

Original Research Article

Assessment of nutritional status of children aged 34-92 months using various nutritional status indices and validity of age independent indices

Nayantara R. Gandra¹, Kalavathy Jasmine Masillamoni^{2*}

¹Department of Pediatrics, Ayaan Institute of Medical Sciences and Teaching Hospital, Moinabad, Hyderabad, Telangana, India

²Department of Pediatrics, Shadan Institute of Medical Sciences, Peerancheru, Hyderabad, Telangana, India

Received: 13 September 2019

Accepted: 05 October 2019

*Correspondence:

Dr. Kalavathy Jasmine Masillamoni,

E-mail: kalaprsd@yahoo.co.in

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Even though there are many programs run by Government to tackle the problem of malnutrition in India, problem of malnutrition is still there. Malnutrition leads to infections and even can lead to death of child in severe cases. The mortality rate is very high compared to other countries. The objective of the study to study validity of age independent various nutritional status indices in comparison to gold standard of weight for age

Methods: Present study was institution based cross sectional study carried out at SDA high school, from January 2019 to July 2019 among 58 school children aged 34-92 months of age. Anthropometric measurements like weight, height, head circumference, chest circumference, mid arm circumference were recorded as per the standard guidelines. Weight for height, weight of age, Kanawati Index, Jelliffe's ratio, Rao index, and Dugdales index was calculated. Gold standard used was weight for age. Sensitivity, specificity, positive predictive value and negative predictive value were calculated for these indices.

Results: Majority of the children belonged to 48-60 months and 61-72 months i.e. 29.3% each. Males were more than females. Prevalence of malnutrition was 60.3%, 48.3%, 51.7%, 91.4%, and 56.8% based on weight for age, Kanawati index, Rao index, Jelliffe's ratio and Dugdale's index respectively. Dugdale's index was found to have high sensitivity (85.7%) and specificity (86.9%) compared to all other indices.

Conclusions: Among age independent indices of nutritional status available, Dugdales index can be used as it has been found that it has remarkably higher sensitivity and specificity compared to other age independent indices of nutritional status.

Keywords: Age independent Comparison, Gold standard, Nutritional status indices, Validity, Weight for age

INTRODUCTION

Community nutrition problem is reflected by the child nutritional status. As per the data it has been said that 48% of the Indian children are stunted and the prevalence of the underweight is 43%. The prevalence of severe underweight is 16% and the prevalence of severe stunting is 24%. The prevalence of wasting among children less than five years is 20%. As per other data and study source

it has been said that the prevalence of underweight was 71.5%, the prevalence of stunting was 70.1% and the prevalence of wasting was 62.7%.^{1,2}

Child growth is commonly affected by two major factors like infections and malnutrition. Infections in children are mainly due to insufficient food intake. It has been estimated that globally >26,000 children below the age of the five years die every day. Most of these children are

from developing countries. Various indices are available to assess the nutritional status of the child like Weight as per age, height as per age, weight as per height etc. The overall nutrition status of the childhood life is reflected in height for age. Weight as per height reflects the recent influence on the nutritional status of the child. The overall and recent changes are reflected by weight as per age.^{3,4}

Even though there are many programs run by Government to tackle the problem of malnutrition in India, the problem of malnutrition is still there. Malnutrition leads to infections and even can lead to death of the child in severe cases. The mortality rate is very high compared to other countries.⁵

Present study was carried out to study validity of age independent various nutritional status indices in comparison to gold standard of weight for age.

METHODS

A cross sectional study conducted at SDA high school, Abids, Hyderabad, Telangana, India. The study was carried out from January 2019 to July 2019. This includes the topic planning, Institute Ethics Committee clearance, data collection, and data analysis and article preparation. The study was carried out among 58 school children aged 34-92 months of age.

Inclusion criteria

- School children present on the day of data collection
- School teachers willing to allow their students to participate in the present study

Exclusion criteria

- Students who are not cooperative for anthropometric measurements
- Any child with medical complaints at the time of survey

First of all the permission was taken from the Institute Ethics Committee. One school name SDA high school, Abids was selected. The school was having classes from LKG to X standard. Permission from Principal of the school was taken after explaining the nature of the study. Permission was also obtained from the individual class teacher. If they were busy and could not give permission, that class was omitted.

All present and eligible children were examined as per the protocol and the data was entered in the pre-designed, pre tested, study questionnaire. Baseline details like age, sex, residence, religion, were recorded with the help of teacher.

Anthropometric measurements like weight, height, head circumference, chest circumference, mid arm

circumference was recorded as per the standard guidelines.

Statistical methods

Weight for height, weight of age, Kanawati Index, Jelliffe’s ratio, Rao index, and Dugdales index was calculated. The gold standard used was weight for age. Sensitivity, specificity, positive predictive value and negative predictive value were calculated for Kanawati Index, Jelliffe’s ratio, Rao index, Dugdales index.

RESULTS

Distribution of study subjects as per demographic variables. Majority of the children were in the age group of 48-60 months and 61-72 months i.e. 29.3% each.

