

Evaluate the effectiveness of protein ball on nutritional status among anganawadi children of selected villages, under Devarayasamudra Primary Health Center, Kolar district, Karnataka

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ABSTRACT

Background: Malnutrition remains a prevalent issue in rural India, particularly among anganawadi children, affecting physical and cognitive development. With limited access to nutrient-rich diets, community-based solutions become essential.

Materials & Methods: A true experimental design was adopted using a simple random sampling technique with the lottery method to select sixty Anganwadi children (Mild & Moderate malnourished children), among thirty assigned to the experimental group and thirty allocated to the control group. Baseline anthropometric measurements were recorded, and the experimental group received mid-morning protein ball supplements on alternate days for 60 days. Nutritional status was assessed in both groups before and after the intervention using standardized tools. Data were analyzed using descriptive and inferential statistics, including paired t-tests and chi-square tests.

Results: The experimental group showed a significant improvement in nutritional status, with mean scores rising from 78.07 (SD = 6.41) to 88.13 (SD = 5.88), $t = 22.649$, $p = 0.001$. The control group showed from 78.70 (SD = 5.83) to 81.13 (SD = 5.89), $t = 2.81$, $p = 0.037$. The intervention demonstrated statistically significant effectiveness.

Discussion: The findings of this study support the use of protein ball supplementation as an effective intervention for improving child nutrition at the community level. The statistically significant improvements in the experimental group align with existing research emphasizing the role of protein-rich foods in combating undernutrition. The simplicity, affordability, and cultural acceptability of the protein ball make it viable addition to supplementary nutrition programs under ICDS.

Conclusion The study concludes that Protein ball supplementation effectively improves anganawadi children's nutrition and offers a low-cost solution for community programs.

Keywords: Protein ball, Nutritional status, Anganawadi children, Dietary intervention, Community health.

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Introduction

Nutrition is the science of food and its nutrients, including their interactions, roles in growth, and prevention of disease¹. In developing countries, malnutrition remains a significant public health issue contributing to infant mortality, poor cognitive development, and increased susceptibility to infections². Among children under five, protein-energy malnutrition (PEM) is the most prevalent form, particularly in socioeconomically disadvantaged communities³. The World Health Organization defines PEM as a spectrum of conditions caused by varying degrees of protein and calorie deficiency, often exacerbated by recurrent infections⁴. According to the National Family Health Survey-4 (NFHS-4), underweight prevalence among rural children in India stands at 38.3%, compared to 29.1% in urban areas⁵. The World Bank describes malnutrition in India as a "silent emergency," with prevalence rates nearly five times higher than in China and double that of Sub-Saharan Africa⁶. UNICEF reports that wasting—defined by low weight-for-height—is a

strong predictor of child mortality, with undernutrition contributing to 35% of deaths among children under five⁷. Frequent illnesses such as diarrhea also exacerbate nutritional deficiencies in this age group. Fortifying plant-based foods and ensuring adequate protein intake are essential strategies to improve nutrition in resource-limited settings⁸. Protein-rich foods support growth, immunity, and hormonal regulation. In community health, nurses play a vital role in implementing nutritional interventions, especially those targeting early childhood⁹. Locally adapted, affordable supplements such as protein balls offer a promising strategy to improve nutritional status among anganawadi children.

OBJECTIVES OF THE STUDY

To assess the nutritional status of anganawadi children before administering protein ball in both experimental and control group. To evaluate the effectiveness of protein ball on nutritional status among anganawadi children by comparing pre and post intervention in both experimental and control group. To determine the association between the Pre-test nutritional status with

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selected socio-demographic variables of anganawadi children.

HYPOTHESIS

H1: There will be significant improvement in the nutritional status after administration of protein ball in the experimental group.

H2: There will be significant association between Pre-test nutritional status with selected socio-demographic variables.

