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Development, Validation Of PM POSHAN Scale And Testing It's Efficacy For Effective Monitoring Of The PM POSHAN Scheme

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Abstract: The main vision of the Pradhan Mantri POshan SHAkti Nirman (PM POSHAN) scheme is to increase the school enrolment of children, provide nourishment and eradicate classroom hunger and malnutrition. Several Methods have been used to ensure the effective implementation of the scheme, but none of them covered all the aspects of the scheme. The primary objective of this study is to develop a comprehensive, quantitative, efficient, and user-friendly scoring scale that encompasses all aspects of the PM POSHAN scheme. The effectiveness of this scale will be assessed in various schools, aiming to improve the monitoring process and enhance the implementation of the scheme. Both qualitative and quantitative methods were used to develop the scale. A purposive sampling technique was used to select the schools and associated kitchens to test the scale. The results revealed that PM POSHAN scale evaluation in schools showed compliance with government guidelines in purchasing, storage, and cleaning of cooking areas. However, improvements were needed in food preparation, cooking, personal hygiene, school authority involvement, beneficiary satisfaction, and infrastructure. Quality assurance results were concerning, revealing non-compliance with guidelines and unacceptable outcomes. To conclude, this is the first-ever tool developed to date, covering all the categories included in the guidelines. This will thus help in the effective monitoring of the scheme. Moreover, its availability in digital format and local language (Marathi) adds to its accessibility.

Index Terms - PM POSHAN Scheme, Monitoring, Adolescents, Schools, Mumbai

I. INTRODUCTION

The PM POSHAN scheme earlier known as the Midday Meal scheme has a long history in India. In the middle of the 1980s, the states of Kerala, Gujarat, Tamil Nadu, and Pondicherry began offering midday meals to primary school students. Since 2001, it has become the world's largest school feeding programme for underprivileged children. The main objectives of the scheme are to increase the school enrolment of children, provide nourishment and eradicate classroom hunger and malnutrition[1]. According to the study conducted by Kaur R, the government has successfully reached its goal of increasing school enrolment, particularly among girls in grade 1[2.] To ensure the efficient implementation of the scheme, the government has established specific guidelines known as the "Pradhan Mantri Poshan Shakti Niman Guidelines [3]." These Guidelines encompass various aspects such as raw material procurement, preparation, cooking, cleaning of cooking areas, personal hygiene, cleanliness, and meal testing. The Maharashtra government has implemented various monitoring methods in Mumbai. Three supervisors were appointed for each of the three zones (Mumbai City, Eastern Zone, and Western Zone). They conduct random visits to schools and kitchens, address meal-related complaints, and warn vendors of malpractice. Various other monitoring approaches involved the use of the MDM MIS App, SMS System, and IVRS (Interactive Voice Response System) all of which were used to keep a record of data about students who consumed meals daily. A more recent approach involved the use of face detection and food identification through image processing. After detecting the face, the system checks whether food is served on the plate or not. If food is served, the count is increased; otherwise, there is no change in the

count of the students who received the meal [4]. Though these monitoring methods and technological advancements aim to enhance the effective implementation of the PM POSHAN scheme they do not comprehensively cover all aspects outlined in the guidelines. Apart from this, despite all the efforts by the Government of India, a recent study revealed, that 1 in 7.5 children often suffer from both calorie and protein deficiencies in their diet, and only 1 in 3.6 children who ate midday meals were deficient in protein [1]. Therefore, primary objective of this study is to develop a comprehensive, quantitative, efficient, and user-friendly scoring scale that encompasses all aspects of the PM POSHAN scheme and ensure that the objective of eradicating classroom hunger and malnutrition is achieved.

II. METHODOLGY

2.1 Algorithm of development of PM POSHAN Scale: The Score based scale was developed in English and Marathi based on the Guidelines on "Pradhan Mantri Poshan Shakti Niman Guidelines", literature survey and observation method.

2.2 Development of Manual of Scoring Scale: A comprehensive manual has been created for the PM POSHAN Scale to facilitate its effective utilization by government officials, nutritionists, social workers, and other individuals involved in monitoring government schemes.

2.3 Content Validation of the tool: The PM POSHAN Scale and the scoring manual were validated by two public health nutritionists in Mumbai.

