

## Review Article

# Do South Asian Nutrition Guidelines for Critically Ill Recommend Commercial Feeds or Blended Tube Feeds? – A Narrative Review

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### Abstract:

*In the previous years, blended tube feeds have been replaced by commercialized feeds; however, literature suggests that blended tube feeds are still being used to feed critically ill patients. Aim of this narrative review is to review the South Asian Critical Care Nutrition Guidelines type of feed recommendations. From the eight South Asian Countries, Critical Care Nutrition Guidelines are available only from Pakistan, India and Sri Lanka. Review of these guidelines indicate discrepancies with types of feed when compared to international guidelines such as nutrition guidelines from American Society for Parenteral and Enteral Nutrition. Indian and Sri Lankan Guidelines give way to administer Blended Tube Feeds in critically ill patients. There is no available literature to back their recommendation regarding use of blended tube feeds in critically ill patients. Reasons and evidence for recommendations of blended tube feeds need to be explored, while determining whether these feeds are valid replacement for commercial enteral feeds.*

**Key words:** Blended Tube Feed, Commercial Feed, Critically Ill, Feeding Product.

### Introduction

South Asian countries include India, Pakistan, Bangladesh, Sri Lanka, Nepal, Afghanistan, Bhutan, and the Maldives, making up a total of eight nations. Of these countries, India is the most, and Maldives the least populated, with a population of 1276.2 million and 0.38 million in India and Maldives, respectively<sup>1</sup>. Information about the number of intensive care units (ICU) in these countries is limited. There are an estimated 70,000 beds in Intensive Care Units [ICU] all over India<sup>2</sup>. In Bangladesh, the first ICU was established in 1980. Since then the number of ICUs in Bangladesh increased over time, but the exact numbers is not clear<sup>3</sup>. Some other sources reported that they are about 100 ICUs in Sri Lanka<sup>4</sup>, 33 ICUs

in Katmandu city, Nepal<sup>5</sup>. No exact data is available regarding number of ICUs in Afghanistan, but it has been reported that a 10-bed ICU was in the main referral hospital in Kabul, Afghanistan<sup>6</sup>. No data is available regarding the number of ICUs or ICU beds in Pakistan, Bhutan or Maldives.

These countries, except for Afghanistan and Bhutan have established critical care societies. Indian Society of Critical Care Medicine (ISCCM) was established in 1993. The members comprise of physicians, nurses, physiotherapists and other allied health professionals<sup>7</sup>. Similarly, Bangladesh Society of Critical Care Medicine comprising of physicians, nurses, physiotherapists and other allied health professionals was established in 2009<sup>8</sup>. On the other hand, Sri Lankan Society of Critical Care Medicine (SSCCM), established in 2002 is comprised mostly of doctors and nurses<sup>9</sup>. Critical Care Medicine Societies in Nepal and Maldives were formed in 2010 and 2017 respectively<sup>10,11</sup>. In terms of nutrition guidelines for ICU, only Sri Lanka, India and Pakistan have published their guidelines which are available online.

In the previous years, blended tube feeds (BTF) has been used extensively as the main source of feeding even in more advanced countries like United States (US)<sup>12</sup>. BTF is defined as any form of feed that is given by enteral route to a patient, and is not commercialized. These include soups, broths, liquefied foods, and juices. They are used to feed to the patient via the enteral route. Such feeds are either prepared in the hospital kitchen or at home by the patient relatives<sup>13,14</sup>.

Over the years, enteral nutrition has evolved so much that BTF have been replaced by commercialized feeds (CF)<sup>12,15</sup>. This has led to the improvement in nutrition provision including providing feed that is nutritionally complete with less risk of microbial contamination and greater flexibility in modifying feeds according to patients' requirements<sup>12</sup>. In addition, CF are designed for different patient categories.

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Many types of CF are available including polymeric formula, high protein formula, immune-modular formula, high protein with low electrolytes formula, and low protein with low electrolyte formula. In addition, certain CF with a modular nutrition content, such as carbohydrate, protein and lipid modular are available. Such formula helps a dietitian to plan and tailor enteral nutrition for the patient according to their clinical needs to meet the nutrition goals of the patient<sup>15</sup>.

BTF, even if planned by a skilled dietitian may not be able to provide the required amount of nutrition<sup>16</sup>. In addition, nutritional balance of such feeds are questionable<sup>16</sup>. Although international dietary recommendations speak against the use of BTF in medically unstable patients<sup>17</sup>, use of BTF are reported in some countries such as Iran, Sri Lanka and India<sup>13,14,18</sup>. In an article published in Nutrition Issues in Gastroenterology series #176, it was mentioned that 70 – 75% of those recipes contain fluids, and micronutrients such as multivitamin, calcium, and other minerals may need to be added into BTF<sup>19</sup>. This raises questions whether BTF can be used as an alternative to CF for enteral nutrition in critically ill patients.

