Food Security and Nutritional Status among Rural Poor: Evaluating the Impact of Rural Livelihood Mission in Odisha, India

Abhisek Mishra[1,*], Sujit Kumar Mishra[2], Iswar Baitharu[3] and Tushar Kanti Das[4]

[1]*Nabakrushna Choudhury Centre for Development Studies, Bhubaneswar, Odisha, India*

[2]*School of Applied Sciences, Centurion University of Technology and Management, Odisha, India*

[3]*Department of Environmental Sciences, Sambalpur University, India*

[4]*Department of Business Administration, Sambalpur University, Odisha, India*

Abstract: This paper empirically examines the effect of participation in National Rural Livelihood Mission (NRLM) on the food security of rural poor. In parallel, it also introspects the nutritional profiles of the respondents. Data were collected from 220 respondents (including both beneficiaries and non-beneficiaries) through a structured questionnaire from Sonepur district of Odisha (India). For assessing the nutritional profile, the study uses 24 hour recall and food frequency questionnaire methods to collect the information on food consumption. Then food items were converted into their equivalent calories. A food security index (FSI) was constructed to capture the food security taking the average calories of food consumed by the respondents. The study finds a better food consumption pattern among beneficiaries than the non-beneficiaries. Further, the impact of NRLM is examined using randomised control trial method and finds a positive impact of the programme on the food security. That means, participation in the programme helps the beneficiaries to attain food security. Therefore, participation should be encouraged to mitigate the food insecurity problem.

Keywords: Food security, Impact evaluation, National Rural Livelihood Mission (NRLM) Nutrition.

1. INTRODUCTION

Since 1990s, irrespective of rapid economic growth, malnutrition and food insecurity have emerged as confounding factors in the Indian economy (Narayan, 2015). The importance of food security came to the limelight after the world food conference (held in 1974) where availability of food both at national and household level was emphasised. Food security is a situation that ensures physical, social, and economic access to the sufficient, safe, and nutritious food for active and healthy life to all people at all time (FAO, 2002). In India, despite of large increase in production of food, a larger section of the population are still exposed to limited assess of balanced diets (Narayan, 2015) due to non-affordability. This situation of non-affordability occurs due to unsecured livelihood and collapse in the income level of rural poor (Borton & Shoham, 1991; Chakraborty, 2005; Patnaik, 2010; Kulkarni, 2010; Yamba *et al*., 2017; Pingali *et al*., 2019). This implies, attainment of secured livelihood automatically ensures food security of rural poor, since food security has been identified as one dimension[1] of livelihood security (Lindenberg, 2002; Mishra, 2017).

The Government of India has been undertaking different development policies, either directly or indirectly for the attainment of food security of rural poor. Income generation and measures for food production are important factors to be taken care of while introducing policies for food security (Mellor, 1978). The recently introduced self-employment programme namely National Rural Livelihood Mission (NRLM) in one hand helps the beneficiaries in achieving their secured livelihoods (more than mere employment generation) through different financial and non-financial services. . On other hand, the programme provides financial support as well as agricultural training. The training received coupled with the financial assistance increases the agricultural production solving the problem of food availability. In the context of food affordability, existing literature (Mishra, 2018) advocates that livelihood security can be achieved through NRLM. At this outset, the extent of mitigating the food insecurity problem through NRLM vis a vis providing secured livelihood is a policy concern. This study is carried out to examine the above policy question.

2. RATIONALE OF THE STUDY

The real impact of a programme comes out when the study is conducted in a backward region (Mohapatra & Sahoo, 2016) of a country. Odisha is identified as one of the poorest states in India with a high level of hunger and food insecurity (Mishra,

*Address correspondence to this author at the Nabakrushna Choudhury Centre for Development Studies, Bhubaneswar Odisha, India; Tel: +91-9777603236; Fax: (06815) 222150; E-mail: abhisek.mishra@hotmail.com

[1]Lindenberg (2002) identified economic security, food security, health security, nutritional security, educational security and empowerment as the dimensions of livelihood security. Further, Mishra (2017) considered habitat security as one dimension of livelihood security.

E-ISSN: 1929-7092/20

Debata, & Dewangan 2019, Sahoo, 2019). Further, in Odisha, the Kalahandi-Bolangir -Koraput (KBK)[2] zone is popularised as the poorest region in India characterised by people with poor nutritional intake (Kujur, 2006; Parida, 2008; Rahman, 2016). Sonepur, being an indispensable core area of KBK zone signifies its backwardness. This provides the motivation to conduct the study in Sonepur district.

