

## Nutritional Health Belief Model for Understanding Motivational Health Behaviour of Farmers

**Satyapriya<sup>1</sup>, S. Bishnoi<sup>2</sup>, S. Singh<sup>3</sup>, K.N. Singh<sup>4</sup>, M. Ray<sup>5</sup>, S. Dahiya<sup>6</sup>, S.K. Dubey<sup>7</sup>,  
A. Singh<sup>8</sup>, P. Mishra<sup>9</sup>, Rubeka<sup>10</sup>, R. Shankar<sup>11</sup>, M. Yadav<sup>12</sup>, J. Pandey<sup>13</sup>,  
V. Rai<sup>14</sup>, S.P. Singh<sup>15</sup>, S.K. Mahapatra<sup>16</sup> and Premlata Singh<sup>17</sup>**

1. Pr. Scientist, 2. Scientist, 3. Pr. Scientist, 10,11,12. SRF, 17. Pr. Scientist, & Head, IARI, New Delhi, 4. Pr. Scientist, & Head, 5. Scientist, 6. Sr. Scientist, 13, 14. SRF, IASRI, New Delhi., 7. PS, 8. Director, 15. SRF, ATARI, Kanpur, 9. JD Ext., 16. SRF, OUAT, Bhubaneswar,

*Corresponding author e-mail: srest2011@gmail.com*

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### ABSTRACT

*All people, whether educated or not, urban or rural, have cultural belief about the nutrition, health, causes of sickness or their remedial measures. Where professionals believe in substantial empirical evidence, farmers on the contrary rely more on observations, past experiences and accessibility of things needed to support their native lifestyle. According to a previous report (Satyapriya et al., 2020), the strengthening of internal Nutritional Health Locus of Control (NHLC) can help farmers feel more empowered and take charge of their nutrition and health. Thus their beliefs that rely more on cultural systems, can be revised in the light of new information and awareness. The 'Health Belief Model' (HBM) can be used alone or in combination with other models of learning theories and approaches, as the theoretical basis of a health education programs. Since no model or learning theory can explain or predict all aspects of health behavior, it will be more practical to combine compatible theories and models to create stronger health education programs. (Renuka et al., 2014). The HBM is often combined with: "Social learning theories and behavioral changes" in health education programs. In this study a Nutritional Health Belief Model (NHBM) has been used to understand the motivation to improve health, in context of anemia and nutritional health behavior among 100 farmers of backward districts of UP and Haryana in India. The sample of 100 farmers, was selected by simple random sampling technique. These districts in the 2 States were selected particularly due to their nutritional vulnerability. A basic framework has been designed to elucidate NHBM from the existing model health beliefs. Mokken's Scaling Analysis (MSA) was used to select for a farmer's perspective on nutritional health and motivational factors that influence their nutritional health beliefs. Since beliefs are related to health consciousness the relation between the major key factors of NHBM have also been reported in this study through Confirmatory Factor Analysis (CFA). NHBM complying to health consciousness and related key factors was the major deciding factor in agri-nutri linkage to health.*

**Key words:** Anemia; Farmer; Health Belief Model; Health; Malnutrition; Motivation; Nutrition;

**B**eliefs are an important psychological constructs to understand and to bring about desirable behavioral changes. The three major psychological constructs namely behavioral beliefs, normative beliefs and control beliefs are driven by factors such as attitude toward the behaviour, subjective norm and perceived behavioral control. Thus, it is said that the actual behavioral control is channelized in a pathway: beliefs → intentions →

behavioral change.

