Introduction: Data from several sources revealed that huge incongruity persists in nutritional status across the states in India. Thus, this study was undertaken to generate a nutritional index, so that these disparities could be quantified and comparison be done. 

Materials and Methods: A nutritional index for 21 major states of India has been constructed on the basis of eight important nutrition-related indicators. The scaled value of each indicator for all the states was calculated. Each indicator was assigned an arbitrary weight (Wi) on the basis of its impact on nutritional status. On the basis of the scaled value and weight given to the particular indicator, a composite-weighted index was thus calculated. 

Results: States were ranked on their nutritional status as per the final composite score they attained. Out of 21 major states, Kerala took the top position followed by Jammu and Kashmir and Himachal Pradesh on the 2nd and 3rd position, respectively, while Uttar Pradesh got the lowest rank followed by Bihar and Jharkhand on the 2nd and 3rd lowest positions. 

Conclusion: Our study concludes that not taking an account of the burden of malnutrition when disbursing funds leads to ineffective implementation of various nutritional programs. Integrated Child Development Services has already been brought in mission mode under Poshan Abhiyan. Other determinants, i.e., illiteracy, poor sanitation, diseases, and infections, should also be considered and addressed through nutritional programs.

Keywords: Composite score, malnutrition, NITI Aayog, nutrition index, Poshan Abhiyan
services, whereas in some states, AWCs failed to achieve 100% registration of children. Thus, the undernourished children remained unspotted. To acknowledge these challenges, a more ambitious program, i.e., Poshan Abhiyan derived by a National Nutritional Strategy, has been launched in 2018 to successfully reach to MALNUTRITION-FREE INDIA by 2022.\[^{10}\]

Data from several sources revealed that huge incongruity persists in nutritional status across the states in India.\[^{11,12}\] Thus, this study was undertaken to generate a nutritional index, so that these disparities could be quantified and comparisons be done. Second, this study was done to bring about appropriate and cost-effective interventions needed to improve the nutrition of vulnerable children.

**Materials and Methods**

A nutritional index for 21 major states of India has been constructed on the basis of eight important nutrition-related indicators. These eight indicators were grouped into two categories, namely, key input indicators and nutritional outcome indicators. The scaled value of each indicator for all the states was calculated. For positive indicator i.e. % children breastfed within 1 hr of birth (source: NFHS 4),\[^{13}\] children exclusively breastfed under age of 6 months (source: NFHS 4),\[^{13}\] and per capita fund released under ICDS for supplementary nutrition (Authors calculation; numerator has been taken from data available from Ministry of Consumer Affairs, Food and Public Distribution\[^{14}\] and denominator has been taken from census 2011); scaled value was calculated as follows:\[^{15}\]

\[
Si = \frac{(Xi - Minimum value) \times 100}{(Maximum value - Minimum value)}
\]

where \(Si\) = Scaled value for positive indicator and \(Xi\) = Data value of the indicator.

Similarly, For negative indicator i.e. % stunted children under 5 years age (source: NFHS 4),\[^{13}\] % wasted children under 5 years age (source: NFHS 4),\[^{13}\] % anaemic children under 5 years age (source: NFHS 4)\[^{13}\] and population covered per AWC (Source: Authors calculation; numerator has been taken from census 2011 and denominator has been taken from data available from Ministry of Women and Child Development)\[^{16}\]; scaled value was calculated as follows:\[^{15}\]

\[
Si = \frac{(Maximum value - Xi) \times 100}{(Maximum value - Minimumum value)}
\]

where \(Si\) = Scaled value for negative indicator and \(Xi\) = Data value of the indicator.

*The minimum and maximum value for each of the positive and negative indicator was determined based on the values for that indicator across states. As all the indicators included in the study do not have an equal importance. So, each indicator was assigned an arbitrary weight (Wi) on the basis of its impact on nutritional status. Finally, on the basis of the above-scaled value and weight given to the particular indicator, a composite-weighted index was thus calculated as follows:\[^{15}\]

\[
Composite - weighted index = \frac{\sum Wi \times Si}{\sum Wi}
\]

Table 1 provides the value of arbitrary weight given to each indicator for calculating the final score and ranking of states. The highest weight, i.e., 100, was given to indicators which are directly linked to health and have maximum impact on nutrition.

