

Impact of Rice Pudding on Preschool-Aged Children's Health: an Overview of a Pilot Study



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Abstract

Background: Preschool-aged children of disadvantaged households in Nepal have a higher prevalence rate of under nutrition. A major contributing reason is the inadequate maternal knowledge, existing taboos and unscientific food recommendation practices.

Aim: This pilot study evaluates the impact of the rice pudding feeding programme on child health and calculates the costs of the preparation.

Materials and Methods: A before-and-after study of children aged under-five attending a day-care centre in remote Nepal. Children's weight, height and MUAC (Mid-Upper Arm Circumference) were compared before and after the rice pudding programme which lasted 54 days.

Results: 42 children (boys 43% & girls 57%), of whom 90% had gained weight whilst the weight of the remaining 10% of children stayed constant. Similarly, 78% had increased MUAC while 12% of 2 children improved slightly. The study was inexpensive, US\$ 0.34 per day per child and likely to be cost-effective.

Conclusion: A regular healthy diet of rice pudding helps children's nutritional need. It is important to consider right dietary practice, including portion sizes, and community awareness about healthy diet and impact of child health as well as sustainability.

Key Messages

- Significantly improved child's weight and MUAC.
- Partnership programme leads to cost-effectiveness and sustainability of the programme.
- This programme could be replicated in the similar areas in Nepal.

Keywords: Rice Pudding; Healthy Diet; Knowledge; Beliefs; Attitudes; Poverty; School Meal and Malnutrition; Child Health; Well-Nourished Children; Preservatives; Artificial Flavouring; Synthetic Chemicals; Mobilization; Innovation; Portable Stadiometer

Introduction

Most children who suffer from hunger, infections, most other diseases, or who are deficient in certain nutrients do not have the same potential for cognitive skill development as well-nourished children [1-4]. Good nutritional and health status have a powerful effect on how well a student performs and learns at school [4-6]. Poor nutrition among school-aged children impairs their learning and development through poor participation in learning experiences, physiological changes, or both [5,6,7]. Research highlights a link between under-nutrition, as a determinant for poor health, and the educational performance of school children [8-12].

Study Rationale

In 2013, the World Food Programme (WFP) estimated that nearly 368 million children from developing and developed countries received a meal every day at school, at an annual cost of School USD 45 to 75 billion [12] the school meals programme plays a crucial role in the diets of children in poor families. This study targeted the following aspects: evaluation of the anthropometric changes of the under-five children, [12,13,14] assessment of the costs of the rice pudding meals, raising awareness about a healthy 3 diet [16,20]. It ultimately aimed to support Sustainable Development Goals 2, 3 and 5 [1,13-16] In order to inform

intervention plans, a pilot study was undertaken as the first step to begin building an appropriate evidence base on improving child health and food behaviour [4,9,13,17-19].

Objectives

This study focused on addressing child hunger and micronutrient deficiencies, both of which can impact weight, height and MUAC (Mid-Upper Arm Circumference) [3,17,14,20,21] through the provision of rice pudding as a meal in schools. It set out to address three aspects:

- Evaluate the impact of the rice pudding feeding programme on child health.
- Calculate the costs of the preparation.
- Increase the level of awareness about a healthy diet and local involvement in the school snack programme.

Materials and Methods

Study design

The pilot study [22,23] aimed to evaluate and compare the anthropometric progress of children under five. All the children who enrolled at Jugal Child Development Center (CDC) were included in the study [24].

Study population and exclusion criteria

This study selected the Jugal Child Development Center (CDC) of Sindhupalchowk district of Nepal and recruited 42 children [25,26]. There were no declines or withdrawals after the start of the study [22,4].

Duration

The study started on 21 December 2015 and ended on 21 February 2016. The rice pudding was served for 54 days during the *Tiffin (snack)* time between 12:00 to 13:00 pm. The CDC opened Sunday to Friday from 9:00-15:00 hrs.