OPERATIONAL DEFINITIONS

1. Anganawadi children: In the present study the Anganawadi children refers to children aged between 3-5 years and registered in anganawadi centers.
2. Protein ball: The present study Protein ball refers to the recipe adopted, which consist of ingredients like jowar, rice, wheat, Bengal gram dhal, green gram dhal, ground nuts, ghee and jaggery.
3. Nutritional status: In the present study the nutritional status of change on body weight of children with mild and moderate malnutrition.
4. Effectiveness: It refers to the positive outcome of nutritional status on malnourished under five

children after the administration of protein ball.

Methods and Material: A true experimental (pre-test and post-test control group) research design was adopted for this study. The ethical clearance (SDUCON/IEC/PG-136/2023-2024) was obtained from the institutional ethical committee of Sri Devaraj Urs College of Nursing. A formal written permission was obtained from the Deputy Director of Department of Women and Child Welfare at kolar district. Using simple random sampling technique 60 (30 Experimental group and 30 Control group) samples were selected who will fulfilled the inclusion criteria.

Inclusion criteria:

1. Children attending anganawadi centers.
2. Both male and female children age group between 3 to 5 years.
3. Children with mild and moderately malnourished.

Exclusion criteria:

1. Children suffering from any chronic illness.
2. Children classified as severely malnourished.
3. Children who do not cooperate during the data collection.

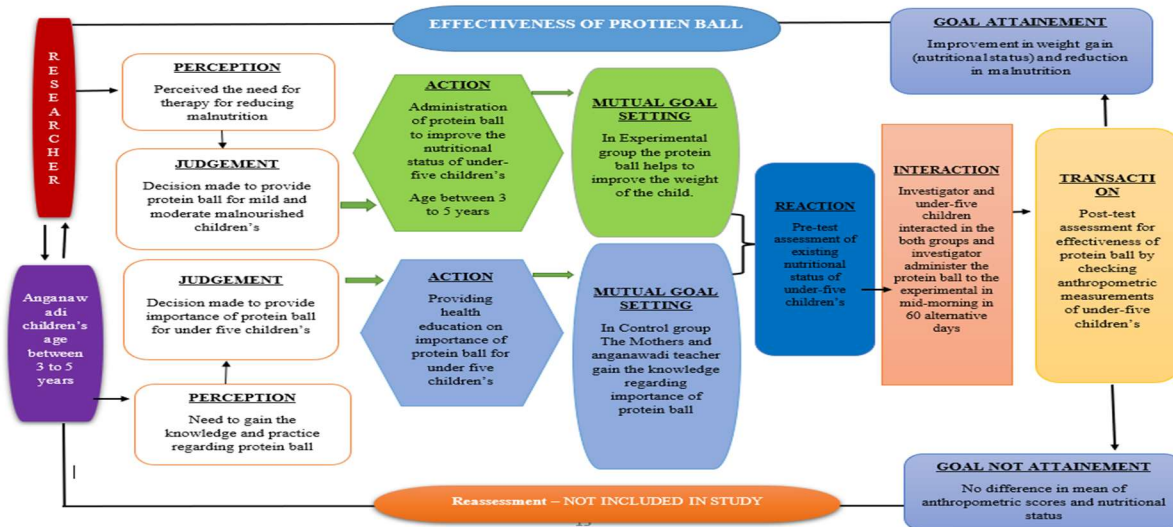


Figure. 1 Conceptual Framework Based on Modified Imogene Kings Goal Attainment

TOOLS AND TECHNIQUE

SECTION A: Socio demographic data includes Age of the child, Gender, Birth weight, type of diet, type of family, order of the child, Educational status of mother, Occupation of mother, Socioeconomic status, history of hospitalization from past one year.

SECTION B: Anthropometric measurements which include the growth parameters like height, weight, mid arm circumference, head circumference and chest circumference along with classification of degree of malnutrition.

