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Factors Affecting Women's Participation in Livestock Management Activities and Its Impact on the Living Standards of Rural Women in Bangladesh

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Abstract: The livestock sector plays a significant role in contributing to the economic growth of Bangladesh, ensuring food security, and reducing poverty in rural areas. Most importantly, the participation of rural women in animal husbandry is of particular significance. The purpose of this study is to investigate the factors that influence women's engagement in livestock rearing and its impact on living standards. Using primary data collected through interviews, descriptive and inferential statistical analyses were conducted. Factor analysis revealed seven key factors significantly influenced by animal husbandry: asset creation, provision of essentials, organic fertilizer production, overall living standards improvement, financial autonomy, fuel generation, and children's education facilitation. In this study, multivariate analysis of variance confirmed the substantial impact of animal husbandry on these factors, emphasizing its role in enhancing the livelihoods of rural women. This study recommends transformative interventions to improve the living conditions of rural women in Bangladesh, thereby fostering broader economic development. The novelty of this research article lies in its detailed and methodologically rigorous analysis of the impact of livestock management on rural women's living standards in Bangladesh, employing advanced statistical techniques and offering practical policy recommendations. This comprehensive approach fills gaps in existing research and provides new insights into the socioeconomic benefits of livestock rearing for rural women.

Keywords: livestock management, living standard, rural women, Bangladesh.

影响妇女参与畜牧业管理活动的因素及其对孟加拉国农村妇女生活水平的影响

摘要：畜牧业在促进孟加拉国经济增长、确保粮食安全和减少农村贫困方面发挥着重要作用。最重要的是，农村妇女参与畜牧业具有特别重要的意义。本研究的目的是调查影响妇女参与畜牧业及其对生活水平影响的因素。利用通过访谈收集的原始数据，进行了描述性和推论性统计分析。因子分析揭示了受畜牧业显著影响的七个关键因素：资产创造、必需品供应、有机肥料生产、整体生活水平改善、财务自主、燃料生产和儿童教育便利。在本研究中，多元方差分析证实了畜牧业对这些因素的重大影响，强调了其在改善农村妇女生计方面的作用。本研究建议采取变革性干预措施，改善孟加拉国农村妇女的生活条件，从而促进更广泛的经济发展。这篇研究论文的创新之处在于，它详细而严谨地分析了畜牧业管理对孟加拉国农村妇女生活水平的影响，采用了先进的统计技术，并提出了切实可行的政策建议。这种全面的方法填补了现有研究的空白，并为农村妇女畜牧业的社会经济效益提供了新的见解。

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关键词：牲畜管理、生活水平、农村妇女、孟加拉国。

1. Introduction

Agriculture is the primary contributor to the developing world's gross domestic product, employment creation, poverty alleviation, and dietary needs, among others. A country's destiny in the developing world is intricately tied to the steady expansion of its agricultural sector. Simultaneously, this progress requires the proactive engagement of rural households in the ongoing development process. Parallel to one another, agricultural development, growth, and poverty reduction occur in developing countries. Concurrently, the four subsectors of the agriculture sector have played a significant role in alleviating destitution throughout developing countries [3]. Within this category of sub-sectors, livestock bears considerable importance, as evidenced by the fact that three-quarters of impoverished households rely on it to support their livelihoods [8]. Rural regions of developing countries are home to a diverse range of livestock, including both small and large ruminants (e.g., poultry, goats, and sheep). The latter category typically includes bison, cattle, and so on. Livestock provide numerous benefits in rural developing countries through various agricultural systems. Thus, livestock can not only alleviate poverty but also enhance the socioeconomic conditions of the rural poor in developing nations by virtue of its numerous advantages. Raising livestock is a laborious endeavor that demands both time and expertise. Women are primarily responsible for the care of livestock in rural regions of developing countries, in addition to other household duties, including cooking, dishwashing, housekeeping, and supervision of children and elderly individuals [1]. In terms of the nation's prospective economic development, this sector holds a lot of promise. In terms of GDP, agriculture makes a substantial contribution, which was 11.5% in FY 2021-22 [18]. Only the livestock and fishing subsectors make for 35–40% of the total agriculture sector. This represents roughly 7-8% of the GDP overall, of which 1.53% comes from the animal husbandry and 3.57 percent from the subsector of fisheries. Furthermore, this subsector provides more than 90% of all animal protein [19].

Improving citizens' health and nutrition intake is one of the state's main responsibilities, as stated in Article 18(1) of the People's Republic of Bangladesh Constitution. In addition, the Constitution calls attention to matters like food, the right to work, and a decrease in unemployment rates regarding upholding the fundamental rights of the people. In accordance with its constitutional duties, the Ministry of Fisheries and Livestock has been assiduously pursuing the improvement of fish, meat, milk, and egg productivity to meet the growing demand for animal protein and nutrition among the population. In addition, the ministry has been ensuring that women participate in its programs and activities in accordance with national laws, such as the National Livestock Development Policy 2007, the Microcredit Disbursement Rules of 2011, and the National Poultry Development Policy of 2008. Additionally, this ministry has been leading the way in ensuring that women receive a fair share of the benefits from these initiatives [19].

This study's main goal is to investigate how Bangladeshi rural women's living conditions are affected by animal husbandry. Primary sources of data were used in this study; these sources were obtained from respondents through in-person interviews. Several descriptive and inferential statistical techniques were employed in this study's data analysis, including logistic regression, factor analysis, and multivariate analysis of variance (MANOVA). The following are the study's objectives:

i. To determine the reasons for entering the field of animal husbandry

ii. To investigate the activities engaged in by women in livestock farming

iii. To identify the factors affecting rural women's living standards and affected by animal husbandry

iv. To determine whether there is a significant relationship between animal husbandry and the living conditions of rural women

Therefore, this paper proposes the following hypothesis to be tested.

