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# STUDY OF ANTHROPOMETRIC INDICES USED IN IDENTIFYING BENEFICIARIES OF FOOD SUPPLEMENTATION PROGRAMMES

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SUMMARY. Anthropometric data obtained by measuring school children in the second year in school in a defined area was used to study the relative usefulness of the commonly used anthropometric indices and modes of presentation. Indices using height, though providing more information, seem not very practicable to be determined routinely at field level. In identifying beneficiaries of an intervention programme, it seems most appropriate to use the index weight for age and consider those below the third percentile to be the beneficiaries of such programmes, as this is likely to identify almost all moderately and severely undernourished. Such an identification is important as a preventive and promotive activity aimed at reducing the problem of undernutrition among young children.

## INTRODUCTION

Anthropometry is a widely used tool in the direct assessment of nutritional status of an individual or of a community.[1] The basis for the use of this method is the assumption that nutritional inadequacy causes growth retardation. The different gradings or "classifications" of malnutrition that have been developed recently have been based on the severity of growth retardation and such "classifications" have been widely used in the assessment of the prevalence of protein-energy malnutrition(PEM) in the community and in identifying beneficiaries for nutrition intervention programmes. More recently use of anthropometric criteria have been recommended in assessing the effectiveness of food supplementation programmes.[9]

Use of classifications based on anthropometric criteria have been suggested for analysis of cross-sectional data as a part of nutritional monitoring and surveillance programmes.[7] This is specially important because such applications are likely to make international comparisons possible. Classification by Gomez[3] uses the index weight for age and percent deviation from median value to identify different grades of malnutrition. In the classification suggested by Waterlow & Rutishauser[8] the two indices, weight for age and weight for height are used to identify those that are in acute PEM, i.e., those with height for age $<90\%$, and those in chronic PEM being those in whom the weight for height index is $<90\%$. A third catgory "concurrent acute chronic PEM" could also be identified using the same indices.

The other commonly used modes of presentation of anthropometric indices are to express them in relation to a centile distribution and by presenting the data as standard deviation (SD) scores.

Even though the use of different indices and classifications based on anthropometric data as the main criterion to assess the nutritional status has been critically reviewed,[4] this method still remains one of the most practicable of the tools available for nutritional assessment at community level.

A comparative study of the commonly used anthropometric criteria and modes of presentation was carried out with a view to studying their relative uses and limitations in identifying beneficiaries for food supplementation programmes.

## METHODOLOGY

The study population comprised of all children in the second year at school attending the primary schools in the University Community Health Project Area, Kotte. A list of all such children was obtained from the schools and the date of birth of each child was recorded from the information available at the school to enable accurate assessment of age.

Weight and height measurements were taken for each child according to the standard techniques.[2] Weight measurements were taken using a beam balance (Model - Avery), Two observers were responsible for taking all the measurements using the same instruments, which were standardised. The accuracy of the measurements were assessed by using the standardizaton procedures.[9]

## RESULTS

Weight and height measurements were taken on 853 children, 65.4% were males and 34.6% females with a median age of 6 yrs 11 months and ages ranging from 6 yrs 2 months to 9 yrs 7 months. From the data available from the above study, the following anthropometric indices were developed—weight for age, height for age and weight for height.

The distribution of these indices according to the percentage deviation from the reference median values is given in Table 1. (The reference values used were those from NCHS data). It is seen that for a majority of children the index weight for age seem to have a negative deviation from the median value, the dispersion being wide.

**TABLE 1. Distribution of anthropometric indices as a percentage of the median of the corresponding NCHS reference values**

| Index | Percentage deviation from median | | | | | | |
|---|---|---|---|---|---|---|---|
| | <60 | 60— | 70— | 80— | 90— | 100—110 | Total |
| Wt. for age | 19 (2.2) | 139 (16.3) | 329 (38.6) | 267 (31.4) | 99 (11.6) | — | 853 (100) |
| Ht. for age | — | — | 1 (0.12) | 108 (12.7) | 657 (77.0) | 87 (10.2) | 853 (100) |
| Wt. for Ht. | 4 (0.5) | 6 (0.7) | 107 (12.5) | 483 (56.7) | 212 (24.9) | 41 (4.0) | 853 (99) |

(Percentages given within brackets)

Presentation of anthropometric data in relation to a centile distribution enables identification of an individual within a distribution of a given variable in the reference population. The advantage of such an analysis is that no error arises from the fact that the indices in the reference population may be skewed. However, if a large proportion of the population lies far outside the reference population, such a group cannot be accurately classified . Presenting the data obtained from the present study in relation to the centile distribution shows that 47.1% of the study population had their weight for age index below the 3rd percentile while the corresponding figures for height for age and weight for height were 23% and 30.7% respectively (Table 2).