Assessment of nutritional level: Percentage of malnutrition was calculated by using formula:

$$\text{Degree of Malnutrition} = \frac{\text{Actual weight}}{\text{Expected weight}} \times 100$$

For age group 1 year to 6 years (Weech's formula): Expected weight = Age in years X 2=8

Degree of malnutrition is classified based on WHO classification

- a. >90% body weight - nourished
- b. 76-89% body weight 1st degree malnutrition
- c. 60-75% body weight 2nd degree malnutrition

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d. <60% body weight 3rd degree malnutrition

SECTION C: Administration of Protein ball, Ingredients of Protein ball contains jowar flour (15 g), rice flour (10 g), wheat flour (15 g), Bengal gram dhal (15 g), green gram dhal (15 g), groundnuts (15 g), ghee (10 g), and jaggery (15 g), giving a total weight of approximately 110 g per protein ball. The total protein content per ball was calculated as 13.82 g, and the energy value was approximately 476 kcal per ball.

PRESENTATION OF DATA

The data are organized and presented in four sections.

The data was collected from 24/03/2025 to 22/05/2025 i.e. over a period of 8 weeks. The time schedule for data collection and administration of protein ball was alternative days from 10AM to 12PM. In 30 samples (experimental group) were administration of protein ball for mild and moderate malnourished children's in a midmorning of alternative 60 days. Anthropometric measurements checked for all after 8 weeks. Post test was conducted on the sixty day after intervention. Data were analyzed using SPSS version 20.

Section A: -Table 1: Socio demographic variables of Participants.

Sl. no	Variable	Experimental group		Control group	
		f	%	f	%
01	Age (in Years):				
	3 Years	17	56.7	8	26.7
	4 Years	7	23.3	18	60
	5 Years	6	20	4	13.3
02	Gender				
	Boys	13	43.3	18	60
	Girls	17	56.7	12	40
03	Birth weight				
	Less than 2.5 kg	9	30	4	13.3
	More than 2.5 kg	21	70	26	86.7
04	Diet				
	Vegetarian	0	0	0	0
	Mixed	30	100	30	100
05	Type of family				
	Nuclear	18	60	17	56.7
	Joint	12	40	13	43.3
	Extend	0	0	0	0
06	Order of child				
	1	17	56.7	18	60
	2	8	26.6	9	30
	3	5	16.7	2	6.7
	4	0	0	1	3.3
07	Educational status of mother				
	No formal education	0	0	7	23.4
	Higher status	4	13.3	1	3.3
	SSLC	16	53.3	13	43.3
	PUC and above	10	33.4	9	30
08	Occupation of mother				
	Home maker	25	83.4	24	80
	Private employee	3	10	5	16.7
	Govt employee	0	0	0	0
	Others	2	6.6	1	3.3

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09	Socio-economic status				
	Below poverty	30	100	30	100
	Above poverty	0	0	0	0
10	History of hospitalization				
	Yes	0	0	0	0
	No	30	100	30	100

The socio-demographic data revealed notable patterns among the anganawadi children enrolled in both experimental and control groups. Age distribution varied, with most children in the experimental group being 3 years old (56.7%), while the majority in the control group were aged 4 years (60%). Gender representation showed a slightly higher proportion of girls in the experimental group (56.7%), in contrast to the control group where boys predominated (60%). Regarding birth weight, a favourable trend was observed, with 70% of the experimental group and 86.7% of the control group born weighing more than 2.5 kg. All participants followed a mixed diet, and no vegetarians were reported. Family structure was mainly nuclear in both groups, accounting for 60% and 56.7% respectively, followed by joint families; extended families were absent. Most children were first-born (56.7% in the experimental group and 60% in the control group), with decreasing proportions for second and third-order births. Educational status of mothers showed a clear contrast: the experimental group had no mothers without formal education, while 23.4% of mothers in the control group lacked formal schooling. SSLC and PUC-level qualifications were dominant across both groups. Homemaking was the predominant occupation among mothers, with 83.4% in the experimental and 80% in the control group, while only a few were employed privately. Socio-economic status was uniformly low, with all families falling below the poverty line. Notably, none of the children in either group had a history of hospitalization, suggesting stable baseline health prior to the intervention.

Section B: Objective 1: To assess nutritional status of anganawadi children before administering protein ball in both experimental and control group.