H_0: There is no relationship between the factors of the living standards of rural women and animal husbandry.

H_1: There is a relationship between the factors of the living standards of rural women and animal husbandry.

2. Literature Review

The livestock industry, the most significant agricultural subsector, is a major source of protein, income, and jobs in the economies of many developing nations. Over the last decade, a significant number of studies have been conducted to determine the factors influencing women's involvement in livestock activities and how those factors affect income. Sesay [7] investigated the role of women in livestock production in Sierra Leon. A sample of 384 women actively engaged in livestock production was randomly selected from eight sectors of the Yoni chiefdom. In addition, data were gathered using validated and pretested semi-structured questionnaires. Education,

marital status, family size, experience, farm income, and access to credit were found to have a significant impact on women's participation in livestock production, according to the regression results. The primary impediments to women's engagement in livestock management practices are substandard economic conditions, inadequate literacy, cultural conventions, low self-esteem, and violence directed at women. Thu et al. [9] identified the factors influencing women's participation and decisions in livestock management using descriptive analysis, the chi-square test, and stepwise regression in Myanmar. In their analysis, respondents are small-scale, middle-aged farmers who are occupied with housework and lack formal education, and men make most decisions due to their greater access to resources. They argued that land ownership and information access significantly affect decisions about feeding, medical treatment, and the purchase and sale of livestock. Mataka [6] revealed the impact of women's involvement in livestock production and marketing on food security in Malawi. Tobit regression is used to demonstrate that food security is enhanced through income and nutrition from livestock. Usman et al. [10] argued that women's age, ownership, participation in livestock activities, access to input markets, and education significantly affect livestock income. They added that ownership, training, credit, and market availability could make women's participation in livestock more effective. Awan et al. [12] focused on women's participation and constraints in livestock management activities in Pakistan. In their paper, they conclude that approximately 50% of respondents were middle-aged, and 77% were married. Most participants are illiterate and have 15 years of experience in livestock management. The descriptive findings indicated that the number of animals owned by women was nearly 53% higher than that of males. There was a significant 86% increase in women's participation in livestock management compared with men ($p \leq 0.001$), with women devoting a greater amount of time to diverse livestock management activities. Significant barriers hindering women in the Punjab region from managing livestock included inadequate access to training and financing facilities and the exorbitant expenses associated with veterinary services for animal treatment. Dan and Kim [5] investigated women's participation in livestock farming in Nigeria. In other words, their paper also reveals obstacles to engaging in livestock farming, such as a lack of funds and an absence of knowledge to rear livestock. Women routinely participate in animal enclosure cleaning, watering, and grazing. The correlation analysis indicated that the education level and family size of the respondents had a significant impact on the extent to which women engaged in livestock rearing in the study area. Banuree [4] examined the time and participation of women in various livestock-related activities in Afghanistan. Using descriptive statistics, this paper found that the majority of respondents engaged in pregnant animal care, cleaning cowsheds, feeding animals, making dung cakes, watering animals, milking animals, processing animal products, and disposing of dung. However, they do not take part in the marketing of animals and their products, breeding, vaccination, or treatment. Interestingly, the elderly favor working with animals for the financial and nutritional support of the entire family. Andaleeb et al. [2] used a linear regression model to identify the factors influencing women's participation in livestock production, and the results showed that age, education, experience, loan facility, land ownership, spouse education, and distance to the city affected their ability to engage in such farming. A woman with greater experience can complete a livestock task in a significantly shorter time than a woman with less experience. It was anticipated that larger families and combined families would positively influence female involvement in livestock production. Family credit use has a substantial and favorable impact on female participation. In comparison to households lacking agricultural land, those with agricultural land tend to maintain a greater amount of livestock.

Yasmin and Ikemoto [11] investigated how rural women might combat poverty in their communities by engaging in small-scale dairy farming. The research was conducted in two villages located in the Mymensingh district of Bangladesh. Women were primarily motivated to start farms for personal and social reasons. The findings indicated that women in Village 1 assigned greater significance to dairy farming activities and demonstrated a more substantial enhancement in their economic welfare than women in Village 2. According to Naz et al. [13], women have more empowerment and decision-making authority regarding managing cattle than regarding domestic issues. According to the study findings, women's empowerment is increased when they participate. Giving women access to technical information and support is one way to increase their involvement in livestock management decision-making and ultimately give them more influence. According to Rihan [14], selling or buying eggs, milk products, and poultry are among the activities where rural women participate in livestock decision-making to a fairly high degree. But when it came to raising livestock and determining how many animals needed to be kept, their influence was minimal. The primary socioeconomic determinants influencing rural women's participation in decision-making were age, educational attainment, years of experience raising animals by women, and annual household income. Ahmad et al. [15] showed that the most significant factors influencing rural women's involvement in livestock management activities in Punjab (Pakistan) are related to family labor participation, women's different status, livestock-related issues, and financial resources. Increasing the

involvement of women in the care and production of cattle also benefits the general health, income, and education of the family. Imam [16] demonstrated that the level of education, knowledge about livestock rearing, and extension media contact of rural women played a significant positive role in their participation in income-generating activities through livestock rearing. The problems faced in livestock rearing by rural women had a significant negative impact on their participation in income-generating activities through livestock rearing. According to Naz et al. [17], women were found to participate less in outdoor livestock management activities like cutting fodder and marketing animal produce like milk and milk products due to their limited mobility, patriarchy, lack of technical know-how, and social, cultural, and religious constraints. Instead, women were found to participate more in indoor livestock management activities like feeding animals, serving water, cleaning sheds, milking animals, and preparing milk products. The study found that while livestock rearing experience, extension contact, credit availability, respondent age, and farm income were the positive and significant factors influencing women's involvement in livestock, other factors such as herd size, landholding size, family type, respondents' educational status, and household head were the negative and significant ones.

