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Global Hunger Index Revisited

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SUMMARY

Global Hunger Index (GHI) is the currently used measure of hunger in different countries. GHI suffers from many limitations, some of which are quite serious. GHI is highly biased and lacks statistical vigor. It is based on the use of proxy indicators, comprising undernourishment in general population and undernutrition (stunting and wasting) and under-5 mortality in children. Use of these indicators is questionable since their determinants are not limited to hunger. As an alternative, Nigam (2018) suggested use of behavioral responses-based indicators on access to food. In the present note, his arguments on poor performing GHI are further strengthened.

Keywords: Global hunger index, Proxy indicators, Stunting, Behavioral responses, Resampling inference, Simulation.

1. INTRODUCTION

The end of hunger is one of the United Nations Sustainable Development Goals (SDGs). Measuring hunger itself is a complex issue and hunger has been defined in many ways. In India, the concept of National Sample Survey Office (NSSO) of "getting two square meals a day throughout the year" is far from acceptable for measuring hunger. The Food and Agriculture Organization (FAO) defines hunger as being synonymous with chronic undernourishment. According to the World Health Organization (WHO), though the sensation of hunger is universal, there are different manifestations of hunger. The World Food Program (WFP) treats hunger as not having enough to eat to meet energy requirements. While hunger leads to undernutrition, absence of hunger does not necessarily imply absence of undernutrition. Hunger is characterized by a strong desire or need for food, and the discomfort, weakness, or pain caused by a prolonged lack of food. According to the Food and Nutrition Technical Assistance (FANTA), sponsored Food Access Survey Tools (FAST), validation study in Bangladesh (2003), hunger is also the uneasy or painful sensation caused by lack of food.

As per the 2017 Global Hunger Index (GHI), developed by International Food Policy Research Institute (IFPRI), India ranks 100 among 119 developing countries. India is ranked 103rd out of 119 countries, tied with Nigeria, which also has 31.1 points according to the 2018 GHI. Initially, GHI developed by IFPRI, was the arithmetic mean of three indicators - % undernourished general population, % underweight children of under five years and % mortality rate of under five children. All the three indicators were standardized and were assigned equal weights. The current GHI measure is based on

- % undernourished population.
- % stunted (height-for-age) children of under five years.
- % wasted(weight-for-height) children of under five years.
- % mortality rate of under five children

While first and fourth indicators each are assigned one-third weight, the other two each are assigned one-sixth weight (or combined one third weightage). In effect, equal one-third weight is assigned to three major

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indicators - undernourished population, undernutrition in children and child mortality.

In the past few months, the poorer GHI ranking of India and the associated rise in hungry population has become a very favorite topic for discussion. All segments – political, both opposition and Government, intelligentsia and the public are actively commenting on the scenario of hunger. Unfortunately, the understanding of the subject remains poor. Interestingly, very few have the knowledge that the number of countries in the two rounds of comparisons of GHI reported in 2008 and 2017 differ in terms of countries excluded or included in the two rounds. Moreover, as stated earlier,the indicators used for measuring GHI differ in the two rounds. This makes the comparison between two-time points meaningless. The use of GHI of IFPRI in its current definition also raises a number of questions since there are following limitations which remain unexplained.

2. LIMITATIONS OF GHI

- GHI is a combination of only undernutrition related proxy indicators. The FAST study (2003) suggests that the pattern of nutritional outcomes is too complex for undernutrition to be used as a single proxy for food security (Weisman, 2006). This is further supported by the globally accepted conceptual framework of undernutrition in children which clearly indicates poor consumption and lack of access to food are not the only causes of child stunting or wasting (United Nations International Children's Emergency Fund (UNICEF),1990). Similarly, under-5 mortality may have reasons other than hunger.
- GHI cannot be computed at micro level (e.g. under-5 mortality at district and lower levels not known).
- It gives equal weightage to all indicators even if some indicators may have high values. For example, stunting and wasting might be much higher than under-5 mortality. The current structure of GHI, being simple arithmetic mean of indicator values, gives unduly higher importance to stunting and wasting in situations where these rates are high.
- GHI indicators have a problem of multiple counts (Messet, 2011) and with individual values not known, no edit-check remedy can be undertaken.
- Estimates of GHI have an upward bias. For example, hunger implies undernutrition though undernutrition does not imply hunger. The extent of bias is likely be substantial as hunger is most likely to be a small part of undernourishment, undernutrition and mortality. It is not possible to theoretically evaluate the bias because of the confounding between the various components of GHI and hunger. It may only be possible to evaluate the bias empirically through large data sets.

