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Original article

# Cost comparison between powdered versus energy dense infant formula for undernourished children in a hospital setting

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SUMMARY

*Background & aims:* Ready to use (RTU) infant formulas became available for use in South African hospitals in 2005. However, a major barrier to use these formulae has been the perceived high product cost compared to the product cost of powdered infant formula (PIF). The aim of this cost comparative analysis was to determine the entire cost of these two feeding models.
*Methods:* This retrospective cost analysis used patient data generated from the Red Cross War Memorial Children Hospital (RCWMH), Cape Town, South Africa from 2007 to 2008. The annual cost of administering an energy dense RTU infant feed was compared to a fortified PIF, using published data of undernutrition at 34%. Only direct costs associated with the preparation and delivery were included in the analysis.
*Results:* The fortified PIF versus RTU for 1 day per undernourished child cost 16.52 Euros and 19.61 Euros for the enriched PIF with sunflower and MCT oil respectively, versus the cost of the energy dense RTU feed of 12.51 Euros per day.
*Conclusions:* The decision to feed undernourished infants with enriched PIF versus energy dense RTU feed should not be based not only on the cost of the product, but also the hidden costs, as shown by this publication.


## 1. Introduction

A range of sterile liquid ready to use (RTU) infant formulae became available for use in South African hospitals in the year 2005, and included a pre-term, standard infant, soy, extensively hydrolysed casein and 1 kcal/ml nutrient dense infant formula. However, a major barrier to the use of RTU infant formula has been the perceived high product cost compared to the product cost of powdered infant formula (PIF).

Breastfeeding remains the feed of choice, however in 2007 the World Health Organization (WHO) made recommendations for feeding high risk non-breastfed infants, (e.g. pre-term infants, low-birth-weight infants less than 2.5 kg and immunocompromised children), suggesting a sterile RTU infant formula as feed of choice when available.[1] However, as a caveat to this, the National Nutrition Directorate Guidelines of South Africa suggests the balance should be considered between infant safety and financial costs, when considering infant feeds.[2] Although this is an important consideration for hospitals with limited resources (e.g. appropriately trained nursing staff to manage milk kitchens), cost calculations for feeding "sick" undernourished children often does not account for the costs related to feed preparation in a sterile manner in addition to the cost of feed safe delivery and storage.[1,3]

Marino et al.[4] found that in a tertiary paediatric hospital in South Africa, the overall prevalence of undernourished children under the age of 1 year was 34% using the WHO criteria of $\leq -2$ *z*-scores weight for height/ height for age. In non-breastfed infants with moderate undernutrition ($\leq -2$ *z*-scores), it remains common practice in many centres to enrich standard PIF with modules (carbohydrates and fats) with the aim of increasing the energy density to 1 kcal/ml.[5] However, the impact this has on the protein energy ratio and subsequent catch-up-growth,[1] as well as the cost preparing feeds in a milk kitchen and contamination risk, is seldom taken into account.[6] The alternative practice is to use a 1 kcal/ml RTU feed with a protein energy ratio, designed to meet the needs of

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**Table 1**
PIF with modular additions and the RTU.

| | PIF with fantomalt and sunflower oil (1.4 ml oil and 5 g fantomalt) | PIF with fantomalt and MCT oil (1.5 ml MCT oil and 5 g fantomalt) | RTU (100 ml) |
|---|---|---|---|
| Energy (kcal/100 ml) | 100 | 100 | 100 |
| Protein (g/100 ml) | 1.35 | 1.35 | 2.6 |
| Percentage energy from protein (% per 100 ml) | 5.36 | 5.36 | 10.4 |

growth faltering infants (from birth up to 18 months or 8 kg in body weight) or those with increased requirements. However, the cost-benefit of these formulae has been questioned as they are considerably higher than fortified PIF [cost value alone]. Consequently, there has been continued debate and concern over the cost efficiency of using energy dense (1 kcal) RTU feeds versus fortified PIF. Given that the majority of infants admitted to hospital are nutritionally vulnerable, in particular those who are undernourished or have a high risk disease/condition,[7] we believe that the feeding method chosen is an important consideration both in terms of the benefit for the child, with regards to macro-and micronutrients, as well as for the health care system. Based on these considerations, we identified the need to quantify the actual cost of using fortified PIF compared to using an energy dense RTU feed in a vulnerable cohort of infants admitted to hospital. We hypothesized, based on data from two previously published reports,[4,6] that when all costs were accounted for, using fortified PIF to provide energy dense nutrition support within a tertiary academic paediatric hospital was at least as costly, if not more costly, than using an energy dense RTU feed.

