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Nutritional Health Multidimensional Locus of Control (HMLC) Instrument for Farming Community: Confirmatory factor analysis

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ABSTRACT

India is self-sufficient country in terms of food production. However, it still suffers from nutritional maladies. A prime aspect to understand the issues is to see how farmer's behavior is affected by their locus of control. Nutritional Health Multidimensional Locus of Control has been derived from the premise of Multidimensional health locus of control and locus of control per se. This can be used as an instrument to know the locus and associated factors that can affect the nutritional behavior change especially in context of appropriate agri-nutri interventions. The study was conducted in Odisha and Uttar Pradesh (nutritionally vulnerable areas) .The sample size was 100 farmers selected by simple random sampling technique. Confirmatory factor analysis was employed to find the best among A,B and C forms for farmers. Form A with 18 statements was found to be statistically the best one.

Keywords: Nutritional Health Multidimensional Locus of Control, farmers.

INTRODUCTION

Locus of control refers to an individual's beliefs about the extent of control that they have over things that happen to them (Rotter,1966). The more anxious or depressed a person is, the more external his/her locus of control tends to be and a greater external locus of control is associated with a greater vulnerability to physical illness. Locus of control measures generalized expectancies for internal versus external control of reinforcement. People with an internal locus of control believe that their own actions determine the rewards that they obtain, while those with an external locus of control believe that their own behavior does not matter much and that rewards in life are generally outside of their control. However, trainings and Cognitive restructuring changes the way individuals think, which then leads to alterations in emotions and other cognitive dimensions which is the basis for behavioral changes, especially related to nutritional health.

Furthermore, Health locus of control (HLC) is a construct that refers to how a person's beliefs influence his/her health (Wallston,1978). HLC based on Rotter's social learning theory was developed to measure these beliefs on an introverted internal-external dimensionality (Strickland, 1978 & Rotter, 1966). The individuals with an internal locus of control are believed to have control on the environmental condition and generally are effective in social activity and self-confident while individuals with an external locus of control believe their outcomes are determined by external factors and they do not have control over their health (DeMello,1999).

On the other hand a Multidimensional HLC,(MHLC) construct is an improvement over the classic conceptualization (HLC), which is controlled more by belief in God or physicians or by chance and not by self. The three dimensions (internal, chance, and powerful others) are traditionally assumed to be independent factors whereas some studies have shown significant difference between factor correlations (Luszczynska, 2005&Wallston,2005). Score on each MHLC subscale can be determined by beliefs and actions an individual experiences in his/her life. MHLC scales have three forms A, B, and C. Form A and B are equivalent and can be

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administered to general community (Wallston, 1978) and Form C was developed by Wallston and Stein to evaluate the HLC among unhealthy individuals (Wallston,1994).

The obvious hypothesis. especially for people who highly value their health, is that people who score high on the dimensions of Internal health locus of control (IHLC) (and who, therefore. believe that their own health behavior determines their own health status) should be more likely to carry out healthy behaviors than someone who scores low on the internal (IHLC) or who value other outcomes more highly than being healthy (Wallston,1991;Wallston&Wallston,1982). Similarly, if someone scores high on the Chance health locus of control (CHLC) subscale (thus believing that it is fate, luck or chance that determines their health status), they should be less likely to carry out recommended health behavior. Similarly those who believe that powerful others (God, doctors, leaders etc. determine their health status) are less likely to take actions for their health status. They score high on Powerful others health locus of control (PHLC).

One of the main ways that the MHLC scales have been used are as predictors of health behavior. This is consistent with the scales' theoretical origins, namely Rotter's (1954) social learning theory, where locus of control is conceptualized as a generalized expectancy. In Rotter's theory, expectancies (such as those regarding the likelihood of a desired reinforcement occurring as the result of a particular behavior or set of behaviors in a particular situation) and the value of that reinforcement to the individual in that same particular situation are the main determinants of behavior potential or the likelihood of that behavior occurring in that specific situation. Generalized expectancies (such as locus of control beliefs) are cross-situational; thus, they are more trait-like than state-like. The MHLC was conceived to be partway between a trait like and state-like measure; it was supposed to be applicable to a variety of health-related behaviors and situations, but sensitive enough to change as a function of one's health-related experiences.