**Genesis of health belief model (HBM) :** The HBM was first developed in the 1950s (Regina Firpo-Triplett et al., 1998), in the U.S. The model was developed in response to tuberculosis (TB) health screening program where it provided free TB screening x-rays through mobile units in convenient neighborhoods. However, still only very few adults came out. The reason to this was

that the benefit of such an action with respect to risk of disease was the main concern for which they were not very convinced for a free of cost program as a motivation to provide to them. Thus the model showed that four key concepts: Perceived Susceptibility, Perceived Severity, Perceived Benefits, and Perceived Barriers were to be handled in order to stimulate behavior. Thus the concept of Self-efficacy was a challenge to habitual unhealthy behaviors. (Taylor et al., 2007)

Therefore, the Health Belief Model as a framework can be a prime motivating factor people towards positive health actions against a desire to avoid a negative health consequence(s) that uses the desire to avoid a negative health consequence as the prime motivation. This can be an effective in developing nutritional health education strategies. The meta-analysis provided substantial empirical support for the efficacy of the HBM (Janz et al., 1984). Later additional constructs to better explain changing habitual behaviors (Rimer & Glanz, 2005) by the six key concept definitions and applications of HBM were as below:

1. *Perceived Susceptibility*: One's belief of the chances of getting a condition.
2. *Perceived Severity*: One's belief of how serious a condition and its consequences are.
3. *Perceived Benefits*: One's belief in the efficacy of the advised action to reduce risk or seriousness of impact.
4. *Perceived Barriers*: One's belief in the tangible and psychological costs of the advised behavior.
5. *Cues to Action*: Strategies to activate "readiness" Cues to action would activate that readiness and stimulate overt behaviors.
6. *Self-Efficacy*: Confidence in one's ability to take action. Self-efficacy, or one's confidence in the ability to successfully perform an action.

#### *Nutritional Health Belief Model (NHBM) for farmers*

: So far, the studies in nutritional health are comparably less as compared to the other areas where HBM has been applied. A study on iron-deficiency anemia among women in India (Rai et al., 2018 and Redding et al., 2014) and how iron and folic acid interventions fared in the same is still not clearly understood) and has been emphasized to monitor and evaluate interventions to prevent anemia, as the most urgent needs. The WHO recommends, reducing the level of Iron Deficiency

Anemia (IDA) in India by strengthening its strategy along three pillars- food-based strategies (dietary diversification and food fortification), food supplementation and improvement of health services. Thus, an approach to construct the NHBM will certainly help to understand the behavioral changes in anemia-based interventions for farmers to benefit rural women, as agriculture-based remedies. This can then be suggested as a remedy for alleviating anemia in context to farming systems and to change nutritional attitudes/ behaviors.

## METHODOLOGY

A number of items were prepared based on review of literature and views of experts. Retention of significant statements for scales for NHBM (with respect to anemia) to assess nutritional health belief of farmers, the schedule was prepared from statements from various categories under NHBM. This was done in two stages i.e.:

1. Expert analysis and previous reporting's (literature reviewed)
2. Mokken's analysis that was based on, statements of severity, susceptibility, perceived barrier, benefits, cues to action, self-efficacy and health consciousness were reduced to two stages as above. The scales were:
  - i. Severity (19 to 7 to 5)
  - ii. Susceptibility (11 to 4 to 4)
  - iii. Perceived barriers (13 to 8 to 4)
  - iv. Perceived benefits (15 to 7 to 5)
  - v. Cues to action (7 to 6 to 5)
  - vi. Self-efficacy (8 to 5 to 2)
  - vii. Health consciousness (9 to 7 to 3).

For statistical analysis, Confirmatory Factor analysis (CFA) was used to draw the relation between the seven interstitial factors of the model as above. CFA analysis pointed out to whether specified set of constructs influenced responses in a predicted way. The first step in CFA is to define the most important factor model. In this study, several models are studied to get a best fit model. The total correlation (point-biserial) values for an item between 0 and 0.19 may indicate that the question is not discriminating so well; between 0.2 and 0.39 indicate good discrimination and 0.4 and above indicate very good discrimination. Several fit indices were used such as a) Chi-square test of model fit, b) normed

