# Postgraduate Nutrition Education in India: What is Being Taught? An Analysis of Course Content

Shweta Khandelwal, Tanusree Paul, Lawrence Haddad

## Author Affiliations

Shweta Khandelwal and Tanusree Paul are affiliated with Public Health Foundation of India (PHFI), New Delhi, India. Lawrence Haddad is affiliated with Global Alliance for Improved Nutrition (GAIN).

## Corresponding Author

Please address all inquiries to the corresponding author: Dr Shweta Khandelwal, Associate Professor, Public Health Foundation of India, Plot no 47, Sector 44, Gurgaon, Haryana, India. Email: Shweta.khandelwal@phfi.org

Phone: 01244718400 ext 4450

# Abstract

**Background:** Capacity building in nutrition has been viewed as an important strategy in accelerating undernutrition reduction in low and middle-income countries. This paper investigates whether current nutrition programmes in India are aligned well enough to tackle the nutrition needs of the community.

**Objective:** Nutrition curricula of postgraduate modules in India are analysed to examine whether the current nutrition programs are in accord with the three pillars of nutrition (nutrition specific, nutrition sensitive and nutrition enabling environments).

**Methods:** Combination of internet search, email and telephonic enquiries were used to collect the names of universities offering master's degree in nutrition in India. The variables quantified include types of modules taught with respect to three nutrition pillars, quality of teaching materials, and reading lists and institutional attributes. Descriptive and bivariate analyses were used to accomplish the objectives of the study.

**Results:** 116 universities in India offered 146 masters' programmes in nutrition. Each program's modules were listed (duplicates removed). Of these 680 modules, about two thirds were nutrition specific, 5% were underlying / basic and merely one tenth focused on public health nutrition. Further analysis of reading list available for 186 modules, suggests that of the total 2235 reading lists, only 4.2% references were published in journals. Also, less than 10%of the total references were recent (2005 and beyond).

**Conclusions:** Nutrition curricula in Indian universities are dated, skewed towards the immediate determinants and over reliant on books. There is an urgent need to update and align readings to current thinking on how best to accelerate reductions in all forms of malnutrition.



## Keywords

capacity, public health nutrition, curricula, India, module content


## Abbreviations

Public Health Nutrition (PHN)

# Introduction

Globally, undernutrition is implicated in 45% of under-5 mortality [1]. The children who survive and are stunted or wasted, are less productive at school and in the labour force and are more likely to live in poverty [2]. The rate as well as absolute numbers of stunted and wasted children under the age of 5 in India is among the highest in the world [3]. Countries with high burdens of undernutrition are estimated to suffer a GDP loss of 8-11 percent [2, 4]. Malnutrition still continues to be India's biggest health hazard, according to the Global Nutrition Report 2017. India records 47 million children under 5 suffering from stunting and the highest number of women in the reproductive age group impacted by anaemia [5, 6]. Despite India's rapid economic growth this high rate of stunting is declining slowly, even compared to other countries in the region and it is holding India back in terms of reducing the suffering of its people and increasing economic growth rates [7].

The consensus on what needs to be done to accelerate declines in malnutrition is clear: a combination of nutrition-specific interventions that have nutrition status improvement as their primary goal, nutrition-sensitive interventions that have improvement of nutrition status as one of their key goals, and an enabling environment of strong poverty reduction and governance that supports multi-sector coordination, transparency and responsiveness [8, 9]. Despite this India records low coverage rates for nutrition interventions that would impact maternal and child malnutrition [6]. Vital for the implementation of this consensus set of activities is the ability to think holistically about nutrition, to learn from other sectors on how to prioritize, design and scale up nutrition actions, to engage with other policy interventions to expand the set of nutrition actions, and to engage with a number of stakeholders to influence them to mobilize additional resources and hold them to account for their action or inaction on malnutrition reduction [10, 11].

There are of course many determinants of malnutrition and these abilities are only one key input: the right to food and nutrition, political commitment at several levels, policy coherence, sustainable finance and adequate numbers of nutrition front line workers are examples of other key requirements for progress. But it is reasonable to expect that many but not all of these above abilities can be nurtured and developed further in the context of post-graduate nutrition programmes. This paper asks whether current nutrition

programmes in India are aligned well enough to these attributes. While there are some analyses of nutrition curricula in the US [12-14], we could find only one for India [15]. The current paper builds on Khandelwal et al [15] which was a situation analysis of postgraduate programmes in nutrition in South Asia. It found that of the identified 131 master's degree programmes, only one was in Public Health Nutrition (PHN). Further it reported that only 15 of the 131 programmes had modules in PHN in the entire South Asia region [15]. The focus on PHN is important because it is argued by many that such programmes are more attuned to current thinking on what to do to accelerate undernutrition reduction [11, 16, 17].

