Research Article

Assessment of nutritional status among under-five children based on the nutritional indices in rural area of Bareilly for screening undernutrition

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Abstract

Background: Good nutrition is not only a determinant of development but also an outcome. Anthropometry is an accepted method for defining the nutritional status of children, which require relatively simple equipment, and can be carried out by non-technical personnel after a short period of training and standardization. However, the standard against which nutritional status of the sample population should be determined has been controversial.

Objective: To assess nutritional status among under-five children based on the nutritional indices in rural area of Bareilly for screening undernutrition.

Materials and Methods: A community-based cross-sectional study was conducted in the catchment area of Rural Health and Training Center in Rohilkhand Medical College and Hospital among 398 under-five children using a schedule to find the nutritional indices such as Jeffie's ratio, Arnold index, and weight for age according to IAP (modified Gomez) classification to define nutritional status. Data were entered and analyzed in SPSS, and receiver-operating characteristic (ROC) curves (sensitivity vs. 1 – specificity) were calculated for all the abovementioned indices.

Result: Using height for age, Arnold index, and Jeffie's ratio as the nutritional indices, 63%, 51.7%, and 26.1% children were malnourished, respectively. When the sensitivity and specificity of the nutritional indices were considered, maximum sensitivity was achieved using height for age as the criteria while maximum specificity attained by the use of Arnold index. When using ROC curve, height for age index was the best assessment tool for malnutrition. The correlation between the various indices taking IAP as the gold standard was calculated; *P*-values were 0.004, 0.000, and 0.000, respectively (<0.01 showing highly significant correlation).

Conclusion: Genuine and appropriate assessment of the children using a valid tool can help to eradicate this emerging problem of malnutrition among our future generation.

KEY WORDS: Arnold index, Jeffie's ratio, malnutrition

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Introduction

Nutritional screening is a significant measure of a community health-care system, and the main attention deals with in finding the mild and moderate grades of protein–energy malnutrition (PEM) as nutritional interference in such cases can be imposed by the community health workers. Community health and nutrition can be assessed by their nutritional

status, as it is a sensitive indicator. In determining the health status, particularly in children, nutritional status plays an important role. Nutritional deficiencies result in several morbidities that, in turn, may lead to elevated mortality. Undernutrition is a known factor closely associated with child mortality rates.[1,2] Previous research has shown that children aged up to 5 years constitute the highest risk group for PEM.[3] An analysis of six longitudinal studies by World Health Organization (WHO) showed a sturdy relationship between severity of weight for age deficits and mortality rates: 54% deaths of under-five children in developing countries were accompanied by low weight for age.[4] Efforts to decrease child mortality in developing countries by selective primary health care have been attentive chiefly on the prevention and control of particular infectious diseases, with reduced effort being given to enhancing children's underlying nutritional status.[5]

Persistent malnutrition leads not only to extensive failure toward in achieving the first Millennium Development Goal (MDG) of having poverty and hunger but also weakens the efforts to achieve MDG pertaining to maternal and child health.[6] Malnutrition and hunger are directly proportional to ill-health and poverty.[7] Good nutrition is not only a determinant of development but also an outcome. The two-way relationship between nutrition and development applies equally to malnutrition and poverty.

The paucity of community-based data on nutritional status of preschool children dictates the need for such research work.

Materials and Methods

The study was carried out among 398 children in a rural population in the field practicing area of Rural Health and Training Center, Department of Community Medicine of Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India, located at a distance of 12 km from the college. A list of villages in a defined geographical area was prepared. From this list, villages were randomly selected for the study. Data were collected by visiting every household selected through random sampling using a schedule. Children who were sick or had gone away temporarily were visited again.

In preparation for the survey, six field workers underwent 5 days of field training and standardization in anthropometric techniques. The standardization consisted of repeated exercises in which each worker measured the height, weight, and mid-upper arm circumference of 10 children, turned in the results, and then reassessed the same children in a different order. Supine length of children younger than 2 years and standing height of children aged 2–5 years was measured as described by Jelliffe[3] using equipment adapted to field use. Length and height were measured to the nearest 0.1 cm using a portable wooden measuring board. Weight was measured to the nearest 0.1 kg using a Salter model 235 scale with the child suspended in a cloth sling.[8] Shoes and outer clothing were removed before weighing. Mid-upper arm (midpoint between acromion and olecranon) circumference of the left arm was measured to the nearest 0.1 cm using an insertion-type tape.[9] Head circumference was measured by placing one end of tape on the glabella and placing it around the head over the opisthocranion point and again meeting at glabella. Various anthropometric criteria such as Jeffie's ratio, Arnold index, height for age to define stunting, and weight for age according to IAP (modified Gomez) classification were used to define nutritional status.

Birth records maintained by anganwadi workers were used to determine the age. In about 10% of the cases where records were not available, caretakers were interviewed to find out the age of the child. A "desi" calendar and local events calendar was used for facilitating age ascertainment. Age was computed in complete months. Children who were born before the middle of the month were counted in previous month while those who were born at or beyond middle of the month were counted in the next month.

Result

The comparison of the nutritional indices showed that the prevalence of malnutrition according to IAP (modified Gomez) to be 48.2% while using height for age as the nutritional index, 19.3% children were severely malnourished, followed by 43.7% as mild to moderate malnourished, and rest were normal [Table 1]. Similarly, Arnold index as the nutritional index was able to detect 25.1% children as severely malnourished, 26.6.1% as mild to moderate malnourished, and rest as normal [Table 2]. Jeffie's ratio showed that 26.1% as severely malnourished and 61.1% as mild to moderate malnourished, with rest being normal [Tables 3 and 4].

