An intervention study to monitor weight gain in infants using a home based complementary food recipe and a hand blender

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Abstract

Objectives To assess the efficacy of a home made energy dense weaning food, containing 110–130 kcal (26–30kJ) per 100 ml on prevention of growth faltering during infancy.

Methodology Infants attending four child health welfare clinics in the Medical Officer of Health (Ragama) area were recruited at the age of 4 months. The intervention group received a specially designed hand blender, recipe and advice to prepare a weaning food. The control group received weaning foods without any intervention. They were followed up monthly up to the age of 12 months.

Results 152 infants completed the study (83 from intervention group). The infants in the intervention group gained significantly more weight than the control group (intervention group 2.43 ± 0.72 kg, control group 2.02 ± 0.62 kg, $p = 0.0002$). Both groups showed a drop in the Z score for mean weight for age during the study period but this was less marked in the intervention group.

Conclusions A high energy density home made complementary food was effective in improving the weight gain of infants during the weaning period.

Introduction

Optimum nutrition and good feeding of infants and young children are among the most important determinants of their health, growth, and development. Good feeding practices prevent early growth retardation and malnutrition, and reduce the rates and severity of infections [1]. Over the past decade, there has been a notable decline in low birth weight rates (from 22.8% in 1990 to 16.4% in 1999) in Sri Lanka [2]. Breast feeding rates are high; initiation of breast feeding is thought to be almost 100%, exclusive breast feeding up to 4 months is 51%, and continued breast feeding to 1 year and 2 years are 90% and 62% [3]. A common pattern seen in the growth curve of infants in Sri Lanka is that their growth is satisfactory during the first 4 to 6 months but there is noticeable growth faltering during the second 6 months. The percentage of children with low weight for age increases during first year of life from 0.7% between 3–5 months to 20.2% at the end of the first year [3]. Previous

work on urban and rural populations in the Southern Province has indicated a similar trend in weight of children from about 4 months onwards [4].

The growth faltering in infancy could be due to poor complementary feeding practices [5]. Previous work has shown the inadequacy of energy density of traditionally used complementary feeds, which could have been a major contributory factor for the growth faltering during 4 to 6 months of age [4]. The strategy to overcome this problem is to establish locally acceptable energy dense weaning food formulae. This study tested the hypothesis that the introduction of energy dense home based complementary food containing 110–130 kcal (26–30kJ)/100 ml would be associated with reduction of the incidence of growth faltering during the first year of life.

Study design, materials and methods

Setting

The study was done in the Ragama Medical Officer of Health (MOH) area, Gampaha district, Sri Lanka. The population of this MOH area is about 60 000. Within this area there are four child welfare clinics (CWC) for regular growth monitoring of infants and preschool children.

Infants

One hundred and eighty two infants, born at full term, having no long term medical or surgical problems and not receiving long term medications, were enrolled in the study on completion of 4 months, and followed up until their first birthday. One hundred and three infants attending 3 of the 4 above child welfare clinics formed the study group, and seventy nine children attending the fourth CWC served as the control group (Figure 1). An informed parental consent was taken before enrolment of the infants.

Recruitment began in December 1999 and continued until June 2000. At the time of the study, parents in Sri Lanka were advised to introduce solids at 4 months of age; this was later altered to 6 months in 2001 by the World Health Organization [6]. The follow up was continued until February 2001.

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Figure 1. Flow diagram of the study

Intervention

The intervention consisted of teaching the mothers how to prepare a home based complementary food with high energy density and the supply of a stainless steel hand held mechanical blender (figure 2) for mashing the product to the appropriate consistency. Specific instructions were given on the quantities and the qualities of food items, methods of preparation and the texture of the intended weaning food. The basic food items were raw red rice (30 g), red lentil (15 g) and vegetable oil (7.5ml) all of which were common household food items costing about 3 Sri Lankan Rupees (0.03 USD) per meal. The complementary food had an energy density of 110–130 kilocalories (26–30 kJ)/100ml and the iron and zinc contents were 0.6 mg and 0.3 mg per meal. The feeding frequency varied with the age (1 meal at the age of 4 months, 2 meals at the age of 5 months, 3 meals at the age of 6 months and 4 meals at the age of 7 months onwards). The hand blender was supplied free of charge.

Figure 2. Hand blender

The control group did not receive food recipe, the hand blender, or the method of preparation of weaning foods. These infants received traditional weaning foods according to their mother's choice, and we did not interfere with health education currently given by health authorities.

Measurements

Trained medical graduates collected the necessary information using an interviewer-administered questionnaire. They visited the homes of the infants, and on the first visit (at 4 months) obtained information regarding details of the baby, socio-demographic information of the parents and information regarding breast feeding and formula feeding. Body weight and supine body length were measured, and the equipment was standardised and calibrated to maintain consistency throughout the study. The infants were weighed using a Seca digital scale accurate to nearest 10 g. The length was measured to the nearest half a centimetre by using a standard infantometer. The infants were seen at home monthly, and in addition to the above anthropometric measurements, information was obtained regarding feeding, compliance with the intervention, and illnesses during the period.