This paper goes beyond the analyses in Khandelwal et al [15, 18] in three ways. First, we focus on what is being taught. We go beyond the classification of modules by whether they are PHN or not and we classify modules by whether they are focused on (a) the immediate determinants of nutrition status or on nutrition specific interventions, (b) the underlying determinants of nutrition status or on nutrition sensitive interventions or (c) the basic determinants of nutrition status or on the factors that are important to create an enabling environment for nutrition status improvement. This initial classification is based solely on the name of the module. For the subset of modules for which reading lists and other module descriptors are available, we assess the accuracy of this name-based module classification.

Second, we focus on how the material is being taught. In the absence of data on pedagogy effectiveness and staff-student ratios (both of which we tried to obtain but could not), we focus on module reading lists: (a) how up to date are they (year of publication)? (b) What is the India/ non-India balance of authors cited? And (c) Where are the readings located—in books, journals, or grey materials? Our assumption is that more up to date papers, more diverse authorship and more publications in peer reviewed journals will reflect improved quality of reading materials available for learning.

Third, we focus on who is teaching the material. We classify the institutions by certain features (e.g. location, year of formation, faculty profile) and attempt to identify whether there are some institutional features that are associated with the types of modules offered and the attributes of reading lists noted.

## Materials and Methods

This study, as a subset of a larger study entitled "Capacity Building Initiatives in Public Health Nutrition" has been approved by the Ethics Committee of the institution where this study was carried out (TRC-IEC-179/13). The other parts of the larger study have been published (15,18) or in press (19).

Both quantitative and qualitative methods were employed to collect and analyse the available postgraduate nutrition curricula in India. First, we conducted a search for all nutrition related postgraduate programmes in the country. We had previously undertaken this exercise (15,18), but we repeated it in order to include any recent additions or modifications. We used a combination of search words and phrases within the freely available search engines Google, Google Scholar and PubMed: 'public health nutrition colleges', 'masters in public health nutrition', 'masters' in nutrition', 'nutrition colleges', 'nutrition institutes', 'home science', 'community nutrition', 'therapeutic nutrition', 'food and nutrition' in India. The original electronic searches were supplemented by the use of a snowball approach to get further information. We use the term 'programme' to refer to a curriculum leading to the awarding of a degree recognized by the University/Institution [20] while the term 'modules' refer to a thematic series of lectures or lessons for credit in a particular programme [21].

Second, after acquiring preliminary information on the names of universities/institutes/colleges[1] offering Masters degrees in nutrition, we scoured the institutional websites and collected detailed programme-level information such as: contact details, year of formation, faculty profiles, and detailed curricula including reading lists. The universities were contacted by phone when detailed information was not available on their websites. The details for all universities were compiled and entered into a database.

We then classified all modules in the programmes into 5 main categories (Table 1) based solely on the module name: Immediate/Direct, Underlying/Indirect, Enabling, Public Health Nutrition and Common to All. The connection between module titles and categories is based on the corresponding analyses in the Lancet Nutrition Series of 2013 [4, 8]. The PHN category could conceivably fit within the enabling environment as much of it focuses on the creation of enabling environments at the community level, but we wanted to see how focused

[1] Rather than repeat universities/institutes/colleges throughout the paper we use the shorthand "universities"

the curricula are towards PHN for reasons stated earlier. While modules on methods apply equally to all the other categories they were assigned to a separate category for clarity.