**TABLE 2. Percentile distribution of the anthropometric indices**

| Index | <3 | 3— | 5— | 10— | 30— | 50— | 70— | >90 | Total |
|---|---|---|---|---|---|---|---|---|---|
| Wt. for age | 402 (47.1) | 89 (10.4) | 134 (15.7) | 163 (20.0) | 45 (5.3) | 14 (1.6) | 5 (0.6) | 1 (0.1) | 853 (100) |
| Ht. for age | 196 (23.0) | 73 (8.6) | 119 (14.0) | 252 (29.5) | 126 (14.8) | 62 (7.3) | 21 (2.5) | 4 (0.5) | 853 (100) |
| Wt. for Ht. | 262 (30.7) | 99 (11.6) | 169 (19.8) | 219 (25.7) | 64 (7.5) | 28 (3.3) | 9 (1.1) | 3 (0.3) | 853 (100) |

(Percentages given within brackets)

In comparative analysis, the dispersion of the reference population is as important as its mean or the median and this may significantly vary between sub-groups within the same population. Hence, a dispersion independant constant like the percentage deviation from the median would either overestimate or underestimate those considered normal at a certain age group. This can be avoided by transferring the data into standard deviation scores or Z-scores. On presenting the same data in this form it is seen that the proportion with a deviation of >2 SD is highest in respect of weight for age (Table 3).

**TABLE 3. Distribution of anthropometric indices by SD scores**

| Index | < —3SD | ⩾ 2SD to —3SD | ⩾ 1SD to —2SD | > 1SD to M | M to <1SD | ⩾ 1SD to +2SD | Total |
|---|---|---|---|---|---|---|---|
| Wt. for age | 51 (6.0) | 297 (34.8) | 363 (42.6) | 122 (14.3) | 18 (2.1) | 2 (0.2) | 853 (100) |
| Ht. for age | 30 (3.5) | 145 (17.0) | 312 (36.6) | 279 (32.7) | 78 (9.1) | 9 (1.1) | 853 (100) |
| Wt. for age | 15 (1.8) | 200 (23.5) | 418 (49.0) | 179 (21.0) | 35 (4.1) | 6 (0.7) | 853 (100) |

(Percentages given within brackets)
(M—Median value)

Table 4 shows the distribution of the study population according to Gomez's Classification. In most service oriented programmes, protein energy malnutrition (PEM) grade II and III are identified as beneficiaries, the "cut-off point" used being less than 75% median weight for age. The distribution of the study population by Waterlow classification is given in Table 5.

**TABLE 4. Distribution of population according to Gomez classification and by sex**

| Grade | Male No. | Female No. | Total No. |
|---|---|---|---|
| 0 | 62 (11.11) | 37 (12.54) | 99 (11.61) |
| 1 | 286 (51.25) | 155 (52.54) | 441 (51.70) |
| 2 | 196 (35.13) | 98 (33.22) | 294 (34.47) |
| 3 | 14 (2.51) | 5 (1.59) | 19 (2.23) |
| Total | 558 (100.0) | 295 (100.0) | 853 (100.01) |

Percentages given within brackets

**TABLE 5. Distribution of Population According to Waterlow Classification and by sex**

| Nutritional Category | Male No. | Female No. | Total No. |
|---|---|---|---|
| Normal | 426 (76.34) | 218 (73.90) | 644 (75.50) |
| Wasted | 68 (12.19) | 32 (10.85) | 100 (11.72) |
| Stunted | 51 (9.14) | 41 (13.90) | 92 (10.79) |
| Concurrent | 13 (2.33) | 4 (1.36) | 17 (2.00) |
| Total | 558 (100.0) | 295 (100.01) | 853 (100.01) |

Percentages given within brackets

Relationship between the "cut-off points" used in the Waterlow classification and the SD scores has been studied and it has been observed that in undernourished populations, the -2SD weight for height comes approximately to 80% weight for height and 90% height for age.[7] This suggests the possibility of using the cut-off point -2SD in relation to an anthropometric index in identifying the "undernourished" group. It has also been shown that -2SD scores approximate to the 3rd percentile values in respect for weight for height.