Rice pudding preparation and portion size

Rice pudding²⁹ was prepared according to a traditional recipe with some additional ingredients to enhance nutritional value and improve taste. Preservatives, artificial flavouring and other synthetic chemicals were avoided [3,5,27-29]. A metal cup was used to measure the portion (300 grams/child) of rice pudding. This study did not calculate the calorific content and nutritional information of all the additives [1,19,20,26]. The rice pudding contained dry fruits, sugar, and other ingredients (Table 1). During the intervention, CDC facilitators took the lead role in preparing the rice pudding while mothers assisted in its preparation. Child Nepal (a non-governmental organization) played a crucial role in community mobilization/innovation [26]. The milk for the rice pudding was obtained by mothers from local farmers at a subsidised rate. Other necessary kitchen accessories and fuel for cooking were secured by CDC in collaboration with mothers [25,26,29,30]. It is estimated that the total cost for 300 grams of rice pudding was US\$ 0.34 day/child or Nepali Rupees (NR) 35.50. This cost (Table 1) included materials, management, fuel and labour costs [11,12,17,31,32], the estimated cost was US\$ 14.36 per day for the 42 children (Table 1). The labour cost was subsidised by the local body, particularly by the CDC and mothers' group. There was no or very limited data on the costs for school snacks programmes available in Nepal [5].

Table 1: Description of the materials cost for the rice pudding (daily).

Particulars	Unit	Cost (NRs)	Total (USD)
Clarified butter	500 ml	250	2.39
Raisins	200 mg	50	0.48
Sugar	1 Kg	80	0.76
Rice	1 Kg	100	0.96
Coconut	250 mg	25	0.24
Cashew-nut	200 mg	500	4.79
Cinnamon	50 mg	15	0.14
Milk	10 Liters	400	3.83
Miscellaneous	Fuel and labour charges	80	0.77
Subtotal (daily expenses for 42 children)		1500	14.36
Total cost	USD 0.34 day/child (NRs 35.51)	1500 x 54days = 81,000	775.56 (1USD@ 104.44 NRs. on 20 Dec. 2015)

Note: There was no fixed market price available in Nepal; hence price is based on costs as local markets.

Training and consent

Health workers and CDC teachers underwent training on data collection and recording. Similarly, they were aware of the importance of the healthy diet (rice pudding) and also of the study [32]. The District Public Health Office and District Education Office

of Sindhupalchowk of Nepal have approved the ethical permission for this study and consent were obtained from all parents and guardians prior to the rice pudding distribution programme [8,28,29]. Prior to start the study, the corresponding author had taken a consent from his supervisory team, who reviewed the study proposal of Bournemouth University.

Results

Health and anthropometric measurements

Participating children’s general health was assessed, and the results were normal [2,33,25]. Weight, height and MUAC assessments were undertaken twice by an experienced health professional [1,35] at baseline and upon completion of the study and recorded in the data record form (Table 2). Height and MUAC for children measurements were recorded in centimetres (cm)

(Tables 2&3). Heights of children were measured using a portable stadiometer (Seca) and recorded to the nearest one decimal place [16] similarly; MUAC was measured using a simple and a portable measuring tape and recorded to the nearest single decimal place. Weight was measured on a SECA 882 digital scale and recorded to the nearest 0.1-kg. Weighing scales were standardized with a 5-kg weight at the beginning of each testing day. All children were dressed in light clothing and standard procedures and equipment were used [16,6].

Table 2: Data record form.

S.No.	Name of the Child	Sex(M/F)	Age in Months	Initial data record			Final data record		
				Weight (Kg)	Height (Cm)	MUAC (Cm)	Weight (Kg)	Height (Cm)	MUAC (Cm)

Table 3: Demographics and data records of the participants.

S.No.	Name of the Child	Gender (M/F)	Age (Months)	Initial data			Final data		
				Weight (Kg)	Height (Cm)	MUAC (Cm)	Weight (Kg)	Height (Cm)	MUAC (Cm)
1		F	56	14 kg	91 cm	17 cm	15	92.5	18.8
2		F	59	16 kg	95.3cm	18.2cm	16	95.7	18.9
3		M	48	15 kg	92 cm	17 cm	16	93	17.4
4		M	60	16 Kg	97.2cm	18 cm	17	98	18.8
5		F	60	15 kg	95 cm	18 cm	16.3	95.8	19
6		F	49	13 kg	89.5cm	15.4cm	14.5	90	16.2
7		F	50	15 kg	91.3cm	15 cm	16	92	16
8		M	59	16 kg	90 cm	18 cm	16.4	91	19
9		M	60	16 kg	91.5cm	18.5cm	17	92.4	19.1
10		F	42	14 kg	89 cm	16.6cm	14.2	90.5	17.2
11		M	49	14 kg	91.4cm	18 cm	15	92	18.7
12		F	60	14 kg	96.1cm	18.6cm	15.5	96.6	19
13		M	49	18 kg	98 cm	18 cm	18	98	19
14		M	60	15 kg	95.5cm	18 cm	16.5	96.3	19.2
15		F	49	14 kg	85 cm	16.5cm	14	85.5	17
16		F	47	15 kg	84.8cm	16 cm	16	85.2	17
17		M	49	15 kg	84 cm	16 cm	15.5	85	16.8
18		F	49	13 kg	84.4cm	15 cm	13	85	16
19		M	49	15 kg	91.1cm	17 cm	15.5	92	18
20		F	43	13 kg	84.2 cm	17.2cm	14.2	85	17.9
21		F	41	12 kg	84.5cm	15 cm	13.2	85.2	16
22		F	30	11 kg	83 cm	15 cm	12.5	89.2	16.2
23		F	37	12 kg	89 cm	16 cm	13.5	91	18
24		F	42	13 kg	85 cm	15.2cm	14	86	17
25		M	37	12 kg	85 cm	14 cm	12	86	15
26		M	60	16 kg	89 cm	17 cm	16.2	89.7	18
27		F	39	13 kg	82 cm	16.4cm	13.5	83	17