Previous reviews regarding BTF were done to determine the prevalence of blended tube feed use, and its safety, efficacy and implications for clinical practice, and explore whether BTF is valid as an alternative to CF in children fed via gastrectomy<sup>20</sup>. No reviews are available to explore whether BTF can be used as an alternative CF for enteral nutrition in the critically ill population of South Asia. Therefore, the purpose of this review is to identify enteral nutrition recommendation of the type of feed in the South Asian Enteral Nutrition Guidelines, and to identify whether such feeds are safe to be used as enteral nutrition in critically ill patients.

## Methods

A literature search was done using electronic database sources such as Pubmed and Embase. Search was limited to articles in English language. All the studies mentioning BTF, liquidized feeds, kitchen feeds, and non-commercialized feeds were included. Due to the scarcity of literature on this topic, both hospitalized and home-bound patients were included. Critical care nutrition guidelines from South Asian countries were also included.

## Results

A total of five papers are included in this review from which two are single center studies<sup>18,21</sup> and three are nutrition guidelines<sup>13,14,22</sup>. From the single center studies, one study was an experimental design study done in critical care unit<sup>18</sup>. One study was an online survey among 433 parents of home fed children<sup>21</sup>. The three enteral nutrition guidelines are from India, Sri Lanka and Pakistan<sup>13,14,22</sup>. Guideline recommendations of type of feed is summarized in Table 2 in the annex of this article.

### Effectiveness of Blended Tube Feeds for Enteral Nutrition

Number of studies done using blended tube feeds in critically ill patients is extremely rare. We identified only 2 studies meeting criteria from about 27 search items. The first study

was conducted in Tabriz Iran in a total of 80 critically ill patients. They were randomly allocated into two groups – one group was fed with CF and the other with hospital prepared BTF. The researchers investigated the effects of standard formula versus the blended tube feeds on serum albumin and calcium levels of the subjects. They estimated that the blended tube feeds would provide 0.7kcal/ml with 50 – 60% from carbohydrates, 25 – 35% from fats and 15 – 20% from proteins, and CF would provide 1kcal/ml with 55% from carbohydrates, 30% from fats and 15% from proteins. Biochemical investigations done at day 7 of initiating feeds demonstrated that there was a significant difference in serum albumin and calcium between CF and BTF. Although an increase in albumin level is observed in both groups, the group fed with CF showed a statistically higher increase compared to group fed with BTF. Calcium was increased in group fed with CF, but decreased in group fed with BTF<sup>18</sup>.

Another study was an online survey that explores parents' reported experience with CF and BTF. 49.5% of the parents reported to use BTF, and 50.5% CF exclusively for their home enterally fed children. Reasons reported by parents for choosing BTF were: 1. BTF is more natural than CF, 2. BTF is better tolerated than CF, 3. Do not like the ingredients in CF, 4. To provide family foods, 5. Increase oral intake, 6. Prevent allergies, 7. BTF is less costly. Reasons given by parents who chose CF were not knowing how to prepare BTF, time constraint, inconvenience of using BTF, cost and safety concerns. The study also reported that those children who were fed with BTF met growth goals more than CF fed children, and those who were fed with BTF had less nausea, vomiting, fever, bloating, diarrhea, constipation and pain<sup>21</sup>.

### South Asian Nutrition Guideline Recommendations on Enteral Nutrition Feeding Products

Among the eight South Asian Countries, Critical Care Nutrition Guidelines are available only in Pakistan, India and Sri Lanka<sup>13,14,22</sup>. Table 2 in Appendix summarizes key recommendations in these guidelines regarding type of feed.

Pakistan have ICU feeding protocol instead of guidelines. In their protocol, a flow chart indicating how to choose each of the feeding product, with the name of the product is mentioned specifically. The protocol recommended to initiate standard polymeric formula for most patients. Hydrolyzed formula are recommended in patients with malabsorption, and other disease-specific formula according to patients' clinical presentation<sup>22</sup>. There is no mention of BTF in their protocol.

The Indian critical care nutrition guidelines recommended to use polymeric formula to initiate feeds in critically ill patients. The Indian guidelines stated explicitly that BTF deliver lesser energy and protein than CF. They also stated that the problem of nutrients inconsistency can be prevented by avoiding BTF<sup>13</sup>.