Previous research may have investigated descriptive analysis of study subjects, factors affecting participation in livestock management activities using a multiple linear regression model, constraints within this sector, and recommendations to enhance participation. However, existing research may not offer conclusive evidence regarding the extent to which the living standards of rural women in Bangladesh have improved through animal husbandry as methodological and population gaps may exist. In the case of the methodological gap, this paper examines the impact of animal husbandry on the living standards of rural women through logistic regression, factor analysis, and multivariate analysis. The article's remaining sections are arranged as follows. Initially, the goals of the research are outlined. Subsequently, the study's research methodologies and approaches will be examined. The results of our study will then be examined. Finally, the study's management implications, limitations, and future research prospects are discussed.

3. Methodology of the Study

The objective of this research is to identify the crucial factors that contribute to the engagement of women in livestock management and to examine the impact of such involvement on the quality of life of rural women in Bangladesh. This study used primary data collected from respondents through in-person interviews.

3.1. Sample Size Determination

Women who work closely with animals in several Bangladeshi districts are included in this study. We assume that the population size is unknown. The random sampling technique was employed to select participants for this investigation. With a sampling error of 5%, the sample can be calculated using the following formula. The following formula is employed in this study:

$$n = \frac{z^2 p(1-p)}{e^2} \quad (1)$$

where:
n - sample size
p - maximum variability of the population at 50% (.50)
z - value of the z table at the 95% confidence level = 1.96
e - sampling error at 5%

In calculating the sample size [1], the subsequent assumptions were made to determine the sample size (n = 384). Due to some limitations, only 331 samples were collected.

3.2. Sample Sufficiency and Sphericity Tests

Table 1 provides information about the factor analysis hypothesis. The Kaiser-Meyer-Olkin (KMO)[2] sample sufficiency index, which compares the sizes of the observed correlation coefficients to the sizes of the partial correlation coefficient for the sum of the analysis variables, is 83.3%, and it is reliable because it is above 80%. In addition, the supposition test of sphericity by Bartlett's test [3] (H_0: All correlation coefficients are not quite far from zero) is rejected at the level of statistical significance of $p < 0.05$. For these data, Bartlett's test is highly significant ($p < 0.001$). As a result, both acceptances for the conduct of the factor analysis are satisfied, and we can continue with it.

Table 1 KMO and Bartlett's test (Developed by the authors)

KMO measure of sampling adequacy		.833
Bartlett's test of sphericity	**Approx. Chi-Square**	3446.363
	df.	325
	Sig.	.000

3.3. Sample Distribution

To conduct this study, 331 respondents were interviewed from 14 out of 64 districts in Bangladesh. We selected female respondents. The details of the sample distribution are given in the following figures:

[1] Sample size is a part of the population that is systematically determined and represents the characteristics of the population.
[2] KMO is a measure of sampling adequacy and an index used to examine the appropriateness of factor analysis. Values below 0.5 indicate that factor analysis may not be appropriate.
[3] Bartlett's test of sphericity is a test statistic used to examine the hypothesis that variables are uncorrelated in the population.

Table 2 District-wise sample distribution (Developed by the authors)

District	Frequency	Percentage
Chandpur	22	6.6
Comilla	17	5.1
Dhaka	127	38.4
Faridpur	20	6.0
Gaibandha	4	1.2
Gazipur	12	3.6
Gopalgong	3	.9
Manikgong	75	22.7
Narsingdhi	7	2.1
Rangpur	3	.9
Sherpur	4	1.2
Sirajganj	1	.3
Tangail	25	7.6
Thakurgaon	11	3.3
Total	331	100.0

Fig. 1 shows that most respondents were aged 31–40 years (38%) and 41–50 years (35%), whereas a very small percentage of respondents were 61 or older (3%). Moreover, Fig. 2 shows that most of their husbands' ages were 41–50 years (37%) and 51–60 years (28%). On the contrary, few respondents' husband ages were 21–30 (3%).

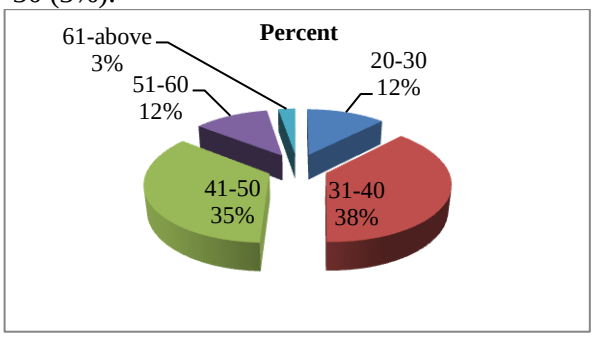


Fig. 1 Age of the respondents (Developed by the authors)

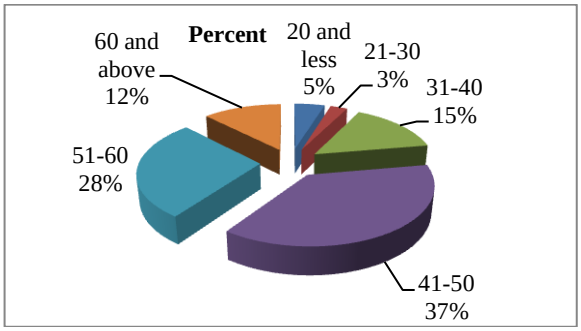


Fig. 2 Age of the respondents' husbands (Developed by the authors)

Fig. 3 and 4 show most respondents' and their husbands' educational levels from one to five years of school.