28		F	31	12 kg	86.2cm	16.6cm	12.5	87	16.9
29		M	36	12 kg	92 cm	16.2cm	12.8	93	17
30		M	48	15 kg	88 cm	16 cm	16	89.4	17.1
31		M	36	10 kg	68.4cm	14 cm	10	69	14.5
32		F	36	13 kg	80 cm	15 cm	14.4	81	16
33		F	39	11 kg	69.7cm	14 cm	12	70.3	14.2
34		F	40	12 kg	90 cm	15.4 m	12.5	91	15.9
35		F	48	12 kg	90.2cm	15 cm	13	91.9	16
36		M	48	14 kg	85 cm	15.3cm	15	86	16.6
37		F	44	14 kg	88 cm	16.5cm	14	88.8	17.2
38		F	24	12 kg	87.1cm	15 cm	12.5	87.7	16
39		M	24	12 kg	86 cm	15.9cm	13.5	87.5	16.4
40		F	29	10 kg	78.5cm	15 cm	10.5	79.2	15.5
41		M	36	13 kg	87.1cm	14 cm	13.5	88	14.7
42		M	24	10 kg	84 cm	14 cm	10.2	85	14.4

Data management and analysis

Data were recorded in a data form (Tables 2 & 3) by the health teacher of the CDC and double checked by a health worker. Based

on the initial data, the height, weight and MUAC of the children were divided into four categories (Table 4). Baseline and final data were calculated and compared [1,2,9,34]. Data were analysed using the IBM SPSS statistical software (version 22.0).

Table 4: Distribution of weight, height and MUAC before and after the rice pudding programme.

Distribution of weight prior to the programme		Weight after programme
Weight range (kg)	Prior proportion (%)	After proportion (%)
12-15	33	12
13-15	53	52
16-18	14	36
Distribution of height prior to the programme		Height after programme
Height range (cm)	Proportion (%)	Proportion (%)
68-75	5	5
76-83	10	7
84-91	64	55
92-98	21	33
Distribution of MUAC prior to programme		MUAC after programme
MUAC range (cm)	Proportion (%)	Proportion (%)
14-16	57	38
17-19	43	62

Rice pudding feeding impacts on children

The majority of the participants were female (57%) with a mean age of 44.7 months. A plurality was between 46-50 months (31%), followed by 36-40 months (22%) and 51-55 months (21%). Only 2% of children were between 31-35 months (Table 3). The 16-18 kg weight group of the children of the total children have significantly gained their weight from 14% to 36%. But 13-15 kg weight group children could not increase their weight (53% vs. 52%) after the rice pudding (Table 4).

The height data showed significant differences between baseline survey data and final data (Tables 3 & 4). Among 42 children participating, the weight of 38 children increased, whilst

four maintained their weight. Similarly, 33 children increased in height and nine children demonstrated a small increment in height. Also, an increment in MUAC was found in 37 students while slight increment was found in the remaining 5 children (Tables 3 & 4). The study data showed significant improvements in the BMI of the children (Tables 3 & 4). MUAC measurement was categorized into two groups (Table 4). The proportion in the higher category had changed significantly from pre-programmed to post-intervention; overall 19% of the children increased their MUAC during the period of the intervention (Tables 3 & 4). Figure 1 show the result of the baseline results which were measured before the pilot study (left side) and after the pilot study (right side).