3. THEORETICAL FRAMEWORK AND EMPIRICAL EVIDENCE

The NRLM ensures that at least one member from each identified rural poor household is brought under the self-help group (SHG) network in a time-bound manner giving preference to women. This makes clear that the NRLM tries to address poverty through SHGs. This participation in SHGs makes the beneficiaries empowered (Desai & Joshi, 2012; Deininger & Liu, 2013; Banerjee *et al*., 2014); and empowerment of women affects the food security positively (Sharaunga, Mudhara, & Bogale, 2016). Further, long term exposure to poverty alleviation programmes (through SHGs) ensures food security as it has a positive impact on the consumption and nutritional intake of beneficiaries (Deininger & Liu, 2009).

Further, financial assistance in the form of revolving fund, seed capital, and community investment fund is provided to the beneficiaries under the programme. Land is found to be a primary asset in the rural area (Mohapatra & Sahoo, 2016); as it is not only used for agricultural production but also used as a security against shocks by selling those assets in the market. Presence of cultivated land encourages beneficiaries to utilise the received fund in on-farm activities that increases the production and self-procurement of food (because of ownership of land). This provides them the ability to generate income which permits them to purchase and consume quality food[3] (Pritchard, Rammohan, & Sekhar, 2016) ensuring food security. Thus, in a nut-shell, it can be articulated that NRLM through its benefits can provide food security to the rural poor. To validate this assumption, this study is carried out with the objective of examining the impact of NRLM on food security.

4. DATA AND METHODOLOGY

4.1. Data

The study is based on both primary and secondary data. To obtain primary data, a field survey was conducted with a structured questionnaire. Likewise, the secondary data were collected from the below-poverty-line (BPL) line for the selection of non-beneficiaries[4]. The non-beneficiaries were selected from the same village of nearby villages. It was imperative to include the non-beneficiaries, as they act as counterfactual[5].

A three stage probability (and non-probability) sampling was followed to collect data- with blocks as primary unit, *Grampanchyats* and villages as secondary unit and the beneficiaries (and non-beneficiaries) as the ultimate sampling unit.

Under the NRLM, two types of blocks were found in Sonepur district, intensive and non-intensive. In the case of intensive blocks, all components of the programme work intensely; where as in the non-intensive blocks all components don't work. In this regard, to obtain an unbiased outcome, data were collected from two blocks (that includes one intensive and one non-intensive). Tarbha was identified as the only intensive block in Sonepur district[6]. Therefore, Tarbha and Sonepur (a non-intensive block chosen as per the logic of empirical research) blocks were taken for the study. In six different *Grampanchayats* of Tarbha block, intensive works were going on; of which five *Panchayats* were taken for the study. Further, one village from each intensive *Panchayat* were chosen at random. On the other hand, five different villages of five *Panchayats* of Sonepur block were selected at random. Lastly, a total of 220 respondents (120 beneficiaries and 100 non-beneficiaries) were interviewed for the study. Non-participants were selected from the same village or nearby villages from the below poverty line (BPL) list. The BPL lists were collected from *Panchayat* office.

4.2. Methodology

The present study aims to examine the impact of NRLM on food security. To capture the food security of

[2]KBK zone is consisting of eight districts namely, Bolangir, Sonepur, Koraput, Nuapada, Malkangiri, Nabrangpur, Kalahandi, and Rayagada.

[3]Quality food refers to the food that is enriched with macro and micro nutrients. Macro nutrients include carbohydrate, protein, fats and dietary fibre; whereas, micro nutrients include vitamins and minerals.

[4]Here, non-beneficiaries for the study include poor who do not participate in the programme with equal characteristics with beneficiaries in terms of age, income and asset holding.

[5]Counterfactual means, what could have been the outcome; if the programme participants would not have participated in the programme.

[6]Data for the present study were collected in the year 2015. At that time, Tarbha was the only intensive block in Sonepur district.

the respondents the present study uses the dietary intake method following Escamilla and Corrêa (2008). The study uses 24 hour recall and food frequency questionnaire methods to collect the information on food consumption. Data on the consumption of different food items were collected in every alternate week for two months consecutively in three seasons (i.e. summer, rainy, and winter). In this way, total ninety (90) days were covered under the study for measuring the parameters. Each food item (with quantity) is converted into equivalent calories.[7] The present study captures the food security through an index called food security index (FSI) taking the average calories of food consumed by the respondents. The FSI was calculated based on the United State Development Programme (USDP) method of calculating Human Development Index (HDI).[8]

$$d_i = \frac{A_i - m_i}{M_i - m_i} \quad (1)$$

Where, d_i is the index of i^{th} dimension. A_i, M_i, m_i are actual value, maximum value and minimum value in i^{th} dimension.