3. INDIA'S PERSPECTIVE

The upward bias in GHI has serious implications. It pushes up the hunger estimate. It puts to disadvantage countries which are poor performers in terms of undernutrition and mortality. These countries, including India, are poorly ranked in the hunger table. India is ranked poorly mainly because of high stunting and wasting rates. Similar concerns have been raised by Neetu Choudhary (2017):

"After witnessing an improvement from 2008 to 2014, India's rank on Global Hunger Index slipped in 2016. This slip is attributed to reformulation of GHI to encompass the multidimensional character of malnutrition, wherein underweight was replaced by stunting and wasting. While GHI scores of several other countries witnessed a decline, India fared worse. This is explained through a stickiness in child stunting levels in India attributed to gendered norms, poor sanitation, and high regional concentration."

If we see the percentage of the undernourished population, India is not doing too bad with about 15% (FAO data 2014-16) of India being undernourished. The corresponding percentage for North Korea, ranked higher in terms of GHI,is 41.Similarly, as per National Family Health Survey (NFHS)-4, the under-five mortality rate in India has also decreased to 50 in 2015-16, down from 74 in 2005-06 (NFHS-3). While it is still high compared to many countries, it is not that disappointing.

India's performance is simply poor regarding percentage of under 5-year-old wasted and stunted children. As per NFHS-4, 21.0% and 38.4% under 5-year-old were wasted and stunted. These are much higher than China (1.8% and 6.3% respectively). The huge difference between the figures of two countries must be due to other reasons as well.

Use of stunting and wasting in the GHI has been contested by many researchers. Former Niti Aayog Vice-Chairman Arvind Panagariya argued that international norms on child stunting and wasting were not applicable to India as the present methodology completely ignores the genetic factors. Similar concerns to using stunting and wasting through the currently used international norms have also been raised by Agarwal and his co-workers (see, Agarwal *et al.* 2015).

Surjit Bhalla, Member Niti Aayog, in his recent article *Hungry for Publicity* in Indian Express on October 14, 2017 complains about the disappearance of honest debate in India. According to him, the IFPRI hunger index is not a hunger index at all; it is an index about child mortality, and stunting, and wasting, and undernourishment of children.

Swaminathan Aiyer in his article in Sunday Times on 22 October, 2017 also holds the view that none of the indicators used in GHI actually measure hunger. India is one of the few countries with hunger data in NSSO surveys. These show that hunger declined from 16% of the population in 1983 to 1.9% in 2004-05. The article strongly suggests that India should restart measuring hunger in NSSO surveys as international organizations will find its results difficult to ignore. Nigam (2016, 2017, 2018), raised a similar concern about the usefulness of GHI. Nigam (2018) also suggested alternative ways to measure hunger.

4. WHY INDIA IS DIFFERENT?

India differs from many other countries in terms of behavior which put it lowly particularly in terms of stunting. There is a genuine nutrition absorption problem in India. The most probable cause of this is bad sanitation, a large component of which is open-defecation. A child suffering from recurrent diarrhea is unlikely to ingest good and healthy food and absorb the nutrition.

5. ALTERNATIVE PATH

With the above stated limitations of GHI, it is timely to explore other viable alternatives to measure hunger. It needs to be appreciated that "hunger measuring indicators" should have a direct bearing on hunger. Nigam (2016) suggested use of following indicators for estimating hunger:

– behavioral responses based indicators like access and anxiety
– dietary intakes of important food stuffs which may be major sources of energy and protein.

Behavioral response based indicators could be complemented with dietary intake data of important food stuffs which are major sources of energy and protein. Information on behavioral responses-based indicators on access to food are not available for the Indian economy and needs to be collected. Interestingly, some limited data were available till recently from NSSO's consumption surveys. For a country like India and many other neighboring countries, the food items that could be considered to be included would be the primary cereal, pulses or beans and fats/oils. For such data, country/state level dietary intake data could be made available through dietary surveys. Use of suitable cut-offs of recommended dietary allowance in respect of each of these food stuffs have direct bearing on hunger may be helpful in arriving at good estimates of hunger. However, choosing the optimum cut-off may be a tricky issue and undertaking dietary surveys a demanding but important task.

With reference to behavioral response based indicators, two studies are available while a third study being undertaken by FAO, Voices of the Hungry (VOH) project, 2012-18. remains to be completed. The two reported studies - FAST (FANTA) from Bangladesh, 2003 and modified FAST (MFAST) from India, 2011, as reported in Nigam (2018) are described below.

