ORIGINAL ARTICLE

MAA tape (Mother's Assessment for Action) -Innovation for diagnosis of nutritional vulnerability of children (6 months to 5 years)-A new tool to empower mothers and caregivers

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ABSTRACT

Background: We devised a non-stretchable cloth tape with a button at 12. 4 cm to be encircled around the mid upper arm of children 6 months to 59 months of age. The objective was to validate and assess utility of the MAA tape as a first screening device by mothers for primary triaging of the children. **Methods:** A study was undertaken on 2289 infants and children attending outpatient department of 9 Medical colleges of Maharashtra, India during Jan. 2022 to Jan. 2023. Study was submitted to ICMR clinical trial registry no.REF/2022/09/05891 and approved by Institutional ethics committees of respective Medical Colleges. Height , weight and MUAC of the baby was taken by the mother and doctor and data was entered using KOBO tool. **Results:** Using MAA tape by doctors, 458 babies had moderate or severe acute malnutrition (20%) out of 2289 children. MAA tape use by mothers and doctors matched in 2240 cases (97.86%). Sensitivity of MAA tape use by mothers was 97.23% and specificity was 98.01% . Sensitivity of MAA tape with respect to MUAC was 64.04% and specificity was 87.04%. **Conclusion:** MAA tape can be used to empower mothers in detecting suspected growth faltering of their children at the earliest.

KEYWORDS

Malnutrition, nutritional vulnerability, empower mothers

INTRODUCTION

Malnutrition is a major cause of morbidity and mortality in children under five years of age. It is estimated that globally, there are 149 million children with stunting and 45 million with wasting (Source UNICEF 2023). India too faces a big burden of child under nutrition. (1,2,3). The NFHS 5 data for Maharashtra released in 2019-2020 reveals that the burden of under nutrition has been nearly at same levels as NFHS. (4) These data show that stunting has changed from 34.2% to 35.2%, wasting unchanged at 25.6%, severe wasting 9.4% to 10.9% and underweight from 36% to 36.1% (5).

Covid 19 pandemic with lockdowns, It was a felt need to devise a simple tape to detect malnutrition in children from 6 months to 59 months as a first screening step to facilitate primary triaging.

If the **MAA (Mother's Assessment for Action)** tape button fitted, it meant that baby's mid upper arm circumference is less than 12.5 cm and hence the baby is likely to have wasting (MAM or SAM).

The Objective of the study was to validate the MAA tape as a first screening device by mothers to facilitate primary triaging of the children 6 months to 59 months.

MATERIAL & METHODS

study type & study design: A multi-centric study involving 9 Government Medical Colleges, 2 private Medical Colleges, one centre of excellence, from the State of Maharashtra, India was undertaken.

study setting: Medical Colleges

study population: Children attending Paediatric departments, Immunization clinics in the age group 6 months to 59 months
study duration: Jan 2022 to Jan 2023
sample size calculation: Minimum sample size was 150 at each center considering that 75% of parents will use the tape correctly, with 5% error =**2200**
inclusion criteria: all healthy chidren whose parents were willing
exclusion criteria: sick children
strategy for data collection: Data was entered in Open source Kobo Collect tool
working definition: Healthy children
ethical issues & informed consent: Study was submitted to ICMR clinical trial registry no. REF/2022/09/05891 and approved by Institutional ethics committees of respective Medical Colleges
data analysis - software, 'R statistical software'.

RESULT

Data were available on MAA tape use by mothers and anthropometric data gathered by doctors from 2289 infants and children.

Table 1 Baseline characteristics of 2289 children

Age group	Gender	Number	Percentage
6- 12 months	Male	215	56
	Female	169	44
	Total	**384**	**16.8**
13-24 months	Male	288	51.5
	Female	271	48.5
	Total	**559**	**24.42**
25 -36 months	Male	280	55.9
	Female	221	44.1
	Total	**501**	**21.88**
37-48months	Male	255	53
	Female	226	47
	Total	**481**	**21**
49-60 months	Male	180	49.5
	Female	184	50.5
	Total	**364**	**15.9**
Grand Total		**2289**	**100**

Table 2 shows center wise distribution of children and wasting detected by doctors

MAA tape and MUAC by doctors.	No. Of children	Aggregate No of SAM (severe acute malnutrition) and MAM (moderate acute malnutrition)	Percentage
a	b	c	d= c X 100/b
Govt Med College, Nagpur	286	57	19.93%
BJ Govt. Med College, Pune	281	39	13.87%
Wadia Childrens' hosp. Mumbai	280	53	18.93%
DY Patil med Coll, Pune	251	38	15.13%
Govt Med Coll. Gondia	243	66	27.16%
Govt Med Coll. Nanded	237	53	22.36%
Grant Govt Med Coll .Mumbai	220	42	19.1%
Govt Med .Coll Akola	161	29	18.01%
MGM Coll.Navi Mumbai	150	25	16.67%
Govt Med Coll .Aurangabad	119	24	20.2%
Govt Med Coll. Yavatmal	29	8	27.5%
Govt Med Coll Chandrapur	28	12	42.86%
Others	3	2	66.67%
Mumbai	1	0	0%
Total	2289	458	20.00%

Table 3 shows comparison of MAA tape use by mothers and doctors

	No	Percentage
Mother's and Doctors MAA Tape results match	2240	97.86%
Mother's and Doctor's MAA Tape results disagree or do not match	49	2.14%
Total	2289	100%

Test of concordance between Mother's and Doctor's MAA tape measurement (McNemar's test)
p-value = 0.000355.
Thus mothers MAA tape use has been found to be comparable to doctor's MAA tape use and the result is statistically significant.

