The Interrelationship of Livelihood, Income and Body Mass Index of Farm Women in West Bengal: Estimation through Score of Socio-Economic and Ecological Correlates

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Abstract—*It is well established and known fact that rural women, who are the important segment of nation, have a great active role in the development of agriculture, animal husbandry, village cottage industries and several other facets of rural life besides the home and family. Nutritional status has a causal effect on work capacity, productivity and, in all livelihoods, economic and social prosperity in low income settings. To identify the socio-economic and agro-ecological factors which are correlated with livelihood, income and body mass index and the status of interrelation amongst them of farm women, this study has been undertaken in Nadia district of West Bengal among 211 farm women. It was found from the study that livelihood, income and body mass index of farm women are interrelated and education, cultivated land, animal entrepreneurial index, land under irrigation index, crop diversification index have recorded significant correlation with these three variables, the predictants of this study. For the upliftment of farm women, the future policy should be formulated based on these views, it will be more effective for them on the point of livelihood, income and also nutritional status. The canonical covariate analysis (CCA) has revealed an important fact that the body mass index of farm women is organically linked with the other predictants like livelihood and income. So the capacity building of the farm women towards attaining proper body mass index, the other considerations would be status of livelihood and level of income as well. In this study these three consequent variables have moved together through their isochronous interaction.*

Keywords: *agro-ecological, body mass index, farm women, income, livelihood, socio-economic*

1. INTRODUCTION

In India woman is the backbone of agricultural workforce but worldwide her hard work has mostly been unpaid. She does the most tedious and back-breaking tasks in agriculture, animal husbandry and homes (1). In India rural women have significant role in cultivation, dairy, fisheries, crop processing and other allied areas. Nearly 70% of Indian rural women are employed in agriculture and they are responsible for 60-80 percent of total food production. Traditionally, women have always played an important role in agriculture- as farmers, co-farmers, wage labours and managers of farms. They have conventionally been producers of food from seed to kitchen. They carry the heavier work burden in food production and because of gender discrimination, get lower returns for their work. The multiple role of women leads to a significant contribution in real terms to the productive system.

Health is an asset to man and to his community and has come to be regarded as a prerequisite to socio-economic development. Nutritional status has a causal effect on work capacity, productivity and, in all likelihood, economic and social prosperity in low income settings. The nutritional and health status of women is of great concern in the contemporary world, because the multiple roles played by women give rise to serious health and nutritional problems (2, 3).

Several studies shows that an increase in women´s control over household income usually has a positive impact on dietary diversity, thus benefiting children´s health, nutrition and education, and consequently food and nutrition security. Women also tend to save more of generated income, and thus improve the household's food security in times of natural disasters, such as drought. Intra-household food allocation can be another limiting factor: even though a household may have enough food, girls and women may still suffer from malnutrition. The present study was thus planned to assess the interrelationship of livelihood, income and body mass index.

2. METHODOLOGY

The present study was conducted in four villages of West Bengal. Selection of the locale was finalized based on the following factors- i) area with preponderance of the problem and character, ii) accessibility, iii) even distribution of respondents, iv) representative to the region. The villages (Bhawanipore, Satyapole, Bramhopur, Panchkahonia) selected come under Haringhata I block of Nadia District. The selection of the district, blocks and Gram Panchayet areas have followed purposive selection. The study was confined to the women of age group 19-60 years only. Randomly 211 subjects willing to participate in the study were chosen. A questionnaire schedule was prepared to collect various information regarding subjects. Schedule was pretested on a non sample population having similar socio-economic background. General information related agro-socioeconomic factors of subjects were collected using the same schedule.

The empirical measurement of the livelihood has been conducted through calculating the wage (daily income), mandays, manpower index, and level of decency of the work.

In this context income is such an important factor has been determined in this present study only in term of Rupees what the respondent do income in a year.

According to WHO Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2).

Data analysis:- The statistical analysis was done on computer in MS-Excel and SPSS with complier. The data was analyzed for mean, Standard deviation, regression co-efficient, path analysis to estimate relations and interactions. The independent variables are X_1-Age, X_2-Education,X_3-Family statement, X_4-Family education, X_5- Homestead land(bigha),X_6- Cultivated land (bigha),X_7- Land under irrigation d (bigha),X_8- Cropping intensity,X_9- Irrigation index, X_{10}- Expenditure index (Education &Others), X_{11}- Expenditure index (Food & Health), X_{12}- Ownership of agricultural implements, X_{13}- Technology socialization status, X_{14}- Animal entrepreneurial index,X_{15}- Animal production consumption index, X_{16}- Animal production sale index,X_{17}- Crop diversification index, X_{18}- Media-social interaction index ,X_{19}- Market interaction,X_{20}- Entrepreneurial interaction,X_{21}- Capacity building index,X_{22}- Credit rotation index, X_{23}- Distance of road,X_{24}- Status of sanitation index,X_{25}- Distance matrix, X_{26}- Health index , X_{27}- Income and the dependent variables are-Y_1- Livelihood, Y_2-Income Index and Y_3-Body mass Index