**Results**

A total of four indicators for each state were selected to reflect the key input in alleviation of malnutrition. Table 2 depicts the state-wise list of key input indicators. Only one indicator, i.e., population covered per AWC, was considered as a negative indicator, and the rest three indicators (% children breastfed within 1 h of birth, % children exclusively breastfed under age of 6 months, and per capita fund released under ICDS for supplementary nutrition) were positive. Similarly, four indicators for each state were selected to evaluate the nutritional outcome [Table 3]. All the four nutritional outcome indicators were considered as a negative indicator, e.g., lower the value, better is the performance.

Figure 1 shows ranking of states based on their nutritional status according to the final composite score. Out of 21 major states, Kerala took the top position followed by Jammu and Kashmir and Himachal Pradesh on the 2\(^{nd}\) and 3\(^{rd}\) position, respectively.
whereas Uttar Pradesh got the lowest rank followed by Bihar and Jharkhand on the 2\textsuperscript{nd} and 3\textsuperscript{rd} lowest position, respectively.

Table 4 shows the categorization of states on the basis of composite score obtained. Good performing states were the ones achieving top one-third scores (score $>55.72$), moderate performing states were the ones falling in middle one-third (score between 55.72 and 37.15), and poor performing states were the ones falling in the lowest one-third score (score $< 37.15$).

**Discussion**

The present study underpins an attempt to compile data on malnutrition from various secondary sources and compares the disparities in the nutritional status of states across India. While stunting and wasting indicate chronic and acute malnutrition, respectively, underweight is a composite indicator and includes both acute (wasting) and chronic (stunting) malnutrition. Limited reduction in the prevalence of malnutrition has been achieved by the country from 48% (stunting), 19.8% (wasting), and 42.5% (underweight) in 2006 to 38%, 21%, and 35.8% in 2016. States such as Kerala, Punjab, and Himachal Pradesh who are performing well in most of the health indicators have also sustained their status in nutrition, but at the same time, states such as Bihar, UP, and Jharkhand are still struggling with the wide prevalence of malnutrition. This is in concordance with the UNICEF report, which documented that all the districts in Bihar have prevalence above 30%, while 36 out of 38 districts have 40% and 13 out of 38 districts have unacceptable high prevalence of 50%. The impressive picture of states like Kerala is attributed to high female literacy and remarkable reach of public distribution system. On the same place, the gloomy picture of states such as Bihar, Jharkhand, and Uttar Pradesh is attributed to poverty, high fertility rate, and low female literacy.

Furthermore, poor and inappropriate infant and young child feeding practices play a significant role in the occurrence of malnutrition, especially in children under 2 years of age. In consonance with this, our study also noted higher prevalence of...
initiation of breastfeeding and exclusive breastfeeding among the top ranking states (Odisha, Assam, etc.). In support of our finding, Masare et al. also concluded in their study in Maharashtra that nonoptimal breastfeeding practices are significant risk factor for underweight infants. Similar finding was recognized by Das and Barua, Ukarande et al., and Kumar and Singh. Statistics of anemia among under 5 age group and not receiving breastfeed in first 4–6 months of their life are at significant risk of anemia.

Another matter of concern in our study was pertaining to per capita fund released under ICDS. Allocating the funds equally to both, high performing as well as poor performing states, falls short to fix the higher malnutrition status of poor performing states like Bihar, Jharkhand and UP. Thus, indicating the need for higher fund allocation for states with high malnutrition prevalence as compared to states with lower prevalence. It is also observed that states such as Gujarat and Tamil Nadu are spending more than the required amount, but still they are lagging behind as moderate performers, indicating that effective implementation of the ICDS program is a matter of equal concern than just the funding constraint.

During the current decade, Odisha and Chhattisgarh have emerged as an exemplary state. Despite being a poor state, Odisha has managed to make a worthy improvement in nutrition (Rank-5). Adequate allocation of fund for supplementary nutrition, skilled and motivated Anganwadi worker which eventually brings down their efficiency and performance. Furthermore, the quality of service is adversely hampered where the AWC is reaching out to populations more than the usual ICDS norm, i.e., 1540.60, 1139.75, 1135.5, and 1325.25, respectively, thus overburdening the Anganwadi coverage.