Thus there are three different "criteria" that could be used to identify the "undernourished". By applying each of these "criteria" to the three commonly used indices, it is possible to study the comparative proportions of children who are identified as "undernourished" (Table 6). This analysis shows that the highest porportion of children are identified as "undernourished" when taking the group whose indices are below 3rd percentile.

**TABLE 6. Comparison of the percentage of children identified as "Malnourished" using different anthropometric indices and 'cut-off' points**

| Index | Cut-off points | Percentage |
|---|---|---|
| Wt. for age | <75% | 36.7 |
| | <3rd centile | 47.1 |
| | —2SD | 40.8 |
| Ht. for age | <90% | 12.3 |
| | <3rd centile | 23.0 |
| | —2SD | 20.5 |
| Wt. for Ht. | <80% | 13.7 |
| | <3rd centile | 30.7 |
| | —2SD | 25.3 |

## DISCUSSION

In the use of anthropometric data to assess nutritional status of a population or of an individual, it is necessary to take into consideration both the index that is to be used in the study as well as the mode of presentation.

The data presented indicate that irrespective of the mode of presentation, the index weight for age indentifies the highest proportion of individuals who have a negative deviation from the central value. This is possibly because this assessment procedure includes both the extent of linear growth failure and leanness of the individual. Taking into consideration the limitations posed by such an assessment in the study of the prevalence of PEM at the community level, an FAO/UNICEF/WHO Expert Committee has recommended the use of height for age and weight for height as more suitable indicators.[10]

Even though indicators using height have a special significance in that it enables differentiation between chronic PEM and acute PEM, their use has to be viewed in relation to the ability to obtain accurate height measurements as a component of routine growth monitoring activities at field level. In this context, the use of the "Thinness chart" seem to be a practical method of identifying the "acutely malnourished", i. e., wasted children, without having to take accurate measurement of height of each child[5].

The need to differentiate between the anthropometric indices to be used in relation to the objectives of the programme has been discussed.[5] In nutritional status prevalence surveys, findings on which policy decisions and programmes with high financial commitments are made need to be based on height and weight measurements. It has been shown that the use of thinness chart is not appropriate in such situations.[9]

The present study showed that, irrespective of the index used, the highest proportion with negative deviation from the central value is identified by taking the proportion below the 3rd centile. Without adequate data to assess the functional significance in relation to cut-off points, it is not possible to draw any definite conclusions regarding the most appropriate index to be used and the method of presentation of data.

In identifying beneficiaries of a nutrition intervention programme, it is necessary to relate to the objectives of such a programme. If the objective is to identify any individual who deviates from "normal" growth and make them the target of nutrition intervention programmes, then taking the cut-off point of "below 3rd centile" using the index weight for age seems to be the most appropriate. However, if the objective is to maximally utilise the limited resources, inclusion of such a group is likely to reduce the impact of such a programme Limiting the target population to the "wasted" group of children seems most appropriate. Use of thinness chart at the clinic level seems to be very relevant in such situations.

From a scientific point of view, such decisions need to take into consideration the dynamics of the process of malnutrition. It has been suggested that there should be no complacency regarding mild and moderate degrees of growth retardation as this is important from an economic point of view as well as that of the individual child, because the protection of children in "mild" and "moderate" degrees will require far less resources and will prove more rewarding than nutritional rehabilitation activities geared towards the severely malnourished.[3]

In Sri Lanka, the growth chart that is presently used in the Child Health Development Record shows the 50th and 3rd centile values of the NCHS standard and uses the index weight for age. In view of the above, it is worth nothing that in the present MCH programmes in Sri Lanka, the position of the weight of the child in relation to the line indicating the 3rd centile value is taken into consideration in identifying beneficiaries of the existing food supplementation programmes.

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