Table 1: Correlation coefficient of Livelihood (Y_1) with 26 independent variables of Total 4 villages, Nadia, West Bengal

	N=211
Age(X_1)	0.1246
Education(X_2)	0.2245**
Family size(X_3)	-0.0366
Family education(X_4)	0.2218**
Homestead land(X_5)	0.0545
Cultivated land(X_6)	0.1082
Land under irrigation(X_7)	0.0936
Cropping intensity(X_8)	-0.2251**
Irrigation index(X_9)	-0.2371**
Expenditure index (Education &Others)(X_{10})	0.1515*
Expenditure index (Food & Health)(X_{11})	0.0545
Ownership of agricultural implements(X_{12})	-0.2313**
Technology socialization status(X_{13})	0.0552
Animal entrepreneurial index(X_{14})	0.0836
Animal production consumption index(X_{15})	0.1483*
Animal production sale index(X_{16})	0.2760**
Crop diversification index(X_{17})	-0.0781
Media-social interaction index(X_{18})	0.4678**
Market interaction(X_{19})	-0.2083**
Entrepreneurial interaction(X_{20})	-0.0429
Capacity building index(X_{21})	0.0859
Credit rotation index(X_{22})	-0.0182
Distance of road(X_{23})	-0.2025**
Status of sanitation index(X_{24})	-0.0437
Distance matrix(X_{25})	0.0994
Health index(X_{26})	-0.0348
*significant at 0.05 level **significant at 0.01 level	

Table-1 presents the coefficient of correlation between livelihood (Y_1) & 26 independent variables of total 4 villages.

Results:-

It has been found that the variables Education(X_2), Family education(X_4), Cropping intensity(X_8), Irrigation index(X_9), Expenditure index (Education &Others)(X_{10}), Ownership of agricultural implements(X_{12}), Animal production consumption index(X_{15}), Animal production sale index(X_{16}), Media-social interaction index(X_{18}), Market interaction(X_{19}) and Distance of road(X_{23}) have come out significantly correlated to the dependent variable livelihood (Y_1)

Revelation:-

Educations(X2) as well as collective family education(X4) have gone significantly correlated with livelihood. So respondents having higher education score have earn better livelihood.The respondents having low score on the following correlates Cropping intensity(X_8), Irrigation index(X_9) and ownership of agricultural implements(X_{12}) have been unique for better livelihood.

The other variable animal production consumption index(X_{15}) and animal production sale index(X_{16}) have also been found significantly and positively correlated to livelihood. So, cattle management by its very nature has been able to generate more livelihoods over crop enterprise. And it has also been reflected that where there has been higher animal production sale index(X_{16}), the livelihood that gone up substantially. In general the animal enterprise has been able to lead the farm families with intensive livelihood generation and at the same time higher sale of animal production i.e milk, egg etc. The respondents having higher exposure to Media-social

interaction index(X_{18}), have also been able to generate better livelihood. The other two variables Market interaction(X_{19}) and Distance of road(X_{23}) have been found to have negative correlation with livelihood generation by decomposing this relationship into direct and indirect effect, a logical conclusion only be possible to justify this pattern of relationship.

Table 2: Correlation coefficient of Income index (Y_2) with 26 independent variables of Total 4 villages, Nadia, West Bengal

	N=211
Age($X1$)	-0.0351
Education($X2$)	0.1901**
Family size($X3$)	-0.2871**
Family education($X4$)	0.1661*
Homestead land($X5$)	0.1406*
Cultivated land($X6$)	0.3456**
Land under irrigation($X7$)	0.3413**
Cropping intensity($X8$)	0.0553
Irrigation index($X9$)	0.0762
Expenditure index (Education &Others)($X10$)	0.2816**
Expenditure index (Food & Health)($X11$)	0.4190**
Ownership of agricultural implements($X12$)	-0.2247**
Technology socialization status($X13$)	0.2381**
Animal entrepreneurial index($X14$)	0.0019
Animal production consumption index($X15$)	0.0581
Animal production sale index($X16$)	0.0649
Crop diversification index($X17$)	0.2427**
Media-social interaction index($X18$)	0.3070**
Market interaction($X19$)	-0.0969
Entrepreneurial interaction($X20$)	0.0728
Capacity building index($X21$)	0.1407*
Credit rotation index($X22$)	0.0864
Distance of road($X23$)	-0.0568
Status of sanitation index($X24$)	-0.0305
Distance matrix($X25$)	0.2645**
Health index($X26$)	-0.0021
*significant at 0.05 level	
**significant at 0.01 level	

Table-2 presents the coefficient of correlation between Income index (Y_2) & 26 independent variables of total 4 villages.