**Table 1: Classification of modules in 5 categories**

| Immediate determinants / Nutrition Specific interventions | Underlying determinants/ Nutrition Sensitive programmes | Basic determinants/ Enabling Environment features | Public Health Nutrition | Applicable at all Levels |
|---|---|---|---|---|
| Food Science (70)<br>Therapeutic Nutrition (198)<br><br>Microbiology and biotech related (54)<br>Food technology (8)<br><br>Biological related (120) | Social and behavioural determinants of health (7)<br><br>Public Health Systems (3) | Nutrition Education (9)<br><br>Government Policies/ Nutrition Programmes (9)<br><br>Human Development (5)<br><br>Rural Sociology (1) | Community nutrition/ Public nutrition/ Public health nutrition (46)<br>Malnutrition (3)<br>Management of Nutrition Problems in the Community (2)<br>Nutrition during Emergencies and Disaster Management (7)<br><br>Nutritional/Social epidemiology (6)<br><br>Women & Reproductive Health / Maternal & Child Nutrition &/OR parenthood nutrition (12) | Research Methods (117)<br><br>Pedagogy (1)<br><br>Workshop on social etiquette (2) |
| Total= 450 | Total=10 | Total= 24 | Total = 76 | Total= 120 |
| Grand Total= 680 | | | | |

Notes:

1. This table refers to the 680 modules from 64 programmes from 54 colleges
2. The figures in parentheses denote the frequency of occurrence of modules under each sub category. Each module can only be classified once.

We also analysed reading lists[2] from as many modules as possible. We characterized the lists using the following criteria.

- How recent they were. We would not expect all readings to be old or new, rather we were looking for a balance of readings in each period cited. No new readings would suggest a module that is out of touch and one with no older readings would suggest a module that is not properly rooted in its literature. We selected the following year cut-offs: <1975, 1975-84, 1985-94, 1995-2004 and after 2005.
- By whether lead author is based inside or outside India. Again, we were looking for a balance. If all the authors would be from within India, then it may suggest some important research is being overlooked. Similarly, if all the authors would be based outside India then some important in-country research and contextual understandings may likely be excluded.
- By whether there is a collaboration of Indian and international authors or not. Collaborations are likely to signal a strong blend of national and international perspectives and strengths and suggest a strong research environment.
- By impact factor of journal: <1, 1-5, and >5. Again, we were looking for a balance. High impact factor journals are, by definition, highly cited and therefore influential, but they are not necessarily broad in perspectives or sufficiently targeted to domestic policy audiences. Low impact factor (IF) journals could signal low quality or an unfashionable topic but may well be more influential among certain policy makers. The cut-offs used are arbitrary, but they reflect the range of IF factors in nutrition journals.
- By whether each publication is a peer reviewed journal, book, or grey material. Peer reviewed journal articles tend to require the most effort to get published, but the difficult process can discourage insightful analysis from researchers with fewer resources and institutional supports. Once more, we were looking for a balance.

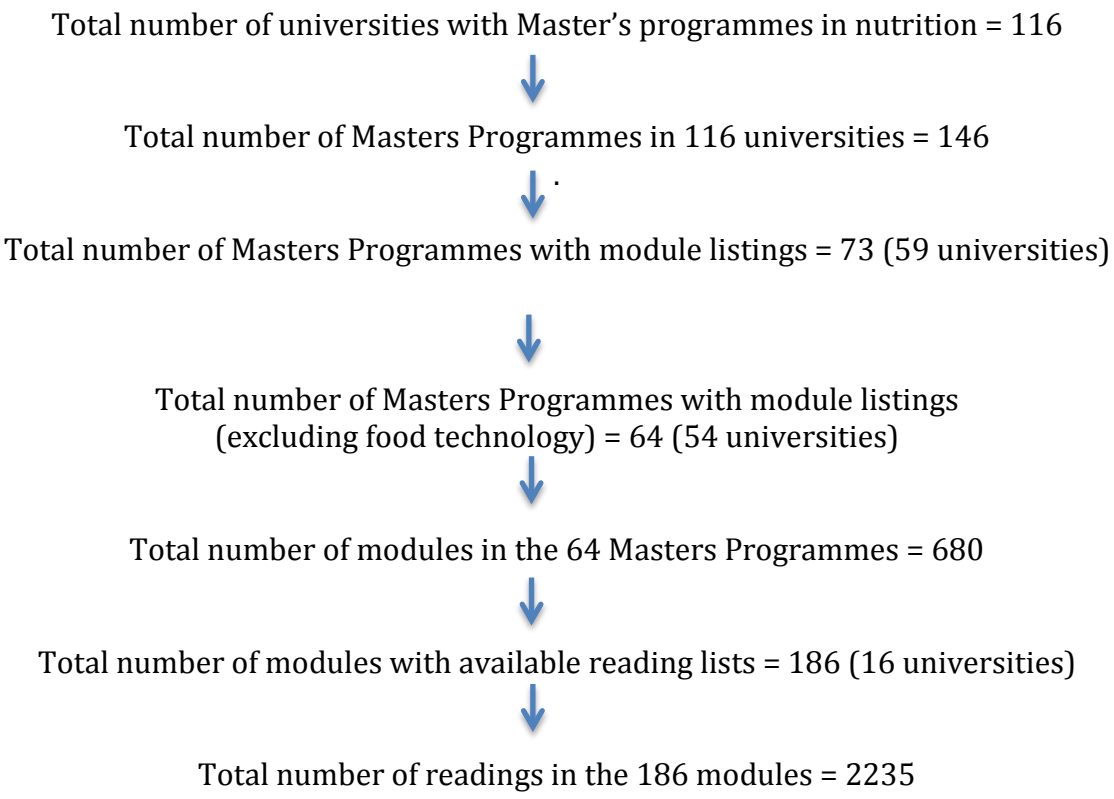
The classification exercise was conducted separately by 2 of the authors and then moderated between them.