4.3. Econometric Impact Evaluation of the NRLM on Food Security

The impact evaluation is structured to investigate the impact (causal effect) of the NRLM on the outcomes (i.e. food security) (Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2007). The evaluation of a policy is based on two theories, the structural approach and the treatment effect approach. The former is applicable where there is universal participation, while the treatment effect approach is applicable where there are two groups: (a)a treatment group that takes part in the program and (b) a comparison group that does not participate in the program (Heckman & Vytlacil, 2005; Mishra & Das, 2017).

Evaluation methods in empirical economics fall into five broad categories, each of which provides an alternative approach for constructing the counterfactual and minimises selection bias[9]. Ravillion (2008) advocates that studies based on a randomised selection method mitigate the selection bias problem to the greatest possible extent. Randomised selection is applicable when the programme is a large one and needs to be implemented in a phase-wise manner (Gertler *et al.* 2007). This method also ensures that each individual has an equal opportunity to take part in the program. The NRLM is a flagship programme that has been implemented in a phase-wise fashion; in addition, participation in the NRLM is voluntary, which implies that the beneficiaries enjoy equal opportunity to participate. Therefore, this method is suitable for estimating the impact. Thus, the present study uses this method to examine the impact of the NRLM on food security.

Data were collected in two phases (baseline and follow-up) for the study. After collecting the follow-up data, significant changes in different parameters (including age, educational qualification, family type, land holding, & food security) of both beneficiaries and non-beneficiaries were studied through *t-test*. Following past literature (Rahman, 1986a, 1986b; Hashemi, Schuler, & Riley, 1996; Pitt & Khandker, 1998; Kabeer, 2001; Gertler *et al*. 2007; Mohapatra & Sahoo, 2016) the impact was estimated using a multiple regression equation taking control variables namely age (A), educational qualification (Ed) and land holding (LH) along with the participation. The dependent variable for the study is the FSI of the respondents; whereas, the treatment variable is the participation in NRLM, which takes the value 1 if participates in the programme and 0 otherwise. The estimable regression equation is presented below.

$$FSI = \alpha + \beta_1 P_i + \beta_2 A_i + \beta_3 Ed_i + \beta_4 LH_i + \varepsilon_i \quad (2)$$

5. RESULTS & DISCUSSION

5.1. Socio-Economic Profile

In the context of social stratification, caste has a significant importance (Mohapatra & Sahoo, 2016). It is found to be one of the key markers of socio-economic status in the rural India (Rao & Ban, 2007). Scheduled castes (SCs) and Scheduled tribes (STs) people have primarily remained outside the mainstream of the society. In the present study, a majority of beneficiaries belong to SC category (85%) followed by Other Backward Classes (OBC) (12%) and general (3%). Approximately same distribution pattern was found for non-participants.

In addition to caste, household income and land holding are also important indicators of economic

[7]https://ndb.nal.usda.gov/ndb/nutrients/index (accessed on 2nd January 2018).
[8]Technical notes, human development reports, 2013, available at http://hdr.undp.org/sites/default/files/hdr_2013_en_technotes.pdf (accessed on 29th May 2018)
[9]Selection bias occurs when the reasons for participation are correlated with the outcome (Gertler *et al*. 2007).

status. The average annual income of beneficiaries was found to be Rs. 38300, whereas the annual income of non-beneficiaries was found to be Rs. 35200. It was observed from the study that 55% of beneficiaries and 31% of non-beneficiaries were having with cultivated land.

5.2. Nutritional Profile of Respondents

Consumption of nutritious food is prerequisite to lead a healthy life and it comes from a balanced diet. Balanced diet ensures eating food that contains carbohydrate, protein, fats and minerals proportionately. The nutritional profiles of both beneficiaries (of NRLM) and non-beneficiaries are presented below (Tables **1** and **2**).

