Summary & Conclusions

SUMMARY AND CONCLUSIONS

A patient is hospitalised only when they become so critically ill that home care is impossible and immediately needs detailed accurate observation in regard to his state of health by the experts and to administer proper medical treatments. Sometimes even situations may arise to perform surgical procedures in concurrence with the patients' physical demand. Surgery, like any injury to the body elicits a series of reactions including release of stress hormones and inflammatory mediators, i.e. cytokines. This release of mediators to the circulation has a major impact on body metabolism. They cause catabolism of glycogen, fat and protein with release of glucose, free fatty acids and amino acids into the circulation, so that substrates are diverted from their normal purposes, e.g. physical activity, to the task of healing and immune response. For optimal rehabilitation and wound healing, the body needs to be in an anabolic state. Recent studies have shown that measures to reduce the stress of surgery can minimise catabolism and support anabolism throughout surgical treatment and allow patients to recover substantially better and faster, even after major surgical operations [*Weimann et. al., 2006*]. Although several factors-age, coexisting disease, type and extent of surgical procedure, blood loss, duration of procedure, skill of surgeon and disease itself – have been shown to be associated with post-operative complications, nutritional depletion is an independent determinant of serious complications after major gastrointestinal surgery [*Silk and Gow 2001*]. Thus, when a patient is sure to undergo surgery, prompt attention to their nutritional status is a primary task [*Campos and Meguid 1992*] so as to fortify the patients for the demands of the surgery.

Pre-existing malnutrition has been shown to be a major clinical problem in surgical patients and is often associated with the post-operative outcome [*Silk and Gow 2001*]. In contrast, to healthy body tissues, undergoing continuous turnover with small physiologic losses being constantly replenished with nutrients from food, in disease especially surgical disease, losses are greatly increased. Replacements of nutrients from food are diminished or absent for a brief or extended period. Thus pre-

operative nutrient deficiency correction should not only provide reserve for meeting up the demands of surgery itself but also to provide reserve for post-operative period. The widespread practice of starving patients in the immediate period after gastrointestinal (G.I) surgery has been challenged by a systemic review and meta-analysis which finds that **'nil by mouth'** after G.I. surgery is not beneficial". The rationale of *nil by mouth* and *gastric decompression* is to prevent post-operative nausea and vomiting and protect the anastomosis, allowing it time to heal before being stressed by food. Nausea vomiting however occurs more commonly after G.I. surgery than after resection of the small intestine and colon. Several authors *[Eastern Association 2003; Moore 2001]* in their own clinical experience have reported that nasogastric decompression can usually be discontinued 12 – 24 hours after reaction of small intestine and colon. There is no evidence that bowel rest and a period of starvation are beneficial for healing of wounds and anastomotic integrity. Indeed, the evidence is that luminal nutrition may enhance wound healing and increase anastomotic strength, particularly in malnourished patients. Therefore, therapeutic nutritional support becomes all more significant as means of aiding recovery. Early enteral nutrition is safe and is associated with beneficial effects such as lower weight loss, early achievement of positive nitrogen balance as compared to conventional regiment of feeding in operated cases of gut perforation [*Malhotra et. al., 2004*]. Patients with non-functioning G.I tract as evidenced by severe peritonitis, intestinal obstruction, short bowel syndrome or intractable diarrhoea may benefit from parenteral nutrition as opposed to intravenous alone [*ASPEN 2002*].

The whole body protein pool as well as that of individual tissues is determined by the *balance between the processes of protein synthesis and degradation.* Thus, body's protein mass plays an important role in not only providing architectural support for cells and also helps to serve vital roles in maintaining their function and survival. These processes in turn are regulated by interactions among hormonal, nutritional, neural, inflammatory and other influences. So advances have been directed in nutritional support for catabolic patients in the preparation of protein rich formulas with more focus including changes in amino acids content with more importance to prepare a promising solution with essential amino acids for catabolic patients. It is always highlighted that the protein-depleted patients have a significantly higher incidence of major complications like pneumonia and had longer hospital stay.