[2] Ideally, we would also want to analyze the readings themselves, but this is beyond the scope of this paper.

# Results and Discussion

Our searches revealed 116 universities in India with 146 masters' programmes meeting the above key word criteria (Figure 1). From these, we managed to collect programme descriptions from 73 programmes in 59 universities. We excluded 9 masters programmes that were primarily food technology focused[3] from the analysis. Hence, we analysed 64 masters' programmes from 54 universities. A comprehensive list of all the modules being offered under these 64 masters' programs was prepared Table 1).

**Figure 1 Study schema depicting availability of curricula and reading lists**




[3]Specifically, those that were on: food technology, biotechnology, food engineering, food processing and technology, food science and technology, and nutrition and food processing

## General Description of Universities included in the programme analysis

Approximately three quarters of the universities with nutrition programmes were from the North and South regions of India. Those in the North constitute a slightly larger percent of the universities with programme descriptions and those in the South a slightly lower percent, but by and large our 54 universities with module listings are geographically representative of the universe 116 universities (Table 2). Just over half of the 54 universities were founded before 1970s. The North is the region with the highest proportion of new universities (post 1970) with available module listings (Table 3).

**Table 2: Regional Distribution of Colleges/Universities**

| **Zone**[4] | **Colleges and Universities for which module descriptions are available and Included (excluding food technology) N (%)** | **Colleges and Universities, Total N (%)** |
|---|---|---|
| Central | 1 (1.9) | 8 (6.9) |
| East | 5 (9.3) | 8 (6.9) |
| North | 23 (42.6) | 34 (29.3) |
| South | 17 (31.5) | 53 (45.7) |
| West | 8 (14.8) | 13 (11.2) |
| Total | 54 (100) | 116 (100) |

[4] East: colleges from West Bengal, Bihar, Orissa, Assam
South: Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Pondicherry
West: Maharashtra, Gujarat
North: Uttar Pradesh, Jammu& Kashmir, Haryana, HImachal Pradesh, Uttrakhand, Rajasthan
Central: Madhya Pradesh and Chhatisgarh

**Table 3: Year of Formation of Colleges/Universities**

| Year of formation | East | North | South | West | Central | Total |
|---|---|---|---|---|---|---|
| Before 1970 | 4 | 10 | 9 | 6 | 0 | 29 |
| 1970-1990 | 1 | 9 | 6 | 2 | 0 | 18 |
| After 1990 | 0 | 4 | 2 | 0 | 1 | 7 |
| ***Total*** | ***5*** | ***23*** | ***17*** | ***8*** | ***1*** | ***54*** |

Profiles of departmental faculty were available for 26 of the 54 universities. Sixteen of the 26 universities have faculties where over 50 percent of the staff have PhDs. More than 50 percent of the faculties contained no professors (Table 4).