Tables **1** and **2** portray that the nutritional profile of beneficiaries are better than the non-beneficiaries. On the contrary to this neither the beneficiaries nor the non-beneficiaries meet the per day minimum prescribed calories requirement of 2234 Kcal, who are involved in moderate work (Rao, 2010). Carbohydrate, protein, and fat contribute to the body's energy requirements. This can be achieved through the consumption of a balanced diet. An imbalanced diet may lead to different diseases. For example, diet with high fat could lead to obesity and similarly a low-fat high-carbohydrate diet might increase a particular type of lipid profile (Harshman & Aldoori, 2006). Therefore, consumption of a balanced diet is highly essential for a human body being to be healthy. Dietary reference (Harshman & Aldoori, 2006) suggests that adults consume 45% to 65% , 20% to 35%, and 10% to 35% of their total calories from carbohydrate, fat, and protein respectively. The present study finds a similar pattern of food consumption among the respondents. The prescribed carbohydrate consumption for women who do moderate work is between 180 g/day to 230g/day.

Table 1: Average Nutritional Profile of NRLM Beneficiaries in a Day

Food items	Quantity consumed (g)	Carbohydrate(g)	Protein(g)	Total lipids(g)	Energy(Kcal)
Rice(wild rice cooked)	300	64.02	11.97	1.02	303
Pulses (cooked, boiled, drained with salt)	50	19.49	2.98	0.68	55.5
Onion(Raw)	100	9.34	1.1	0.1	40
Garlic(Raw)	1	0.3306	0.0636	0.005	0.4
Cucumber (raw)	120	4.356	0.78	0.132	18
Cauliflower(cooked, boiled with salt)	130	5.343	2.392	0.585	29.9
Ladyfinger(cooked, boiled with salt)	80	47.76	8.48	7.28	290.4
Brinjal(cooked, boiled with salt	60	4.884	0.498	0.138	19.8
Potato (cooked)	100	24.24	2.44	0.1	105
Drumstick (cooked)	6	0.6544	0.1254	0.0114	2.16
Egg	100	0.83	13.61	14.84	196
Chicken	25	-	6	3.4	50.9
Sweet potato leaves (boiled, cooked)	60	4.428	1.308	0.204	21
Drumstick leaves(boiled, cooked)	220	24.53	11.462	2.046	132
Turmeric	2	1.3428	0.1936	0.065	6.24
Ginger	1	0.7162	0.0898	0.0424	3.35
Mustard	3	0.8427	0.7824	1.0872	15.24
Coriander	1	0.5499	0.1237	0.1777	2.98
Cumin	1	0.4424	0.1781	0.2227	3.75
Total		214.1	64.57	32.13	1295.62

(**Source:** https://ndb.nal.usda.gov/ndb/search/list).

Table 2: Average Nutritional Profile of Non-Beneficiaries in a Day

Food items	Quantity consumed (g)	Carbohydrate(g)	Protein(g)	Total lipids(g)	Energy(K cal)
Rice(wild rice cooked)	280	60.59	11.172	0.952	282.8
Pulses(cooked, boiled, drained with salt)	40	7.796	16.688	3.808	310.8
Onion(raw)	220	20.54	2.42	0.22	88
Garlic(raw)	90	29.75	5.724	0.45	134.1
Cucumber (raw)	70	2.541	0.455	0.077	10.5
Potato (cooked)	120	29.088	2.928	0.12	126
Egg Chicken	100 20	0.83 -	13.61 4.8	14.84 2.6	196 4
Sweet potato leaves (boiled, cooked)	30	2.214	0.654	0.102	10.5
Drumstick leaves(boiled, cooked)	70	7.805	3.689	0.651	42
Turmeric	2	1.3428	0.1936	0.065	6.24
Ginger	1	0.7162	0.0898	0.0424	3.35
Mustard	3	0.8427	0.7824	1.0872	15.24
Coriander	1	0.5499	0.1237	0.1777	2.98
Cumin	1	0.4424	0.1781	0.2227	3.75
Total		165.09	63.50	25.41	1040.26

(**Source:** https://ndb.nal.usda.gov/ndb/search/list).

From Tables **1** and **2**, it is apparent that only the beneficiaries are consuming as per the prescribed standard.