Recent research had identified the use of *'magical' immunonutrient-Glutamine.* Approximately, five to ten grams per day of glutamine are consumed in the diet, and under normal circumstances dietary intake and synthesis of glutamine is adequate and is balanced with the demand. Because of the body's capacity to synthesise this amino acid, it has long been thought that glutamine was not a necessary component of the diet. In situations where a particular tissue is in greater need of glutamine, inter-organ transfer of glutamine usually makes up for increased site-specific requirements. However, under certain pathological circumstances the body's tissues need more glutamine than the overall amount supplied by diet and de novo synthesis. During catabolic stress, for instance, intracellular glutamine levels can drop more than 50 percent, and plasma concentration falls 30 percent. If supply of glutamine in the diet is reduced and demand the same or increased then the body must look for alternative sources. The two available options are either an increase in the synthesis or mobilisation of stored aminoacid [*Hall et al., 1996*]. It is under these circumstances that supplemental glutamine becomes necessary. Various clinical studies suggest a direct relationship between low extra cellular glutamine and clinical outcome.

In the light of the above facts, the present study was undertaken to have knowledge regarding the types of nutrition received routinely by the hospitalised (subjects enrolled for the study) patients undergoing gastro intestinal surgery procedures related to various complications. In addition, it was intended to study if the pre-operative and post-operative enteral nutrition support so provided through routine hospital diet could satisfy the demands of such patients. Further, an effort was also made to develop low cost kitchen-based polymeric protein rich enteral diets with sources from soy and milk and their efficacies were studied in overall improvement in the quality of nutritional status in patients undergoing surgical procedures.

Since, glutamine is absent from conventional regimens aimed at nutritional support as mentioned earlier; as its deficiency can occur during periods of metabolic stress; this has lead to the reclassification of glutamine as *'conditionally essential aminoacids'*. But sadly till to date no use of such immunonutrient is not in regular practice in most of the hospitals as a part of nutritional support. Glutamine can be successfully supplemented in the tube feeding formulas. Since we have supplemented glutamine in enteral form in G.I disorders a major problem is

absorption of glutamine. First part [*Fish 1997*] glutamine EN first metabolised by G.I tract and liver before reaching circulation. We do not know which part of the dose is decomposed (*e.g* gastric acid) or how fast glutamine is absorbed in the lumen. Before considering the utility of immunoenhancing formulas, which are generally in comparision with standard enteral formulas, one must be convinced that enteral nutrition compared with no nutrition support at all for a particular group of patients [*Karen et. al., 2003*]. Thus an effort was made to enrich the substrate of polymeric kitchen-based protein two enteral diets with enteral glutamine. Further, comparison was made to study the efficacy between polymeric kitchen-based protein rich enteral diets and subsequent substrate enriched with glutamine in surgical gastrointestinal patients.

Section I:

To proceed for the study titled *"Impact of substrate-enriched kitchen-based protein rich polymeric enteral diets with enteral glutamine on the surgical gastrointestinal patients"* it was necessary to have a glimpse of the **disease prevalence pattern** in some ICUs' of the hospitals at Ahmedabad, Gujarat. Based on the baseline data, the study group for the present research study was selected

The hospitals selected for the study have been represented as A, B and C for ethical reasons. The data were mostly obtained form the three hospitals were based on retrospective records. Out of 1002 patients survey done hospital A, B and C shared 14.27 %, 30.43 % and 55.28 % patients. In every hospital males were double than the females. Average age of patients was 46.11 years, 47.85 years and 56.28 years. Disease distribution pattern reflected that patients admitted in the ICUs of the three hospitals had a range of complications of which 47.6 % were cardiac associated diseases and 20.4 % constituted gastrointestinal diseases. Rest 31.9 % had other type of complications. In overall analysis males were found to be more than females. Further study of the gastrointestinal disease profile 204 patients were found to be admitted to the ICU with different types of complaints such as abdominal hernia, appendicitis, calculus cholecystitis, hemorrhoids, intestinal obstruction etc. totaling 51.4 %. Rest 48.5 % patients had other types of G.I problems such as sigmoid colectomy, spleenectomy, bleeding of duodenal ulcer, ileostomy closure, abdominal injury, pancreatitis, piles and hepatic encephalopathy etc. Further analysis showed