chi-square statistics calculated as ratio of chi square to degrees of freedom, c) Tucker Lewis Index (TLI), d) Root mean square error of approximation (RMSEA), e) Akaike Information Criteria (AIC) and f) Bayesian information criterion (BIC). c) TLI is an incremental fit index. The bigger TLI value indicated better fit for the model; f) BIC is a criterion for model selection among a finite set of models, the model with the lowest BIC is preferred. The CFI is also an incremental fit index. The CFI produces values between 0-1 and high values are the indicators of good fit. d) RMSEA is a persimmons correction index and the value  $< 0.05$  indicate good fit, value near the 0.08 indicates moderate fit, and value  $> 0.1$  indicate poor model fitting (Merkle EC et al., 2016). a) Low value of chi-square statistic and non-significant P value indicate good fit, but these criteria are hardly met in practice (Bollen K.A., 2014), so hence we used normed chi-square statistics instead with a divisional factor of Degree of freedom (DF). A normed chi-square  $< 5$  indicated an adequate model fit, while a value  $> 3$  denoted a close fit (Brown T A., 2015 and Kline R B., 2016). Lower the values of normed chi-square statistics ( $\chi^2$ ), RMSEA, AIC and BIC better is the model whereas higher the values of TLI and CFI better the model. The entire analysis was done employing "Lavaan" package of R software. (Van et al., 2007). Mokken scale Analysis (MSA) (Mokken, 1971; Mokken, Lewis, 1982) has been employed to reduce the number of statements from the total number of statements of NHBM that consisted of seven parameters as denoted above. MSA is a non-parametric approach. The principle to prefer Mokken scale analysis as compared to factor analysis is that it can deal with a smaller number of data and it does not require prior assumptions of the data generating process. Mokken scaling works by seeking one-dimensional sets of items on the basis of Loevinger's coefficient (H). This is based on the extent to which pairs of items, as scored by respondents, conform to Guttman criteria. In a Guttman scale which is deterministic in nature- any pair of items should be scored relative to one another consistently. In other words, of two items item i and item j, if item j represents more of the latent trait than item i (i.e. it is more 'difficult' in psychometric terms) then item i should always be more readily endorsed than item j. Where item pairs are not endorsed in the expected direction (i.e. where an individual endorses item j more

readily than item i) then that is a Guttman error. In this sense, 'difficulty' means the ease with which an item is endorsed or agreed with by respondents and is indicated by the mean score of the item: more 'difficult' items have lower mean scores. Loevinger's coefficient (LC) is calculated for item H ( $H_i$ ); item pair H ( $H_{ij}$ ) and for the overall scale ( $H_s$ ). By this means, and based on the mean scores on items by individuals, a set of questions can be selected. In this study, the statements had  $H_s > 0.3$  were selected. In addition, the present study employed genetic algorithm approach to estimate the value of Loevinger's coefficient (H). The 'Mokken' package in R was used for the analysis (Van der Ark., 2007).

## RESULTS AND DISCUSSION

Confirmatory Factor Analysis (CFA) was used to draw the relation between seven interstitial factors of the model (Table 1). CFA values for all the factors of HBM are given for 7 free parameters. The concept of a fixed or free parameter is essential in CFA.

**Table 1. Confirmatory Factor Analysis (CFA) for fitting of Nutritional Health Belief Model (NHBM)**

|  |                    |
|--|--------------------|
| No. of free parameters                           | 73                 |
| Chi square ( $\chi^2$ )                          | 0.00               |
| Degree of freedom (DF)                           | 454                |
| $\chi^2/DF$                                      | 0.00               |
| Tuckerlewis index (TLI)                          | 0.568              |
| Confirmatory factor index (CFI)                  | 0.604              |
| Root mean square error of approx. (RMSEA-90% CI) | 0.095(0.089-0.100) |
| Akaike information criterion (AIC)               | 21236.879          |
| Bayesian information criterion (BIC)             | 21489.999          |