2.4 Testing of Scoring Scale in Schools: A purposive sampling technique was used to select schools from 3 different zones that are the city zone, the eastern zone, and the western zone. It consisted of a total of four schools, with two schools selected from the western zone, one school from the city zone, and one school from the eastern zone. To gather data, the scoring scale was administered to three groups: the vendor, school authorities, and 13-14-year-old school children. Before administering the scale, informed consent was obtained from all participants, ensuring that they were fully aware of the study's purpose and voluntarily agreed to participate.

2.5 Statistical Analysis

Qualitative statistical analysis was performed.

III. RESULTS AND DISCUSSION

3.1 Development of PM POSHAN Scale:

The descriptive guidelines were grouped under nine different categories purchasing, storage, preparation, cooking, cleaning, personal hygiene, the role of school authorities, beneficiaries' satisfaction with the scheme, and Infrastructural Requirements for Food Safety and Hygiene and Quality Assurance. Each of these categories were assigned an individual scoring system, which allowed for a detailed evaluation of each aspect. Additionally, an overall total score was provided, which summed up the performance across all categories. Table 1 presents the scoring details for each category as well as the overall score, enabling a holistic assessment of the scheme across various schools and kitchens. This tool has been developed in both English and Marathi, and copyright applications have been filed for each language with the Diary Numbers 14391/2024-CO/L and 14400/2024-CO/L, respectively.

Table 1: Scoring pattern for each individual category

Category	Question Number	Maximum Scores	Remarks
Purchasing	I 1-4	20	0 – 5 (1st Q = 0 – 25 %) – Unacceptable 6 – 10 (2nd Q = 25 – 50 %) – Needs urgent upgradation 11 – 15 (3rd Q = 50 – 75 %) - Acceptable, but can Improve 16 – 20 (4th Q = 75 - 100 %) - Compliant with government guidelines
Storage	II 1- 4	20	
Preparation and Cooking	III 1- 4	20	
Cleaning of Cooking area	IV 1- 4	20	
Personal hygiene, cleanliness and health check-ups of Cook cum Helpers	V 1- 4	20	
Role of School Authorities	VI 1 - 7	35	0 – 9 (1st Q = 0 – 25 %) – Unacceptable 10 – 18 (2nd Q = 25 – 50 %) – Needs urgent upgradation 19 – 27 (3rd Q = 50 – 75 %) - Acceptable, but can Improve 28 – 35 (4th Q = 75 - 100 %) - Compliant with government guidelines
Beneficiaries Satisfaction	VII 1 – 4	20	0 – 5 (1st Q = 0 – 25 %) – Unacceptable 6 – 10 (2nd Q = 25 – 50 %) – Needs urgent upgradation 11 – 15 (3rd Q = 50 – 75 %) - Acceptable, but can Improve 16 – 20 (4th Q = 75 - 100 %) - Compliant with government guidelines
Infrastructural Requirements for Food Safety and Hygiene	VIII a: 1- 7 VIII b: 1- 4 VIII c: 1- 4	60	0 – 15 (1st Q = 0 – 25 %) - Unacceptable 16 – 30 (2nd Q = 25 – 50 %) - Needs urgent upgradation 31 – 45 (3rd Q = 50 – 75 %) - Acceptable, but can Improve 46 – 60 (4th Q = 75 - 100 %) - Compliant with government guidelines
Quality Assurance	IX 1- 6	30	0 – 8 (1st Q = 0 – 25 %) – Unacceptable 9 – 15 (2nd Q = 25 – 50 %) – Needs urgent upgradation 16 – 23 - (3rd Q = 50 – 75 %) Acceptable, but can Improve 23 – 30 (4th Q = 75 - 100 %) - Compliant with government guidelines
Overall Total Score	I - IX	245	0 – 62 (1st Q = 0 – 25 %) – Unacceptable 63 – 123 (2nd Q = 25 – 50 %) – Needs Urgent upgradation 124 – 184 (3rd Q = 50 – 75 %) – Acceptable but needs improvement 185 – 245(4th Q = 75 - 100 %) - Compliant with government guidelines

3.2. Development of Scoring Manual:

The manual includes the PM POSHAN scoring scale, scoring key, which offers detailed guidelines on assigning scores for each category. Additionally, the manual provides recommendations to address the identified challenges and enhance the implementation of the scheme. They serve as valuable insights for decision-makers and stakeholders involved in improving the effectiveness of the program. The manual also consists of a development algorithm and acknowledges the strengths and limitations of the scale.

