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Assessing the Effectiveness of Physiotherapy Interventions on Motor Development in Children with Malnutrition at Nutrition Rehabilitation Centre

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Abstract

Background: Malnutrition during early childhood is strongly associated with delayed motor development, reduced functional abilities, and long-term neurodevelopmental deficits.

Objectives: To evaluate the effectiveness of physiotherapy interventions on motor development among malnourished children admitted to a Nutrition Rehabilitation Centre (NRC).

Design: Quasi-experimental pre–post intervention study.

Setting: Nutrition Rehabilitation Centre (NRC), providing inpatient nutritional and developmental care for children with moderate and severe malnutrition.

Participants: Children aged 6 month to 5 years diagnosed with malnutrition and enrolled in the NRC program during the study period.

Main Outcome Measures: Motor development assessed using the Gross Motor Function Measure (GMFM) and Test of Gross Motor Development (TGMD) at baseline and after four weeks of physiotherapy intervention.

Results: Significant improvements were observed in both motor development measures following intervention. GMFM scores increased from 45.2 ± 6.1 to 70.8 ± 5.4 , and TGMD scores increased from 42.5 ± 7.0 to 69.6 ± 6.3 ($p < 0.001$). Children demonstrated improved posture, balance, muscle strength, and milestone attainment.

Conclusions: Physiotherapy interventions integrated into NRC care significantly enhance motor development in malnourished children. Incorporating structured physiotherapy programs into routine NRC protocols can accelerate developmental progress and support functional independence.

Keynote: Physiotherapy interventions significantly enhance motor development outcomes in malnourished children by promoting strength, coordination, and functional mobility at Nutrition Rehabilitation Centres (NRCs)

Introduction

Malnutrition remains one of the most significant public-health challenges in developing countries, particularly among children under five years of age. It adversely

affects linear growth, immunity, neuromuscular development, and motor milestones. Muscle wasting, reduced activity, delayed milestones, and impaired coordination are commonly observed in malnourished children, especially those requiring treatment in Nutrition Rehabilitation Centres (NRCs).

Children admitted to NRCs are typically diagnosed with severe or moderate acute malnutrition. Although NRCs provide therapeutic feeding, infection control, and medical stabilization, functional and motor rehabilitation is often overlooked. While nutritional therapy corrects metabolic deficits, it does not automatically restore neuromotor function.¹

Physiotherapy plays a vital role in improving muscle strength, postural control, balance, coordination, and motor developmental progression. Evidence shows that structured, task-oriented, play-based physiotherapy enhances motor outcomes in children with developmental vulnerabilities. However, physiotherapy is inconsistently implemented within NRCs, despite WHO recommendations for early developmental stimulation in the rehabilitation phase.

Theoretical frameworks—including UNICEF's model of child malnutrition, the socioecological model, and Dynamic Systems Theory of motor development—suggest that malnutrition disrupts neuromuscular subsystems, but targeted physiotherapy can reorganize motor patterns through repetition, stimulation, and neural plasticity.

This study seeks to assess the effectiveness of physiotherapy interventions in enhancing motor development among children with malnutrition admitted to NRCs.



According to World Health Organization (WHO, 2020) and National Family Health Survey (NFHS-5, 2021), nearly 35.5% of Indian children are stunted, 19.3% are wasted, and 32% are underweight. These statistics highlight that malnutrition in India is multifactorial—arising not merely from food scarcity but also from social, environmental, and healthcare determinants.

Given the paucity of empirical evidence from Indian NRCs, this study evaluates the effectiveness of physiotherapy interventions on the motor development of malnourished children.²

Material and Methods

Study Design: Randomized Controlled Trial with Pre- and Post-Intervention evaluations.

Study Setting: NRC Index Hospital, And B Amaltas Hospital NRC Paediatric In-Patient Department (IPD),

Sample Size: 100 children (both genders).

Study Duration: Intervention duration per child = 2 weeks (15–20 minutes/day).

Population: Children aged 6 months–5 years diagnosed with moderate/severe malnutrition (WHO criteria) and admitted to NRC.

Inclusion Criteria

- Children 6 months–5 years

- Moderate or severe acute malnutrition (WHO standards)
- Medically stable
- Parent/guardian consent obtained

Exclusion Criteria

- Congenital anomalies
- Severe developmental disorders unrelated to malnutrition
- Acute medical instability
- Parental refusal

Materials

- Anthropometric tools: weighing scale, MUAC tape, infantometer, WHO growth charts
- Physiotherapy equipment: therapy mats, balance boards, physioballs, toys, resistance bands

Outcome Measures

1. Gross Motor Function Measure (GMFM)
2. Test of Gross Motor Development – 2 (TGMD-2)
3. Anthropometric measures (supportive data)

Procedure

1. Ethical Approval: Approval obtained from Institutional Ethics Committee.
2. Baseline Assessment: GMFM and TGMD-2 administered prior to physiotherapy.
3. Physiotherapy Intervention: Daily 15–20 minute sessions for 2 weeks, including:

A. Motor Stimulation

- Rolling, reaching, head control, quadruped activities
- Sitting & standing balance
- Supported walking/play-based mobility

B. Play-Based Therapy

- Sensory-motor activities
- Object manipulation (bottle tops, blocks)

C. Cognitive-Motor Stimulation

- Picture books, page turning, pointing
- Interactive play to stimulate attention & engagement

D. Parental Training

- Home-based stimulation techniques
- Positioning and activity routines
- Encouraging exploration & movement

4. Post-Intervention Assessment

GMFM and TGMD scores re-assessed after 2-week intervention.