It is worth noting in our study finding that in states such as Delhi, Uttar Pradesh, Jharkhand, and Bihar, AWCs were catering to population higher than the usual ICDS norm, i.e., 1540.60, 1139.75, 1135.5, and 1325.25, respectively, thus overburdening the Anganwadi worker which eventually brings down their efficiency and performance. Furthermore, the quality of service is adversely hampered where the AWC is reaching out to populations more than the authorized usual norms. Kochar et al. mentioned in their study

Table 3: State wise list of nutritional outcome indicators

| State             | *% Stunted children (<5 years) | *% wasted children (<5 years) | *% underweight children (<5 years) | *% Anemic children (<5 years) |
|-------------------|--------------------------------|-------------------------------|-----------------------------------|-------------------------------|
| Andhra Pradesh    | 31.4                           | 17.2                          | 31.9                              | 58.6                          |
| Assam             | 36.4                           | 17                            | 29.8                              | 35.7                          |
| Bihar             | 48.3                           | 20.8                          | 43.9                              | 63.5                          |
| Chhattisgarh      | 37.6                           | 23.1                          | 37.7                              | 41.6                          |
| Delhi             | 31.9                           | 15.9                          | 27                                | 59.7                          |
| Gujarat           | 38.5                           | 26.4                          | 39.3                              | 62.6                          |
| Haryana           | 34                             | 21.2                          | 29.4                              | 71.7                          |
| Himachal Pradesh  | 26.3                           | 13.7                          | 21.2                              | 53.7                          |
| Jammu and Kashmir | 27.4                           | 12.1                          | 16.6                              | 54.5                          |
| Jharkhand         | 45.3                           | 29                            | 47.8                              | 69.9                          |
| Karnataka         | 36.2                           | 26.1                          | 35.2                              | 60.9                          |
| Kerala            | 19.7                           | 15.7                          | 16.1                              | 35.7                          |
| Madhya Pradesh    | 42                             | 25.8                          | 42.8                              | 68.9                          |
| Maharashtra       | 34.4                           | 25.6                          | 36                                | 53.8                          |
| Odisha            | 34.1                           | 20.4                          | 34.4                              | 44.6                          |
| Punjab            | 25.7                           | 15.6                          | 21.6                              | 56.6                          |
| Rajasthan         | 39.1                           | 23                            | 36.7                              | 60.3                          |
| Tamil Nadu        | 27.1                           | 19.7                          | 23.8                              | 50.7                          |
| Uttar Pradesh     | 46.3                           | 17.9                          | 39.5                              | 63.2                          |
| Uttrakhand        | 33.5                           | 19.5                          | 26.6                              | 59.8                          |
| West Bengal       | 32.5                           | 20.3                          | 31.6                              | 54.2                          |

Table 4: Categorization of states on the basis of composite score

| Good performing states | Moderate performing states | Poor performing states |
|------------------------|---------------------------|------------------------|
| Kerala                 | Andhra Pradesh            | 1. Uttarakhand          |
| Jammu & Kashmir        | Tamil Nadu                | 2. Bihar               |
| Himachal Pradesh       | Punjab                    | 3. Jharkhand            |
| Assam                  | West Bengal               | 4. Madhya Pradesh      |
| Odisha                 | Maharashtra              | 5. Rajasthan            |
| Chhattisgarh           | Uttarakhand               | 6. Gujarat              |
|                       |                           |                        |

The categorization of states is done using the same score cutoffs as the NITI Aayog Healthy states progressive India.
that providing an additional worker of higher ability to a cluster of AWCs might address this human resource constraint at low cost.[34]

**Conclusion**

The study brings forth a composite index, an important tool, that brings all the 21 states at one platform and reveals the fair picture to then analyze the status. Our study concludes that not taking an account of the burden of malnutrition when disbursing funds leads to ineffective implementation of various nutritional programs. ICDS has already been brought in mission mode under Poshan Abhiyan, emphasizing on convergence, targeted approach, use of information technology, social audit, and service delivery for the first 1000 days of life. Apart from these, it is desirable that other determinants, i.e., illiteracy, poor sanitation, diseases, and infections should also be considered and addressed through nutritional programs.

**Limitation**

The current study has some limitations which are required to be marked. First, inclusion of all the states could not be done. Only 21 major states (categorized as per Niti Aayog report for genesis of health index) were included in the study. Second, only limited number of input and output indicators could be used due to nonavailability of data of the others. Thus, the indicators covering diseases and infections contributing to malnutrition could not be incorporated in the study. Third, the weights assigned to each indicator for the calculation of composite index are not standardized and the importance of each indicator to the composite could not be analyzed statistically.

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**Conflicts of interest**

There are no conflicts of interest.

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