Health and nutrition are different sides of the same coin and strongly inter-related. Furthermore, there is a strong connect between Agriculture, Nutrition and Health. Food is the common link between agriculture and nutrition. The food consumed is often not adequate or diverse to meet our dietary nutritional requirements. The increasing concern related to lifestyle diseases (Non-communicable diseases like diabetes) and the triple burden of malnutrition (Undernutrition, micro-nutrients and over-nutrition or obesity) is a concern which needs to be addressed. One effective way is by leveraging agriculture for nutrition. This nutritional malady has a remedy in Agriculture in terms of various bio fortified and other nutritionally rich varieties of crops and Nutri farming Systems (NFS). It is a paradox that our farming community-the producers- are suffering from malnutrition. Another paradox is that in spite of increasing food production (283.37 million tonnes, 2018-2019) there is rampant malnutrition. In this context it becomes essential to trace the Nutritional Health locus of control of farmers (including women farmers) and to understand as of how locus of control affects the behavioral change and decision making capacity in agri-nutri context. The MHLC scale was selected because it is a multi-dimensional scale and has not yet been validated in farming community. To understand the aspect in the light above Nutritional Health multidimensional locus of Control (NHMLC) instrument was developed and validated for farmers, based on the MHLC.

The NHMLC is a predictor of nutritional health behavior. It may be used for predicting nutritional health behavior of farmers including women farmers, in context of developing behavior change, communication materials, designing capacity development, interventions and also for communication based assessment for designing development communication strategies and interventions. This is also relevant in case of Extension for Agri-nutri integration and facilitating behavioural changes to adopt nutri farming systems with biofortified varieties. This understanding is important precursor for bringing desirable changes in nutrition behaviours supported by agri-interventions. Nutritional Health beliefs can be strongly predicted by the extent farmers believe they can go for such good nutritional practices and are likely to have intentions to adopt better agri-nutri practices.

METHODOLOGY

The locale selected for the study was from States of Uttar Pradesh (UP) and Odisha due to their nutritional vulnerability status. In UP the villages of districts Auraiya, Jalaun and Chitrakut were selected whereas in Odisha various villages of Sonepur were selected by random sampling technique to collect data on responses of farmers for nutritional health statements in context of NHMLC (Table 2).The sample size constituted of 100 farmers (selected by random sampling technique). The three forms A,B and C for NHMLC with 18 questions each were used to assess the NHLC in three dimensions: Internality, chance, and powerful others (including God locus of control). Each subscale consisted of 6 items. Each item was scored based on 3-point Likert like scale from 1 (“Agree”) to 3 (“Disagree”), and score for each subscale (Internal, external chance and external powerful others)

was computed. Therefore, each subscale scoring ranged from 6 to 18.

To identify the best suitable form for farmers in context of nutritional health, Confirmatory Factor Analysis (CFA) was employed. CFA tests whether a specified set of items and constructs is influencing responses in a predicted way and how well the measured variables represent the number of constructs. The first step in CFA is to define the factor model. In this study, three models Form A, Form B and Form C were considered. Each of the model has three latent factors so that 6 questions were in each subscale (INHLC, CNHLC and PNHLC). For all statements item-total correlation was computed. Values for an item-total correlation (point-biserial) between 0 and 0.19 may indicate that the statement is not discriminating well, values between 0.20 and 0.39 indicate good discrimination, and values 0.40 and above indicate very good discrimination. Cronbach's alpha was computed for each sub scale. Cronbach's alpha value of 0.70 or higher is considered "acceptable".

Maximum likelihood estimation was used for the three models. The three models *viz.* Form A, Form B and Form C were evaluated using six fit indices. Chi-square test of model fit, normed chi-square statistics calculated as ratio of chi square to degrees of freedom, Tucker Lewis Index (TLI), root mean square error of approximation (RMSEA), Akaike Information Criteria (AIC) and Bayesian information criterion (BIC) were also utilized. BIC is a criterion for model selection among a finite set of models, the model with the lowest BIC is preferred. TFI is an incremental fit index. The bigger TLI value indicates better fit for the model.

The CFI is an incremental fit index. The Comparative Fit Index (CFI) produces values between 0-1 and high values are indicators of good fit. RMSEA is a persimmons correction index and the value < 0.05 indicate good fit, value near the 0.08 indicate moderate fit, and value > 0.1 indicate poor model fitting (Merkle, 2016).

