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Original Article

Homemade blenderized Ryles tube formula is equally efficient as commercial formula in terms of anthropometric and biochemical measurements in tertiary care neurologic intensive care unit: A single center study

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ABSTRACT

Objectives: In Indian intensive care units (ICUs), malnutrition is a leading cause of death and morbidity. There is a scarcity of information on the state of malnutrition in India and the efficacy of homemade Ryle's tube formula in neurologic cases as compared to commercial formula feed. The goals of the present study were to evaluate the nutritional status of neurological disorder patients, to prepare a home-based feed using locally available cereal and pulse combinations, and to investigate the impact of two different Ryes tube formulas on nutritional status.

Material and Methods: A prospective, randomized comparative study was conducted in the neurological ICU of a tertiary care medical college hospital located in rural Telangana. Group A was given commercial formula, while Group B was given homemade Ryle's tube formula, which was calorically equivalent to commercial formula. The Harris-Benedict equation was used to determine the patients' caloric requirements. During hospital stay, both groups received a comparable amount of Ryle's tube feeding. The impact of two different formulations was evaluated using quantitative indices including weight, body mass index, triceps skinfold thickness, and serum albumin over a period of 2 weeks. The standard deviation and mean were determined. The researchers used a paired t-test with a two-tailed distribution. If the $P < 0.05$, it was considered significant. For data processing, open-source software open Epi 2007 was used.

Results: In both classes, thirty patients were enrolled. On admission, the demographic profiles of both groups were identical, as evidenced by non-significant *P*-values. According to the sample parameters, there was no substantial difference between the two formulas at the end of the study period. Both formulas were equally efficacious for the nutritional assessment parameters during the study period.

Conclusion: On initial admission, malnutrition was uncommon in the neurologic ICU. In terms of study parameters, both formulas were equally efficient. The homemade blenderized formula was 50% less expensive than commercial formula, making it an important nutritional supplementation option for the deprived strata of the population.

Keywords: Malnutrition, Neurosurgical intensive care unit, Enteral nutrition, Homemade blenderized formula, Commercial formula

INTRODUCTION

In recent years, there has been an increasing recognition of the value of providing dietary support in patient care in order to enhance overall physical outcomes. Patients who are critically ill have special dietary needs that require a high level of nutritional care.[1] In response to injury, resting energy intake can increase, resulting in significant catabolism, hyperglycemia, progressive lean body mass, changes in serum trace element levels, fluid retention, and decreased synthesis of visceral proteins such as albumin. Malnutrition has historically been related to a worse outcome in intensive care units (ICUs) with a high prevalence of malnutrition.[2]

In India, there is a high prevalence of neurologic disorders, and patients receive insufficient nutritional therapy and lack of awareness regarding nutritional therapies, resulting in undernutrition and increased mortality, morbidity, and hospital costs.[3] To address these issues, a holistic plan for dealing with neurologic cases in ICU is needed, which includes determining the disease burden, assessing the nutritional status of these patients, and developing a low-cost nutritional supplement for these patients. Blenderised feed is used in many developing countries because it is less expensive than commercially prepared feeds, but it is seldom used in developed countries.[4] It is viscous, so bits of food can get stuck in the feeding tube, and although wider bore tubes can be used, the possibility of complications increases. In the Indian population, there is a scarcity of evidence on the effectiveness of malnutrition in tertiary care neurologic ICUs. In addition, there is a scarcity of evidence on the effectiveness of blenderized foods in this population. The current research is being conducted to close the gap between these two points.

MATERIAL AND METHODS

The research was carried out in a tertiary care medical college hospital in rural Telangana's neurosurgical ICU. A total of 60 patients were sampled using a judgemental purposive sampling method between May and June 2020. Prior to the start of the research, the institutional ethics committee gave their approval (IEC/PIMS/2020/August/12).

Males and females over the age of 18 who were admitted to a neurosurgical ICU and required enteral nutrition met the inclusion requirements. To begin enteral feeding, the European Society for Clinical Nutrition and Metabolism guidelines were followed. Patients who had allergies to foods were excluded, as were patients whose intended calories were not supplied by enteral food or who needed parentral nutrition. To be a part of the study protocol, all patient relatives were counseled and given written clear and informed consent.

The participants in the study were split into two classes. Using a computer-generated random number table, Group A and Group B were formed, each with 30 patients. Group A received commercial formula, while Group B received homemade Ryle's tube formula.

Preparation of blenderized food

The ingredients used for the preparation of the feed were divided broadly into base and macronutrients.

Base

The bases used for the preparation of the nasogastric feed were both energy contributing and non-energy contributing fluid which included the following:

a. Energy contributing fluid–buffalo milk
b. Non-energy contributing fluid–water.

Measurement of ingredients

- Solid ingredients were weighed by the "Arshia" weighing machine. The no error point was adjusted with the bowl
- Liquid ingredients were measured with calibrated measuring spoons and cup
- Powered ingredients were either weighed or measured with measuring spoons.

Procedure

The food safety guidelines established by Food and Drug Administration were used for the safe preparation of the feeds.