## 2. Materials and methods

This retrospective "real life" cost comparative analysis is based on actual feed and preparation costs for patients generated from data previously published at the RCWMCH, Cape Town, South Africa from 2007 to 2008.[4,6] This tertiary paediatric hospital admitted 7800 children under the age of 12 months during that period, which this cost comparative analysis is based on. The costs presented, represent the proportion (34%) of undernourished infants <12 months admitted to the RCWMH during 2007 to 2008. These infants, as part of their inpatient management plan, would be receiving nutritional support via an enriched PIF or an energy dense RTU feed, with the aim of promoting catch up growth. It is important to note that, due to the risk of bacterial contamination of feeds,[6] it was not the practice at RCWMCH to use F75 and F100 (formulas for management of severe malnutrition), as part of the nutrition management of these infants, particularly evidence to support their efficacy in children under the age of 1 year is lacking,[8] in addition to which a significant number were known to be HIV infected with a high prevalence of community acquired gastroenteritis, increasing their mortality risk.[9] As such we have not compared or commented on the efficacy or the cost of F100 (used in the rehabilitation phase) to an energy dense RTU feed. All infants were prescribed multivitamin syrup part of their usual medical management. Infants who met the criteria for ongoing nutrition support on discharge as part of their rehabilitation, were enrolled in the local Nutrition Supplementation Programme of the Health Facility Based Nutrition Programme.

The total annual cost of administering an energy dense RTU infant feed [Infatrini®; Nutricia, Amsterdam] (to undernourished infants) was compared to a fortified PIF [Pelargon®; Nestle, Vevey] (standard PIF in non-breastfed infants). For the purpose of this study, we use used prevalence data of undernutrition at 34% (using the WHO criteria <−2 z scores) from RCWMH, which was previously published by Marino et al.[4] The cost analysis of the PIF took into account quantities of commercial maltodextrin (Fantomalt®; Nutricia, Amsterdam) and sunflower oil, or medium triglyceride oil (MCT oil®; Nutricia, Amsterdam), both were used in standard practice for managing children with moderate malnutrition at

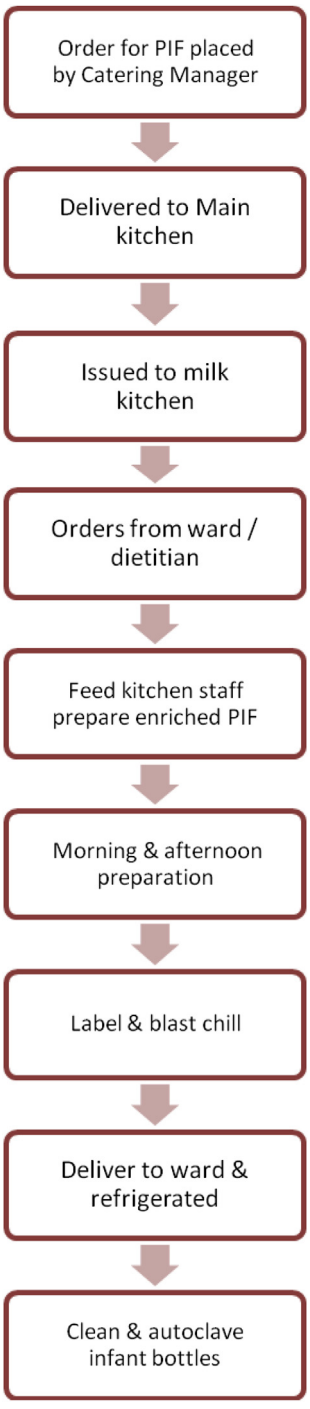


**Fig. 1.** Procedure for ordering, preparation and delivery of enriched PIF.