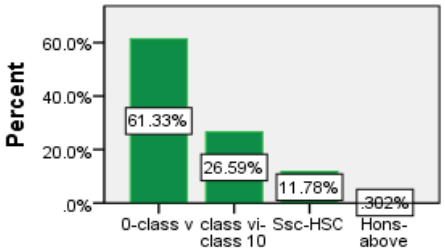


Fig. 3 Educational qualifications of the respondents (Developed by the authors)

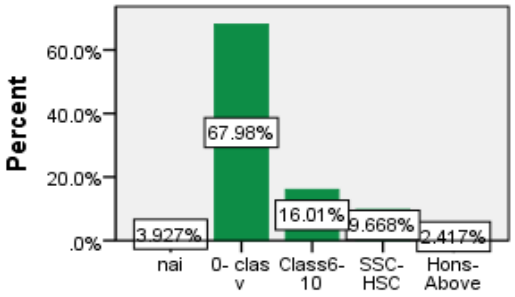


Fig. 4 Educational qualifications of the respondents' husbands (Developed by the authors)

Table 3 shows that slightly more than 95% of female respondents were married and approximately 4% were widows.

Table 3 Marital status (Developed by the authors)

	Frequency	Percentage
Unmarried	2	.6
Married	315	95.2
Widow	14	4.2
Total	331	100.0

Fig. 5 shows that agriculture (139), business (61), and service (60) are the main occupations of the respondents' husbands.

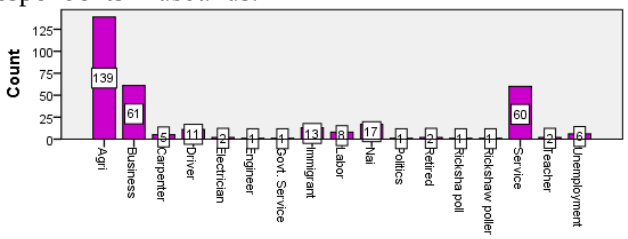


Fig. 5 Occupations of the respondents' husbands (Developed by the authors)

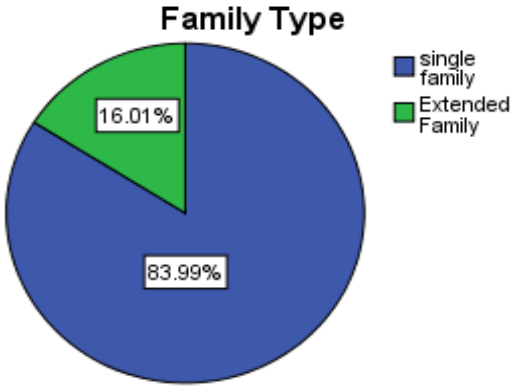


Fig. 6 Family type (Developed by the authors)

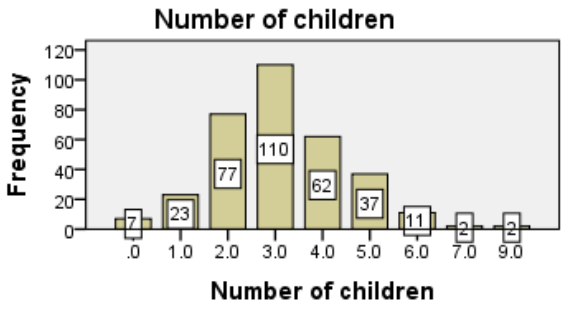


Fig. 7 Number of children (Developed by the authors)

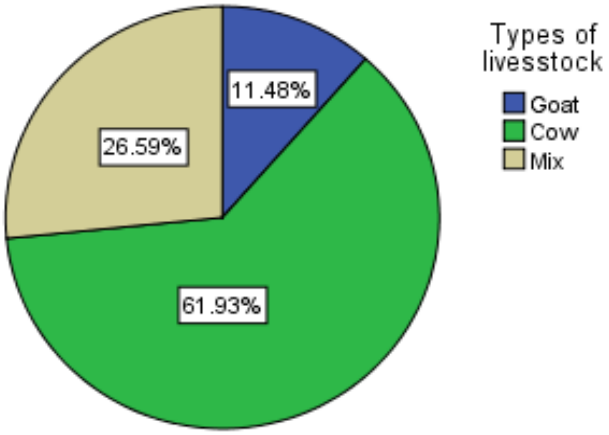


Fig. 8 Livestock types (Developed by the authors)

3.4. Questionnaire Setup and Reliability Test

The questionnaire used in this study was assessed using the Likert scale and dichotomous methods[4]. The Likert scale questionnaire was designed with a 5-point scale, where 5 indicates strongly agree and 1 indicates strongly disagree. A dichotomous questionnaire was designed with a two-point scale ranging from 0 to 1, with 0 indicating "No" and 1 indicating "Yes." Table 4 shows the reliability coefficient[5] of the questionnaire. Cronbach's alpha [6] of the questionnaire was 0.905, which is excellently acceptable, as per Nunnally [20][7].

Table 4 Reliability[8] statistics (Developed by the authors)

Cronbach's Alpha	Number of Items
0.905	60

The questionnaire used in the study set-up includes reasons for getting involved in animal husbandry, the activity of women in animal husbandry, and its impact on the living standards of rural women.

3.5. Data Collection Techniques

A survey was performed with 331 female respondents from 14 districts in Bangladesh. All the data in this study were collected by interview using a questionnaire with a random sampling technique. The interviewers were bachelor students at the Economics Department of the Asian University of Bangladesh. The interviewers were appropriately trained on matters representing the questionnaire for data collection before resuming the interview. This research was conducted from June 2023 to December 2023.

3.6. Data Analysis Methods

This study used descriptive and inferential statistical [9] methods for data analysis. Logistic regression [10] was used to determine the impact of involvement in the livestock activities of rural women on their standard of living. Factor analysis[11] in SPSS (Statistical Package for the Social Sciences) program was used to reduce items or affected factors related to animal husbandry in Bangladesh. MANOVA [12] was used to show the overall and individual significant effects of independent variables on dependent variables when developing a model of this study.