The total number of free parameters in a CFA model is determined by the number of known values (no. of statements here) in your observed population variance-covariance matrix  $\hat{\Sigma}$ , given by the formula  $p(p+1)/2$  where p is the number of items in your survey which was 82 statements for NHBM when tested initially. Chi-square test of model fitting, normed chi-square statistics calculated as ratio of chi square to degrees of freedom (454) was found to be 0 which is indicative of adequate fitting of the model because a normed chi-square  $< 5$  indicates an adequately fitted model. The TLI and CFI was found to be 0.568 and 0.604 which shows the incremental nature of both the indices which ranges between 0-1 and a higher value indicates a better fitted model. Lower the value of RAMSEA, AIC and BIC

**Table 2. The significant items retained for scales for NHBM**

| <i>Severity</i>   | 3                   | 2         | 1          |
|---|---------------------|-----------|------------|
| To what extent (anemia) threatens your health at all  | Very serious threat | Some      | No threat  |
| My whole life would be negatively affected if a family member or myself had anemia  | Yes                 | Not sure  | No         |
| Anemia has serious financial burden   | Agree               | Neutral   | Disagree   |
| Anemia will affect my whole life  | Agree               | Neutral   | Disagree   |
| How serious do you think anemia is?   | Not severe          | Not sure  | Serious    |
| <i>Susceptibility</i>   |                     |           |            |
| How concerned are you about getting anemia  | Concerned           | Not sure  | Not at all |
| Not having kitchen garden, poultry, fish on your farm makes it likely that you will be prone to deficiency diseases   | High                | So-So     | Low        |
| My lifestyle will make me prone to anemia someday   | High                | So-So     | Low        |
| How likely do you think you are to be anemic  | Not likely          | Not sure  | Likely     |
| <i>Perceived barriers</i>   |                     |           |            |
| You are able to focus attention on practicing healthy/nutritional practices and health habits, regardless of what is and how you feel?  | Yes                 | Sometimes | No         |
| Many things keep me from correcting my healthy eating habits and practicing healthy habits  | Yes                 | Not sure  | No         |
| Cultural influences prevent me from following diverse diet  | Very strong         | Strong    | Weak       |
| Person with deficiency diseases fear of social isolation  | Yes                 | Not sure  | No         |
| <i>Perceived benefits</i>   |                     |           |            |
| Spending money to consume balanced diet (especially iron rich) is a good long-term way to save money.   | Agree               | Not sure  | No         |
| Information & advice from experts may help reduce my chances of developing anemia   | Agree               | Not sure  | No         |
| Adopting a nutritious diet may prevent anemia.  | Agree               | Not sure  | No         |
| I believe that supplements (Iron, Zinc, Vit.D) & balanced diet are helpful for my health.   | Agree               | Not sure  | No         |
| I believe that I can go for a Nutri Kitchen Garden  | Agree               | Not sure  | No         |
| <i>Cues to action</i>   |                     |           |            |
| Counseling and nutrition education help in combating malnutrition   | Yes                 | Not sure  | No         |
| I adopt healthy eating habits and practices because friend/neighbor informed about impact of healthy food and importance of healthy and nutritious diet                             | Yes                 | Not sure  | No         |
| I adopt healthy eating habits and practices because I listened to or read something in the newspaper in other literature in television / radio programs about healthy eating habits | Yes                 | Not sure  | No         |
| I adopt healthy eating habits and practices because my family members experienced negative health consequences from indiscriminate eating of foods in daily diets                   | Yes                 | Not sure  | No         |
| If nutritious and healthy food options are available at affordable prices, I will be ready to consume   | Yes                 | Not sure  | No         |
| <i>Self-efficacy</i>  |                     |           |            |
| How confident are you that you can overcome anemia/osteoporosis   | 10-30 %             | 30-60%    | 60-90%     |
| I have the determination needed to follow a new diet plan for better health (free from anemia )   | 10-30%              | 30-60%    | 60-90%     |
| <i>Health consciousness</i>   |                     |           |            |
| I am very health conscious  | To a great extent   | Somewhat  | Not at all |
| I am conscious of my state of health on a daily basis   | Always              | Somewhat  | Not at all |
| I am very involved about my health issues   | Mostly              | Somewhat  | Not at all |