Protein is an important component of every cell in human body. It is used to build and repair tissues. Further, it can be used for making enzymes, hormones and other chemicals required for various metabolic pathways. Therefore, fulfilling the minimum protein requirement of the body is vital. For living being, an average of 0.8g protein is required per kg of body weight (Harshman & Aldoori, 2006). Therefore, based on the above calculation, they require a minimum of 35.6g/day. Further, Gopalan *et al*. (2016) advocate that a woman who is engaged in moderate work with a body weight of 50 kg should consume protein of 55g/day. In the present study, the average weight of the respondents is found to be 44.5 kg. That signifies that they are underweight. Interestingly, the study finds a better protein consumption of 64.57g/day and 63.50g/day in the case of beneficiaries and non-beneficiaries respectively, which is much above the minimum prescribed protein requirement.

Alike carbohydrate and protein, fats also play an essential role which provides energy as well as essential fatty acids to meet the body's metabolic requirements. There are two types of essential fatty acids namely n-6 and n-3. The former type of fatty acid helps in the integration of cell membrane, whereas the later is essential for certain metabolic function and protection against cardiovascular diseases (Rao, 2010). Fish oil is found to be an important source for n-3 fatty acid. Vegetable oils like mustard, soya are rich in lenolenic acid, which gets converted into n-3 fatty acid in the body. In the present study, it was found that the respondents use mustard oil for cooking purpose. Therefore, there is a less possibility of cardio vascular diseases among the respondents.

Apart from this, the consumption of tomato was found to be frequent in the case of both beneficiaries and non-beneficiaries (though it is not mentioned in the table). Thus, they obtain vitamins (vitaminB1, B2, B3, & B6, vitamin C), minerals (Calcium, Iron, and Magnesium), fatty acids and amino acids from it. Consumption of drumstick and drumstick leave provides minerals, vitamins, and phytochemicals, which are useful for the treatment of malnutrition, augment breast milk in lactating mothers (Gopalkrishnan, Doriya, &Kumar, 2016).Antioxidant and anti inflammatory effects could be realised due to the consumption of onion and turmeric (Griffith, Trueman, Crowther,

Thomas, & Smith, 2002; Gupta, Patchva, & Agrawal, 2012). Consumption of ginger provides potassium which helps and protects them from neural disease (Choi, Kim, Jeong, & Oh, 2018). Along with this, the respondents consume different fruits in different seasons. Fruits are the major source for micronutrients and minerals. It was found from the interview that fruits like banana, watermelon, apple, orange, guava, and grapes are consumed by the respondents. Further, the frequency of consuming fruits in non-beneficiaries is found to be very low in comparison to the beneficiaries.

From the analysis of nutritional profile of the respondents, a similar pattern consumption of macronutrients (carbohydrate, protein, and fats) is found for both beneficiaries and non-beneficiaries. On the contrary, the presence of food enriched with micronutrients, vitamins, and minerals are found to be less in the diet of non-beneficiaries than beneficiaries. That is because the beneficiaries are getting an opportunity to interact with the society (through SHG) which motivates them to consume quality food within the limited resources.

5.3. Econometric Impact of NRLM on Food Security

In the case of randomised assignment, it is assumed that no external factors other than the programme explain the differences in the outcome between the treatment and control groups (Gertler *et al*., 2007). In order to validate this assumption, independent sample *t-test* was used to examine the significant difference in the characteristics of both the groups. It was observed (Table **3**) that the average characteristics of the respondents in both the groups were very similar. This signifies the choice of a valid counterfactual, which ensures the internal validity. Further, the present study finds a positive impact of NRLM on food security (Table **4**). Table **4** depicts the information that participation in NRLM bears a significant positive effect on food security. Along with the participation, land holding also bears a positive effect on food security. It signifies the situation when the people have their own land there is a greater possibility of capitalising the benefits (both financial and non-financial) in solving food insecurity problem.

In the post-independence India, the introduction of food security oriented strategy for the reduction of poverty has come to assume vital importance. Public distribution system (PDS), the largest food subsidy programme (Jha, Gaiha, Pandey, & Kaicker, 2013) was implemented for ensuring food security. Though the programme was large, its effects on calories intake on poor were low (Radhakrishna, Subbarao, Indrakant,

Table 3: Balance between Treatment and Comparison Groups at Baseline

Household Characteristics	Treatment group (N=120)	Control group (N=100)	Difference	t- stat
Age	36.55	36.60	-0.0570	-0.056
Educational qualification	3.890	4.176	-0.2866	-0.848
Family Type (single=1)	0.263	0.265	-0.002	-0.033
Family Type (joint=1)	0.737	0.735	0.002	0.033
Dependency ratio	0.69	0.70	-0.01	-0.480
Land holding	1.20	0.88	0.32	2.055
Food security	0.31	0.20	0.11	4.708

(**Source**: Authors' calculation).