Table 2: Frequency and Percentage Distribution of Samples in experimental and control group according to Pre-test level of malnutrition among under five years children. N=60

The table 2 represents that the in the experimental group Highest 66.6% had mild malnutrition and 33.4% participants

Degree of malnutrition	Experimental group		Control group	
	f	%	f	%
Normal	0	0	0	0
Mild	20	66.6	24	80
Moderate	10	33.4	06	20
Severe	0	0	0	0

had moderate malnutrition. Where as in control group: Highest 80% participants had mild malnutrition and 20% participants had moderate malnutrition.

Section C: Objective 2: To evaluate the effectiveness of protein ball on nutritional status among anganawadi children by comparing pre and post intervention in both experimental and control group.

Experimental group:

Table 3: Mean with standard deviation of anthropometric measurements in experimental group before and after interventions. n1=30

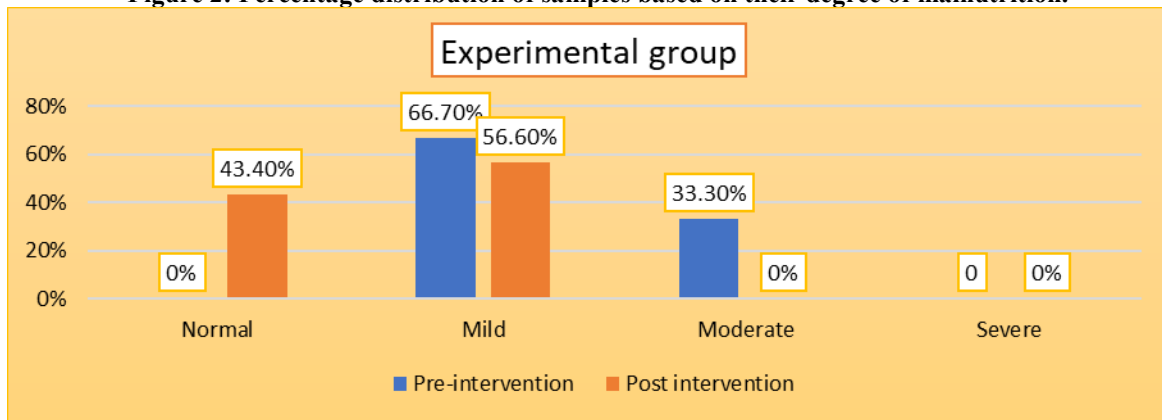
Anthropometric measurements	Pre-intervention		Post-intervention	
	Mean	SD	Mean	SD
Weight in kg	11.97	1.542	13.43	1.406
Height in cm	88.40	8.889	88.50	8.842
Head circumference in cm	46.80	3.231	46.80	3.231
Chest circumference in cm	52.57	3.683	52.57	3.683
Midarm circumference in cm	13.53	0.937	13.53	0.937
Degree of malnutrition in %	78.07	6.411	88.13	5.882

The table 3 expressed as mean values with their respective standard deviations (SD). Notably, the mean weight increased from 11.97 kg (± 1.542) to 13.43 kg (± 1.406), indicating substantial improvement in body mass. Height showed a slight change from 88.40 cm (± 8.889) to 88.50 cm (± 8.842), consistent with age-related growth. Head circumference (46.80 cm ± 3.231), chest circumference (52.57 cm ± 3.683), and midarm circumference (13.53 cm ± 0.937) remained unchanged,

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suggesting stable physical development during the study period. Importantly, the degree of malnutrition improved markedly from 78.07% (± 6.411) to 88.13% (± 5.882), reflecting the intervention's effectiveness in enhancing nutritional recovery. These findings underscore the positive impact of the intervention on child nutrition, with weight and malnutrition percentage showing the greatest responsiveness.

Figure 2: Percentage distribution of samples based on their degree of malnutrition.



The above figure 2 represent that the, most of the participants had mild malnutrition (66.7%), while 33.3% experienced moderate malnutrition in before the interventions. And after the intervention a significant improvement is observed 43.4% of individuals transitioned to normal nutritional status. The number of individuals with mild malnutrition decreased 56.6%, and moderate malnutrition was eliminated entirely.