that hospital A (63.7 %) had more number of G.I cases followed by hospital B (23.0 %) and hospital C (13.2 %). It was necessary to have an understanding of length of stay in the hospital for each patient. About 84.4% patients were found to stay less than 7 days whereas 11.2 % stayed more than a week (8 - 14days). However, only 4.3 % patients were noted to stay more than 15 days. Longer days of hospital stay may be related to complex nature of the disease, which of course would have added the hospital cost undesirably. Study of mortality pattern showed a very low incidence overall (3.3 %) picture in the individual hospital was 6.9 %, 1.6 % and 4.6 % in the hospitals A, B and C respectively. Mortality may be explained on the basis of virulent nature of the disease, delayed reporting by the patients. About 94.1% patients were found to expire within 7days of admission whereas only 5.8 % were found to expire after a week of admission.

From the findings of the above study (Section I) it was clear that *gastrointestinal diseases were second most important one next to cardiac disease.* Using this baseline data various review articles on gastrointestinal diseases were referred in order to have a deeper understanding of the nutritional status of hospitalised gastrointestinal patients. In summary all articles had one common theme that till the date no discipline in medicine has benefited more from the current advances in nutritional support of hospitalised patients than has surgery. Even, as recently 15 years ago some surgical patients would have died from malnutrition, sepsis and multiple organ failure because enteral feedings were not possible or were not adequate. But now these patients survive major surgical procedures, debilating gastrointestinal diseases. Well the ability to feed the patients who cannot or will not eat is a major advance in surgical care. Since malnutrition is directly or indirectly related to patients post-operative outcome every effort is made till date to provide optimal nutritional support, which is regarded as primary therapy for such patients who develop malnutrition secondary to G.I diseases. Moreover, surgical procedures were mostly carried out for the correction of G.I diseased condition if not possible to treat through medications.

Cost is the major factor, which precludes use of commercially available products by population in general thus population mainly depends on existing poor nutritional practices, which are inadequate to meet the hyper metabolic demands of the patients.

Nutritional Intervention:

This study was undertaken to develop polymeric kitchen-based formulas and subsequent substrate enrichment with glutamine in order to provide complete nutrition package to the patients undergoing surgical procedures with cost effectiveness. The study was divided into two sections - In ***Section II,*** efficacy of polymeric kitchen based enteral diets with sources of protein from soy (*EnS*) and milk (*EnM*) were compared with routine hospital diet (*EnR*) and in ***Section III,*** impact of substrate enriched with glutamine in polymeric kitchen based protein rich enteral diets with sources of protein from soy (*GEnS*) and milk (*GEnM*) were compared with glutamine enriched routine hospital diet (*GEnR*). Patients were subcategorised (Sm, Mm, Wn) categorised, supplemented and comparisons have been made based on the nutritional risk index (NRI) scoring for all the study groups. In general Wn are not considered subjects for nutrition but based on diseased condition they were supplemented with diet as they were also at nutritionally risk as per NRI. Even as per guidelines ESPEN [*2006*], EN is indicated even in patients without obvious undernutrition, if it is anticipated that the patient will be unable to eat for more than 7 days perioperatively. It is also indicated in patients who cannot maintain oral intake above 60 % of recommended intake for more than 10 days. In this study supplementation and comparison of impact of diet was made on stratification based on patients at nutritional risk level (NRI). The supplemented kitchen based diet was isocaloric and isonitrogenous (provided 21 % protein per litre of feed) and enteral glutamine was supplemented as 0.3 $gkg^{-1}day^{-1}$ weight along with the supplemented diets in the two phases of study, respectively.