Sri Lankan Guidelines on Nutritional Support in ICU is totally different from the above mentioned guidelines as they recommend to use enteral feeds prepared in-house, and they have provided charts of nutritional values of food. Moreover, they also allow relatives to bring home-prepared feeds for

critically ill patients. However, they advised dietitians' evaluation for those who preferred to bring home-made feeds. In their guideline CF are mentioned as something that may be added to where appropriate and available<sup>14</sup>.

### Discussion

Three critical care nutrition guidelines from South Asian Countries were sought from this literature search. The three guidelines are from Pakistan, India and Sri Lanka<sup>13,14,22</sup>. Recommendation regarding type of feed in Pakistan Critical Care Nutrition Guideline is aligned with recommendations given in international critical care nutrition guidelines such as American Society for Parenteral and Enteral Nutrition [ASPEN] Guideline for Nutrition in Critically Ill Patient<sup>23</sup>. Similar to ASPEN, Pakistan nutrition guidelines recommends to initiate feeds in general critically ill patient with standard polymeric formula. However, Indian Critical Care Nutrition Guideline and Sri Lankan Critical Care nutrition guideline formulated in 2018 and 2014 respectively gives way to administer BTF in critically ill patients<sup>13,14</sup>. Although Indian guideline was formulated recently<sup>13</sup>, Sri Lankan guideline was formulated 5 years ago, and was recommended to be reviewed in 2016<sup>14</sup>.

This raises concern with respect to risk of contamination and nutritional content of feeds. In a study done to evaluate microbial contamination of blended tube feeds and commercial feeds using 13 blended tube feed samples and 12 commercial samples, the researchers found that both types of samples were susceptible to contamination unless strict safety handling procedures are met<sup>24</sup>. Similar results were found in a study conducted in US<sup>26</sup>. In both of these studies, BTF was prepared in hospital kitchen with food safety protocols being followed<sup>24,26</sup>. If the feeds for critically ill patients are allowed to be prepared at home as stated in Indian and Sri Lankan Guidelines<sup>13,14</sup>, safety in food handling and preparation is questionable. Food safety can also be questionable even if BTF is prepared in a hospital unless food safety protocols are strictly followed. Literature reviews revealed that hospital prepared BTF itself can contain coliforms<sup>27</sup>.

Another concern is whether BTF can provide the nutritional requirements of critically ill patients. In a research done to evaluate the nutritional content and viscosity of hospital-prepared BTF using feeds prepared in-house kitchen of 4 different hospitals in Philippines, the researchers discovered that the in-house prepared feeds had unpredictable nutritional values and varying consistencies although they were prepared according to instructions of dietitians<sup>16</sup>. The providers of BTF in this study claimed that the feeds were nutritionally complete<sup>6</sup>. Vitamin levels and trace elements such as Zinc were undetectable in many samples<sup>16</sup>. In addition, there were marked discrepancies between expected and measured values with respect to energy and macronutrients<sup>16</sup>. Furthermore, the viscosity of blended tube feeds was very high and varied<sup>16</sup>. High viscosity can cause tube blockage during BTF delivery. In addition, preparation of BTF can be time consuming.

A rapid review was done to explore whether BTF is a valid alternative to CF in children fed enterally via gastrectomy.

This review reported that BTF had variable nutrient compositions. This variation can be due to geographical source of food, the season and stage of maturity of the natural produce, and storage and method of cooking. It was reported that such feeds would not be able to provide full nutrition even in Home Enteral Nutrition [HEN] patients. They recommended to conduct more research to explore the risks, benefits, impacts and outcomes of BTF<sup>25</sup>.

It is evident that in contrast to international guidelines, BTF are still being used to feed critically ill patients in South Asian countries. There are no studies that support the use of BTF. This raises questions why it is still then being practiced. Is it more natural, better tolerated, able to prevent food allergy, or less costly? The reasons for choosing BTF were not mentioned in the guidelines. No study has been done to assess knowledge, attitude, practice or behavior of ICU staff regarding standard nutritional management and recent ICU guidelines in South Asian countries that can explain why BTF are still being used in the ICU. If cost is the reason for providing BTF, there is no cost analysis papers available from these countries to support their reason to recommend BTF.

### Conclusion

This review found that some guidelines from South Asian countries (i.e. Sri Lanka and India) allow the use of BTF in critically ill patients. Recommendation to use of BTF in South Asian countries in this era is a huge concern. Further investigation needs to be done to understand the safety of BTF and the reasons behind their use. A randomized controlled trial to investigate the difference in mortality outcomes between patient fed with CF and BTF is warranted.