Control group:

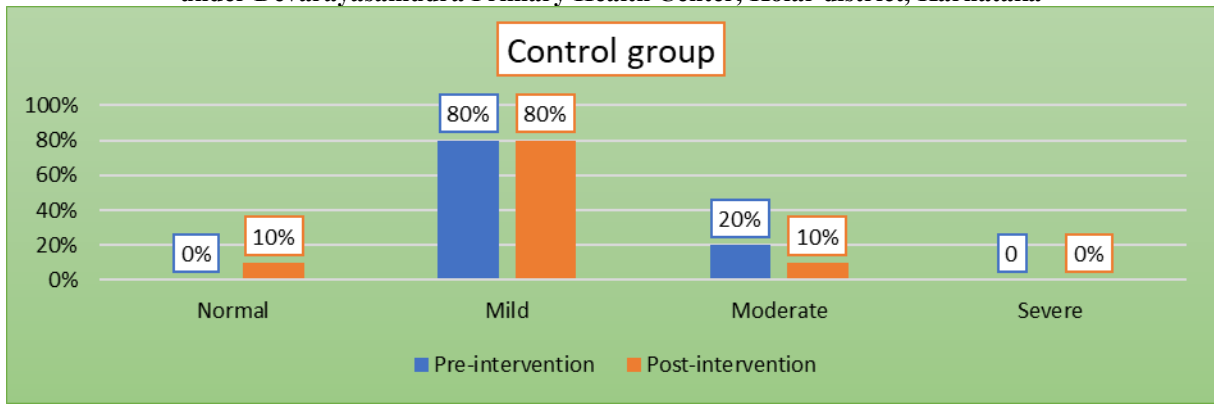
Table 4: Mean with standard deviation of anthropometric measurements in control group. n2=30

Anthropometric measurements	Pre-intervention		Post-intervention	
	Mean	SD	Mean	SD
Weight in kg	12.83	1.472	13.10	1.417
Height in cm	84.67	13.633	85.00	13.401
Head circumference in cm	45.50	1.378	45.50	1.378
Chest circumference in cm	51.67	1.862	51.83	1.722
Midarm circumference in cm	14.00	1.095	13.83	0.753
Degree of malnutrition in %	78.70	5.832	81.03	5.991

The table 4 presented as mean values with corresponding standard deviations (SD). Post-intervention weight increased from 12.83 kg (± 1.472) to 13.10 kg (± 1.417), indicating a favourable response to nutritional support. Height showed a minor increase from 84.67 cm (± 13.633) to 85.00 cm (± 13.401), reflecting expected growth. Head circumference remained unchanged at 45.50 cm (± 1.378), suggesting stable neurodevelopment. Chest circumference showed a slight increase, from 51.67 cm (± 1.862) to 51.83 cm (± 1.722), while midarm circumference slightly decreased from 14.00 cm (± 1.095) to 13.83 cm (± 0.753), potentially indicating temporary variability in muscle or fat stores. Notably, the pre-intervention means score of degree of malnutrition was 78.70 with SD 5.832 and post-intervention mean score of weight is 81.03 with SD 5.891 slightly increased.

Figure 3: Percentage distribution of samples based on their degree of malnutrition. n2=30

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The above figure 3 represents that the, most of the participants had mild malnutrition (80%), while 20% experienced moderate malnutrition in before the interventions. And after the intervention maximum of the participants had mild malnutrition (80%), while 10% experienced moderate malnutrition and 10% significant improvement is observed in control group with absence of interventions.

Table 5: Effectiveness of protein ball on nutritional status of anganawadi children experimental and control group using paired t-test. N = 30+30

Test	Experimental group(n1=30)				Control group(n2=30)			
	Mean	SD	t-value	P value	Mean	SD	t-value	P value
Pre-intervention scores	78.07	6.411	22.649	0.001 SS	78.70	5.832	2.81	0.037 NS
Post-intervention scores	88.13	5.882			81.03	5.891		

Note: - 'SS- statistically Significant, df=29, t - value = 3.979, t-table = 3.460 & P<0.05'.