Comparison between polymeric protein rich enteral diets with sources of protein from soy (EnS), milk (EnM) and routine hospital enteral diet (EnR) was made among 61 surgical gastrointestinal patients selected randomly to receive the respective diets. The subjects were carefully matched with age, demographic profile and diseases they suffered from. They were identified as nutritional risk as per the criteria reported by Townstead [2002] as recent weight loss >10 % body weight and/or body weight of 80 % to 85 % ideal body weight and serum albumin concentration of less than 3.0 g dl^{-1}. *Overall, NRI score rated 58.9 % of the study patients as 'severely malnourished' (Sm) with a mean weight loss of > 57.0 % of the*

UBW. Nutrient intake assessment was done during pre-operative stage and post-operative stages. *Pre-operative nutrient intake* especially, *energy and protein for the study groups (EnR, EnS, EnM) were found to be significantly low compared to their respective requirement.* Further, subgroup analysis also elicitated a low intake in both energy and protein by the respective subcategories of *EnR, EnS and EnM* study groups during pre-operative stage as compared to their requirements though values were non significant. *Post-operative intake was better in both energy and protein in EnS study group whereas, calorie intake was adequate but protein intake was found to be significantly low in EnM study group as compared to their requirements. However, EnR study group had significantly low intake of both energy and protein as compared to their requirement.* Further subgroup analysis of *EnR, EnS, EnM* study groups also showed a significantly low intake of energy and protein by the three subcategories of *EnR* study group. Sm and Mm subcategories of *EnS* study group had better intake of energy and protein, whereas Wn subcategory had lower intake of energy and protein intake was adequate as compared to their requirements. Sm subcategory of *EnM* study group had significantly lower intake of energy whereas, calorie intake was found to be adequate for Mm and Wn subcategories as compared to their requirements. However, in all the three subcategories protein intake was found to be significantly low as compared to their requirements. Moreover, comparison study between the Sm subcategories in the three study groups showed that Sm subcategory of *EnS and EnM* study groups during post-operative stage had significantly better intake of protein as compared to Sm subcategory of *EnR* study group. *Comparison between pre-operative and post-operative intake* revealed that *energy intake in EnS and EnM study groups were much better in post-operative EN stage compared to pre-operative stage. Protein intake was found to be significantly higher in post-operative EN stage in EnS and EnM study groups.* Protein intake was found to be better in Sm and Mm subcategories of *EnS* and all three subcategories of *EnM* study groups respectively, on subgroup analysis. Such an observation was not observed in *EnR* study group. *Comparisons among the study groups with respect to adequacies of post-operative intake further reflected that calorie and protein intakes were significantly higher in EnS and EnM study groups compared to EnR study group.* However such an observation was not found in subgroup analysis for any of the three study groups (*EnR, EnS, ENM*).

The incidence of feed related complications was higher in the enteral fed patients of EnR compared to patients of EnM and EnS. Impacts of diets on biochemical profile, weight loss/gain and length of stay were observed. *The hemoglobin level did not alter much in all the three study groups. EnR study group showed a negligible drop in total protein in post-operative stage whereas, a trend for improvement was seen in EnS and EnM study groups.* Even *EnS* and *EnM* study groups showed an improvement in the level after post-operative EN as compared to pre-operative stage, whereas, *EnR* study group showed a negligible drop in albumin level. Further, during subgroup analysis, all the three subcategories showed an improvement. In case of *EnS* study group, Sm subcategory showed an upward trend, whereas Mm and Wn showed downward trend in hemoglobin level during post-operative EN compared to pre-operative stage. Total protein levels of the three subcategories of *EnR* study group showed a downward trend, whereas an upward trend was observed in Sm and Mm subcategory of *EnS* study group and Sm subcategory of *EnM* study group. The albumin level of only Sm subcategory of *EnR* study group showed an improvement whereas, incase of *EnS* and *EnM* study groups Sm and Mm subcategories in *EnS* study group and Mm subcategory in EnM study group respectively, showed improvement in post-operative stage. *Thus Sm subcategory in general for the three study groups in general, showed improvement in total protein and albumin levels.* Moreover, *comparisons between the groups showed a significant improvement in total protein and albumin in EnS and EnM study groups.* Further, Sm subcategory of *EnS* study group had significant improvement in total protein compared to subcategory of *EnR* study group.