3.3. Testing of PM POSHAN Scale in Schools:

The PM POSHAN scale was tested in a total of four schools, with one school being government-aided and the remaining three schools belonging to the Municipal Corporation of Greater Mumbai (MCGM). Among the four kitchens that were surveyed, the kitchen of one MCGM School was operated by a non-governmental organization (NGO), while the kitchens of the other three schools were managed by Mahila Sanstha.

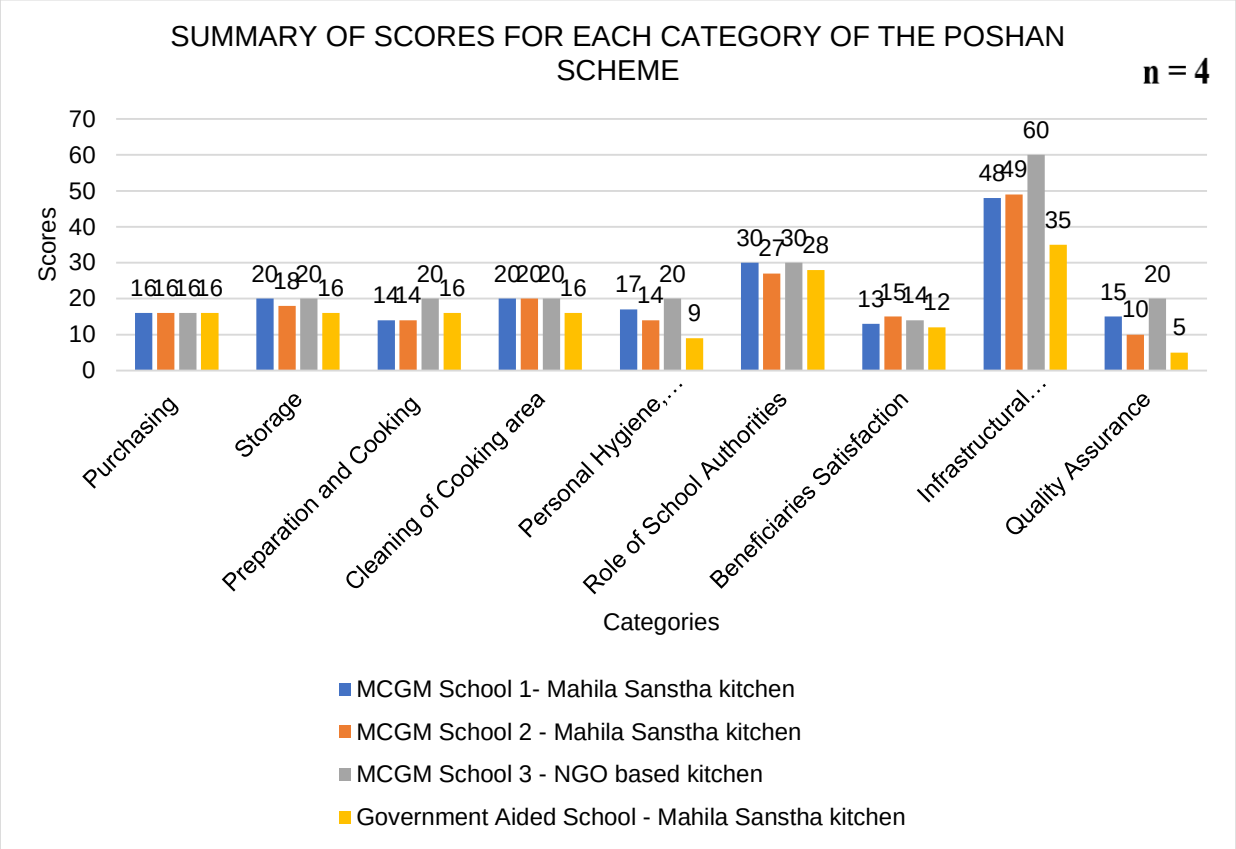

Figure 1: Summary of scores for each category of the POSHAN scheme

The pattern of compliance with government guidelines in each category:

Purchasing: In this category, all four schools included in the study demonstrated compliance with government guidelines and received a score of 16 as shown in Figure 1. The respective kitchens of these schools procured packaged daals, oils, and spices that possessed the required FSSAI logo, indicating adherence to food safety standards. However, it is noteworthy that the guidelines recommended the use of double-fortified salt by the vendor, but none of the schools were able to utilize it due to its unavailability

Storage: During the examination of the four kitchens in the study, it was found that three kitchens followed recommended practices for storing food grains and spices. However, all four schools used non-plastic bags for storing fruits and vegetables. Three kitchens also maintained a suitable distance from the floor by using racks or pallets.