The weight for age Z score was calculated in relation to new WHO standards for breast fed babies. Two sample tests were performed using EpiInfo (EpiInfo 6, version 6.04 (1996), Centers for Disease Control and Prevention, Atlanta, Georgia, USA, and World Health Organization, Geneva, Switzerland). Approval for the study was obtained from the ethics committee of Faculty of Medicine, University of Kelaniya.

Results

Eighty three infants from the intervention group and 69 from the control group completed the study. Two of the common reasons for dropping out were leaving the study area and poor compliance. The drop-out rate in the intervention group was 20 (19.4%) and in the control group 10 (12.6%), with no statistically significant difference.

The family backgrounds of the 2 groups who participated in the study were similar. Almost all the mothers were literate and the majority was in late twenties or early thirties (table 1). The birth weight, period of exclusive breast feeding, number of breast feeds per day and age at complementary feeding were identical in the two groups. In both groups, three out of four babies had been exclusively breast fed for at least 4 months, and the mean age at complementary feeding was nearly 4 months.

The weight gained by each child during the study period was calculated by subtracting its weight at 4 months from its weight at 12 months. There was a significantly higher ($p = 0.0002$) mean weight gain in the intervention group (2.43; SD 0.72 kg) than in the control group (2.02; SD 0.62 kg).

The growth of infants in the two groups was compared by using weight for age Z scores as well. If the infants maintain their Z score during the follow up period a plot of mean Z score against age should produce a straight line parallel to X-axis. In the present study infants from both groups showed a drop in Z score with increasing age but this drop was less marked for infants in the intervention group (figure 3).

Figure 3. Drop in weight for age Z scores in the 2 groups.

Table 1. Characteristics of infants and parents included in the study

		Intervention group (n=83)	Comparison group (n=69)
Sex distribution	Female (%)	58.2	65.8
	Male (%)	41.8	34.2
Birth weight (kg)	Mean $\pm$ SD	3.0 $\pm$ 0.5	2.9 $\pm$ 0.4
Age at complementary feeding (months)	Mean $\pm$ SD	3.9 $\pm$ 0.3	3.8 $\pm$ 0.5
Percentage receiving formula feeds		19.8	26.0
Maternal age (years)	Mean $\pm$ SD	27.8 $\pm$ 4.7	28.0 $\pm$ 6.1
Maternal education†	None	0.0	2.7
	Up to grade 5	2.2	5.5
	Grade 6 – 11	67.0	68.5
	Completed school	25.3	23.3
	Higher education	5.5	0.0
Monthly income‡ (Sri Lankan rupees‡)	Less than 5 000	46.1	35.6
	5 000 – 10 000	29.7	49.3
	More than 10 000	24.2	15.1

† % in each category, ‡one US dollar is approximately 100 Sri Lankan Rupees

Discussion

The high energy density home made complementary food preparation used in our study was effective in improving weight gain and reducing growth faltering during infancy. The infants who received this preparation gained an average of 0.41kg more than the infants receiving traditional weaning foods over the 8-month period of study.

Most of the intervention studies done during the weaning period of infants measure the efficacy of educational programs, and so far few studies have evaluated the outcome of introducing high energy density weaning food formulae. The improvement in weight gain in Indian children using a high calorie (941kJ/100g) weaning food formula was compatible with ours. Infants aged 4 months were recruited in this study, and they gained an average of 0.25 kg more than the controls at the age of 12 months [7].

The weaning preparation used in our study contained 110–130kcal (26–30 KJ)/100g, an energy density higher than that of traditional weaning foods (20–40kcal (4.7–7.1kJ)/100ml) used in the country. The energy density of our weaning preparation was increased by adding vegetable oil. Two studies in South Africa and South America have shown, even though the total amount consumed from high energy density meal was low, that there was a significant increase in total daily energy intake [8, 9]. A short term study (for 24 hours) in Indian infants, failed to find an increase in total daily energy intake after adding oil [10]. This was mainly attributed to displacement of infants from breast feeding.

The standards used for monitoring weight gain in our study were WHO standards for breast fed infants [11]. Although both groups deviated from WHO standards, the drop was less marked in the intervention group showing the efficacy of the intervention in minimising the weight drop.

Our sample was drawn from a small geographical area and we did not observe any statistically significant difference in the characteristics of infants or their socio-economic background. The drawbacks in our weaning food preparation included low protein, iron and zinc contents than recommended [12]. However, the requirements of some micro-nutrients during infancy are uncertain and it is difficult to meet them using typical complementary foods given at 6 to 12 months of age [13]. In practice, this could be overcome by adding vegetables (including green vegetables), eggs, fish and meat to the basic constituents during cooking, and fruits such as banana and avocado after cooking, at an appropriate age. This will improve the nutritional quality, and also change taste and texture of the food, increasing palatability. Introduction of meat as an early complementary food provides daily requirement of protein and improves intake of zinc [14, 15]. Other confounding variables such as infections were not assessed during the study, and we assumed that these were equally distributed among study and control groups. Although there were drop-outs in both groups, the rates were not statistically significant.

We conclude that a simple, high energy dense, home based weaning formula prepared from locally available

ingredients, is effective in reducing growth faltering during infancy. We suggest that it is imperative to introduce weaning foods with higher energy at the beginning of weaning and to continue it throughout the weaning period.

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