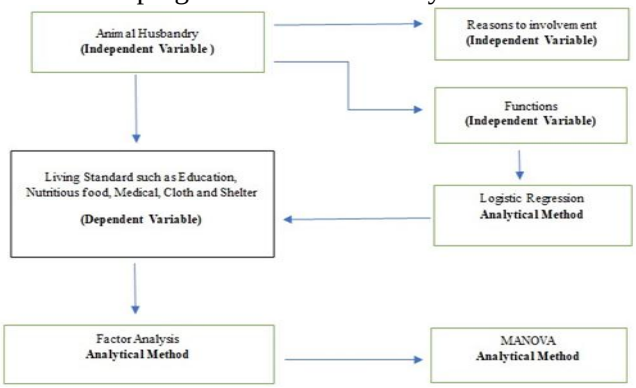


Fig. 9 Flowchart of the methodological framework (Developed by the authors)

4. Results and Discussion

4.1. Reasons

According to Table 5, most respondents (78.5% and 73.7%, respectively) raised animals as a means of reducing poverty and achieving financial sustainability. For family issues, a sizable portion of respondents (60.1%) kept livestock. To address the scarcity of milk and meat, a substantial portion of respondents (59.8% and 38%) are engaging in animal ownership. Additionally, 54.4% of respondents said they kept cattle to create employment. The majority of the respondents (32.1%, 46.2%, 44.1%, and 42%) are involved in the livestock industry as a result of family customs, encouragement from family members, family

[4] The Likert scale is a quantitative measure utilized to elicit individuals' degree of agreement or disagreement with a specific statement, typically comprised of five or seven points.
[5] A measure of the accuracy of a test or measuring instrument obtained by measuring the same individuals twice and computing the correlation between the two sets of measures.
[6] Cronbach's alpha is a measure of internal consistency, which assesses the extent to which a set of items are cohesive and related to one another. It is considered a measure of scale reliability.
[7] Nunnally [20] proposed a rule of thumb of 0.7. More recently, it has been suggested that 0.8 is cited as a minimum alpha. Alpha is heavily dependent on the number of items in the scale. Even when using items with poor internal consistency, a reliable scale can be obtained if the scale is long enough.
[8] Reliability refers to the consistency or repeatability of an operationalized measure.
[9] Inferential statistics are concerned with making predictions or inferences about a population from observations and analysis of a sample.
[10] Logistic regression regresses a dichotomous dependent variable on a set of independent variables.
[11] Factor analysis is an explorative process. Factor Analysis reduces the information in a model by reducing the dimensions of the observations.
[12] In statistics, the MANOVA procedure compares multivariate sample means. As a multivariate procedure, it is used when there are two or more dependent variables and is typically followed by a significance test involving individual dependent variables separately.

expertise in this field, and prior work experience. A greater proportion of respondents (48.6% and 39%, respectively) are dependent on cattle for the production of organic fertilizer and fuel. Many respondents (56.5%) claimed that their participation in matters relating to livestock management was favorable for animal rearing. Conversely, a few of participants (about 15%, 17%, 18%, and 20%, respectively) expressed inspiration from government-backed livestock management initiatives, media coverage, NGO debt, and training. However, 15% of respondents said that they kept cattle because their spouses or other family members had physically or psychologically abused them.

Table 5 Reasons for engaging in animal husbandry (Developed by the authors)

Reasons	Frequency	Percent (%)
Family problems	199	60.1
Family tradition in animal husbandry	106	32.1
Family encouragement	153	46.2
His skills and knowledge in this field	146	44.1
Previous experience	139	42
The media	57	17.2
With the help of NGO's debt	59	17.8
With government support	51	15.4
Training in animal husbandry	66	20
To address the shortage of meat	126	38
To address milk shortage	198	59.8
To become financially sustainable	260	78.5
Aiming at organic fertilizer production	129	39
Aiming to generate fuel	161	48.6
Aiming to create employment	180	54.4
Aiming at poverty alleviation	244	73.7
Being subjected to physical and mental abuse by husband or other family members	49	14.8
Due to favorable animal-rearing environments	187	56.5

4.2. Functions

Table 6 demonstrates the range of livestock management tasks that women engage in, including cutting fodder, watering and feeding animals, gathering manure and preparing manure cakes, washing animals, cleaning animal sheds, milking, and assisting with animal reproduction, among other tasks. However, women are less involved in the marketing, processing, and sale of milk.

Table 6 Functions (Developed by the authors)

Activities	Frequency	Percentage (%)
1. Cutting grass or hay	294	88.8
2. Bringing grass	264	79.8
3. Feeding the grass	313	94.6
4. Collecting dung	300	90.6
5. Making dung cakes as fuel	264	79.8
6. Selling outside	142	42.9
7. Bathing	318	96.1
8. Working to give water to animals	322	97.3
9. Collecting milk	265	80.1
10. Processing milk	160	48.3
11. Different food products are prepared using milk (e.g., butter, cheese, curd, and ghee).	127	38.4
12. Milk (e.g., butter, cheese, curd, and ghee) is marketed.	72	21.8
13. Directly connected to selling milk	190	57.4
14. The space is clean.	317	95.8
15. Directly involved in selling animals	228	68.9
16. Helping with animal breeding	250	75.5

4.3. Logistic Regression

Logistic regression estimates the probability of an event occurring based on a given dataset of independent variables. As the regressands (producing milk products, selling animals, and marketing milk products) are binary variables, this study considers logistic regression with respect to the number of livestock to determine the impact of involvement in the livestock activities of rural women on their livelihoods.