Formulation of cereal pulse mixture

Enteral feeds were formulated with the commonly available, cost-effective, and easily digestible indigenous protein-rich foods such as soya bean, green gram daal, moth beans along with staple cereals such as rice, wheat, ragi as cereal and pulse combination give all essential amino acids as well as energy. Wheat, green gram dhal, and rice were washed in water, dried and roasted, and grinded. The ingredients and the quantity used are as given in [Table 1].

Development of amylase rich flour (ARF)

For preparing ARF, moth beans, and ragi in the above ingredients were soaked overnight for in 2–3 volume of water, drained for excess water, germinated in dark for 24 h, sundried for 5–6 h, roasted on low flame to remove moisture and grind into fine powder.

Formulation of enteral feed

All above ingredients were mixed together and kept in airtight bottle and required quantities were taken each time

Table 1: Ingredients and the quantity used for preparation of Homemade blenderized food.

Ingredients	Quantity	Mean nutritive value (Kcal)
Rice	20 gms	26
Wheat	10 gms	34
Ragi	5 gms	22
Processed soya bean	60 gms	220
Green gram daal	10 gms	23
Moth beans	5 gms	17
Total	110 gms	342

Gms: Grams

of making blend (10 g for each feed). A local pharmacy provided the commercial formula that was used. Both formulas have a calorie content of about 1 kcal/mL. After dilution, both formulations had nutritional properties that were almost identical in terms of calories. The caloric content of the food was calculated by the Atwater system.

Ryle's tube protocols

For enteral tube feeding, neurologic patients were randomly assigned to obtain a standardized formula or homemade formulas. Patients were cared for by a variety of doctors, the majority of whom were not involved in the research.

The bedside nurse arranged all of the enteric feeding tubes. A nasogastric tube (size 14) was inserted into the stomach of all participants, regardless of which category they are assigned to. An immediate X-ray confirmed the location. The feeding tubes were given to all of the patients as soon as possible. The ICU nursing staffs were taught how to insert the Ryle's tube by the principal researchers or the ICU intensivist.

The Harris-Benedict equation was used to measure the patient's caloric requirements.[4] The primary investigator kept a close eye on the feeding schedule.

REE-Resting energy expenditure

- Women REE = 655+(9.6*weight in kg)+(1.85* height in cm)–(4.7* age in years)
- Men REE = 66+(13.7*weight in kg)+(5* height in cm)– (6.8* age in years).

Caloric need = 1.25* REE.

Frequency and quantity of Ryle's tube feeding

Intermittent boluses were used to administer all feeds. To reach the target goal pace, they were started at 50 ml/feed every 2nd hourly and increased to 200 ml/feed every 2nd hourly if tolerated within the next 2 days. If the residual volume was >50% of the previous feeding volume, the next feed was withheld. The total amount of feed given to and patient per day was determined by calculating his caloric needs using the above-mentioned calorie need calculation formula. Patients were removed from the sample if their residual volume was consistently higher. The primary outcome variable in both groups was the variation in weight, body mass index (BMI), triceps skinfold thickness, and serum albumin over a 2 weeks span. The cost differential between the two groups was the secondary outcome measure.

RESULTS AND DISCUSSION

The study enrolled a total of 60 participants. Male and female ratios of both categories were identical in demographic data. Primary neurosurgeons made various types of neurological diagnoses. Diffuse axonal injury, four cases were in Group A and two cases in group B. For traumatic brain injury, both groups contain 12 cases. Intracerebral bleed was found in seven cases of group A and eight cases of Group B. Cerebrovascular accident was found in five cases of Group A and four cases of Group B. penumocephalus and scaphoaid fracture was found in 1 case of Group A and 2 cases in Group B.

Weight on admission for Group A was 52.26 ± 9.73, while for Group B it is 54.43 ± 13.21. The *P*-value by student *t*-test was 0.232, indicating both groups were similar in their admission weight. Weight got reduced in both groups during stay in the hospital. On the 8th day when weight was recorded, weight was reduced by 1.2% in Group A and 2.5% in Group B. Weight reduction was found negligible in both the groups. It was observed that on the admission the triceps skin fold thickness was 10.83 in the both the groups. They were compared with reference range which indicated similar values indicating normal status. Negligible increase in Group A was observed while values remained same in Group B. *P*-value indicates no significant difference.

Serum albumin levels in Group A on admission was 3.6 ± 0.51 while in Group B it is 3.5 ± 0.56 with a $P = 0.177$ indicating both groups were similar. Serum albumin slightly increased to 3.73 ± 0.38 in Group A while increase in Group B was more with 3.81 ± 0.42. Though serum albumin rise is more in Group B compared to Group A, the difference did not show statistical significance with $P = 0.204$. The data is as presented in [Table 2]. The cost of blenderized food is half of commercially prepared food.