**Table 3. Nutritional Health Belief items (in context of Anemia) for assessing nutritional health beliefs of farmers (Based on MSA)**

| Items of Model              | Statement  | Loevinger's coefficient | SE    |
|-----------------------------|--|-------------------------|-------|
| <i>Severity</i>             |  |                         |       |
| SR1                         | To what extent (anemia) threatens your health  | 0.483                   | 0.045 |
| SR2                         | My whole life would be negatively affected if a family member or myself had anemia   | 0.431                   | 0.040 |
| SR3                         | Anemia has serious financial burden  | 0.432                   | 0.050 |
| SR4                         | Anemia will affect my whole life   | 0.449                   | 0.041 |
| SR6                         | How serious do you think anemia is?  | 0.386                   | 0.040 |
| <i>Susceptibility</i>       |  |                         |       |
| SU1                         | How concerned are you about getting anemia?  | 0.631                   | 0.040 |
| SU2                         | Not having kitchen garden, poultry, fish on your farm makes it likely that you will be prone to deficiency diseases like anemia          | 0.572                   | 0.050 |
| SU3                         | My lifestyle will make me prone to anemia someday  | 0.499                   | 0.041 |
| SU4                         | How likely do you think you are to be anemic   | 0.648                   | 0.052 |
| <i>Perceived barriers</i>   |  |                         |       |
| PB1                         | You are not able to focus attention on practicing healthy/nutritional practices, regardless of what is and how you feel                  | 0.431                   | 0.040 |
| PB2                         | Many things keep you from following nutritionally healthy practices  | 0.532                   | 0.050 |
| PB3                         | Cultural influences prevent you from following diverse diet  | 0.449                   | 0.041 |
| PB4                         | Person with deficiency diseases causes fear of degraded social image   | 0.348                   | 0.052 |
| <i>Benefits</i>             |  |                         |       |
| BE1                         | Spending money to consume balanced diet (especially iron rich) is a good long-term way to save money.                                    | 1.000                   | 0.000 |
| BE2                         | Information & advice from experts may help reduce my chances of developing anemia  | 1.000                   | 0.000 |
| BE3                         | Adopting a nutritious diet may prevent anemia.   | 1.000                   | 0.000 |
| BE4                         | I believe that supplements (Iron, zinc, Vit.D) & balanced diet are helpful for my health.  | 1.000                   | 0.000 |
| BE5                         | I believe that I can go for a Nutri Kitchen Garden   | 1.000                   | 0.000 |
| <i>Cuesto Action</i>        |  |                         |       |
| CA1                         | Counseling and nutrition education help in combating malnutrition  | 0.758                   | 0.046 |
| CA2                         | I adopt healthy eating practices because friends informed about its importance.  | 0.456                   | 0.045 |
| CA3                         | I adopt healthy eating practices because I listened to or read in the newspaper/ magazine, in radio programs about it.                   | 0.531                   | 0.020 |
| CA4                         | I adopt healthy eating practices because my family members experienced negative health consequences from indiscriminate eating of foods. | 0.332                   | 0.050 |
| CA5                         | If nutritious and healthy food options are available at affordable prices, I am ready to consume   | 0.489                   | 0.489 |
| <i>Self-efficacy</i>        |  |                         |       |
| SE1                         | How confident are you that you can overcome anemia   | 0.448                   | 0.182 |
| SE2                         | I have the determination needed to follow a new diet plan for better health (anemia free)  | 0.448                   | 0.182 |
| <i>Health consciousness</i> |  |                         |       |
| HC1                         | I am very health conscious   | 0.443 (0.059)           | 0.059 |
| HC2                         | I am very involved about my health issues  | 0.465 (0.049)           | 0.049 |
| HC3                         | I am very conscious of my nutrition & diet   | 0.408 (0.067)           | 0.048 |

values better is the model fitting and the same has been found in the results that all the values were found to be in range and hence the Nutritional Health Belief Model is well fitted statically.

