate level for existing 3 diseases (p = 0.000). Occupation also mattered; students had no co-morbidity health issue but business owners exhibited a higher prevalence of co-morbidities at 27.8% & 22.2% (p = 0.000). Lastly, household income significantly showed that comorbidity of 2 or more diseases were highest among the richest participants comprising 50% & 37.5% accordingly (p = 0.000).

Table 3: Prevalence of co-morbidity

Co-morbidity	n	%
Any disease	140	70
Only 1 disease	30	15
2 Diseases	23	11.5
3 Diseases	7	3.5

Table 4: Association between co-morbidity and demographic characteristics

	Co-morbidity				
	Any disease	**Only 1 disease**	**2 Diseases**	**3 Diseases**	**P-value**
Sex					
Male	73 (68.2)	14 (13.1)	14 (13.1)	6 (5.6)	.252
Female	67 (72)	16 (17.2)	9 (9.7)	1 (1.1)	
Marital status					.000
Unmarried	97 (91.5)	7 (6.6)	1 (0.9)	1 (0.9)	
Married	43 (46.7)	22 (23.9)	21 (22.8)	6 (6.5)	
Widow	0 (0.0)	1 (50.0)	1 (50)	0 (0.0)	
Age					.000
18-35	119 (93.7)	7 (5.5)	1 (0.8)	0 (0.0)	
36-50	18 (50.0)	12 (33.3)	6 (16.7)	0 (0.0)	

51-65	3 (8.1)	11(29.7)	16 (43.2)	7 (18.9)	
Education					.000
Undergraduate	2 (33.3)	2 (33.3)	2 (33.3)	0 (0.0)	
Graduate	122 (78.2)	18 (11.5)	10 (6.4)	6 (3.8)	
Postgraduate	16(42.1)	10(26.3)	11(28.9)	1(2.6)	
Occupation					.000
Student	99 (94.3)	6 (5.7)	0 (0.0)	0 (0.0)	
Business	5 (27.8)	4 (22.2)	5 (27.8)	4 (22.2)	
Service holder	36 (46.8)	20 (26.0)	18 (23.4)	3 (3.9)	
Household Income					
Poorest	58 (80.6)	10 (13.9)	3 (4.2)	1 (1.4)	.000
Poor	46 (90.2)	4 (7.8)	1 (2.0)	0 (0.0)	
Moderate	30 (53.6)	12 (21.4)	12 (21.4)	2 (3.6)	
Rich	5 (38.5)	4 (30.8)	3 (23.1)	1 (7.7)	
Richest	1 (12.5)	0 (0.0)	4 (50)	3 (37.5)	
BMI Asian Cutoff					.040
Underweight	13 (81.3)	3 (18.8)	0 (0.0)	0 (0.0)	
Normal	60 (80)	8 (10.7)	5 (6.7)	2 (2.7)	
Overweight	35 (67.3)	8 (15.4)	9 (17.3)	0 (0.0)	
Obese	32 (56.1)	11 (19.3)	9 (15.8)	5 (8.8)	

DISCUSSION

This study sheds light on the intricate relationship between demographic factors, socioeconomic status (SES), and the prevalence of cardiometabolic diseases among urban residents in Dhaka. More than two-thirds of participants reported at least one health condition. It aligns with the previous studies which suggested that rapidly urbanizing setting plays role in the disease prevalence, as urbanization causes change dietary habits (M. Ali et al., 2024; Hatice et al., 2022). Prevalence of cardiometabolic diseases were higher in men than women which supports the previous findings (Al-Zubayer et al., 2021; M. Ali et al., 2024; M. K. Ali et al., 2016).

Most of the unmarried individuals exhibited a higher prevalence of any diseases compared to married individuals. This aligns with previous research suggesting that marriage can offer social support and promote healthier lifestyles, potentially buffering against chronic diseases (*Resolution on Poverty and Socioeconomic Status*, 2022). However, in regards of comorbidity, about one-fourth of the married population showed higher incidence than unmarried ones. It's important to acknowledge that the dynamics of social support within marriage can be complex, and not all spousal support is beneficial. Some studies suggest that marriage can also introduce stressors that negatively impact health, underscoring the need for a nuanced understanding of this association (Nair, 2021).