The data presented in Table 7 indicates that, as suggested by the estimated coefficient of having livestock, a unit increase in the log of the odds in favor of producing milk products (e.g., butter, cheese, curd, and ghee) is associated with a rise of 0.08 units, resulting in an increase of 8.12% in the odds of producing milk products. Additionally, a unit increase in the log of the odds in favor of marketing milk products is associated with an increase of 0.09 units, resulting in a rise of 9.53% in the odds of marketing milk products. Similarly, a unit increase in the log of the odds in favor of selling animals is associated with an increase of 0.09 units, leading to a rise of 9.45% in the odds of selling animals.

Table 7 Logistic regression results in number of livestock independent variables (Developed by the authors)

Dependent variable	Coefficient	Std. Error	Z statistics	Probability
Producing milk products (e.g., butter, cheese, curd, and ghee)	.0780654	.035032	2.23	0.026
Milk product marketing	.0910646	.0372217	2.45	0.014
Selling animals	.0902902	.0432026	2.09	0.037

4.4. Factor Analysis

Seven significant characteristics affected by animal husbandry were identified by factor analysis. The outcome demonstrates that the variables' communalities are rather high (the average communality is larger than 0.5), indicating that the data set's variables are generally cohesive (Appendix 1). The creation of assets and living standards (24.779%),

provision of necessities and improvement of entertainment (10.550%), production of organic fertilizer and increased crop yields (8.908%), improvement of the general standard of living, socially and financially (7.428%), promotion of financial independence (4.430%), production of fuel and reduction of expenses (4.230%), and verification of children's education (3.999%) were the most significant factors identified (Table 8).

Table 8 Total variance explained (Developed by the authors)

Component	Initial Eigenvalues		
	Total	% variance	Cumulative %
Creation of assets and levels of living	6.443	24.779	24.779
Assured necessities and improved amusement	2.743	10.550	35.329
Organic fertilizer production and enhanced crop yields	2.316	8.908	44.237
Improved standard of living overall, socially, and financially	1.931	7.428	51.665
Encouraged financial independence	1.152	4.430	56.095
Generated fuel and reduced expenses	1.100	4.230	60.324
Determined children's education	1.040	3.999	64.323

4.5. MANOVA

MANOVA indicated that the factors identified through the factor analysis were significantly influenced by animal husbandry in Bangladesh. The MANOVA output has two segments. The first part involves multivariate tests.

Table 9 shows a significant impact of animal husbandry on all factors related to the living standard of rural women in Bangladesh. There is not a single multivariate test; there are four different ones. In this case, they are all significant ($p < 0.05$), and as a result, we can conclude that animal husbandry has a significant effect on all of the identified living standard factors for rural women in Bangladesh.

Table 9 Multivariate tests[d] (Developed by the authors)

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial eta squared
Intercept	**Pillai's Trace**	.055	2.666[b]	7.000	321.000	.011	.055
	Wilks' Lambda	.945	2.666[b]	7.000	321.000	.011	.055
	Hotelling's Trace	.058	2.666[b]	7.000	321.000	.011	.055
	Roy's Largest Root	.058	2.666[b]	7.000	321.000	.011	.055
Animal Husbandry	**Pillai's Trace[13]**	1.024	23.909	21.000	969.000	.000	.341
	Wilks' Lambda[14]	.122	47.396	21.000	922.289	.000	.504
	Hotelling's Trace[15]	5.996	91.271	21.000	959.000	.000	.667
	Roy's Largest Root[16]	5.793	267.327[c]	7.000	323.000	.000	.853

[a] Design: Intercept + Overall
[b] Exact statistic
[c] The statistic is an upper bound on F that yields a lower bound at the significance level.
[d] Computed with alpha = .05

[13] Pillai's trace is a measure that yields positive values, suggesting the magnitude of the effect on the model. As the value of Pillai's trace increases, it indicates that the effect in question has a more significant impact on the model. Pillai's trace is closely related to the Bartlett trace, which was developed by M. S. Bartlett.
[14] Wilks' Lambda is a positive-valued statistic ranging from 0 to 1. Decreasing values of the statistic indicate effects that contribute more to the model.
[15] Hotelling's trace is the sum of the eigenvalues of the test matrix. This is a positive-valued statistic for which increasing values indicate effects that contribute more to the model. Hotelling's trace is always larger than Pillai's, but when the eigenvalues of the test matrix are small, these two statistics are nearly equal. This indicates that the effect does not contribute significantly to the model.
[16] Roy's largest root is the largest eigenvalue of the test matrix. Thus, it is a positive-valued statistic for which increasing values indicate effects that contribute more to the model. Roy's largest root is always less than or equal to Hotelling's trace. When these two statistics are equal, the effect is predominantly associated with only one of the dependent variables, there is a strong correlation between the dependent variables, or the effect does not contribute much to the model.

The second part of the results is univariate tests, whose results are used to determine the effect of animal husbandry on individual identified living standard factors.

These univariate tests (Table 10) indicated that animal husbandry has a significant effect on individual identified living standard factors, such as creation of assets and levels of living {F (3,327) = 72.393, p = 0.000, η^2 = .399}, assured necessities and improved amusement{F (3,327) = 26.820, p = 0.000, η^2 = .197}, organic fertilizer production and enhanced crop yields {F (3,327) = 13.804, p = 0.000, η^2 = .112}, improved standard of living overall, socially, and financially {F (3,327) = 7.256, p = 0.000, η^2 = .062}, encouraged financial independence {F (3,327) = 12.904, p = 0.000, η^2 = .106}, generated fuel and reduced expenses {F (3,327) = 8.683, p = 0.000, η^2 = .074}, and determined children's education {F (3,327) = 8.570, p = 0.000, η^2 = .073}.