Results:- It has been found that the variables Education(X_2), Family size X_3), Family education(X_4), Homestead land(X_5),Cultivated land(X_6), Land under irrigation(X_7), Expenditure index (Education &Others)(X_{10}), Expenditure index (Food & Health)(X_{11}), Ownership of agricultural implements(X_{12}), Technology socialization status(X_{13}), Crop diversification index(X_{17}), Media-social interaction index(X_{18}), Capacity building index(X_{21}), Distance matrix(X_{25}) have come out significantly correlated to the dependent variable Income index (Y_2).

Revelation:- The higher family size (X_3) in this village has contributed to smaller family income as well by providing more per capita income, that's why the correlation has been found in negative direction. The education(X_2) and Family education (X_4) have added a positive direction on higher

income. So education as a whole has got a positive & cumulative impact on family income of the respondents. The agro ecological variables homestead land(X_5), cultivated land(X_6), land under irrigation(X_7) have been found a positive and significantly correlated with income. The villages by becoming a one of the most advanced village in the adjoining blocks in terms of agricultural modernization and diversification with higher cropping intensity(X_8) and irrigation index(X_9) have been able in setting the income index (Y_2) to a higher echelon.

The expenditure index (Food & Health) (X_{11}) and Expenditure index (Education &Others) (X_{10}) have positively been associated with income to imply that better allocation of expenditure (food & health), Expenditure (Education &Others) is possible only when the income goes on. Ownership of agricultural implements(X_{12}) is negatively correlated with the income. The technology socialization status(X_{13}) has also been better for the respondents having higher income. That's why they have recorded a positive & significant correlation with income.

The respondents are having higher crop diversification(X_{17}), they are managing the risk better and hence assure a better income. The other variables show that the respondents are of higher income those who are widely interactive with media(X_{18}), higher Capacity building index(X_{21}). So, the better capacity building character and media interactions have lead the respondents to generate better income. It is to also note that distance matrix (X_{25}) is also correlated with income and play a important role on rural life.

Table 3: Correlation coefficient of Body Mass Index (Y_3) with 26 independent variables of Total 4 villages, Nadia, West Bengal

	N=211
Age($X1$)	0.2125**
Education($X2$)	0.0263
Family size($X3$)	0.0347
Family education($X4$)	0.0976
Homestead land($X5$)	0.0185
Cultivated land($X6$)	0.1141
Land under irrigation($X7$)	0.1183
Cropping intensity($X8$)	-0.0052
Irrigation index($X9$)	-0.0053
Expenditure index (Education &Others)($X10$)	-0.1116
Expenditure index (Food & Health)($X11$)	-0.1218
Ownership of agricultural implements($X12$)	-0.1138
Technology socialization status($X13$)	0.1482*
Animal entrepreneurial index($X14$)	-0.1779*
Animal production consumption index($X15$)	-0.1204
Animal production sale index($X16$)	-0.1456*
Crop diversification index($X17$)	0.1072
Media-social interaction index($X18$)	0.1972**
Market interaction($X19$)	-0.1273
Entrepreneurial interaction($X20$)	-0.0998
Capacity building index($X21$)	-0.1163
Credit rotation index($X22$)	0.0532

Distance of road(X23)	-0.1280
Status of sanitation index(X24)	0.0327
Distance matrix(X25)	-0.0519
Health index(X26)	-0.0662
*significant at 0.05 level	
**significant at 0.01 level	

Table-3 presents the coefficient of correlation between Body Mass Index (Y_3) & 26 independent variables of total 4 villages.

