Physical Activity as a Clinical Tool in the Assessment of Malnutrition

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Objective: To measure physical activity in children with wasting and to look for association between poor physical activity and wasting. **Methods**: Physical activity was measured in 56 children with wasting, using Children's Activity Rating Scale, and compared with age- and sex-matched controls. **Results**: A significant association was found between poor physical activity and malnutrition as determined by weight-for-height Z Score <-2 (*P*=0.001) and mid-upper-arm circumference (*P*=0.002). **Conclusion**: Physical activity can be used as clinical parameter to assess malnutrition.

Keywords: *Anthropometry, Diagnosis, Protein energy malnutrition.*

Due to paucity of other clinical criteria, visible wasting being very subjective and bipedal edema seen only in a minority, anthropometry is the gold standard for diagnosis of malnutrition. Anthropometry has limitations as it is based on assumption that different populations given the same diet, will have similar height and weight outcome, irrespective of race, ethnicity and geography [1-3]. Malnutrition leads to reduced physical activity [4,5], irrespective of confounders, and thus is an objective scale to measure physical activity and could be a good clinical index of malnutrition. The present study was designed to compare the physical activity in wasted children [weight-for-height *z* score (WHZ) < –2 SD] with that of the normal children.

METHODS

This cross-sectional study was conducted in Nildoh region of Nagpur district. All children aged between 1 and 5 years having WHZ <–2SD were eligible for inclusion. Children suffering from acute infections or chronic organic diseases were excluded. Children were enrolled from 29 *Anganwadi* centers in the study area. Control children with WHZ >–2 SD were identified from the same household or neighbourhood. They were selected in 1:1 ratio and matched with respect to age and sex of the case. Where there was more than one eligible control, only one was selected randomly. The study was approved by the institutional ethics committee. Informed parental consent was obtained.

Weight, height/length and mid-upper-arm Circum-ference (MUAC) were measured by standard procedures [6]. WHZ was calculated using WHO Anthro for PC software. Physical activity was measured by direct observation method using Children's Activity Rating Scale (CARS) [7]. CARS classifies activity into five age appropriate activity levels with level 1 and 2 as sedentary, and 3,4 and 5 indicating slow, moderate and vigorous translocation activities, respectively [8,9]. In preparatory phase of the study, two observers (a junior doctor and a social worker) underwent ten hours of training spread over a week on how to use CARS. Activities were recorded in the Anganwadi Center between 9 AM and 1 PM. Each child was observed for one hour, during unstructured play activity time in the morning, on two different days of the week. Recording was done on a standard proforma divided into 30 second periods with separate columns for the activity categories. A tick was placed in the appropriate column for any activity which lasted for at least 15 seconds. Percentage of total activities performed in each grade during the entire period of observation was calculated. Moderate vigorous activity was defined as activity level corresponding to CARS grades 4 and 5 while grades 1, 2 and 3 defined sedentary and slow translocation activities [9]. Using the receiver operating characteristic [ROC] curve analysis, the best cut-off percentage for poor physical activity was determined as an aggregate of grades 1, 2 3. If a child spent more than the estimated cut-off value of the total activity time in grades 1, 2 and 3, he/she was considered to be having poor physical activity. All analyses were performed using STATA, Version 10.1.

RESULTS

A total of 112 children (62 males; 56 cases and 56 controls)

WHAT THIS STUDY ADDS?

Physical activity is significantly lower in children having wasting.

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were studied. The mean (SD) for weight, height, WHZ and MUAC for cases were 9.15 (3.12) kg, 85.1 (15.1) cms, 2.55 (0.52) and 13.17 (1.25) cms, respectively, and for controls were 10.63 (2.80) kg], 84.0 (13.3) cms, 1.04 (0.58) and 13.87 (1.12) cms (1.12), respectively. As 10 children from the control group did not complete the stipulated two-hour observation for physical activity, they were not included in further statistical analysis. Interobserver agreement, calculated simply by the proportion of observations where the two observers agreed on their observations, was found to be 86%..

Table **I** compares the average percentage activity spent in each grade by cases and controls. Children spending more than 43% (determined by the most optimum specificity and sensitivity values on ROC analysis) of their total activity in grades 1, 2 and 3 were labeled to have poor physical activity. Cases were significantly more involved in activity grades 1, 2 and 3, (sedentary levels of activity), whereas controls spent significantly more time in activity grades 4 and 5 (moderate to vigorous physical activities). Forty-five out of 56 cases (80.4%) had poor physical activity as compared to only 9 out of 46 (19.6%) controls. A statistically significant association was found between poor physical activity and wasting (OR=16.8, 95% CI 5.73-50.85; *P*<0.001).

Low MUAC (<12.5 cms) was found in 24 (23.5%) children ; 19 belonged to the group with WHZ ≤–2 and 5 had WHZ >–2. Poor physical activity was found to be higher in children with low MUAC (*P*=0.002; OR= 4.19, 95% CI 1.67-14.51), in comparison with those with normal MUAC.

TABLE I COMPARISON OF PHYSICAL ACTIVITY IN MALNOURISHED AND NON-MALNOURISHED CHILDREN

Level of physical activity	Percentage of time spent, Mean (SD)		P value
	Cases (N=56)	Controls (N=56)	
Grade 1	30.08 (14.35)	09.43 (12.71)	<0.001
Grade 2	23.60 (9.64)	11.02 (7.28)	<0.001
Grade 3	17.07 (4.61)	17.30 (5.39)	0.40
Grade 4	15.38 (9.58)	27.30 (8.64)	<0.001
Grade 5	13.80 (15.8)	34.34 (13.78)	<0.001

Cases: WHZ<–2   Controls WHZ >–2.

DISCUSSION

In this study, poor physical activity was associated with WHZ <–2 and was able to distinguish these children from those with a WHZ >–2. Children with wasting spent significantly higher time in lower grades of physical activity as compared to children without wasting. Not all children considered wasted based on WHZ had MUAC <12.5 cms; this finding is consistent with previous publications [10]. In our study a significant association with poor physical activity was noted even among those with low MUAC.

This study was conducted on a convenience sample of 56 children attending the Anganwadi centers. The small sample size and the study design limit the generalizability of the findings. A larger cross-sectional study would be needed to determine the predictive value of physical activity scale as a diagnostic tool.

Physical activity has never been considered as a clinical tool for assessment of malnutrition. The causal relationship between undernutrition and physical activity has been well described in literature. Children compensate for lack of dietary energy by decreasing energy expenditure through reduced physical activity [4,5], but the relationship between wasting and physical activity measured objectively has not been studied earlier.

We conclude that the physical activity compares favourably with the anthropometric gold standard WHZ and maybe considered as an additional clinical tool for confirmation of malnutrition.

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