Preparation and Cooking: In this category, all four kitchen vendors ensured that cereals were cleaned before cooking, either manually or with the help of machines. This aligns with the findings of a study that highlighted the hygienic process of cleaning, sorting, and roasting grains [5]. Regarding vegetables, two kitchens cut and then washed them, while the other two kitchens thoroughly washed the vegetables before chopping, which helps retain more nutrients. Three kitchens used clean chopping boards, complying with the guidelines. However, one kitchen used wooden stands for chopping, which is not recommended.

Cleaning of cooking area: In the category of Cleaning of cooking all four kitchens were observed to clean their floors and slabs daily. Additionally, three out of the four schools ensured that cleaning accessories like kitchen cloths, mops, and brushes were washed daily. The utensils in all four kitchens were cleaned by removing debris, rinsing, scrubbing with detergent, and washing under running tap water. Three schools also followed the protocol of using clean cloths for hand wiping and surface cleaning. Overall, the schools were compliant with government guidelines in this category. However, raising awareness and providing additional training could further improve this aspect.

Personal hygiene, cleanliness and health check-ups of cook cum helpers: In the category of personal hygiene of cook cum helpers, observations revealed that only individuals in two kitchens managed by the Mahila Sanstha and the NGO adhered to wearing laundered clothes and keeping their nails trimmed. However, one Mahila Sanstha kitchen did not follow the protocol of cleaning and washing hands with soap, detergent, and water before starting work. Cook cum helpers associated with the Mahila Sanstha wore jewellery while cooking, whereas helpers from the NGO-operated kitchen followed the recommended protocol. Clean protective aprons and headgear were observed in the kitchens of the Mahila Sanstha and the NGO, but not in the other two kitchens. Another study revealed similar findings, where staff from the NGO wore clean uniforms with caps [5].

Role of School Authorities: The school authorities were surveyed regarding the practice of serving a fixed portion of the meal by trained professionals in the school. It was noteworthy to observe that this practice was followed in all four schools. However, it was observed that children consumed meals according to their individual needs rather than adhering to the fixed portion recommended by the government. Thus, a discrepancy was observed between the recommended portion and its actual implementation. Remarkably, food wastage or leftovers from the total quantity received were rarely observed across the four schools. Based on the interactions, it was understood that the schools communicated the quantity of food required to the kitchens one day in advance, considering the number of students expected to eat the meal. The practice of teachers tasting the meals before serving them to the children was followed by teachers in three schools, but not consistently in one MCGM school. Additionally, all four schools diligently maintained records of the meal's arrival time, taste, and total quantity received in kilograms, and entered this data regularly into the Mid-Day Meal Management Information System (MDM MIS) app.

A study concluded that, teachers reported challenges related to midday meals, including insufficient recess time and managing the process while attending to their own needs [5] .

Beneficiaries Satisfaction – The results revealed that among the total number of students, approximately 41-60% expressed their liking for the meals in all four schools. However, when considering the daily consumption patterns, only 0-20% of students in the government-aided school consumed the meals regularly. In contrast, in the two MCGM schools, approximately 41-60% of students consumed the meals daily, while in one MCGM school, 61-80% of students did so. These findings indicate that Mahila Sanstha, which supplies the meals to the government-aided school, needs to improve the quality of the meals to increase their acceptance among students on a daily basis.

The students were also asked about their desire for variety in the menu. It was observed that 81-100% of students from one MCGM school expressed a desire for more variety, while 61-80% of students from the other two MCGM schools wished for more interesting options. However, only 0-20% of students from the government-aided school requested more variety. This could be attributed to the fact that many students preferred to bring their own meals. Furthermore, when asked about the portion size, approximately 81-100% of students from all four schools found it to be adequate. These results indicate a clear need for the government to improve the weekly menu, add more variety to it, and ensure that the meals are made tasty. The preferences expressed by the children included dishes such as rajma pulav, poha, chole chawal, biryani, chana masala with rice, upma, sheera, and idli.

In a study conducted in Karnataka among adolescents, it was observed that including finger millet idli, little and pearl millet bisi belle bath, and upma, were highly accepted by them. This suggests that millets have the potential to be used as a replacement or supplement for rice in school [6]. However, a common feature observed in all locations was the repetition of grains, seasonings, and flavours in the meals offered by the Mid-Day Meal scheme [5].