Overall a mean weight loss of 8.66 % was observed for EnR study group, whereas a weight gain of 3.98 % could be observed for EnS study group whereas, a weight loss of only 0.02 % could be noted for EnM study group. Further, subgroup analysis indicated that Sm, Mm, Wn subcategories had significant weight loss in *EnR* study group and Mm, Wn subcategories in *EnM* study group. Weight gain was noted in Sm (0.92 %), Mm (2.77 %) and Wn (1.52 %) of *EnS* study group. However, a weight gain of 2.21 % in Sm subcategory could be noted for *EnM* study group. Moreover, *an average total stay up to EN stage was longer for EnR (22.4 days) whereas, EnS had shorter stay by 5.9 days*; a significant difference was observed with EN stay for *EnR* study group compared to *EnS* and *EnM* study groups. Further analysis reflected that

Sm subcategory for *EnR* study group had shorter stay whereas Wn of *EnS* study groups and Sm, Wn subcategories in *EnM* study groups had shorter stay. A significant difference could be noted in total length of stay of *EnRs'* compared to *EnM* and *EnS* study groups. Moreover, Wn subcategory in *EnR* study group had significantly longer stay compared to subcategories of *EnS* and *EnM* study groups.

Section III:

Comparison between polymeric protein rich enteral diet with sources of protein from soy (GEnS), milk (GEnM) and routine hospital enteral diet (GEnR) with subsequent substrate enriched with glutamine was made among 45 surgical gastrointestinal patients selected randomly to receive the respective diets. The subjects were carefully matched with age, demographic profile and diseases they suffered from. They were identified as nutritional risk as per the criteria reported by Townstead [2002] as recent weight loss >10 % body weight and/or body weight of 80 % to 85 % ideal body weight and serum albumin concentration of less than 3.0 g dl^{-1} as [per the previous section of study. Overall, NRI score identified 58.9 % of the study patients as 'severely malnourished' (Sm) with a mean weight loss of > 35.6 % of the UBW. Nutrient intake assessment was done during pre-operative stage and post-operative stages. *Pre-operative nutrient* intake in general for the study groups *(GEnR, GEnS, GEnM)* were adequate in calories but protein intake was found to be significantly low as compared to their requirements. From the subgroup analysis it was observed that in *GEnR* study group, Sm subcategory had low intake of protein, whereas low intake of energy and protein was noted in Mm subcategory and a downward trend of protein intake was observed in Wn subcategory as compared to their requirements. Three subcategories of *GEnS* study group had adequate intake of calories and significantly a low intake of protein were noticed in Sm and Mm subcategories. Even energy intake was adequate whereas protein intake was low in all the three subcategories and significantly low in Mm subcategory in *GEnM* study group. During post-operative EN stage the calorie and protein intake by *GEnR* study group was significantly low whereas, a better intake was noted in *GEnS* and *GEnM* study groups as compared to their requirement. Further, *comparison between pre-operative and post-operative intake* revealed that energy and protein intakes of *GEnR* study group was significantly low whereas, protein intake was found to be