Table 4: Impact of NRLM on Livelihood Security using Randomised Assignment

Independent variables	β	Robust Standard Error
Participation in the programme (P)	0.295	0.05(4.55)**
Age (A)	-0.161	0.03(-0.43)
Educational qualification (Ed)	0.038	0.013(0.548)
Land Holding (LH)	0.069	0.024(2.995)*
R^2	0.16	

Notes: *and ** represent significance at 5% and 1% levels. Absolute t-values are mentioned in the parenthesis. β=standardised coefficients.

&Ravi, 1997; Kochar, 2005; Svedberg, 2012) due to leakages[10] (Dreze & Khera, 2015). Mid-day meal (MDM) was implemented for improving nutritional profile of school-going children. Sharma *et al*. (1995) reveal a positive impact of it on nutritional improvement of regular beneficiaries. The finding of the present study goes in line with the past literature (Deininger & Liu, 2009) and exhibits a positive impact of NRLM on food security.

6. CONCLUSION

Over the last one decade, the importance of food security has widely been acknowledged. Different poverty alleviation programmes are being implemented(directly or indirectly)for achieving food security. NRLM, the recently introduced self-employment type programme not only provides secured livelihood but also helps in the food production which are essential for any policy implemented for food security (Mellor, 1978).

The study finds that the nutritional profile of both the beneficiaries and non-beneficiaries are similar in the context of consumption of macronutrient (carbohydrate, protein, & fats). The consumption of micronutrient is found to be better in the case of beneficiaries than the non-beneficiaries. Further, the study finds a positive impact of participation on food security of rural poor. Thus, it can be concluded that participation in NRLM helps the beneficiaries in consuming a balanced diet through awareness that helps them in achieving food security. Therefore, participation in the programme should be encouraged.

ACKNOWLEDGEMENTS

We would like to thank the anonymous reviewers for their insightful and scholastic comments that helped us in restructuring and fine-tuning the manuscript.

REFERENCES

Deininger, K., and Liu, Y.(2009)Longer-Term Economic Impacts of Self-Help Groups in India,(World Bank: Working Paper 4886), Policy Research Working papers, retrieved on 18th July 2017 http://www.ruralfinanceandinvestment.org/sites/default/files/1270045576004_Economic_impacts_of_SGH_in_India_2.pdf (accessed on 18th July 2017).

Deininger,K., and Liu, Y.(2013)Economic and Social Impacts of an Innovative Self-Help Group Model in India. World Development,43, 149–163. https://doi.org/10.1016/j.worlddev.2012.09.019

Desai, R. M., and Joshi, S. (2012)Collective Action and Community Development: Evidence from Women's Self-Help Groups in Rural India. Retrieved on 23rd July 2017. http://www.isid.ac.in/~pu/seminar/31_07_2012_Paper.pdf.

Dreze, J., and Khera, R. (2015) Understanding leakages in the public distribution system. Economic & Political weekly, 1(7), 39-42.

Gertler,P., Martinez,S., Premand,P., Rawling, B.L., and Vermeersch, J.M.C. (2007) Impact evaluation in practice. Washington, DC: World Bank.

Gopalakrishnan, L., Doriya, K., and Kumar, D.S. (2016) Moringa Oleifera: A review on nutritive importance and its medical application. Food science and human wellness, 5(2), 49-56. https://doi.org/10.1016/j.fshw.2016.04.001

Gopalan, C., Rama Sastri, B.V., and Balasubramanian, S.C. (2016). *Nutritive value of Indian Foods*. (Hyderabad: National Institute of Nutrition).

Griffith, G., Trueman, L., Crowther, T., Thomas, B., and Smith, B. (2002) Onion- a global benefit to health. phytother Res, 16(7), 603-615. https://doi.org/10.1002/ptr.1222

Gupta,S.C., Patchva, S., and Agrawal, B.B. (2012) Discovery of curcumin, a component of golden spice, and its miraculous biological activities. Clinical and experimental pharmacology and physiology, 39(3), 283-299. https://doi.org/10.1111/j.1440-1681.2011.05648.x

Hashem, S.M., Schuler, R.S., and Riley, A.P.(1996) Rural credit programmes and women's empowerment in Bangladesh. World Development, 24 (4), 635-653. https://doi.org/10.1016/0305-750X(95)00159-A

Heckman, J., and Vytlaci, E. (2005) Structural equations, Treatment Effects and Economic Policy Evaluations. Econometrica, 73(3), 669-738. https://doi.org/10.1111/j.1468-0262.2005.00594.x

Kujur, R. (2006) Underdevelopment and naxal movement. Economic & political weekly, 41(7), 557-559.