The table 5 shows that the experimental group had a significant improvement in mean score from 78.07 ± 6.411 (pre-test) to 88.13 ± 5.88 (post-test), with a calculated t value of 22.649, which was greater than the table value (3.659), indicating statistical significance at p = 0.0001 (df = 29). In contrast, the control group showed a change from 78.70 ± 5.832 to 81.03 ± 5.891, with a calculated t value of 2.81, which was less than the table value, indicating no statistically significant difference at p = 0.05 (df = 29).

Hence, in experimental group highly statistically significant. Finally, study concluded that protein ball was effective to improve the nutritional status of under-five children.

Table 6: Effectiveness of protein ball on nutritional status of anganawadi children by comparing between the experimental and control groups post-test scores. N=30+30

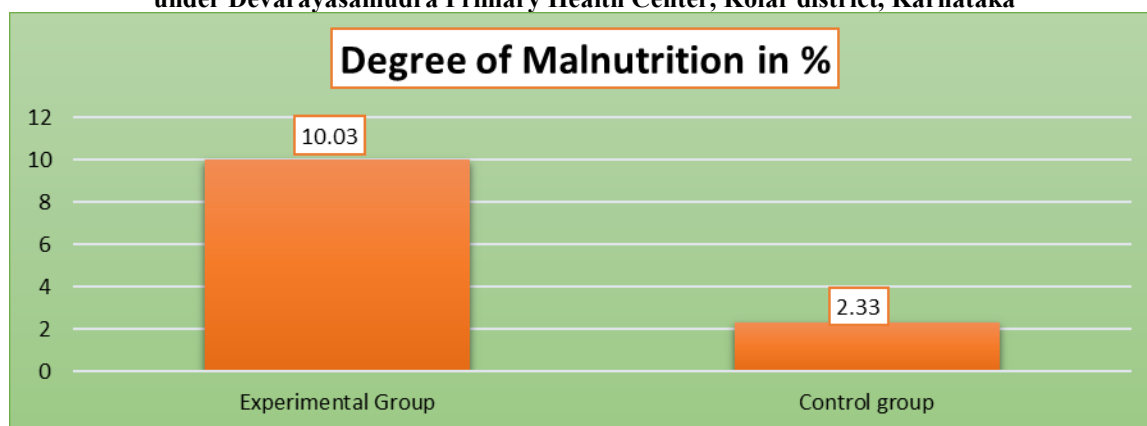
Test	Independent "t" test			
	Mean	SD	t-value	P value
post-experimental group scores	88.13	5.882	4.67	0.001 SS
Post-control group scores	81.03	5.891		

Note: - SS- statistically Significant, df=58, t calculated value = 4.67, t-table = 3.460 & P<0.05

The unpaired t test showed that the post-test mean score of the experimental group (88.13 ± 5.882) was significantly higher than that of the control group (81.03 ± 5.891) (t = 4.67, p = 0.001), indicating a statistically significant difference between the two groups.

Fig. 4: Comparison of overall Mean difference score of nutritional status in control and experimental group to find out the effectiveness of protein ball.

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Section D: Objective 3: To determine the association between the Pre-test nutritional status with selected socio demographic variables of anganawadi children.

Table 7: Association between the Pre-test nutritional scores with selected socio demographic variables in experimental group. n1=30

SI No	Demographic variable		Degree of malnutrition		Chi square valve	df	P< 0.05 Valve inference
			Below median <78	Above median >78			
01	Age in years	<4years >4 years	14 04	10 02	0.138	1	0.709 NS
02	Gender	Boys Girls	05 13	08 04	4.434	1	0.03 SS
03	Birth Weight	< 2.5 kgs >2.5 kgs	07 11	02 10	1.693	1	0.193 NS
04	Type of Family	Nuclear family Joint family	10 08	08 04	0.370	1	0.542 NS
05	Order of child	< 02 >02	12 06	05 07	1.832	1	0.178 NS
06	Educational status of mother	Higher primary and SSLC PUC and above	12 06	08 04	0	1	1 NS
07	Occupation of mother	Homemaker Private employee and Others	15 03	10 02	0	1	1 NS