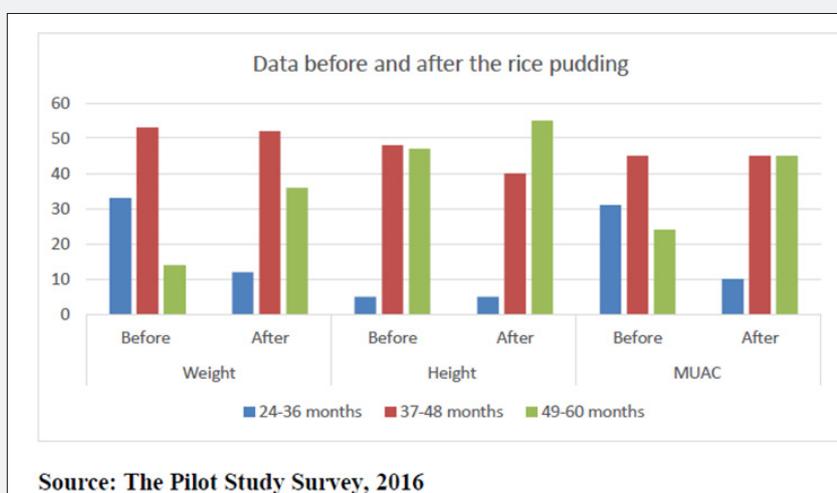
Figure 1: Children are enjoying rice pudding at the daycare centre.

Discussion

A free rice pudding was provided six days a week for two months at Jugal Child Development Centre, for children aged 2-5 years in an area with high levels of poverty [35]. Results indicated that this intervention enabled households to increase their expenditure on nutritious food items and spend less on junk foods [20,24]. A significant increase in daycare centre enrolment and in continuing education is also associated with the programme [12,35]. In Nepal, the impact of the rice pudding has not been studied extensively [30]. The rice pudding is termed '*Khir*' in Nepali language and accepted by all local religious and ethnic groups. *Khir* is also one of the popular recipes amongst the children and a nutritionally recommended food item [19,36]. Adding butter (ghee), sugar, raisins and other ingredients to rice pudding increases its nutritional value in terms of energy nutrients and improves its sensory acceptability [36]. *Khir* is easy to prepare, with an associated low cost [37]. This study has empowered parents and members of the community to intervene in food behaviours and thus have an impact on improving children's health and potentially have a beneficial effect on their 8 education. This intervention has played a vital role for increasing the knowledge about a healthy diet amongst mothers, teachers,

health workers and executive members of the CDC [35] which might be accepted by policy makers and various donor groups.

The study identified significant increases in children's weight, height and MUAC (Tables 3 & 4) and improved knowledge about a healthy diet amongst the parents [35,37]. Similarly, considering the growth of the children after introduction of school meals, de Onis et al. [37] describe the significant growth of under-five children (Figure 1), an outcome similar to the one observed in this pilot study (Figure 2). A study conducted in Ghana by Abizari et al. [34] indicated an important role for micronutrient-dense foods in the achievement of micronutrient adequacy within school feeding programmes, something our study also described (Figures 2 & 3). Abizari's cohort additionally showed that nutritional dietary intake was remarkably higher and more sufficient among children participating in a school feeding plan. Singh et al. [17] conducted a study on children whose families' income suffered from drought; their work reported that the school meal programme acted as a safety net for children, whose health was significantly improved [17]. However, our study also reflected the similar results (Table 2) as Singh et al. [17] highlighted in his study as well as Gleason and Dodd [24].



Source: The Pilot Study Survey, 2016

Figure 2: Baseline and final evaluation of the pilot study.



Figure 3: (A) Mother is helping to feed rice pudding, (B) A child is being fed by mother.

A study looking at how school meal participation influences students' weight status, concluded that there was no evidence that either the school snacks (SS) or meal programmes contributed to rising BMI in school children [38]. The authors report that an increase of a single day in the normal school snack programme sharing was linked with a reduction of 0.15 in BMI [35]. They also added that SS package participation may be a protective issue, by encouraging children to take the SS or meal regularly. However, our study also finds poor increment of BMI in the participants (Tables 3 & 4), which may be due to the small sample and short duration. A few questions arise from this pilot intervention, particularly the impact on educational performance, which is not addressed. Baxter et al. [16] report one observational study among fourth-grade children which demonstrates a significant increase in calorie intake upon participation in the school snack [9]. Programme in the classroom compared to those who ate it in the canteen [16]. In our study, all the participants' parents were living under the poverty line and had poor knowledge about a healthy diet [2,4,11,12]. Therefore, they were not capable to provide a healthy food to their children at home which rice pudding programme showed significant improvement in the child health (Tables 3 & 4).