Low value of chi-square statistic and non-significant P value indicate good fit, but these criteria are hardly met in practice (Bollen., 2004), so instead we used normed chi-square statistics. A normed chi-square < 5 indicates an adequate model fit, while a value ≤ 3 denotes a close fit (Brown.2015 &Kline.,2015). Lower the values of normed chi-square statistics, RMSEA, AIC and BIC better the model. Higher the values of TLI and CFI better the model. The analysis was done employing "Lavaan" package of R software.

RESULTS AND DISCUSSION

Model comparison of The Equivalent Forms A, B and C of Nutritional Health Multidimensional Locus of Control. The three models Form A, B and C were evaluated using the fit indices to determine the best model fitting among the available forms.

Table 1: Model fitting for forms A, B and C of Nutritional Health Multidimensional health locus of control.

Model	$\chi 2$	df	$\chi 2$/df	Tucker-Lewis Index (TLI)	Comparative fit Index (CFI)	Root mean square error of approximation RMSEA(90% CI)	Akaike Information Criteria (AIC)	Bayesian Information criterion (BIC)
Form A	282.26	132	2.13	0.627	0.678	0.121 (0.105-0.138)	3015.847	3163.769
Form B	324.67	132	2.45	0.593	0.649	0.131 (0.114-0.145)	3436.751	3584.673
Form C	388.85	132	2.94	0.543	0.606	0.140 (0.124-0.156)	3140.726	3288.648

The comparative analysis of forms on the basis of various indices illustrates the model fit for various forms. A normed chi-square for form A observed was 2.13 while for form B and C it was 2.45 and 2.94 respectively. The lesser the normed chi-square value, the better fit model is considered.Tucker Lewis Index (TLI) of form A was observed as 0.627 whereas for form B and C was 0.593 and 0.543 respectively.

The higher the value of TLI,better fit is considered. Comparative Fit Index (CFI) of form A was observed as 0.678 whereas for form B and C was 0.649 and 0.606 respectively. The higher the value of CFI, better fit is considered. Root mean square error of approximation (RMSEA) for form A was 0.121 while for Form B and C was 0.131 and 0.140 respectively. Lower the value, better fit is expected. Akaike Information Criterion (AIC) for form A was 3015.847 and Bayesian information criterion (BIC) for form A was 3163.769.Lower the values of AIC and BIC, better fit is expected.

By the observation of the values of various indices, Form A stands out as the best one for the farmers. Based on the fit indices it can be inferred that Form A model has higher accuracy as compared to Form B and Form C. Hence we retain the items belonging to Form A and discard the items belonging to Form B and C. The final statements for the selected form A are given in Table 2 along with the item correlation and Cronbach's alpha coefficient

Table 2: Item-total correlations and Cronbach's alpha coefficients of Items (Form- A) for Nutritional Health Multidimensional health locus of control.

Form A		Statements	Item-total correlation	Cronbach's alpha for subscales
Internal	X1	If I get sick due to nutrition deficiency (eg. anemia) it is my own behavior which determines how soon I get well again.	0.144909	0.7258
	X2	No matter what I do, if I am going to get malnutrition disease, I will get it.	0.630672	
	X3	Having regular contact with my Anganwadi/ASHA worker is the best way for me to avoid diseases.	0.697311	
	X4	Most things that affect my health happen to me by accident.	0.337597	
	X5	Whenever I do not feel well, I should consult a health professional	0.34034	
	X6	I am in control of my nutritional status & health	0.33377	
External Chance	X7	My family has a lot to do with my staying nutritionally healthy.	0.648539	0.81489
	X8	When I get sick and suffer from malnutrition diseases I am to blame.	0.636303	
	X9	Luck plays a big part in determining how soon I will recover from diseases.	0.765889	
	X10	My good health is largely a matter of good fortune.	0.639198	
	X11	The main thing which affects my nutritional status & health is what I myself do.	0.520297	
	X12	If I take care of my lifestyle and my diet I can avoid malnutrition diseases.	0.443871	
External Powerful others	X13	Whenever I recover from a deficiency, it's usually because of other people (doctors, nurses, family and friends) have taken care of me.	0.193862	0.75397
	X14	No matter what I do, I 'm likely to get malnutrition diseases.	0.559391	
	X15	If it's meant to be, I will stay healthy.	0.343731	
	X16	If I take the right actions, I can stay healthy.	0.594515	
	X17	Whatever happens to my health & nutritional condition is God's will	0.103278	
	X18	God is in control of my health & nutritional condition.	0.058459	

The value of Cronbach's alpha for internal locus of control observed was 0.7258, whereas for Externality Chance it was 0.81489 and the value for Externality powerful others was 0.75397. Cronbach's alpha 0.70 or higher is considered acceptable. Hence the value observed is reliable in INHLC, CNHLC and PNHLC.