**Table 4: Faculty Profile**

| Proportion of faculties with PhD degrees | No. of colleges |
|---|---|
| No PhD degree | 2 |
| 0 to <50 % of faculty have PhD's | 8 |
| >50 % of faculty have PhD's | 16 |
| Total | 26 |

| Proportion of professors among faculties | No. of colleges |
|---|---|
| No professors | 17 |
| 0 to <50 % of faculty are professors | 5 |
| >50 % of faculty are professors | 6 |
| Total | 26 |

## Classification of modules by module name

We present the classification of the 680 modules from the 64 programmes (across 54 universities) into 5 broad categories (Table 1): nutrition specific (and corresponding immediate determinant level), nutrition sensitive (underlying determinant level), enabling environment (basic determinant level), public health nutrition, and those applicable at all levels (e.g. research methods). By far the largest set of modules is under the broad category

of nutrition specific intervention/immediate determinant, with 451 of the 680 modules. Most of these were either determinant related (food science and biological) or if intervention based they were mainly focused on therapeutic nutrition (treatment rather than prevention). In contrast only 10 of the 680 modules could be classified as nutrition sensitive intervention/underlying determinant-focused, but all within the health field as opposed to, say, agriculture or social protection. We then combined underlying, basic and PHN categories and explored whether there were any differences in their representation by region or age of university. We found no significant differences in the proportion of these modules (16% overall) by region (Table 5a) although the Universities founded before 1900 tended to have a higher proportion of them (27% versus 16% overall -- see Table 5b). Approximately 11% of the 680 modules are classified as Public Health Nutrition: as a proportion of total modules, this is relatively low compared to some other developing countries [13]. Neighbouring countries have fewer absolute numbers of PHN offerings but as a proportion to their overall nutrition modules, PHN features more prominently. For example, Bangladesh has 4 nutrition universities 3 of which (75%) had at least one component of PHN either as part of a module or module. Nepal has 25% (1/4) while Sri Lanka offers 33% (1/3) PHN modules [15].

**Table 5a: Modules Classified Under the Broad Categories by the Location of Universities**

| | Immediate / Nutrition Specific | Underlying/basic/PHN (% of total) | Applicable at all levels | N |
|---|---|---|---|---|
| Central | 6 | 1 (10) | 3 | 10 |
| East | 47 | 11 (16) | 9 | 67 |
| North | 199 | 52 (16) | 57 | 308 |
| South | 134 | 25 (14) | 26 | 185 |
| West | 64 | 21 (19) | 25 | 110 |
| All | 450 | 110 (16) | 120 | 680 |

**Table 5b: Modules Classified Under the Broad Categories by the Year of Formation of Universities**

| | Immediate/ Nutrition Specific | Underlying/ basic/ PHN (% of total) | Applicable at all levels | N |
|---|---|---|---|---|
| Before 1900 | 37 | 17(27) | 7 | 61 |
| 1901- 1970 | 188 | 35 (13) | 48 | 271 |
| After 1971 | 225 | 58 (17) | 65 | 348 |
| TOTAL | 450 | 110 (16) | 120 | 680 |

To determine the accuracy of classifying modules by module name rather than by module content, we selected the modules for which we do have reading lists and then based on an analysis of the reading lists, reclassified them to the 5 broad categories and compared the results from the two methods for the 186 universities that have both sets of data (Table 6). The differences in terms of classification are small which gives us some confidence about classifying modules based solely on module names, as in Table 1.

**Table 6: Classifying Modules in Two Different Ways**

| **Module type** | **Classified by module name** | **Classified by reading lists** |
|---|---|---|
| Nutrition specific intervention/immediate determinants | 120 | 132 |
| Nutrition sensitive/underlying determinants | 10 | 3 |
| Enabling environment/basic determinants | 25 | 19 |
| Public Health Nutrition | 10 | 8 |
| Applicable at all levels | 21 | 10 |
| Not clear (incomplete) | _ | 14 |
| **Total** | 186 | 186 |

## Attributes of Reading Lists

The 186 modules (from 16 universities) for which we had reading lists, generated 2235 readings (Figure). Of these readings, we classified 1627 (73%) as focused on nutrition specific/immediate determinant levels. This should not be surprising given that 63% of the 680 total modules were classified as nutrition specific/immediate, based on module name. Other attributes of the readings are presented in Table 8. The lists often lacked details on the readings, hence the different sample sizes for the different attributes. Nearly 87% of the suggested readings consisted of books as opposed to peer-reviewed journal articles (4.2%) and other materials (9%). Only 9.2% of the readings are listed as 2005 or later, signifying a rather dated set of readings. In terms of authorship, 38% of readings have lead authors from India. This seems low, but is even lower when one considers how few collaborations there are between Indian and non-Indian authors (1.3% of all readings). In terms of the impact factor of journals, of the 93 journal articles cited, the bulk of them (43%) are from journals with impact factors between 1 and 5, which is in the middle range of nutrition journals.[5]