Infrastructural requirements for food safety: This category encompassed three subtopics, as follows:

a. **Guidelines for safety and hygiene of the kitchen cum store:** Two kitchens associated with Mahila Sanstha and one with an NGO consistently met the guidelines, while one kitchen associated with Mahila Sanstha only partially followed them with regards to cleanliness, lighting, ventilation, and free space for movement. The presence of insects and the use of nets or screens on windows and doors were also assessed. Two kitchens associated with Mahila Sanstha and one with an NGO met the guidelines, while one kitchen associated with Mahila Sanstha did not. Utensils were appropriately cleaned and stored in three kitchens. A survey conducted in Chhattisgarh, Karnataka, and Rajasthan revealed deficiencies in kitchen facilities and infrastructure in schools. Makeshift sheds and classrooms were used for cooking, and utensil shortages and inadequate drinking water arrangements were common issues reported. In another school, observations showed a dirty dining area floor and unhygienic plate washing practices involving playground soil [5,7].

b. **Drainage and waste disposal:** The practices related to waste management were assessed in this subtopic. Covered containers were used for waste storage in all three kitchens, except the one operated by Mahila Sanstha. Periodic disposal of waste and separation of waste generated during cooking into separate containers were followed in all four kitchens. However, in terms of emptying, washing, and drying the containers daily before reuse, three kitchens consistently adhered to the guidelines, while one kitchen associated with Mahila Sanstha did not comply.

c. **Pest Control:** Certain aspects of pest control, such as the presence of wire mesh screens on open windows, doors, and ventilators, were observed. Three out of the four kitchens had these screens, while one kitchen associated with Mahila Sanstha did not follow the protocol. Proper storage of pesticides in their original containers, separate from cooking ingredients, along with the maintenance of records regarding the use of pesticides/insecticides, including dates and frequency, were only observed in the kitchen operated by the NGO. However, fire extinguishers were installed in all four kitchens.

Quality Assurance: In the category of Quality Control, various aspects were assessed. The vendors were asked about the frequency of sending meals for testing in a government laboratory, specifically at least once every three months. Surprisingly, only the kitchen operated by the NGO conducted monthly testing. However, it is noteworthy that the testing focused solely on estimating calorific value (Kcals/100g) and protein content (%), with no evaluation of microbial safety. The vendors were also questioned about the professional training undergone by their cook cum helpers. Interestingly, this practice was only observed in the kitchen operated by the NGO. In contrast, the government did not provide any training to the cook cum helpers in the other three kitchens, at least in the last four years. The school authorities were asked if the meals were occasionally tasted by parents, especially during meetings, but this practice was found to occur only once. Additionally, all four schools claimed to regularly supervise the handwashing practices of children. The source of water in all four kitchens was supplied by the MCGM, but none of the vendors had tested the water. A study conducted in Gujarat found that the nutritional content of the midday meals provided in schools was generally low, especially in terms of protein, fat, iron, and iodine, when compared to the daily requirements. The study also revealed the presence of uric acid and aflatoxin in the food grains procured for the scheme, indicating potential contamination [5].

Furthermore, incidents of negligence and apathetic attitudes by midday meal staff and school administrators have led to tragic consequences. For example, Bihar experienced a terrible incident in which 23 children died due to unhygienic cooking practices and contaminated water. As a result, about 150 students from Standard 1 to 5 did not receive a school meal for almost a month[8]. These findings underscore the urgent need for enhanced quality control measures in all schools, particularly in government-aided schools. Regular testing of meals for microbial safety, professional training for cook cum helpers, involvement of parents in taste testing, and water testing are crucial areas that require significant attention and improvement to ensure the safety and nutritional adequacy of the midday meal program.