Co-morbidity of 2 or more diseases were highest among 51-65 years aged population and among them prevalence of hypertension was prominent. Conversely, younger individuals (18-35 years) had lower rates of these conditions. This is consistent with established literature indicating that the risk of cardiometabolic diseases increases with age due to physiological changes and the accumulation of risk factors (Singh-Manoux et al., 2018).

Additionally, this study found that lower educational levels associated with higher rates of hypertension and diabetes. This finding aligns with numerous studies demonstrating that higher education is linked to better health literacy, improved access to healthcare, and healthier lifestyle choices. Individuals with higher health literacy are better equipped to understand and act on health information, leading to improved self-management of chronic conditions (Wu et al., 2025). But when comes to co-morbidity it showed opposite trend, that people with higher literacy were tend to be more susceptible to co-morbidity. This could be due to the demographic status, as in this study location more literate people are from higher socio-economic status and they might expose to unhealthy eating behavior in their aged life. Also, aging is a factor for co-morbidity. At the same time, this study revealed that wealthier participants had a higher prevalence of both hypertension and diabetes which aligns with the findings of a previous study (Biswas et al., 2019). However, research suggests that in certain urban settings, affluent individuals may adopt unhealthy lifestyle choices, such as high-calorie diets and sedentary behaviors, which can increase their risk of cardiometabolic diseases (M. K. Ali et al., 2016; Biswas et al., 2019).

Furthermore, the study's findings regarding BMI was that the use of Asian-specific BMI cutoffs revealed a higher prevalence of obesity compared to standard WHO classifications, emphasizing the limitations of relying solely on universal BMI thresholds (Nie & Ardern, 2014; Sung et al., 2025).

Implication

In light of these findings, targeted public health interventions are crucial for addressing the complex interplay of demographic and socioeconomic factors that shape cardiometabolic health outcomes in urban Dhaka. These interventions should focus on promoting healthier lifestyles, improving health literacy, and creating supportive environments that enable individuals to make informed choices and adopt sustainable health behaviors. By addressing these multifaceted influences, it is possible to reduce the burden of cardiometabolic diseases and promote health equity in this rapidly evolving urban environment.

Limitations

This study offers important insights, but it has some limitations. The sample size was relatively small, which may limit the generalizability of the findings. Additionally, relying on self-reported data regarding health condition can introduce biases. Moreover, the cross-sectional design means we cannot establish causal relationships; we can only observe correlations at a single point in time. Lastly, the focus on urban populations may overlook the experiences of rural residents, who might face different health challenges.

Future Research Directions

Future research should aim to expand on these findings. Longitudinal studies could clarify how dietary habits influence cardiometabolic diseases over time. Increasing the sample size and including diverse populations, both urban and rural, would enhance data robustness. Incorporating biochemical assessments could provide a fuller picture of

health status. Finally, evaluating the effectiveness of targeted public health interventions would be valuable for policymakers and health practitioners.

CONCLUSION

This study emphasizes the important connection among cardiometabolic health, co-morbidity and nutritional status among urban residents in Dhaka. We found that factors like age, marital status, occupation, and household income are closely linked to conditions such as CVD, hypertension, and diabetes. The health outcomes of urban populations are significantly shaped by socio-demographic status. Our research emphasizes the need for targeted interventions to raise nutritional awareness and encourage healthier lifestyle practices, which are essential for reducing the burden of cardiometabolic diseases. Future policies should take these elements into account to develop comprehensive strategies that address the unique needs of different demographic groups. Strengthening collaboration among health authorities, educators, and community organizations will be key to implementing effective health promotion strategies and ensuring a healthier future for all urban residents. Future efforts should focus on tailored strategies that address the unique needs of different demographic groups, ensuring a healthier future for all urban residents.

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The authors declare that no conflict of interest exists.

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