higher in *GEnS* and *GEnM* study groups. Further, subgroup analysis showed that the subcategories of the *GEnR* study group recorded considerably lower intakes of energy and protein by all the three subcategories (Sm, Mm, Wn) and a low protein intake was prominent in Sm and Mm subcategories compared to their requirements. The energy and protein intakes were adequate for Sm subcategory in *GEnS* study group. Mm subcategory category had adequate intake of energy whereas, protein intake was significantly low whereas, Wn subcategory had lower intake of protein and fat as compared to their requirement. In case of *GEnM* study group, the energy and protein intake in Sm, Mm and Wn subcategories were found to be adequate as compared to their requirements. In general, protein intake was significantly higher in Sm, Mm subcategories belonging to *GEnS* study group Mm subcategory of *GEnM.* Even though the levels recorded were not statistically significant, there was an improvement in the protein intake by Sm, Mm subcategories of *GEnM* and Wn subcategory of *GEnS* also. However, there was no appreciable increase in protein intake in *GEnR* study group at post-operative stage as compared to pre-operative stage. *Comparisons among the study groups with respect to adequacies of post-operative intake further reflected that calorie and protein intakes were significantly higher in GEnS and GEnM study groups compared to GEnR study group. However, protein intake in Sm subcategory was found significantly higher only in GEnM study group compared to Sm subcategory of GEnR study group.* However such an observation was not found in subgroup analysis for any of the three study groups (*GEnR, GEnS, GEnM*). *The incidence of feed related complications was higher in the enteral fed patients of GEnR compared to patients of GEnM and GEnS.* Impacts of diets on biochemical profile, weight loss/gain and length of stay were observed. In the post-operative stage, hemoglobin levels did not alter much in all the three study groups except *GEnS. GEnR* study group showed a negligible improvement in total protein. The total protein level showed improvement *GEnS* study group whereas, *GEnM* showed slight improvement after post-operative EN stage compared to pre-operative stage. Similarly, improvement in albumin level is observed for *GEnS* whereas, a slight improvement is noted for *GEnM* after post-operative EN as compared to pre-operative stage. On subgroup analysis, the hemoglobin level of the two subcategories (Sm, Mm) showed a drop after EN stage whereas, an upward trend was noted in Wn subcategory of the *GEnR* study group. Total protein level

showed a downward, whereas an upward trend was noticed in albumin level trend after EN stage in Sm. In case of Mm subcategory downward trend for both total protein and albumin was observed whereas, an upward trend of the above values was noticed in Wn subcategory. In case of *GEnS* study group all the three subcategories exhibited an improvement in hemoglobin, total protein and albumin level. Even hemoglobin level showed a drop in post-operative stage in all the three subcategories in GEnM study group. Total protein and albumin levels of Sm subcategory showed an upward trend. In case of Mm and Wn subcategories, a downward trend was noticed for the above parameters. *Thus Sm subcategory in general for GEnS and GEnM study groups in general, showed improvement in total protein and albumin levels and Wn subcategory had improvement in albumin level.* Moreover, *comparisons between the groups showed a significant improvement in total protein and albumin levels in GEnS and total protein level in GEnM study groups.* Such observation was not noticed on subgroup analysis among Sm subcategory of the three study groups.

Patients registered loss of weight in *GEnR* study group 2.34 % whereas, in case of *GEnS* and *GEnM* study groups, a significant increase in weight (*GEnS:* 3.87 %; *GEnM:* 2.56 %) was observed during discharge as compared to the weight recorded at the time of admission. In general, weight loss was noted in all the subcategories of *GEnR* study group [Sm: 2.33 %; Mm: 4.02 % and Wn: 0.39 %], which was found to be statistically significant for Sm and Mm subcategories as compared to their weight at the time of admission. However, out of the three subgroups of *GEnS* study group, a significant weight gain of 6.94 % was recorded in Sm and 0.43 % in Mm subcategories. Wn subcategory also recorded increase in weight [1.70 %] at the time of discharge and was found to be statistically non-significant. Of the three subcategories from *GEnM* study group only a significant weight gain was recorded in Sm and Wn subcategories [(Sm: 4.35 %) and (Wn: 5.17 %)] at the time of discharge as compared to the value observed at the time of admission. The Mm subcategory recorded a loss of weight (2.22 %) at the time of discharge as compared to the value recorded at the time of admission.