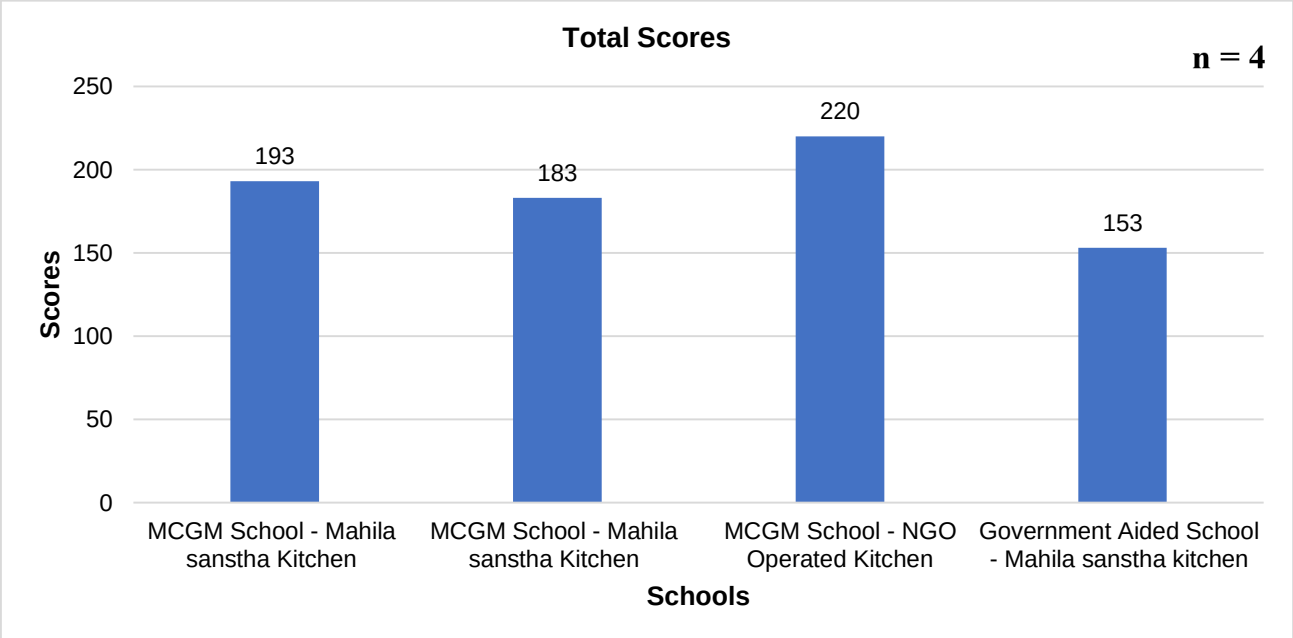

Figure 2: Total scores of all the 4 schools

Total Scores: The overall scores obtained by each school are presented in Figure 5.2.16, illustrating the performance of the schools in compliance with government guidelines. Among the schools evaluated, the MCGM School with an NGO-operated kitchen achieved the highest score of 220, indicating their adherence to government guidelines. The next highest score of 193 was obtained by another MCGM School managed by the Mahila Sanstha. On the other hand, the other MCGM School, also operated by Mahila Sanstha, received a relatively low score of 183. Similarly, the government-aided school, managed by Mahila Sanstha, received a very low score of 153. These schools and their associated kitchens require significant support and assistance, both in terms of training and financial aid, to enhance their performance and compliance with government guidelines.

Thus, testing of the PM POSHAN scale in different schools revealed compliance with government guidelines in areas such as purchasing, storage, and cleaning of cooking areas. However, there was significant room for improvement in categories such as food preparation, cooking, personal hygiene, the role of school authorities, beneficiary satisfaction, and infrastructural requirements. The quality assurance results were particularly concerning, as they indicated non-compliance with government guidelines and unacceptable outcomes, highlighting the urgent need for addressing these issues.

Table 2: Comparative Analysis of Existing Evaluation Methods and the Developed PM POSHAN Scale

Parameters	MDM App	Interactive Voice Response System (IVRS)	Face Detection techniques	Supervisors	PM POSHAN SCALE
Number of children Eating the meals	√	√	√	√	√
Student's preferences (Likes and Dislikes)					√
Hygiene Conditions and Assessment of Kitchens				√	√
Challenges faced by School				√	√
Quantitative Assessment (Through Scores)					√
User-friendly and quick		√			√

Cost Friendly					√

As evident from the table above, the PM POSHAN SCALE emerges as a comprehensive and convenient monitoring tool that facilitates prompt action in areas requiring improvement.

IV. CONCLUSION

To our knowledge, this is the first-ever tool which has been developed to date which covers all the categories included in the guidelines. The implementation of this tool holds potential benefits for the community in various ways, including:

1. Improved compliance of eating meals among adolescents through the provision of hygienically prepared and delicious meals. This, in turn, can contribute to their overall nutrient intake, which is crucial during this developmental stage.
2. The comprehensive monitoring capabilities of this tool can help reduce the wastage of government resources. By promptly identifying areas of concern and enabling swift action, it aids in maximizing the effective utilization of available resources.

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