There were only eight children in the age group of 73-92 months. Males were more than females. This may be due to more presence of male children in the school at the time of survey. 70.7% of the children were Muslim followed by 25.9% of Hindu children and there were only two children who were Christian.(Table 1)

Table 1: Distribution of study subjects as per demographic variables.

Demographic variable	Number	%	
Age (months)	34-47	16	27.6
	48-60	17	29.3
	61-72	17	29.3
	73-92	08	13.8
Sex	Male	40	71
	Female	18	31
Religion	Hindu	15	25.9
	Muslim	41	70.7
	Christian	02	3.4

Table 2: The knowledge about symptoms of rabies among the study population (n=52).

Weight for age percentile	Category of malnutrition	Number	%
< 50	Malnutrition	35	60.3
> 50	Normal	23	39.7
Total		58	100

Distribution of children as per weight for age. Weight of age more than 50th percentile was taken as normal nutritional status of the child and weight for age less than 50th percentile was considered as malnutrition.

Accordingly, it has been found that the prevalence of malnutrition was 60.3% i.e. 35 out of 58 studied children were found to have malnutrition. Only 23 out of 58 studied children were found to have normal nutritional status. (Table 2)

Distribution of children as per Kanawati index. As per the Kanawati index 30 children i.e. 51.7% were found to have normal nutritional status. 28 children out of 58 i.e. 48.3% were found to have mild malnutrition. No child was found to have moderate malnutrition and no child was found to have severe malnutrition.(Table 3)

Table 3: Distribution of children as per kanawati index.

Kanawati index	Category of malnutrition	Number	%
< 0.25	Severe malnutrition	0	0
0.26-0.279	Moderate malnutrition	0	0
0.28-0.31	Mild malnutrition	28	48.3
> 0.32	Normal	30	51.7
Total		58	100

Table 4: Distribution of children as per Rao index.

Rao index	Category of malnutrition	Number	%
< 0.13	Severe malnutrition	21	36.2
0.13-0.139	Mild to moderate malnutrition	09	15.5
> 0.14	Normal	28	48.3
Total		58	100

Distribution of children as per Rao index. As per Rao index it has been observed that 28 children out of 58 studied, i.e. 48.3% were found to have normal nutritional status. 9 out of 58 studied children, i.e. 15.5% were found to have Mild to moderate malnutrition. 21 out of 58

Table 7: Sensitivity and specificity of Kanawati index, Rao index, Dugdale’s index and jeliffe’s ratio against gold standard of weight for age.

Index	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Kanawati index	62.9	73.9	78.6	56.7
Rao index	68.6	73.9	80	60.7
Dugdale’s	85.7	86.9	90.9	80
Jeliffe’s ratio	88.6	4.3	58.5	1.9

Sensitivity and specificity of Kanawati index, Rao index and BMI against gold standard of weight for age. Weight for age was taken as gold standard. All other indices like Kanawati index, Rao index, Dugdale’s index and Jeliffe’s ratio were compared with the weight for age gold standard. Jeliffe’s ratio was the most sensitive index but lacks specificity drastically. Out of these four indices, only Dugdale’s index was found to have high sensitivity (85.7%) and specificity (86.9%) compared to all other indices. It has a sensitivity of 85.7% and specificity of 86.9%. Kanawati index has sensitivity of 62.9% and specificity of 73.9%. Rao index also gave similar results. (Table 7)

studied children, i.e. 36.2% were found to have severe malnutrition. (Table 4)

Table 5: Distribution of children as per jeliffe’s ratio.

Jeliffe’s ratio	Number	%
Normal (> 1)	05	8.6
Malnutrition (< 1)	53	91.4
Total	57	100

Distribution of children as per Jeliffe’s ratio. As per Jeliffe’s ratio it has been observed that 53 children out of 58 studied, i.e. 91.4% were found to have normal nutritional status. 5 out of 58 studied children, i.e. 8.6% were found to have severe malnutrition. (Table 5)

Table 6: Distribution of children as per dugdale’s index.

Dugdals index	Category of malnutrition	Number	%
< 0.79	Severe malnutrition	11	18.9
0.79-0.87	Mild to moderate malnutrition	22	37.9
> 0.88	Normal	25	43.2
Total		58	100

Distribution of children as per Dugdale’s index. As per Dugdale’s index it has been observed that 25 children out of 58 studied, i.e. 43.2% were found to have normal nutritional status. 22 out of 58 studied, i.e. 37.9% were found to have Mild to moderate malnutrition. 11 out of 58 studied, i.e. 18.9% were found to have severe malnutrition. (Table 6)

DISCUSSION

Authors found that the prevalence of malnutrition was 60.3%, 48.3%, 51.7%, 91.4% and 56.8% as per the weight for age, Kanawati index, Rao index, Jeliffe’s index and Dugdale’s index respectively. The sensitivity was 62.9%, 68.3%, 88.6% and 85.7% for Kanawati index, Rao index, Jeliffe’s index and Dugdale’s index respectively. The specificity was 73.9%, 73.9%, 4.3% and 86.9% for Kanawati index, Rao index, Jeliffe’s index and Dugdale’s index respectively. The positive predictive value was 78.6%, 80%, 58.5% and 90.9% for Kanawati index, Rao index, Jeliffe’s index and Dugdale’s index

respectively. The negative predictive value was 56.7%, 60.7%, 1.9% and 80% for Kanawati index, Rao index, Jeliffe's index and Dugdale's index respectively.