One of the two above referred behavioral response based indicators study is the Bangladesh study which developed and validated a measure of household food access to distinguish households facing different degrees of food insecurity. The study was executed in the following 4 major steps: (i) development of the 36 potential questions based prototype FAST module in preparation for the second phase of the study. prototype Food Access Survey Tool (FAST) using the United States "food security core module" as a model, (ii) at the first round of data collection using the prototype module developed was administered to a sample of 600 households randomly selected from among those villages chosen to participate in the World Vision, Bangladesh Food Security Enhancement Initiative (WV/B FSEI) baseline survey and control

villages. Enumerators conveyed the 36-question prototype module to both the household head and the spouse, (iii) a second round of data collection, one year later, was used to interact more closely with a purposively selected sub-sample of 120 households in order to further explore the appropriateness of questions developed for the first round instrument and to generate additional insights to improve the validity and usefulness of the measurement tool, and (iv) a third round of data collection in 2003 for examination of the dynamics of food security over time in the context of WV/B FSEI project activities and secular trends. Each of the 600 households from Round 1 was thus revisited with the same quantitative questionnaire and food security module.

The FAST study demonstrated that access and anxiety components of hunger were measurable. Following the study, a more compact set of tools were developed which narrowed down to only 9 questions in FAST methodology for distinguishing individuals and households experiencing food insecurity related to insufficient quantity and quality of food as well as those households that procured food through unacceptable means, and those with a feeling of vulnerability to downturns in supply (Nord *et al.* 2002; Frongillo 1999; Frongillo *et al.* 1999).

MFAST, is a slightly modified version of FAST used by the Institute of Applied Statistics and Development Studies (IASDS) in 2010 in their micro-level hunger mapping project funded by the Indian Council of Medical Research (ICMR) in one of the most deprived districts, Banda located in highly deprived Bundelkhand region of Uttar Pradesh state of India. MFAST deployed the set of 9 FAST questions which were slightly modified to suit the Indian local conditions (Nigam *et al.* 2016). The objectives of the MFAST study were Gram Panchayat (GP)level mapping of hunger and identifying target areas and target groups for interventions. The study covered 436-GPs and 592 villages in Banda district GPs were grouped in 44 strata, 43 strata with each comprising neighboring 10 GPs, and the last stratum having 6 GPs. Homogeneity was assumed in each group of neighboring panchayats. A household survey was carried out in each such group of GPs. For this, a sample of 10 villages was selected with probability proportional to size systematic sampling with number of households in villages as size measure and from each village; around 20 households were selected with equal probability for the detailed study. The sample size was slightly inflated for non-response. A total of 8953 households were included in the final analysis.

Both FAST and MFAST had 9 questions (more elaborate than the 3 questions of NSSO) seeking food insecurity related behavioral responses. MFAST had the following 9 questions:

1. The family ate few meals per day on a regular basis;
2. Obliged to eat non-preferred instead of preferred food;
3. Sometimes food stored in the house ran out and no cash to buy;
4. Worried frequently about where the next meal would come from;
5. Needed to purchase food frequently (because own production or purchased stores ran out);
6. Took food on credit from a local store;
7. Needed to borrow food from relatives/neighbors to make a meal;
8. Needed to borrow food in order to meet social obligations
9. Members of the household who had to skip the meal due to lack of food: (i) working adult, (ii) house-wife, (iii) both, (iv) elderly persons, and (v) children

Questions 3-9 together provide food insecure households with hunger. Question 9 gives hunger at individual level and reflects most severe form of hunger. Using questions 3-8, MFAST gave the household hunger estimate for Banda as 22.7. Interestingly, response to each of 6 questions, 3-8, provides an estimate of hunger and an average of these 6 hunger estimates gives the hunger index.

FAST and MFAST also have the problem of multiple counts but with the availability of complete data sets, edit checks are feasible to address the possible errors. The FAST and MFAST studies together provide some similarities in terms of their results on some hunger components like access and anxiety.

Based on MFAST experience, Nigam (2018) suggested reducing the 9-questions module to only a

set of 3-questions module by reframing and rewording the questions.

1. The family ate meals per day on a regular basis
2. Worried frequently about where the next meal would come from as the food stored in the house ran out and no cash to buy more
3. Had to take food on credit from a local store/ relatives or neighbors to make a meal for the family or to serve a meal to guests or relatives.

Reduction as above makes it easy to be used in any survey enquiry. It has the potential of being part of a larger consumption survey like that of NSSO in India.

6. IMPROVED HUNGER ESTIMATES

In summary, there can be three types of indicators for estimating hunger. These are undernutrition related index GHI of IFPRI, survey based behavioral responses as in FAST and MFAST, and dietary intakes of important food stuffs. A crucial point to be noted is that each component of these estimates is, in itself, a hunger estimate. The following two statistical theory-based options, were proposed by Nigam (2018).First of these utilizes simulation technique for screening all the hunger indicators one by one for important criteria like consistency and stability, and then build the hunger estimate. The second option is to use macro level model-based study involving multi-sector variables like climatic, social and economic conditions and food-security outcomes and use techniques like big data analysis, modeling (random forest etc.) and data mining. We elaborate here on the properties of simulation-based approach.