Table 10 Tests of between-subject effects (Developed by the authors)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Creation of assets and levels of living	131.701[a]	3	43.900	72.393	.000	.399
	Assured necessities and improved amusement	65.164[b]	3	21.721	26.820	.000	.197
	Organic fertilizer production and enhanced crop yields	37.094[c]	3	12.365	13.804	.000	.112
	Improved standard of living overall, socially, and financially	20.598[d]	3	6.866	7.256	.000	.062
	Encouraged financial independence	34.933[e]	3	11.644	12.904	.000	.106
	Generated fuel and reduced expenses	24.349[f]	3	8.116	8.683	.000	.074
	Determined children's education	24.055[g]	3	8.018	8.570	.000	.073
Intercept	Creation of assets and levels of living	.549	1	.549	.905	.342	.003
	Assured necessities and improved amusement	.007	1	.007	.009	.924	.000
	Organic fertilizer production and enhanced crop yields	.216	1	.216	.241	.624	.001
	Improved standard of living overall, socially, and financially	3.450	1	3.450	3.646	.057	.011
	Encouraged financial independence	.266	1	.266	.295	.588	.001
	Generated fuel and reduced expenses	.276	1	.276	.295	.587	.001
	Determined children's education	.307	1	.307	.328	.567	.001
Animal Husbandry	Creation of assets and levels of living	131.701	3	43.900	72.393	.000	.399
	Assured necessities and improved amusement	65.164	3	21.721	26.820	.000	.197
	Organic fertilizer production and enhanced crop yields	37.094	3	12.365	13.804	.000	.112
	Improved standard of living overall, socially, and financially	20.598	3	6.866	7.256	.000	.062
	Encouraged financial independence	34.933	3	11.644	12.904	.000	.106
	Generated fuel and reduced expenses	24.349	3	8.116	8.683	.000	.074
	Determined children's education	24.055	3	8.018	8.570	.000	.073
Error	Creation of assets and levels of living	198.299	327	.606			
	Assured necessities and improved amusement	264.836	327	.810			
	Organic fertilizer production and enhanced crop yields	292.906	327	.896			
	Improved standard of living overall, socially, and financially	309.402	327	.946			
	Encouraged financial independence	295.067	327	.902			
	Generated fuel and reduced expenses	305.651	327	.935			
	Determined children's education	305.945	327	.936			
Total	Creation of assets and levels of living	330.000	331				
	Assured necessities and improved amusement	330.000	331				
	Organic fertilizer production and enhanced crop yields	330.000	331				
	Improved standard of living overall, socially, and financially	330.000	331				
	Encouraged financial independence	330.000	331				
	Generated fuel and reduced expenses	330.000	331				
	Determined children's education	330.000	331				
Corrected Total	Creation of assets and levels of living	330.000	330				
	Assured necessities and improved	330.000	330				

	amusement		
	Organic fertilizer production and enhanced crop yields	330.000	330
	Improved standard of living overall, socially, and financially	330.000	330
	Encouraged financial independence	330.000	330
	Generated fuel and reduced expenses	330.000	330
	Determined children's education	330.000	330

[a] R Squared = .399 (Adjusted R Squared = .394)
[b] R Squared = .197 (Adjusted R Squared = .190)
[c] R Squared = .112 (Adjusted R Squared = .104)
[d] R Squared = .062 (Adjusted R Squared = .054)
[e] R Squared = .106 (Adjusted R Squared = .098)
[f] R Squared = .074 (Adjusted R Squared = .065)
[g] R Squared = .073 (Adjusted R Squared = .064)
[h] Computed with alpha = .05

5. Conclusion

This study's main objective was to investigate how Bangladeshi rural women's living conditions were affected by animal husbandry. Finding elements affecting rural women's living standards and the noteworthy correlation between animal husbandry and rural women's living standards constituted another goal of the research.

Our analysis of the data revealed certain conclusions from the study. Around 79% and 74% of respondents raised animals as a means of reducing poverty and achieving financial sustainability. On the other hand, only 15% of respondents said that they kept cattle because their spouses or other family members had physically or psychologically abused them. According to the findings, women participated more in cutting fodder, watering and feeding animals, gathering manure and preparing manure cakes, washing animals, cleaning animal sheds, milking, and assisting with animal reproduction, among other tasks. However, women participated less in the marketing, processing, and sales of milk. Moreover, the estimated coefficients of logistic regression ensure that the living standards of rural women are accelerated through livestock farming activities. In addition, seven significant factors impacted by animal husbandry were identified by factor analysis. The creation of assets and living standards (24.779%), provision of necessities and improvement of entertainment (10.550%), production of organic fertilizer and increased crop yields (8.908%), improvement of the general standard of living, socially and financially (7.428%), promotion of financial independence (4.430%), production of fuel and reduction of expenses (4.230%), and provision of education for children (3.999%) are the factors found to be most significant. Animal husbandry in Bangladesh has a considerable impact on all seven factors (64.323%). Furthermore, MANOVA yields two types of results. The first, multivariate tests, demonstrate that Bangladeshi animal husbandry has a large overall influence on the components identified by factor analysis. The second test, a univariate one, revealed that animal husbandry had a significant impact on seven factors.

According to our research, rural women engage in various activities and support their families by providing them with income, food, and fuel derived from animals. The situation regarding the living standards of rural women in Bangladesh will change if there is a revolution in the factors identified, such as the creation of assets and levels of living, ensuring necessities and improving amusement, producing organic fertilizer and enhanced crop yields; improving the standard of living overall, socially, and financially; encouraging financial independence, generating fuel and reducing expenses, and ensuring children's education. Furthermore, it will help achieve economic and rural development in Bangladesh. The academic contribution of this study to the literature on rural development and gender studies is by providing insights into how animal husbandry can be a key driver of economic and social progress for rural women. This highlights the potential of livestock farming as a tool for improving rural livelihoods and achieving broader rural development goals in Bangladesh.