Katyal R et al, noted that the prevalence of malnutrition was 48.2%, 74.3%, 33.1% and 45.5% as per the weight for age, Kanawati index, Rao index, Jeliffe's index and Dugdale's index respectively. This is less compared to the findings of the present study. They concluded based on the ROC curve that Dugdale's index was the best among the age independent indices. Authors also observed similar findings.⁶

Raje V et al, observed that the prevalence of malnutrition was 36.11%, 41.67%, 42.59% and 66.67% as per weight for height, body mass index, and weight for age by IAP classification and by Kanawati and McLaren index respectively. This is less compared to the findings of the present study. They stated that Kanawati and McLaren index was better, but this is not the case with this finding.⁷

Mishra BK et al, found that factors like education, social class and children from lower caste were significantly affected with malnutrition. It was also noted that when there was prolongation of the exclusive breast feeding the prevalence of the malnutrition increased. They concluded that "the infant feeding practices and prevalence of malnourished children in comparison to Orissan average".⁸

Saito K et al, noted that the females were 3.4 times more at risk of malnutrition compared to males.⁹ Children with Father being labor were at 2.98 times more at risk of malnutrition compared to children with father not laborer. The authors stated that "Based on their traditional beliefs, the mothers did not believe that medical care was an appropriate intervention for childhood illnesses such as malnutrition or measles".

Gupta PK et al, studied 1424 children from school. The prevalence of morbidities among boys was 52.8% and higher among girls i.e. 67.4%. Per family there were 5.13 children on an average. The authors also noted that prevalence of malnutrition among boys was 84.6% and that of girls was 81%. These findings are very high compared to the findings of the present study where author found that the prevalence of malnutrition was 60.3%. The author found that the prevalence of stunting was 20% in boys and girls.¹⁰

Anuradha R et al, observed that the 66.5% of the children were underweight. This finding is in collaboration with the finding of the present study where authors found that the prevalence of malnutrition was 60.3%. The author noted that 46.2% were having grade 1 malnutrition. As the age increased, the prevalence increased significantly. Males were affected more than the females. The prevalence was more in lower social classes.¹¹

CONCLUSION

As age may not be available all the time; due to recording errors in the date of birth age dependent criteria like weight for age, height for age become doubtful though considered very effective in assessment of the nutritional status of the child. Hence many age independent criteria have been in studied and in use also. Among age independent indices of nutritional status available, Dugdales index can be used as it has been found that it has remarkably higher sensitivity and specificity compared to other age independent indices of nutritional status.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Pelletier DL, Frongillo EA. Changes in child survival are strongly associated with changes in malnutrition in developing countries. *J Nutr.* 2003; 133(1):107-19.
2. Rasania SK, Sachdev TR. Nutritional status and feeding practices of children attending MCH Centre. *Indian J Community Med.* 2001; 26(3):145-50.
3. Pelletier DL, Frongillo EA, Schroeder DG, Habicht JP. A methodology for estimating the contribution of malnutrition to child mortality in developing countries. *J Nutr.* 1994; 124(10):2106-22.
4. Khan ME. Cultural determinants of infant mortality in India. *J Fam Welfare.* 1993;39(2):3-13.
5. Karla S. An Investment in Children's Health, Nutrition & Education Is the Foundation Stone for All National Development. *Indian J Mat Child Health:* 1991;2(3):98.
6. Katyal R, Singh SP, Joshi HS, Joshi G, Singh A. An assessment of the validity of the nutritional indices among under-fives in the catchment area of rural health and training center of a teaching institute in Bareilly. *J Family Med Prim Care* 2016 Apr-Jun; 5(2): 383-6.
7. Raje V, Raje V, Punamia A, Patil SS. Detection of under nutrition among preschool children. *Journal of Evolution of Medical and Dental Sciences* 2013;2(48):9305-9.
8. 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.
9. Saito K, Korzenik JR, Jekel JF, Bhattacharji S. A case-control study of maternal knowledge of malnutrition and health-care-seeking attitudes in rural South India. *Yale J Biol Med.* 1997 Mar-Apr;70(2):149-60.
10. Gupta PK. Health status of rural school children. *Indian Pediatr.* 1989 Jun;26(6):581-4.

11. Anuradha R, Sivanandham R, Salome SD, Francis R, Roopa D, Sampavi S, et al. Nutritional Status of Children Aged 3-6 Years in a Rural Area of Tamil Nadu. *J Clin Diagn Res*. 2014 Oct;8(10):JC01-4.

Cite this article as: Gandra NR, Masillamoni KJ. Assessment of nutritional status of children aged 34-92 months using various nutritional status indices and validity of age independent indices. *Int J Contemp Pediatr* 2019;6:2593-7.