Furthermore, factor scores of the statements were also calculated to find out if all the questions were important and significant. The results are given in Table 3.

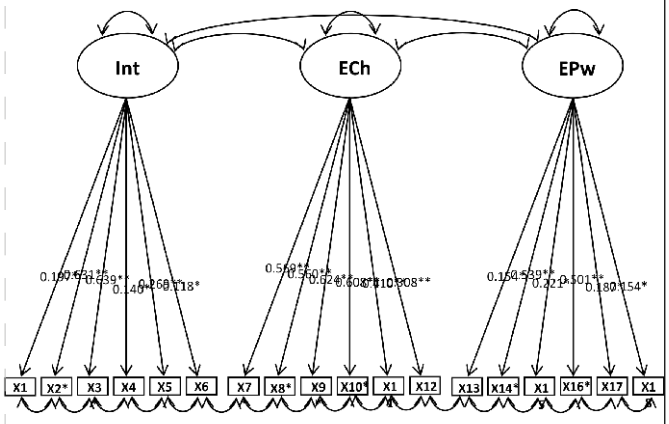
Table 3: Factor scores of the statements

Latent Variable	Questions	Factor Score	Std. Error
Internal	X1	0.197*	0.074
	X2*	0.631**	0.079
	X3*	0.639**	0.073
	X4	0.140*	0.068
	X5	0.269**	0.085
	X6	0.118*	0.065
Externality Chance	X7*	0.569**	0.078
	X8*	0.560**	0.076
	X9*	0.624**	0.067
	X10*	0.608**	0.075
	X11	0.410**	0.071
	X12	0.308**	0.075
Externality powerful others	X13	0.154*	0.069
	X14*	0.539**	0.081
	X15	0.221*	0.068
	X16*	0.501**	0.078
	X17	0.187*	0.069
	X18	0.154*	0.072

* (P<0.05) ** (P<0.01)

From Table 3 it can be inferred that all the questions are significant. For Internal factor X2- "No matter what I do, if I am going to get malnutrition disease, I will get it." and X3- "Having regular contact with my Anganwadi/ASHA worker is the best way for me to avoid diseases " items are important. For externality chance, X7- "My family has a lot to do with my staying nutritionally healthy", X8-"When I get sick and suffer from malnutrition diseases I am to blame.",X9- "Luck plays a big part in determining how soon I will recover from diseases" and X10- "My good health is largely a matter of good fortune" are important. For Externality powerful others X14- "No matter what I do, I 'm likely to get malnutrition diseases" and X16- "If I take the right actions, I can stay healthy" are important.The graphical plot of confirmatory factor analysis for NHMLC is given in Fig.1

Fig. 1: Graphical Plot of CFA



X1 to X18 statements as given in Table 2/Table 3.
Int= Nutritional health Internal locus of control
ECh= Nutritional health External locus of control-Chance
Epw= Nutritional health External locus of control-Powerful others

CONCLUSION

It is very critical to assess and develop internal Nutritional Health Locus of control. The nutritional health multi-dimensional health locus of control stresses upon the role of locus in nutritional behavior changes. The confirmatory factor analysis used for the study concluded that among the equivalent forms A, B and C, form A was found to be the best for farming community. Strengthening internal Nutritional Health Locus of Control (NHLC) can help them to feel more empowered to take charge of their nutrition and health. In nutshell having internal NHLC will be incredibly empowering for farming community and agri-nutri interventions can be successfully implemented. Such a change in locus from External Chance, External Powerful others to internal can help farmers to be motivated, to change and explore ways to improve and cope with their health and nutrition situations with respect to their own farming systems, dietary diversity, food production and consumption. The good news is that one can change one's locus of control beliefs, regardless of how deeply entrenched they are with cognitive restructuring and other techniques.

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