### References

1. Sawe, B. E. (2018). South Asia: Constituent Countries And Their Populations And Economies. Retrieved: September 15, 2019, from <https://www.worldatlas.com/articles/the-population-and-economy-of-the-south-asian-countries.html>
2. Jayaram, R., & Ramakrishnan, N. (2008). Cost of intensive care in India. *Indian J Crit Care Med*, 12(2), 55–61. doi: 10.4103/0972-5229.42558; 10.4103/0972-5229.42558
3. Mostafa, N. (2018). Critical Care Medicine: Bangladesh Perspective. *Adv J Emerg Med*, 2(3), 1–2. doi: 10.22114/ajem.v0i0.79
4. Pinto, V., & Kudavidanage, B. (2018). Critical care in Sri Lanka – the past, present and future. Retrieved September 15, 2019 from <http://www.sundaytimes.lk/180610/sunday-times-2/critical-care-in-sri-lanka-the-past-present-and-future-297394.html>
5. Acharya, S. P. (2013). Critical care medicine in Nepal: where are we? *Int Health*, 5(2), 92–95. doi: 10.1093/inthealth/iht010
6. Lin, A. H., Glover, D. E., & Myers, J. S. (2011). An Overview of Afghan National Army Critical Care Capabilities. *Military Medicine*, 176(9), 1003–1006. doi: 10.7205/milmed-d-11-00036
7. Indian Society of Critical Care Medicine [ISCCM]. (2018). About ISCCM. Retrieved September 15, 2019 from <http://www.isccm.org/>
8. Bangladesh Society of Critical Care Medicine [BSCCM]. (2019). Home: Bangladesh Society of Critical Care Medicine. Retrieved September 15, 2019 from <http://www.bsccm.net/>

9. Sri Lankan Society of Critical Care Medicine [SSCCM]. (2017). Sri Lankan Society of Critical Care and Emergency Medicine. Retrieved September 15, 2019 from <http://www.sscem.com/>
10. Nepalese Society of Critical Care Medicine [NSCCM]. (2018). Nepalese Society of Critical Care Medicine - NSCCM - Home. Retrieved September 15, 2019 from <http://www.nscem.org.np/>
11. Maldives Society of Critical Care and Emergency Medicine [MSCCEM], (2017). Retrieved September 15, 2019 from: [https://web.facebook.com/pg/msccem.01/about/?ref=page\\_internal](https://web.facebook.com/pg/msccem.01/about/?ref=page_internal)
12. Campbell, S. M., (2006). An Anthology of Advances in Enteral Tube Feeding Formulations. *Nutr Clin Pract*, 21(4), 10.1177/0115426506021004411
13. Mehta, Y., Sunavala, J., Zirpe, K., Tyagi, N., Garg, S., Sinha, S., . . . Kadhe, G. (2018). Practice guidelines for nutrition in critically ill patients: A relook for Indian scenario. *Indian J Crit Care Med*, 22(4), 263. doi:10.4103/ijccm.ijccm\_3\_18
14. Faculty of Critical Care & Nutrition Division of Ministry of Health Sri Lanka (2014). *Guidelines on Nutritional Support in ICU*. The College of Anesthesiologist in Sri Lanka & Ministry of Health Sri Lanka
15. Chernoff, R., (2006). History of Tube Feeding - An Overview of Tube Feeding: From Ancient Times to the Future, *Nutr Clin Pract*, 21(4), 408 – 410.
16. Sullivan, M. M., Sorreda-Esguerra, P., Platon, M. B., Castro, C. G., Chou, N. R., Comer, G. M. & Alarcon, P., (2004). Nutritional analysis of blenderized enteral diets in the Philippines, *Asia Pac J Clin Nutr*, 13(4), 385 – 390
17. Brown, B, Roehl, K. & Betz, M., (2014). Enteral Nutrition Formula Selection: Current Evidence and Implications for Practice, *Nutr Clin Pract*, 30(1), 72 – 85. Doi: 10.1177/0884533614561791.
18. Jazayeri, S. M. H. M. & Ostadrahimi, A., (2016). Standard enteral feeding improves nutritional status compared with hospital prepared blended formula among Intensive Care Unit (ICU) patients, *Progress in Nutrition*, 18(1), 22 – 25.
19. Parrish, C. R., (2018). Blenderized feeding options – the sky's the limit, *Nutrition Issues in Gastroenterology, series #176*
20. Carter, H., Johnson, K., Johnson, T. W., Spurlock, A., (2018). Blended tube feeding prevalence, efficacy, and safety: What does the literature say?, *J Am Assoc Nurse Pract*, 30 (2018)150–157. Doi: 10.1097/JXX.0000000000000009
21. Johnson, T. W., Spurlock, A. L., Epp, L., Hurt, R. & Mundi, M. S., (2017). Reemergence of Blended Tube Feeding and Parent's Reported Experiences in Their Tube Fed Children, *J Altern. Complementary Med*, 24(4), 369 – 373. Doi: 10.1089/acm.2017.0134
22. Ikram, S., Hussain, E., Zubairi, A. S. (2016). Nutrition in intensive care in adults review of the literature and development of evidence based feeding protocols. *The Journal of the Pakistan Medical Association*, 66(9), 1154-1164.
23. McClave, S. A., Taylor, B. E., Martindale, R. G., Warren, M. M., Johnson, D. R., Braunschweig, C., . . . Compher, C. (2016). Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. *Journal of Parenteral and Enteral Nutrition*, 40(2), 159-211. doi:10.1177/0148607115621863
24. Pinto, P. O. M., Correial, E. F., Pereira, K. C., Sobrinol, P. S. C. S. & Silval, D. F., (2015). Microbiological quality and safe handling of enteral diets in hospital in Minas Gerais, Brazil, *Brazilian Journal of Microbiology*, 46(2), 583 – 589. doi: : <http://dx.doi.org/10.1590/S1517-838246220131141>
25. Coad, J., Toft, A., Lapwood, S., Manning, J., Hunter, M., Jenkins, H., . . . Widdas, D., (2017). Blended foods for tube-fed children: a safe and realistic option? A rapid review of the evidence, *Arch Dis Child*, 102 (2017), 274 – 278. Doi: 10.1136/archdischild-2016-311030
26. Johnson, T. W., Milton, D. L., Johnson, K., Carter, H., Hurt, R. T., Mundi, M. S., . . . Spurlock, A. L., (2019). Comparison of microbial growth between commercial formula and blenderized food for tube feeding, *Nutr Clin Pract* 34(2), 257-263.
27. Jalali, M., Sabzghabae, A. M., Badri, S. S., Soltani, H. A. & Maracy, M. R., (2009). Bacterial contamination of hospital-prepared enteral tube feeding formulas in Isfahan, Iran, *Journal of Research in Medical Science*, 14(3). 149-156.