Results:- It has been found that the variables Age(X_1), Technology socialization status(X_{13}), Animal entrepreneurial index(X_{14}), Animal production sale index(X_{16}), Media-social interaction index(X_{18}) are significantly correlated with the dependent variable Body Mass Index(Y_3).
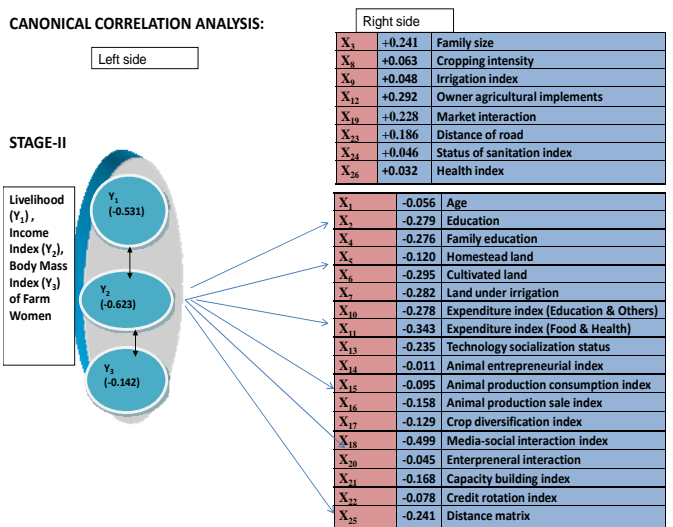
Revelation:-Body Mass Index is the physio-morphological reflexion of the age(X_1) or, age can be estimated through Body mass Index as well. Technology socialization status(X_{13}) has got a positive correlation to denote that the respondents who are incompliant with technology adoption process, they have got a better Body mass Index. Animal entrepreneurial index(X_{14}) and Animal production sale index(X_{16}) have created negative bearing on Body Mass Index that need to be interpreted through path analysis. It has been found that the respondents who are more exposed to Media-social interaction index(X_{18}), they are also characterized by Body Mass Index.

Canonical Covariate: The Interaction between left side &right side variables

The canonical covariate analysis has been applied here to deviate the variables into two set of conglomerations i.e left side variables$(Y_1.Y_3)$ and right side variables$(X_1.X_{26})$.

It is found from the result that, the dependent variables, Livelihood (Y_1), Income Index (Y_2), and Body Mass Index (Y_3) have formed a conglomeration based on their homogeneity of interactions. It reveals that Body Mass Index helps better livelihood earning as well as income. It is especially true, when the farm women are to exert their, manual skills and proficiency to support the farm based livelihood vis –a- vis income.

This conglomeration has rightly been looked up the right side variables for being mutually impacted with Age(X_1), Education(X_2), Family education(X_4), Homestead land(X_5), Cultivated land(X_6), Land under irrigation(X_7), Expenditure index (Education &Others)(X_{10}), Expenditure index (Food & Health)(X_{11}), Technology socialization status(X_{13}), Animal entrepreneurial index(X_{14}), Animal production consumption index(X_{15}), Animal production sale index(X_{16}), Crop diversification index(X_{17}), Media-social interaction index(X_{18}), Enterpreneral interaction(X_{20}), Capacity building index(X_{21}), Credit rotation index(X_{22}) and Distance matrix(X_{25}).

CANONICAL CORRELATION ANALYSIS:

X_3	+0.241	Family size
X_8	+0.063	Cropping intensity
X_9	+0.048	Irrigation index
X_{12}	+0.292	Owner agricultural implements
X_{19}	+0.228	Market interaction
X_{23}	+0.186	Distance of road
X_{24}	+0.046	Status of sanitation index
X_{26}	+0.032	Health index

X_1	-0.056	Age
X_2	-0.279	Education
X_4	-0.276	Family education
X_5	-0.120	Homestead land
X_6	-0.295	Cultivated land
X_7	-0.282	Land under irrigation
X_{10}	-0.278	Expenditure index (Education & Others)
X_{11}	-0.343	Expenditure index (Food & Health)
X_{13}	-0.235	Technology socialization status
X_{14}	-0.011	Animal entrepreneurial index
X_{15}	-0.095	Animal production consumption index
X_{16}	-0.158	Animal production sale index
X_{17}	-0.129	Crop diversification index
X_{18}	-0.499	Media-social interaction index
X_{20}	-0.045	Enterpreneral interaction
X_{21}	-0.168	Capacity building index
X_{22}	-0.078	Credit rotation index
X_{25}	-0.241	Distance matrix

3. CONCLUSION

Livelihood generation is a continuous process and it is one of the most complex socioeconomic outcomes, which again are impacted by the institutional functioning and resource endowment. It was found from the study that livelihood, income and body mass index of farm women are interrelated and education, cultivated land, animal entrepreneurial index, land under irrigation index, crop diversification index have recorded significant correlation with these three variables, the predictants of this study. For the upliftment of farm women, the future policy should be formulated based on these views, it will be more effective for them on the point of livelihood, income and also nutritional status. In this present study the canonical covariate analysis (CCA) has revealed an important fact that the body mass index of farm women is organically linked with the other predictants like livelihood and income. So the capacity building of the farm women towards attaining proper body mass index, the other considerations would be status of livelihood and level of income as well. In this study these three consequent variables have moved together through their isochronous interaction.

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