**Table 7: Classification of the 2235 Readings (from 186 reading lists from the 16 colleges/universities)**

| **Classification into the following groups, based on module content** | **Number of readings** |
|---|---|
| Immediate/Nutrition Specific | *1627* |
| Underlying/Nutrition Sensitive | *70* |
| Basic/Enabling Environment | *202* |
| Public Health Nutrition | *90* |
| Applicable at all Levels | *120* |
| Not clear (incomplete) | *126* |
| **Total** | ***2235*** |

[5] Examples of the impact factors (as of Sept 2014 http://impactfactor.weebly.com/nutrition.html) for nutrition – related journals are: The Lancet (39), BMJ (17.1), American J. of Clinical Nutrition (6.5), Nutrition Reviews (4.6), J. Nutrition (4.19), British J. Nutrition (3.3) European Journal of Clinical Nutrition (2.6), Food Policy (2.2) and Food and Nutrition Policy (2.1).

**Table 8: Detailed Attributes of the Readings**

| **Attribute of Reading List** | **N** | **%** |
|---|---|---|
| **Total no. of readings** | **2235** | **100** |
| Books | 1940 | 86.8 |
| Peer reviewed journals | 93 | 4.2 |
| Grey material, reports and other manuals | 202 | 9 |
| Total | 2235 | 100 |
| ***Year of publication*** | | |
| 2005 and beyond | 206 | 9.2 |
| 1995-2004 | 665 | 36.2 |
| 1985-1994 | 448 | 24.4 |
| 1975-1984 | 380 | 20.7 |
| <1975 | 187 | 10.2 |
| Total | 2038 | 100 |
| ***Authorship*** | | |
| Readings, lead author outside of India | 1340 | 72.4 |
| Lead author from India | 511 | 38.1 |
| Total | 1851* | 100 |
| ***Collaborations of Indian and International authors*** | | |
| Yes | 24 | 1.3 |
| No | 1817 | 98.7 |
| Total | 1841* | 100 |
| ***In journals with impact factors*** | | |
| >5 | 29 | 31.2 |
| >1 to <5 | 40 | 43 |
| <1 | 24 | 25.8 |
| Total no. readings in journals | 93 | 100 |

*N varies due to missing information

Table 9 explores these data further by listing the mean reading list data for each of the 16 universities for which reading lists are available. The representation of modules in the immediate and nutrition specific category ranges from 39.5% to 88.8%. The average percent of readings published after 2005 ranges from 0% to 29.6% and the average percent of readings in journal articles ranges from 0% to 24%. So clearly there is quite a high degree of variation in module readings. Given the small sample sizes we could not find any significant differences in these percentages by year of university formation (Table 10) or by whether a university is public or private (Table 11).

**Table 9: University by University Characteristics of Nutrition Module Readings**

| University/ college (anonymous) | Public/ Private | Percent of university/college's readings | | | |
|---|---|---|---|---|---|
| | | Immediate category | Rest (underlying/ others) | Published in 2005 and beyond | Journal articles |
| 1 | Private | 77.6 | 22.4 | 2.4 | 2.4 |
| 2 | Private | 80.5 | 19.5 | 8.8 | 3.6 |
| 3 | Public | 67.7 | 32.3 | 29.6 | 1.1 |
| 4 | Public | 75.0 | 25.0 | 0.0 | 24.0 |
| 5 | Public | 69.2 | 30.8 | 7.7 | 0.0 |
| 6 | Public | 76.9 | 23.1 | 0.0 | 0.0 |
| 7 | Public | 67.4 | 32.6 | 11.8 | 2.6 |
| 8 | Private | 82.0 | 18.0 | 11.0 | 5.8 |
| 9 | Public | 60.6 | 39.4 | 10.2 | 0.0 |
| 10 | Public | 88.8 | 11.2 | 11.8 | 0.0 |
| 11 | Public | 39.5 | 60.5 | 14.0 | 2.3 |
| 12 | Public | 46.2 | 53.8 | 1.9 | 0.0 |
| 13 | Private | 69.2 | 30.8 | 2.2 | 1.1 |
| 14 | Public | 76.7 | 23.3 | 9.3 | 0.0 |
| 15 | Public | 64.7 | 35.3 | 12.9 | 1.2 |
| 16 | Public | 77.8 | 22.2 | 2.1 | 7.6 |
| **Average across all 16** | **4 private and 12 public** | **72.8% (1627/2235)** | **27.2 % (608/2235)** | **9.2% (206/2235)** | **4.2% (93/2235)** |