Table 8: Association between the Pre-test nutritional scores with selected socio demographic variables in Control group. n2=30

SI No	Demographic variable		Degree of malnutrition		Chi square valve	df	P< 0.05 Valve inference
			Below median <88.50	Above median >88.50			
01	Age in years	<4 years >4 years	01 14	07 08	6.136	1	0.01 SS

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02	Gender	Boys	10	08	0.555	1	0.456
		Girls	05	07			NS
03	Birth Weight	< 2.5 kgs	01	03	1.153	1	0.282
		>2.5 kgs	14	12			NS
04	Type of Family	Nuclear family	08	09	0.135	1	0.712
		Joint family	07	06			NS
05	Order of child	<02	08	10	0.267	1	0.605
		>02	07	05			NS
06	Educational status of mother	Higher primary and			0.158	1	
		SSLC	10	11			
		PUC and above	05	04			0.697
07	Occupation of mother	Homemaker			3.333	1	
		Private employee and	10	14			0.067
		Others	05	01			NS

The above table 7&8 depicts that the chi-square test was applied to determine the association between pre-test nutritional scores and selected socio-demographic variables of Anganwadi children in both experimental and control groups. The results revealed that In the experimental group, gender showed a statistically significant association with the degree of malnutrition ($\chi^2 = 4.434$, $df = 1$, $p = 0.03$), indicating that nutritional status significantly differed between boys and girls, whereas in the control group, age of the child showed a statistically significant association with the degree of malnutrition ($\chi^2 = 6.136$, $df = 1$, $p = 0.01$), indicating variation in nutritional status according to age group. and all other demographic variables were not statistically significant ($p > 0.05$).

Discussion: Overall, the study findings indicate that protein ball supplementation significantly improved the nutritional status of Anganwadi children in the experimental group, while no significant improvement was observed in the control group. The lack of association between nutritional outcomes and socio-demographic variables in both groups suggests that the improvement was attributable to the intervention. Hence, protein ball supplementation is a simple, cost-effective, and feasible community-based strategy for improving child nutrition.

IMPLICATION TO NURSING PRACTICE

- The finding of the study has following implication in nursing.
- Nurses can identify undernourished children through community screening and provide appropriate nutritional interventions.
- Nurses ensure hygienic preparation and distribution of protein-rich supplements.
- Health education to parents and caregivers helps prevent malnutrition.
- Collaboration with Anganwadi workers supports sustainable dietary practices.

RECOMMENDATIONS:

- Scale up the intervention across other Anganawadi centers under the PHC with routine monitoring by nursing staff.
- Integrated nutrition counselling for caregivers alongside supplementation to improve household dietary diversity.
- Develop simple IEC materials and cooking demonstrations to promote sustainability at the community level.

- Advocate for inclusion of such food-based supplements in state or district-level child nutrition schemes.
- A longitudinal study can be done to assess the morbidity status of malnourished children.
- A comparative study on prevalence of malnutrition in urban and rural area can done among under five children. There is great need to conduct more research to become community people familiar with this recipe.

LIMITATIONS

- Restricted to selected villages; generalizability may be limited.
- Short-term study duration limits assessment of sustained nutritional improvement.
- Compliance with daily intake and taste acceptance may vary among children.
- External factors like seasonal illness, family food practices, or migration can influence outcomes.
- The study was limited to only pre-schooler children.
- The study was limited to only rural area anganawadi centers.
- The study was limited to only children coming to anganawadi centers.

CONCLUSION

The majority of Anganwadi children were found to be malnourished. The findings of the study suggest that protein ball supplementation is effective in improving the nutritional status of under-five children. The use of community resources and locally available ingredients makes this intervention feasible, sustainable, and suitable for daily implementation, thereby promoting a healthy life among under-five children.

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