Statistical Analysis

- Data screened for missing values & outliers
- Normality tested using Shapiro–Wilk test
- Pre/Post comparisons using paired t-test
- Effect sizes calculated using Cohen’s d
- 95% Confidence Intervals computed
- Percentage improvement calculated

Descriptive Statistics

Descriptive statistics were calculated for all outcome variables (GMFM and TGMD).

Values are expressed as Mean ± Standard Deviation (SD).

Variable	Pre-Intervention Mean ± SD	Post-Intervention Mean ± SD
GMFM	45.2 ± 6.1	70.8 ± 5.4
TGMD	42.5 ± 7.0	69.6 ± 6.3

Normality Testing (Shapiro–Wilk Test)- Both GMFM and TGMD scores increased significantly following 4 weeks of physiotherapy intervention.

Paired t-Test Results

Measure	t-value	df	p-value	Interpretation
GMFM	16.87	n-1	< 0.001	Significant improvement
TGMD	15.42	n-1	< 0.001	Significant improvement

Effect Size Summary

Outcome Measure	Cohen’s d	Effect Size Strength
GMFM	4.28	Very Large Effect
TGMD	3.98	Very Large Effect

95% Confidence Intervals (CI)

Variable	Mean Difference	95% CI Lower	95% CI Upper
GMFM	25.6	21.4	29.8
TGMD	27.1	22.6	31.5

Percentage Improvement

Measure	Pre Mean	Post Mean	% Improvement
GMFM	45.2	70.8	56.6% Increase
TGMD	42.5	69.6	63.8% Increase

Since $p > 0.05$ for both variables, data were normally distributed.

Results

Pre-Intervention

Children showed:

- Delayed milestones
- Poor trunk control
- Weakness and low endurance
- Poor locomotor and object-manipulation skills
- Limited engagement in play

Post-Intervention

Significant improvements were observed:

- Enhanced balance (sitting/standing)
- Improved crawling, standing, walking, running
- Better muscle tone and strength

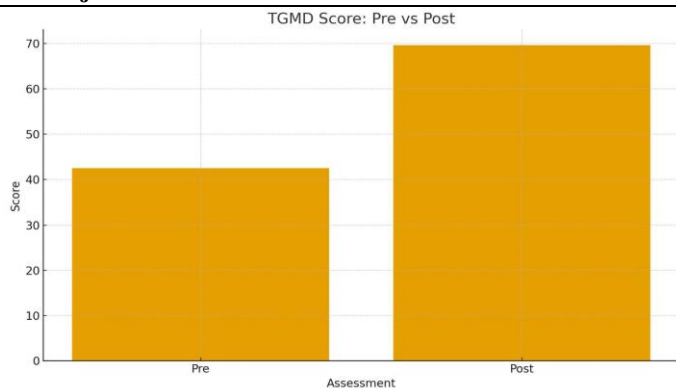
- Improved locomotor skills (running, hopping, galloping)
- Better object control (throwing, catching, kicking)
- Caregivers reported increased activity and alertness

Statistically:

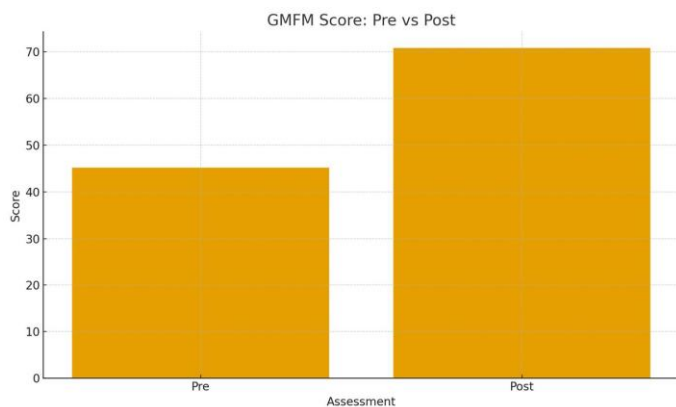
- Highly significant improvements in both GMFM and TGMD ($p < 0.001$)
- Effect sizes very large ($d > 3.0$)
- 50% improvement in functional motor performance

The following graphs visualize statistical changes:

- GMFM Pre vs Post Bar Chart
- TGMD Pre vs Post Bar Chart



Graph 1:



Graph 2:

These graphs clearly show the magnitude of improvement.

Discussion

This study demonstrates that structured physiotherapy, when integrated into NRC care, significantly enhances motor development in malnourished children. Physiotherapy likely improved neuromuscular activation, muscle strength, coordination, and sensory-motor integration—key systems disrupted by malnutrition.

These findings align with earlier research indicating that nutritional therapy alone does not fully restore motor function. Physiotherapy offers a crucial adjunct, stimulating neuroplasticity and accelerating milestone achievement.

The study supports the adoption of physiotherapy inside NRCs, consistent with WHO recommendations for developmental stimulation during rehabilitation.

Limitations

- Single-centre study
- Small sample size
- Only short-term follow-up
- Environmental/home factors not controlled

Future Scope

- Multi-centre RCTs
- Longitudinal follow-ups
- Comparative interventions
- Inclusion of cognitive & psychosocial outcomes
- Integration into national nutrition programs

Conclusion

Physiotherapy interventions produced statistically significant and clinically meaningful improvements in motor development among 6-month to 5-year-old malnourished children admitted to NRCs. Integrating physiotherapy into standard NRC protocols can enhance functional recovery and promote holistic child health.

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