Average total stay upto EN were longer in *GEnR* study group (18.7 days). A significant longer stay upto EN was noted in *GEnR* study group (18.7 days) with respect to total number days, by 14.5 days in *GEnS* and 14.4 days in *GEnM*,

respectively. Wn subcategory of *GEnR* study group had shorter duration of stay as compared to Sm and Mm subcategories. Sm subcategory had longer stay compared to other two subcategories in *GEnS* study group whereas, Wn subcategory had a longer duration of hospital stay as compared to other two subcategories in *GEnM* study group.

Impact of with *(GEnR, GEnS GEnM)* (Or) without *(EnR, EnS EnM)* glutamine supplementation between study groups and comparison among the groups in overall improvement in biochemical outcome clearly revealed that *higher percentage of patients in EnS study group* [TP: 52.4 %; Alb: 66.7 %] *had upward trend in total protein and albumin level but still a much better results were elicitated by patients in GEnS group* [TP: 93.3 %; Alb: 86.7 %]. *Even percent of patients with a downward trend in total protein and albumin levels were low in GEnS compared to other study groups.* Added to these the formulas were cost effective [Appendix 2] also, thereby paving the way for future use and to the benefit of the patients.

CONCLUSIONS:

Advances in knowledge, technology coupled with sophisticated instrumentation and techniques have produced wealth of information about etiology to epidemiology of diseases that affect the mankind since time immemorial. Many of the communicable and non-communicable diseases have been now brought under control with the invent of life saving drugs and through surgical interventions. In any type of intervention, at the core lies good nutrition. In this regard, for the past one decade, extensive research is being carried out in the area of molecular nutrition particularly in the management of critically ill patients.

The metabolic aberrations in the critically ill patients are many fold & understanding the pathophysiology & pathobiochemistry have greatly helped in bringing back the patients to clinically healthy state, as early as possible thereby decreasing the hospital stay. The recovery greatly depends on the quality nutrition provided through parenteral & enteral as the case may be. Specifically with regard to the enteral feeds, there have been continuous attempts to improve the quality of feeds based on the new information available on macro & micronutrients in imparting good health. In this regard, treatment with glutamine has attracted greater attention in the management of critically ill patients.

Further, as the cost of treatment with commercial feeds are much higher, research studies were also directed to the area of kitchen based foods formulated using the newer nutritional informations e.g., functional foods immunomodulator etc. These facts acted as stimulus to undertake the present study. Critical illness arising from the gastrointestinal disorders are many & predominantly heterogeneous in nature. Working on this area is also a challenge & we wanted to convert this challenge to opportunity & planned the present study with locally available foods. To understand the effectiveness, we also attempted to test these feeds enriched with substrate glutamine known to act as recovery entrances and immunomodulator in critically ill surgical gastrointestinal patients.

From the studies carried out by us, we conclude that out of the 3 kitchen based diets, *EnS* followed by *EnM* appeared to be promising as exhibited by better tolerance picture by 'severely malnourished' patients which was evidenced through an improvement of biochemical parameters coupled with weight increment and a reduction in hospital stay. On the other hand, routine hospital enteral diet if not balanced will not have a positive effect in improving the nutritional status of surgical patients. Moreover, if diets are optimal in their quality with better tolerance capacity subsequent substrate enrichment with glutamine will surely bring some promising results as seen in case of *GEnS* surgical gastrointestinal study group. Further, the positive effect of glutamine can be seen even when supplemented along with routine hospital diet in this study. Results also indirectly indicate that glutamine has the potential to increase protein synthesis and save muscle protein and faster recovery resulting in a shorter, hospital stay (as seen in *GEnR* study group), possibly due to less post-operative complications. These positive changes ultimately contribute to cutting the expenses in direct cost.

Lastly, the present study has also opened up several doors *(a) Inspite of the heterogeneity in patients group, noticing an improvement is a big step forward which further can be tested with a large number of patients of a single disease in detail and (b) also opens up the avenue for testing newly formulated enteral feeds based on the modern knowledge of food composition of different foods.*

Thus, the present study carried out in one of most difficuilt areas is an enriching experience, which will go a long way in the treatment of critically ill patients particularly when the patients belong to lower socioeconomic state.