Lindenberg, M. (2002)Measuring household security at the family and community level in the developing world. World Development, 30(2), 301-318. https://doi.org/10.1016/S0305-750X(01)00105-X

Mishra, A. (2017) Policy deign of National Rural Livelihood Mission (NRLM): A critical assessment. International Journal of Management and Development studies, 6(8),54-60.

Mishra, A., and Das, T.K. (2017) Methods of Impact evaluation: A review, retrieved from on 20th August 2017. https://dx.doi.org/10.2139/ssrn.2943601

Mishra, A., Debata, B., and Dewangan, J.K. (2019). Determinants of participation in National Rural Livelihood Mission: An investigation in Odisha, India. *The Empirical Economics Letters,*18 (8), 895-901.

Mohapatra, S., and Sahoo, B.K. (2016) Determinants of participation in self-help-groups (SHG) and its impact on women empowerment. Indian Growth and Development Review, 9(1), 53-78.

Parida, N.K. 2008.Chronic Poverty and Hunger in KBK Region of Orissa: Identifying Causes in the Perspective of a Case Study in Watershed Development Project in Nabarangpur District, retrieved on 12th March 2018 https://www.google.com/search?q=Parida%2C+N.%2C+2008.+Chronic+Poverty+and+Hunger+in+KBK+Region+of+Orissa%3A+IdentifyingCauses+in+the+Perspective+of+a+Case+Study+in+Watershed+Development+Project+inNabarangpur+District&oq=Parida%2C+N.%2C+2008.+Chronic+Poverty+and+Hunger+in+KBK+Region+of+Orissa%3A+IdentifyingCauses+in+the+Perspective+of+a+Case+Study+in+Watershed+Development+Project+inNabarangpur+District&aqs=chrome..69i57.1958j0j7&sourceid=chrome&ie=UTF-8

Pingali, P., Aiyar, A., Abraham, M., and Rahman, A. (2019). *Transforming Food Systems for a Rising India*. Available at

[10]It refers to the proportion of PDS rice and wheat released by the Food Corporation of India (FCI) that fails to reach consumers (Dreze & Khera, 2015).

https://www.palgrave.com › book (accessed on 26th January 2020). https://doi.org/10.1007/978-3-030-14409-8

Prez –Escamalia R., and Segall-Correa A.M. (2008) Food insecurity measurement and indicators. Rev. Nutr., Campinas, 21:15s-26s. Retrievedon 17th April 2018. https://doi.org/10.1590/S1415-52732008000700003

Radhakrishnan, R., subharao, K., Indrakant, S., Ravi, C. (2012) India's public distribution system: a national and international perspective, retrieved from http://documents.worldbank.org/curated/en/820471468750260965/pdf/multi-page.pdf (accessed on 22nd August, 2018).

Rahman, A. (1986a) *Impact of Grameen bank intervention on rural power structure*, Working Paper No 2, Bangladesh Institute of Development Studies, Dhaka.

Rahman, R.I. (1986b) *Impact of Grameen bank on situation of poor rural women*, Working Paper No.1, Grameen Bank Evaluation Project, BIDS, Dhaka.

Rao, B.S.N. (2010) Nutrition requirements and dietary intake for Indians. NFI Bulletin,31(1),1-5.

Sahoo, P. (2019). *Dynamics of Rural Poverty in Odisha.* Available at file:///C:/Users/Dell/Desktop/JRGE/MPRA_paper_755201.pdf (accessed on 25th January 2020).

Sharaunga, S., Mudhara, M., and Bogale, A. (2016) Effects of women empowerment on household food security in rural Kwazulu-Natal province. Development policy review,34(2),223-252. https://doi.org/10.1111/dpr.12151

Yamba, S., Appiah, D.O., Siaw, L.P., and Asante, F. (2017). Smallholder Farmers' livelihood security options amidst climate variability and change in rural Ghana. *Scientifica.* https://doi.org/10.1155/2017/1868290

Received on 02-10-2019 Accepted on 26-01-2020 Published on 21-02-2020

DOI: https://doi.org/10.6000/1929-7092.2020.09.14