## Appendix

**Table 1: Studies investigating blended tube feed**

Author	Study Design	Population	Sample Size	What was investigated	Outcome
Jazayeri et al., 2016	Intervention	ICU – adults	40 BTF 40 CF	Outcome (serum albumin and calcium level) of BTF vs CF in ICU	<ul style="list-style-type: none"> <li>• Serum albumin was raised in both groups, but serum albumin was raised statistically higher in CF group compared to BTF group</li> <li>• Calcium was decreased in BTF group, but raised in CF group</li> </ul>
Jhonson et al., 2017	Online survey	Parents of home fed children	433 49.5% BTF 50.5% CF	Explore parents reported experience with BTF	<p>Reasons for choosing BTF: more natural, better tolerance, does not like CF ingredients, provide family foods, increase oral intake, prevent allergies, less costly</p> <p>Reasons for not choosing BTF: not knowing how to prepare, time constrain, inconvenience, cost, safety concerns</p>

Abbreviations: ICU (Intensive Care Unit), BTF (Blended Tube Feeds), CF (Commercial Feeds)

**Table 2: Guidelines recommendations regarding type of feed in critically ill patient**

<b>Guideline</b>	<b>Country</b>	<b>Year</b>	<b>Recommended types of feeds</b>
American Society for Parenteral and Enteral Nutrition	America – International	2016	To initiate enteral nutrition with standard polymeric formula in most patients Immune modulating formula to be reserved for patients with Traumatic brain injury and surgical critically ill patients
Evidence-based Feeding Protocols in intensive care units	Pakistan	2016	To initiate enteral nutrition with standard polymeric formula in most patients Use hydrolyzed formula in malabsorption Use other disease-specific formula in special cases
Practice Guideline for Nutrition in Critically Ill Patients	India	2018	Standard polymeric formula in critically ill patients Compared to commercialized feeds, blenderized feeds deliver lesser energy and protein – inconsistency in nutrients can be avoided by using standard polymeric formula feeds Routine use of specialty formula to be avoided
Guidelines on Nutritional Support in ICU	Sri Lanka	2014	Enteral feeds prepared in-house (chart of recipes provided in the guideline) Commercial products can be added as appropriate where available Relatives of patients admitted in intensive care unit can be given the choice to bring feed prepared at home with feed preparation recipe and instructions given by the dietitian – a list of feed recipes are given at the annex of guideline. The recipes call for feeds that require fresh produce to be cooked at home and then blended Consider polymeric preparation