There is a strong link between nutrition and neurological illnesses. When intake is inadequate or metabolic rate is high, neurological patients are at an increased nutritional risk of protein-energy malnutrition or micronutrient deficiencies. Obesity can also be caused by inactivity and a reduction in total energy expenditure. Patients with neurological illnesses account for 15% of in-patients in acute care hospitals, 30% of in-patients in rehabilitation centers, and 50% of nursing home patients. Malnutrition has been shown to increase

Table 2: Change in anthropometric measurements over 15 day period in admitted groups.

Variable	Group A	Group B	*P*-value[#]
Weight on admission	52.26±9.73	54.43±13.21	0.232
Weight on 15th day	51.66±10.05	53.03±16.15	0.302
Body mass index on admission	24.06±1.10	25.45±1.22	0.241
Body mass index on15th day	23.06±1.1	24.52±1.32	0.221
Triceps skin fold thickness on admission	10.83±1.96	10.83±1.72	0.497
Triceps skin fold thickness 15th day	10.58±2.09	10.83±1.62	0.306
Serum albumin on admission	3.6±0.51	3.5±0.56	0.177
Serum albumin on 15th day	3.73±0.38	3.81±0.42	0.204

[#]*P-value is calculated by two tailed t-test for continuous variables<0.05 considered significant*

mortality, impair rehabilitation efficacy, and raise the likelihood of impairment in these patients.

Nutritional support is a vital component of therapy for patients who have suffered central nervous system trauma, and it is a determinant in survival and successful rehabilitation. Early nutritional treatment in individuals with head injuries has been linked to fewer infections and a tendency toward better survival and disability outcomes.[5] Enteral nutrition is linked to a better prognosis when started within 48 h following injury. The current study was proposed since there are numerous reasons to include neurological cases in the research sample. They are prone to malnutrition and require long-term Ryle's tube feeding, as previously stated. Many studies have shown that early feeding improves prognosis.[6] Second, cost is a key barrier for patients, and many impoverished patients cannot afford expensive commercial formulas, making this group the most in need of the formula. Handmade food costs 15 rupees each feed in our study, while commercial food costs 30 rupees per feed, implying that homemade food is half the price of commercial food. Homemade enteral food formulae have a number of advantages over commercial formulae. Hundreds of phytochemicals and fiber found in fruits, vegetables, whole grains, and other foods are good overall health and gastrointestinal system. Processed components such as corn syrup, maltodextrin, sucrose, casein, whey and soy proteins, soy and corn oils, and extremely limited amounts and types of fiber are found in conventional enteral nutrition products. Commercial enteral nutrition products provide concentrated supplies of calories and protein, as well as all of the known needed vitamins and minerals in standardized amounts and in a convenient and safe manner. However, they lack the phytochemicals and fibers present in whole meals.[7] Blenders allow home tube-fed patients to ingest fruits, vegetables, entire grains, legumes, seafood, nuts, and a variety of additional protein and healthy fat sources.

On admission, all of the patients in our study group showed no signs of malnutrition and had a BMI that was close to normal. Malnutrition increases during hospitalization, according to studies, due to a variety of causes.[8] Anorexia, shortness of breath, dysphagia, mucositis, and other symptoms of the condition sometimes results in poor nutrition intake. In other circumstances, they occur concurrently with problems in digestion or absorption of food, or increased nutritional requirements. When we consider that many diagnostic or therapeutic treatments need fasting and that there are illnesses that suggest the rest of the digestive tract, we can see how a patient's hospital stay can influence the onset or development of malnutrition. Both groups in our study lost relatively little weight, showing that both formulas did a good job of preventing malnutrition.

When we looked at the nutritional status of neurological patients, we discovered that the mean BMI in both groups was normal, indicating that weight-related malnutrition was not widespread at the time of admission. The majority of the patients were of normal weight and BMI. On contrast to prior studies in the Indian population[8] in the previous study, the incidence of malnutrition in hospitalized patients ranges from 40% to 50%, the patients included was trauma and cancer patients, but they have not segregated the patients as neurosurgical patients admitted in ICU. In comparison to our study, we did not had malnutrition on admission in neurosurgical ICU., this is a new finding in our research. It's possible that the explanation has anything to do with the patient population analyzed. Diabetes and hypertension are common risk factors for Cerebrovascular accidents, and all patients with neurological illnesses were included in the study. Both are common in persons who are either normal weight or obese. Similarly, all head injuries were caused by automobile accidents, and none were caused by falls. Furthermore, vehicular accidents are more likely in younger and healthier age groups, which explain our patients' normal weight status.

Homemade formulations are 50% less expensive than commercial formulas, according to the results of a cost comparison between the two.

CONCLUSION

Homemade Ryle's tube formula feed was proven to be just as effective as the most expensive commercial formula available.

The cost of homemade formula feed was roughly half that of store-bought formula feed. There was no significant difference in the influence of commercial versus homemade feeds on the patients' weight, skinfold thickness, or blood albumin levels.

Limitations

This research has a number of limitations. The first flaw is that sample bias exists. The second limitation is the sample size, which was small in this case, thus extra caution is needed when applying these findings to various ICUs. Furthermore, because many neurological patients may require long-term nutritional support, new studies with long-term nutritional support assessments may provide additional insight into blenderized formula.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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