There are various limitations to our investigation. The fact that we collected only 331 samples is the first limitation of this investigation. 64 districts were excluded from the sample collection (331 respondents from 14 districts in Bangladesh were questioned.). The second drawback is that we neglected to pay attention to the many limitations that the researchers encountered while conducting this study. Furthermore, we did not compare the contributions of men and women in this field.

The recommendations of this study are that to increase women's contribution to household income and eventually to the national income, the government and other institutions must set up programs or projects that are specifically aimed at women. These programs and projects should train women and increase their capacity for better and more profitable livestock farming. Livestock rearing should be thoroughly covered in SSC and HSC textbooks, together with guidance on how to raise animals and an examination of the advantages that come with doing so. This will encourage students to take an interest in raising

livestock. The government might raise incentives to target female farmers, in particular, to encourage their involvement and provide financially struggling farmers a fair shot.

The results also demonstrate that the living conditions of rural women are significantly correlated with the parameters found. However, the cultural, social, and economic elements that maintain women's underdevelopment or regression were not the focus of the study. These unique constraints may persuade future academics to examine this issue more thoroughly. Future researchers will have a thorough understanding of the degree to which engaging in livestock activities raises living standards if they conduct this study.

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Appendices

Appendix 1 Communalities of the variables (Developed by the authors)

Sl. No.	Variable names	Initial	Extraction
1.	You can keep the surplus money from animal husbandry as your property.	1.000	.718
2.	The surplus can be used for your needs.	1.000	.730
3.	Since you are raising animals, you are valued in making various family decisions.	1.000	.303
4.	You can buy your favorite clothes with your spare money.	1.000	.715
5.	You can get medical treatment for yourself and your family with your own money.	1.000	.651
6.	You can buy and consume nutritious food for yourself and your family with your surplus money.	1.000	.686
7.	He could build a house with his own money.	1.000	.604
8.	He could build a hygienic toilet with his own money.	1.000	.543
9.	He was able to purchase assets in his own name using his surplus money.	1.000	.677
10.	He managed to save surplus money in his own name from rearing animals.	1.000	.564
11.	He was able to spend surplus money from animal husbandry on higher education.	1.000	.586
12.	Able to send all children to school	1.000	.773
13.	He allocated the income generated from this sector toward funding an educational program for children.	1.000	.717
14.	Using the income generated from this industry, they were able to finance social and religious celebrations (1st Baisakh, Eid ul Fitr, and Eid ul Adha).	1.000	.574
15.	He could save income from this sector and invest it in other sectors.	1.000	.310
16.	Able to invest in the development of cattle breeding (technology, construction of animal shelters)	1.000	.489
17.	Financial grants from the government and NGOs (e.g., a house from a farm) received due to involvement in this work	1.000	.510
18.	Manure can be made using dung.	1.000	.783
19.	Agricultural production has increased using this fertilizer.	1.000	.856
20.	As a result, he was able to reduce the cost of buying artificial fertilizers.	1.000	.782
21.	They make dung cakes and use them as fuel.	1.000	.775
22.	Manure has been stored in one place to produce fuel gas.	1.000	.573
23.	By using cow dung as fuel, the family was able to reduce costs.	1.000	.788
24.	Your social status has increased since you raised animals.	1.000	.591
25.	Your financial capacity has increased since raising animals.	1.000	.720
26.	Your overall quality of life has increased since you raised animals.	1.000	.708

Extraction Method: Principal Component Analysis

Appendix 2 Creation of assets and levels of living (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	He was able to purchase assets in his own name using his surplus money.	.782
2.	He could build a house with his own money.	.729
3.	Financial grants from the government and NGOs (e.g., a house from a farm) received due to involvement in this work	.703
4.	He was able to spend surplus money from animal husbandry on higher education.	.696
5.	He could build a hygienic toilet with his own money.	.660
6.	Manure has been stored in one place to produce fuel gas.	.606
7.	Able to invest in the development of cattle breeding (technology and construction of animal shelters)	.593
8.	He managed to save surplus money from rearing animals in his own name.	.555
9.	He could save income from this sector and invest it in other sectors.	.357

Appendix 3 Assured necessities and improved amusement (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	You can buy and consume nutritious food for yourself and your family with your surplus money.	.783
2.	You can get medical treatment for yourself and your family with your own money.	.753
3.	Using the income generated from this industry, they were able to finance social and religious celebrations (1st Baisakh, Eid ul Fitr, and Eid ul Adha).	.692
4.	You can buy your favorite clothes with your spare money.	.685

Appendix 4 Organic fertilizer production and enhanced crop yields (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	Agricultural production has increased using this fertilizer.	.893
2.	Manure can be made using dung.	.864
3.	As a result, he was able to reduce the cost of buying artificial fertilizers.	.829

Appendix 5 Improved standard of living overall, socially, and financially (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	Your overall quality of life has increased since you raised animals.	.831
2.	Your financial capacity has increased since raising animals.	.817
3.	Your social status has increased since you raised animals.	.697
4.	Since you are raising animals, you are valued in making various family decisions.	.327

Appendix 6 Encouraged financial independence (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	The surplus can be used for your needs.	.797
2.	You can keep the surplus money from animal husbandry as your property.	.775

Appendix 7 Generated fuel and reduced expenses (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	They make dung cakes and use them as fuel.	.838
2.	By using cow dung as fuel, the family was able to reduce costs.	.828

Appendix 8 Determined children's education (Developed by the authors)

Sl. No.	Variable Names	Factor Loadings
1.	Able to send all children to school	.801
2.	He allocated the income generated from this sector toward funding an educational program for children.	.628

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