**Table 10: Reading Classified by Year of Formation**

| Year of formation | Percentage in underlying/others | Percentage published in 2005 or more recently | Percentage published in journals | N |
|---|---|---|---|---|
| Before 1970 | 29.7 | 9.9 | 3.3 | 11 |
| 1970-1990 | 29.5 | 5.5 | 3.2 | 5 |

(PS: The third category ie. after 1990 is missing for these 16 universities)

**Table 11: Reading List Classified by Type of University**

| Type of university | Percentage in underlying/others | Published in 2005 or more recently | Percentage published in journals | N |
|---|---|---|---|---|
| Public | 32.5 | 9.3 | 3.2 | 12 |
| Private | 21.2 | 6.1 | 3.2 | 4 |

# Discussion

Based on the set of 54 universities, 64 programmes and 680 modules analysed in this paper we find that what is being taught in Indian universities on nutrition is:

1. Skewed towards immediate determinants of undernutrition and related interventions and does not pay enough attention to the underlying determinants of undernutrition such as food security, water and sanitation, income, education and women's empowerment. In addition, only 76 out of 680 nutrition modules are listed as public health nutrition. This is thought by many to be one of the most modern branches of nutrition, bringing together determinants at different levels in a holistic, action oriented manner (22, 23).
2. Dated and over reliant on books. There are very few readings listed from the past 10 years. Very few peer reviewed journal articles are included in reading lists, although the journals that are listed have good impact factors.

3. Not benefitting from collaborations between Indian and non-Indian authors, being too reliant on non-Indian authors working in isolation from Indian authors.
4. Not sufficiently supported by Professors. Over half of all faculties do not contain a single Professor. Professors are not necessarily the best teachers and may not be the most up to date in the literature, but their presence can attract younger researchers and they are better equipped to allocate for resources for nutrition within University administrations.

It is beyond the scope of this paper to try to understand why certain universities do better than others in these domains. Despite our best efforts, data were available for module analysis of only half of the courses identified and reading list analysis is based on a quarter of modules and <15% of universities. Current sample sizes (16 universities for module readings) limit meaningful statistical analysis. Either the sample has to be increased or qualitative work needs to be undertaken. This will be the focus of future work. Further, the present study assumed that course content will build appropriate competencies. Although curricula analysis sheds light on the potential competencies it can help to build, the importance of appropriate pedagogies for imparting practice-based training cannot be undermined. The readers will need to therefore view the results in the light of these limitations.

## Conclusion

We conclude that what is being taught in Indian universities about malnutrition is dated, skewed towards the immediate level of determinants, and over reliant on books. Too many faculties contain no professors. There are too few international collaborations involving Indian researchers. Interviews with academics and public health professionals from research institutes, international organisations, medical institutions and public health departments in India highlight the weak leadership, poor quality of training in public health nutrition, lack of sound mentorship to inspire thoughts and action and the poor quality of research to inform policies [24].

Robust and high quality educational initiatives from the universities need to be supplemented with strong government leadership and resource commitment to creating and nurturing the PHN cadre (4, 16, 22, 23, 25). Indian resources need to be invested in Indian-

led nutrition research programmes which foster international collaborations, in nutrition faculty development and in curriculum revisions.

It is our view that business as usual in postgraduate nutrition education is not inspiring or equipping the new generation of researchers and practitioners to accelerate malnutrition reduction. Unless this approach to postgraduate education changes, we believe it will continue to be an important brake on progress in fighting all forms of malnutrition in India.

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## Conflict of interest

No financial interest or any conflict of interest exists.