Table 4 shows number of SAM, MAM detected by using Doctors data on MAA tape.

Age group	No of children	Babies with MAA tape fitting -i.e SAM+MAM	Percentage
6-12 months	384	93	24.2%
13-24 months	559	114	20.4%
25-36 months	501	84	16.8%
37-48 months	481	102	21.2%
49-60 months	364	65	17.9%
Total	2289	458	20.00%

Table 5. Comparison of Mother's and Doctor's use of MAA tape Tests to compare validities (Nofuentes & Regad 2019).

Diagnostic test	Gold Standard	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Mother's MAA tape	Doctor's MAA tape	97.23%	98.01%	91.92%	99.34%
Doctor's MAA tape	Doctor's MUAC	64.04	87.04	39.49	94.83
Mother's MAA tape	Doctor's MUAC	66.29%	86.10%	38.65%	95.08%
Mother's MAA Tape	Doctor's WFH	28.22%	82.50%	32.97%	79.03%
Doctor's MAA Tape	Doctor's WFH	26.17%	83.30%	32.33%	78.72%

Table 6 shows mothers' perception about MAA tape

Mother's questionnaire after 6 months post measurement?	Reply	Number 2289 total (N 2289)	Percentage
a	B	c	d = c X 100/ N (2289)
Did you know how to use MAA tape?	Yes	1939	84.71%
	No	350	15.29%
Have you understood the importance of use of MAA tape?	Yes	2267	99.04%
	No	22	0.96%
Have you received nutrition counselling for your child?	Yes	2175	95.02%
	No	114	4.98

DISCUSSION

Screening and diagnosis of malnutrition is an important step in management of malnutrition to avoid untoward outcomes. This step of detection was particularly difficult in Covid times. Covid 19 pandemic resulted in lockdown in India in 2020. Even after that, availability of public health facilities and programs was severely compromised. Maharashtra State with substantial tally and toll of Covid 19 too had lockdown followed by guarded and cautious opening of essential medical emergency services. Therefore, community services through ICDS for mother and child had got disrupted during this period besides the livelihood crisis. Routine home visits either through HBYC services by ASHA/ ANM were not possible (anthropometric measurements like taking length /height, weight of the baby). Therefore, categorizing the child into SAM, MAM, SUW, MUW, stunting was very difficult. If baby was found vulnerable, prompt action could be initiated. With this aim in mind , we devised a non-stretchable cloth tape with a button at 12.4 cm. When the tape is encircled around the mid upper arm of the baby and if the button fits , it indicates that the mid upper arm circumference of the baby is 12.4 cm or less thereby indicating that the baby has MAM or SAM. This hypothesis was tested by taking mother's observation of MAA tape and comparing it with MAA tape use by the doctor. It was seen that in 97.86% of the babies, the MAA tape observation by the mother and doctor was identical which is highly significant statistically. (p-value = 0.000355.)

Use of MAA tape by mother showed high sensitivity of 97.23 % and specificity of 98.01 %. Thus use of the tape by mother was as good as that used by doctors with least false positives and negatives. MAA tape use by mothers when compared with MUAC used by doctors showed sensitivity of66.29% and specificity of 86.10%. This is also comparable to use of MUAC by doctors and its comparison to MAA tape used by doctor (64.04 %,87.04%. respectively) All these observations make MAA tape a good tool for use by parents in the community as a first screening device.

However, when MAA tape was compared with weight for height in diagnosis of SAM and MAM, it showed a sensitivity of 28.22% and specificity of 82.5%. This observation compared with doctors MAA tape and doctors' weight for height is similar. (26.17% and 83.30% respectively).It is known that weight for height and MUAC identify different sets of children with malnutrition.20% of children had malnutrition with maximum number (24.2%) in 6 months to 12 month group and highest number from Chandrapur Medical College (42.86%).

Mother or care giver's perception,84.71% of mothers found it easy to use MAA tape,99.04% understood its importance and 95.02 % had received nutrition counselling at the end of 6 months when they were given the questionnaire.

There are no studies on use of MAA tape in literature. Few workers have used MUAC tape given to parents labeling it 'Family MUAC'. In a study by Frank CB et.al [6]. On the use of family MUAC or mother MUAC , encouraging results were seen. When mothers used the MUAC, detection was earlier and better than community health workers. Study was undertaken in Niger on 12893 mothers. Mothers observations were not inferior to CHW s in screening for malnutrition and it was at a substantially lower cost. Children in the 'Mothers Zone' were admitted at an earlier stage of SAM and required fewer hospitalizations.

CONCLUSION

Making mothers the focal point of screening strategies should be included in malnutrition treatment programs. All these observations tend to infer that MAA tape a good tool for use by mothers in the community as a first screening device.

RECOMMENDATION

There is an acute need of devising a methodology to empower the parent or caregiver to gauge the nutritional status of their child themselves. Easy tool for nutritional

assessment of children helps the mother to take quick action for children with malnutrition in emergency situation like Covid 19 pandemic, displacement ,war,famine.

LIMITATION OF THE STUDY

The study was limited to Maharashtra with small sample size.

RELEVANCE OF THE STUDY

Mothers' empowerment for nutritional assessment of children is the best way to control malnutrition in community.

AUTHORS CONTRIBUTION

MP, RJ, SS & RN designed the study and idea. PM, AD, CR collected the data and analysis .SK,& PG were involved data analysis. All authors have contributed equally in drafting the paper which was approved by MP

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

.The authors haven't used any generative AI/AI assisted technologies in the writing process.

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