As far as the sensitivity and specificity of the nutritional indices were concerned, maximum sensitivity was achieved using height for age as the criteria followed by Arnold and Jeffie's ratio while maximum specificity was attained by the use of Arnold index, followed by Jeffie's ratio and height for age, which showed the least specificity [Table 5]. Using receiver-operating characteristic (ROC) curve, the area under the curve was 0.630, 0.578, and 0.653 for Arnold index, Jeffie's ratio, and height for age, respectively, which indicates that height for age is the best index for the assessment of malnutrition showing maximum area under the curve. The correlation between the various indices taking IAP as the gold standard shows correlation coefficient as 0.156, 0.0260, and 0.389 for Jeffie's ratio, Arnold index, and height for age, respectively, and the *P*-values were 0.004, 0.000, and 0.000, respectively, which being less than 0.01, showing its high significance.

Discussion

Height for age index is the best assessment tool for malnutrition using ROC curve. Assessment of malnutrition according to the various indices was 51.7% using the Arnold index and 63% using height for age. This is comparable with studies done by Mishra and Mishra,[10] which showed a higher

Table 1: Grading of the under-five children according to height/age index

Stunting (height for age %)	Frequency	Percentage
<85	77	19.3
92.5–85	174	43.7
>92.5	147	36.9
Total	398	100.0

Table 2: Grading of the under-five children according to Arnold index

Arnold index	Frequency	Percentage
<12.5	100	25.1
12.5–13.5	106	26.6
13.5–17	192	48.2
Total	398	100.0

Table 3: Grading of the under-five children according to Jeffie's ratio

Jeffie's ratio	Frequency	Percentage
<1 (age < 1 year)	30	7.5
>1 (age < 1 year)	21	5.3
<1 (age > 1 year)	243	61.1
>1 (age > 1 year)	104	26.1
Total	398	100.0

Table 4: Distribution of wasting and stunting among the under-five children

	Wasted, *n* (%)	Not wasted, *n* (%)
Stunted	18 (36.73)	174 (49.8)
Not Stunted	31 (63.2)	175 (50.1)
Total	49 (100)	349 (100)

Table 5: Validity of the nutritional indices for the detection of undernutrition

Indices	Sensitivity (%)	Specificity (%)	Positive predictive value	Negative predictive value	χ^2	*P*
Jeffie's ratio	53.4	62.1	56.72963	58.88411	2.424	0.120
Arnold index	57.9	68.0	62.737	63.44815	3.138	0.076
Stunting (height/age)	92.7	37.9	58.14166	84.80139	100.503	0.000

percentage of children belonging to undernourished class as per mid-arm circumference (27% and 31% in urban and rural, respectively) and lowest in respect of Gomez classification (10% and 12%, respectively). According to the study done by Mitra et al.,[11] there were 12.39% malnourished using the Arnold's index as a tool to screen malnutrition and 14.87% were declared stunted according to the height for age criteria. The prevalence of the types of malnutrition was high in the study conducted by Kumar et al.,[12] which showed the prevalence as being 49.6% and 48.8% for underweight and stunting, respectively.

The basic strength of this study is a step toward finding an appropriate tool for screening malnutrition. The only limitation is that the study needs to be conducted on a large group of population so that the results can be generalized to increase the external validity.

The indexed study makes it evident that various nutritional indices used such as height for age, Arnold's index, and Jeffie's ratio need to be prioritized as a screening tool.

From the above-presented picture, it becomes evident that future efforts should be directed toward establishing more uniform and standard classification systems for a particular population group that will enable comparison of results.

Conclusion

Screening of the malnourished children using the most appropriate nutritional indices as the tool is a big challenge in this era of public health. The best criteria for the assessment of malnutrition though this research work comes out to be height for age. This stringently requires the strengthening and application of the best screening tool in the various nutritional programs to improve the health status of our children.

References

1. Pellitier DL, Frongillo EA Jr, Schroeder DG, Habicht JP. The effects of malnutrition on child mortality in developing countries. Bull World Health Organ 1995;73:443–8.
2. Scrimshaw NS, Taylor CE, Gorden JE. *Interactions of Nutrition and Infection*. WHO Monograph Series 57, Geneva: World Health Organization, 1968. pp. 3–329.
3. Jelliffe DB. *The Assessment of the Nutritional Status of the Community.* Geneva: WHO, 1966. Monograph Series 53.
4. *Physical Status: The Use and Interpretation of Anthropometry*. Report of a WHO Expert Committee. Geneva: World Health Organization, 1995. Technical Report Series 854. pp. 1–452.
5. Walsh JA, Warren KS. Selective primary health care—an interim strategy for disease control in developing countries. N Engl J Med 1979;301:967–74.
6. Sachs JD. Excerpt "Economics and nutrition: how do they intersect?" *SCN News*. July 28, 2004.
7. Bangladesh: Two million children suffer from malnutrition. *Integrated Regional Information Networks (IRIN)*. April 9, 2009.
8. Morley D. *Paediatric Priorities in the Developing World*. London: Butterworth and Co., 1973. p. 141.
9. Zerfas AJ. The insertion tape: a new circumference tape for use in nutritional assessment. Am J Clin Nutr 1975;28:782–7.

10. Mishra BK, Mishra S. Nutritional anthropometry and preschool child feeding practices in working mothers of central Orissa. Stud. Home Comm Sci 2007;1(2):139–44.
11. Mitra M, Tiwari A, Ghosh R, Bharati P. Dimensions and causes of child malnutrition: a study of preschool children of Raipur, Chhattisgarh, India. Anthropologist 2004;6(4):247–52.
12. Kumar R, Aggarwal AK, Iyengar SD. Nutritional status of children: validity of mid-upper arm circumference for screening undernutrition. Indian Pediatr 1996;33:189–96.

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