Retention of significant statements for scales for NHBM (in context of anemia) and health consciousness for assessing nutritional health belief of farmers the schedule. This was done in two stages i.e.: 1. Expert analysis and 2. Review of literature and Mokken's analysis has been shown in Table 2.

Table 2 represents the selected statements under the seven main key constructs of nutritional health belief model which are 1. Severity, 2. Susceptibility, 3. Perceived barriers, 4. Perceived benefits, 5. Cues to action, 6. Self-efficacy and 7. Health consciousness. These constructs play a vital role in understanding various health, lifestyle practices, behaviors and to understanding whether the subject is woke/aware on these aspects or not. (Kim, Ahn & No, 2012) highlighted in their findings that Confirmatory Factor Analysis (CFA) of various dimensions of nutrition health belief model has a constructive ability and these key constructs acts as a validation measure to understand nutrition knowledge and behavioral intentions. Based on this model, the decision and motivation of a person to choose a behavior is related to perceptions of a person at risk position (perceived sensitivity) and severity (perceived severity), his/her belief in the usefulness of action to reduce the risk of a disease, or to understand the benefits of nutritional health action (perceived benefits) with respect to its barriers and moderating factors such as demographic characteristics and psychosocial variables. Cues to action also facilitate the adoption of health behavior. This model generally focuses on the change in one's beliefs and believes that change in beliefs leads to a change in behavior (Gheisari *et al.*, 2009). The combined effect of these factors leads to an individual to undertake the recommended preventive health action (Khan, 2014). These constructs specifies a discrete set of common-sense beliefs that appear to explain, or mediate, the effects of demographic variables on behavior patterns and are amenable to change through educational intervention (Abraham & Sheeran, 2014). Therefore, this model could be applied to a range of nutritional and health behaviors and for shaping behavior patterns relevant to human welfare.

In the Table 3, statements after applying scaling techniques for NHBM (in context of anemia) for assessing nutritional health belief of farmers has been shown. It consists of all the finalized statements of all the seven parameters of the model after reduction on the basis of Mokken Scaling Analysis (MSA) which is then added to the schedule prepared for the famers as a tool.

The MSA approach computes the Loevinger's coefficient for all the statements. The statements which are having Loevinger's coefficient more than 0.3 are considered statistically significant. Hence, the statements reported in Table 3 are all statistically significant. The highest value of Loevinger's coefficient for retained statements were for benefit construct (1.00), which indicates the counseling, awareness and affordability of nutri rich variety in kitchen garden is a key concern for adoption, consumption. Likewise, other construct like Health consciousness, Self-efficacy, Cues to Action etc. are equally important for assessing nutritional health beliefs of farmers

## CONCLUSION

In this present study NHBM was framed in which the basic model of health belief has been used to understand the significance of various statements of a schedule. The key elements of NHBM such as Susceptibility, Severity, Perceived Barriers, Benefits, Cues to Action, Self-efficacy and Health consciousness have been validated from 73 statements to 28 statements for farmers in context of their beliefs about nutrition and anemia. In order to reduce the items, expert advice and review of literature, CFA and MSA were applied in the basic model of HBM to design the framework of NHBM. All the key factors of NHBM play a very important roles as a decision factor in combating diseases like malnutrition and anemia and also in context of agri-nutri linkages to the farmers. Thus, the scale developed can be a very efficient tool, which therefore can act as an important vehicle for studies which include schedules and surveys to understand the nutritional health beliefs, values, perceptions and health consciousness, in order to bring about desirable changes in selective behavior for better nutritional health, creating awareness about the major prevalent diseases in rural India, designing the agri-nutri intervention plans and capacity building.

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