The benefit of the approach used here is the link between supporting children's education while enhancing their food security [31,39]. The study confirmed that the programme was remarkably cost-effective and significantly successful in terms of growth of BMI [6,14,39]. The study's key message is that a longer course of the healthy food certainly would bring drastic changes in children's BMI [13,34]. For example, six months rice pudding programme, instead of two months, would play a vital role on child health [13,34].

Cost of the Intervention

Healthy foods are expensive for poor people in Nepal [11,26,27,39]. Children are compelled to consume whatever food is prepared for the parents due to various factors such as poverty, poor knowledge on child feeding practices, time constraints, and poor resources [40,19,23]. Local participation is part of the development of ownership and community involvement and further contributes to the cost-effectiveness of the intervention, which favours its sustainability [11,12,17,27,36,39]. This study has also demonstrated an example of the community mobilization,

partnership and ultimately cost-effectiveness of the programme. This study showed the cost per portion/per child/per day was US\$0.34 including commodity costs and USD 14.36/day for 42 children [11,19]. A financial analysis by WFP12 explained why school meals/snacks costs are so inconsistent. WFP (2013)12 study found that the commodity costs were generally the main cost component and these varied. For example, Curtis et al. [39]. gathered the information that the actual cost of a school meals/snack around the Europe, USA and Australia which demonstrated a very high cost than this study such as Scotland USD 2.94, Sweden USD 2.66, USA USD 2.0 and Australia 10 USD 2.32 respectively. The partnership with the local community affects three key areas impact: cost-effectiveness, ownership and sustainability of the programme. This offers an acceptable and innovative approach towards scaling up nutrition within the community.

Study Strengths and Limitations

This study is part of a successful partnership programme between the CDC and researcher, driven by the local institution, and offers a practical application of food behaviour and environmental level change [11,33,27,37,32]. This study used a participatory approach which reduced the cost of the programme by using the local resources Likewise the local community economy was supported with the utilization of the local resources [14,27,32]. Still, this pilot study has acknowledged weaknesses. The intervention was limited to eight weeks, but lessons learnt are likely to be applicable to other poor communities in Nepal. A few children reportedly suffered from vomiting and diarrhoea after eating the rice pudding, which was probably due to weak digestive systems, or food intolerance, but would need to be considered if scaling up.

Conclusions

The school meal programme plays a crucial role in the diets of children in poor families by providing free snacks [10,11,17,14]. This pilot study resulted in progressive changes in the health of children and helped to increase awareness among the mothers regarding healthy dietary habits. School meals should include fruits, vegetables and calcium-rich dairy beverages and foods to enhance their nutritional content and contribution and increase child access and exposure to nutritious meal options; however, this carries a cost implication. This programme is ideally suited to high-poverty

areas where it can contribute to the child's daily dietary intake. The study attracted modest charitable donations from the public to fund it [41] and this is recommended as this could help initiate similar interventions in resource-poor areas and enable sustainability. This study contributes to the evidence for policy and practice in relation to school meals/snacks programmes that positively contribute to improving community food behaviour and to national nutrition programme aims and the achievement of sustainable development goals [4,9,15].

Ethical Approval

The District Public Health Office and District Education Office of Sindhupalchowk of Nepal have given ethical permission for this study and consent were obtained from all parents and guardians prior to the rice pudding distribution programme [8,28,29]. The author applied ethical approval from the local government authority where this study did not involve that are of high risk for the participants and also this study is not involved in any specimens, tissue samples or vertebrate animals, embryos or tissues. Prior to starting the study, the corresponding author had taken consent from his supervisory team, who reviewed the study proposal with Bournemouth University. On the other hand,

there were no any risks occurred during the data collection. The researchers and management team had paid high attention on any occurrence. First Aid Kit was placed at all the data collection area to tackle minor injury and provide some pain relief tablets. In case of some incidence occurred at the feeding place, the ambulance will be called and patient will be sent to the nearest health institutions for the further treatment. The participants did not expose to any risks by participating in the study [42,43].

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Financial Report

This research project received no specific grant from any funding agency, commercial or not-for-profit sector. The author has picked up money (collected) from the road and streets and subsidized material costs by the local community (Table 5).

Table 5: Sources of funding.

Source	Total (NRs.)	Total (US\$)	Remarks
Contribution by the researcher	48,000.00	459.59	In two and half years, the first author collected dropped money (mainly coins) while walking in the streets (Geoghegan, 2008). His friends and relatives also contributed (nearly 5%) to this programme.
Contribution by the local people	33,000.00	315.97	Supported by the local management of snack distribution programme, local community people including CDC.
Total	81,000.00	775.56	(1 US\$ = 104.44 NRs. on 20 Dec. 2015)

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