## References

1. Horton R and S Lo. Nutrition: a quintessential sustainable development goal. Lancet 2013; 382:371-2.
2. Hoddinott J, Alderman H, NABehrman J R, Haddad L, Horton S. The economic rationale for investing in stunting reduction. Matern Child Nutr 2013;9:69-82.
3. International Food Policy Research Institute. 2016. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. Washington, DC. Available at: https://data.unicef.org/wp-content/uploads/2016/06/130565-1.pdf Accessed on 23 Nov 2017.
4. Gillespie S, Haddad L, Mannar V, Menon P, Nisbett N. The politics of reducing malnutrition: building commitment and accelerating progress. Lancet 2013;382:552-69.

5. Tripathi S. Despite 19% decline in childhood stunting, India's battle against malnutrition still looks bleak. First post. March 29, 2016. (http://www.firstpost.com/living/despite-19-decline-in-childhood-stunting-indias-battle-against-malnutrition-still-looks-bleak-2701006.html)
6. Development Initiatives, 2017. Global Nutrition Report 2017: Nourishing the SDGs. Bristol, UK: Development Initiatives. (http://www.globalnutritionreport.org/)
7. Haddad L. India's Malnutrition Enigmas: Why They Must Not Be a Distraction from Action 2013; Institute of Development Studies.
8. Ruel MT and Alderman H. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? Lancet 2013;382:536-51.
9. Menon P, Covic N M, Harrigan P B, Horton S E, Kazi N M, Lamstein S, Neufeld L, Oakley E, Pelletier D. Strengthening implementation and utilization of nutrition interventions through research: a framework and research agenda. Ann N Y Acad Sci 2014.
10. Baillie E, Bjarnholt C, Gruber M, Hughes R. A capacity-building conceptual framework for public health nutrition practice. Public Health Nutr 2009;12:1031-8.
11. Shrimpton R, Hughes R, Recine E, Mason JB, Sanders D, Marks GC, Margetts B. Nutrition capacity development: a practice framework. Public Health Nutr 2014;17:682-8.
12. Adams KM, Lindell KC, Kohlmeier M, Zeisel SH. Status of nutrition education in medical schools. Am J Clin Nutr 2006;83:941s-944s.
13. Lindell KC, Adams KM, Kohlmeier M, Zeisel SH. The evolution of Nutrition in Medicine, a computer-assisted nutrition curriculum. Am J Clin Nutr 2006;83:956s-962s.
14. Adams KM, Kohlmeier M, Powell M, Zeisel SH. Nutrition in medicine: nutrition education for medical students and residents. Nutr Clin Pract 2010;25:471-80.
15. Khandelwal S et al., .Postgraduate education in nutrition in south Asia: a huge mismatch between investments and needs. BMC Med Educ 2014;14:3.
16. Hughes R. Time for leadership development interventions in the public health nutrition workforce. Public Health Nutr 2009;12:1029.

17. Tomlinson M, Rahman A, Sanders D, Maselko J, Rotheram-Borus MJ.Leveraging paraprofessionals and family strengths to improve coverage and penetration of nutrition and early child development services. Ann N Y Acad Sci 2014;1308:162-71.
18. Khandelwal S. et al.. Mapping of nutrition teaching and training initiatives in India: the need for Public Health Nutrition. Public Health Nutr 2012;15:2020-5.
19. Khandelwal S, Srivastava A, Paul T, Nisbett N, Laxminarayan R. Exploring Perspectives on Public Health Nutrition in India: A Qualitative Analysis. ACCEPTED (in press) National Journal of Public health 2017
20. Maryland. U.o. Academic Programs. ; Available at: https://www.provost.umd.edu/PCC_DOCUMENTS/I_Academic_Programs.htm Accessed 23 Nov 2017
21. Dictionaries.O. 2017 .Available at: https://en.oxforddictionaries.com/definition/module Accessed 23 Nov 2017.
22. Lawrence MA, Galal O, Margetts BM, Yngve A. Building global alliances for public health nutrition training. Nutr Rev. 2009;67 Suppl 1:S66-8.
23. Shrimpton R, Miller M, Nishida C, Delisle H, Spies L, Blaney S. Monitoring public health nutrition capacity development. World Nutrition. 2017(1):62-70%V 8.
24. Nisbett N, Wach E, Haddad L, Arifeen S E. What are the Factors Enabling and Constraining Effective Leaders in Nutrition? A Four Country Study. Available at: https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/4121/Wp447.pdf?sequence=1 Accessed 23 Nov 2017.
25. LaLonde RJ. Building capacity to evaluate health and nutrition programs. J Public Health Manag Pract 2009;15:90-9.