In a large-scale complex survey, the data sets have unduly large coefficient of variations (cv) mostly as a fallout of non-sampling errors from multiple sources. Any use of such data sets leads to estimates with large cv even if one uses the best tools to build the estimate. The purpose of hunger index is to compare hunger across countries, regions and states. Estimates of almost all macro level indicators - undernutrition related, behavioral responses and dietary intakes, are likely to differ in terms of sampling design, sample size criterion and non-sampling errors emanating from inconsistencies and variations by different implementing agencies. For example, NFHS in India are being implemented by several agencies in different states/regions. To this list we can add variations in methodology, tools, analysis and interpretation. This renders different estimates not only inconsistent but also highly imprecise.

In Monte Carlo type simulation methods, variance reduction is used to increase the precision of the estimates. Simulation is a resampling technique which provides insight into bias, sampling variance, consistency and stability. In simulation, thousands of computer-generated repeated samples based upon the available data are used to approximate the sampling distribution of the hunger estimate. Multiple iterations are performed with approximately 10 percent of samples being randomly selected and removed from the data set based on mean square error in each iteration. A suitable estimate is then built leaving out those indicators which perform poorly on the chosen criteria.

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REFERENCES

Agarwal, K.N., Bansal, A.K andAgarwal, D.K. (2015). Growth pattern in Indian children, Statistics and Applications, **13**, Nos. 1&2, 2015 (New Series), pp. 11-23

Food Access Survey Tools (FAST) (2003). Validation study in Bangladesh.

Food and Nutrition Technical Assistance (FANTA) Project (2012) USAID.

Frongillo, E.A., Jr. "Validation of Measures of Food Insecurity and Hunger." Journal of Nutrition, 1999, **129 (2S):** 506S-509S.

Frongillo, E.A., Jr., B. Rauschenbach, C. Olsen, A. Kendall, and A. Colmenares. "Questionnaire-based Measures Are Valid for the Identification of Rural Households with Hunger and Food Insecurity." Journal of Nutrition, 1999, 127:699-705. International Food Policy Research Institute (2008). India state hunger index.

International Food Policy Research Institute. India State Hunger Index. 2008.

International Food Policy Research Institute. 2015 Global Hunger Index: Armed Conflict and the Challenge of Hunger, Chapter 1. 2015.

Kausik, G. (2017). How a faulty metric to calculate global hunger is creating a flawed narrative against India. OPINDIA @ OpIndia_com http://www.opindia.com/…/how-a-faulty-metric-to-calculate-…/ PRESS RELEASE August 1, 2017.

Micro Level Hunger Mapping (2010) Project report of Institute of Applied Statistics and Development Studies for Indian Council of Medical Research.

Masset, E. (2011). A review of hunger indices and methods to monitor country commitment to fighting hunger. For FAO Food Policy, **36:** S102-108.

National Family Health Survey (NFHS) 3 (2005-06).

National Family Health Survey (NFHS) 4 (2015-16).

Neetu Choudhary (2017). India's Slip on Global Hunger Index, Economic and Political Weekly, **52**, Issue No. 34.

Nigam, A.K. (2016). Measuring Hunger. Plenary talk at the Conference of Indian Society of Statistics, Computer and Applications held at Jammu University, Jammu.

Nigam, A.K. (2017). Measuring Hunger- Some Alternatives. Plenary talk at the Conference of Indian Society of Statistics, Computer and Applications held at SKUAST, Jammu.

Nigam, A.K. (2018). Improving Global Hunger Index. Agricultural Research (August Issue).

Nigam, A.K., Srivastava R, Tiwari PP, Saxena Reeta and Shukla Shruti (2016). Hunger in gram panchayats of Banda district (U.P.) ~ A micro-level study. Journal of the Indian Society of Agricultural Statistics, **70(1)** 41-50.

Nord, M., M. Andrews, and S. Carlson. "Household Food Security in the United States, 2001."

Undernourished Population in India (2014-16), FAO

UNICEF (1990). Conceptual Framework of Undernutrition.

Washington, D.C.: Economic Research Service, U.S. Department of Agriculture. 2002.Shortridge Julie, Falconi Stefanie, Zaitchik Ben and Guikema Seth (2015). Signs of hunger, Pullinger *et al.* 2015-Significance (1) Royal Statistical Society.

Wiesmann, D. (2006). A global hunger index: Measurement concept, ranking of countries, and trends. International Food Policy Research Institute.