Benefits of fasting abbreviation and early refeeding of multimodal perioperative care protocols

Benefícios da abreviação de jejum e realimentação precoce dos protocolos de cuidados perioperatórios multimodais

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ABSTRACT
The multimodal protocols of perioperative care, as a European project of ERAS-Enhanced Recovery After Surgery and, in Brazil, the project ACERTO (Acceleration of Total Post-
Operative Recovery), emerged as relevant alternatives to reduce preoperative discomforts, including anxiety, thirst, hunger, and enhance the recovery of surgical patients. These initiatives, supported by scientific evidence, advocate the fasting abbreviation with the ingestion of clear liquids up to 2 hours before elective surgery, as a strategy to reduce insulin resistance, immunomodulation and for the purpose of anesthetic induction, without causing risks of aspiration of gastric contents, as well as early refeeding with a small volume of diet, capable of stimulating the gastrointestinal tract and reducing the period of postoperative ileus. In this way, the literature shows that such measures are safe and bring several benefits, such as reducing hospitalization time and reducing the number of complications.

**Keywords:** preoperative fasting, early postoperative refeeding, fasting abbreviation, nutritional supplements in surgery.

**RESUMO**
Os protocolos multimodais de atendimento perioperatórios, como o projeto europeu ERAS-Enhanced Recovery After Surgery e, no Brasil, projeto ACERTO (Aceleração da Recuperação Total Pós-Operatória), surgiram como relevantes alternativas para reduzir os desconfortos pré-operatórios, incluindo ansiedade, sede e fome, e potencializar a recuperação dos pacientes cirúrgicos. Essas iniciativas, respaldadas por evidências científicas, preconizam a abreviação do jejum com ingestão de líquidos claros até 2h antes de operação eletiva, como estratégia para redução da resistência à insulina, imunomodulação e para fins de indução anestésica, sem acarretar riscos de aspiração do conteúdo gástrico; bem como a realimentação precoce com pequeno volume de dieta, capaz de estimular o trato gastrointestinal e reduzir o período de ileo pós-operatório. Nesse sentido, a literatura mostra que tais medidas são seguras e trazem diversos benefícios, como a redução do tempo de internação e redução do número de complicações.

**Palavras-chave:** jejum pré-operatório, realimentação precoce pós-operatório, abreviação do jejum, suplementos nutricionais em cirurgia.

**1 INTRODUCTION**

The multimodal protocols of perioperative care are beneficial alternatives instituted in the services in order to enhance the recovery of surgical patients. Currently, such conducts are organized and advocated by evidence-based international protocols, such as the pioneering European project, ERAS-Enhanced Recovery After Surgery and, in Brazil, the project ACERTO (Acceleration of Total Post-Operative Recovery). With a focused attention to the patient, through a multidisciplinary team of perioperative care, the results in the institutions that implement the guidelines are evident, including the reduction of hospital costs. However, many services still persist in traditional practices, without scientific support and which are seen as dogmas passed on over decades; and with new publications and advancement of evidence-based medicine, they need to be updated. Among the various regulations proposed by the protocols, two recommendations already have extensive published literature: the abbreviation of
preoperative fasting and early refeeding soon after the operation, routines that have been identified as beneficial by several studies.2

The perioperative care routine started from observations of the gastrointestinal surgeon at the University of Copenhagen, Professor Henrik Kehlet, in 2001, after improving a set of recommendations in colorectal surgery; called “fast track”, by which he established a new perioperative clinical protocol named ERAS—Enhanced Recovery After Surgery.3 This program had worldwide repercussions and influenced several hospitals to adopt new practices supported by scientific evidence, with the aim of improving patient recovery. Since then, this concept has been established in several medical specialties, and a common point among the results of the studies is the attenuation of the endocrine and metabolic response to trauma, associated with the reduction of postoperative complications. As a relevant aspect in the protocol, the fasting abbreviation showed an important reduction in preoperative discomforts, such as anxiety, thirst and hunger; and as a highlight, early refeeding, started on the first postoperative day, contributed to breaking the paradigm of “absolute fasting for several days” in patient recovery, showing that early refeeding is safe and reduces length of stay and the number of complications.4

Based on the ERAS protocol, it was created in Brazil in 2005 by professor Dr. José Eduardo Aguilar Nascimento, the ACERTO Project. Initially applied in studies carried out at the Júlio Muller University Hospital of the Federal University of Mato Grosso/Brazil, an audit was carried out in the service and with the involvement of a multidisciplinary team, it was possible to apply several care routines in the pre, intra and postoperative period and the results were positive in the patient’s recovery. The various publications have shown effectiveness in reducing the rates of complications, readmissions, hospitalization time, morbidity, in addition to providing a broad reflection in the care of surgical patients. Based on this information, the ACERTO project started to be implemented in several hospital services in the national territory and produced a significant change in the traditional forms of care for the surgical patient.5

The literature shows that the fasting abbreviation with ingestion of clear liquids up to 2 hours before elective surgery, in addition to being advantageous for contributing to the reduction of catabolism, allows patient satisfaction and is safe for the purpose of anesthetic induction, without causing risks of aspiration of the gastric content. Several anesthesiology societies already recommend this practice in the operative routine. This favors metabolic parameters and has several benefits, such as the reduction of insulin resistance, immunomodulation and improvement in postoperative functional capacity, in addition to the reduction of preoperative discomfort.3
Currently, many studies have been associating sources of carbohydrates and proteins in the drinks used for the fasting abbreviation. Initial work has shown that beverages containing oral carbohydrates, such as maltodextrin, contribute to the reduction of hepatic glycogen breakdown induced by the fasting state, thus preserving the excessive action of catabolism hormones.\textsuperscript{4,6} And, recent studies demonstrate the benefits of associating nutritional supplements that contain nitrogen sources and carbohydrates in the fasting abbreviation, with positive results on energy metabolism, which allows the individual to start an operation in better metabolic conditions, resulting in a postoperative recovery with less morbidity.\textsuperscript{7,8}

Early refeeding represents an essential factor in recovery. The early introduction of small volumes of diet in the postoperative period is able to stimulate the gastrointestinal tract and reduce the period of postoperative ileus. It is known that prolonged fasting after operations is associated with increased venous hydration, and has as possible consequences the development of paralytic ileus, increased hospitalization days and, consequently, hospital costs. Therefore, to accelerate and improve recovery, early refeeding is recommended and currently ultra-early refeeding, already in the anesthetic recovery room, with evidence of peristalsis return, reduction of the metabolic response to stress, shortening of hospital stay and improvement in the immune system and intestinal trophism.\textsuperscript{5} Thus, the present study aims to review the relevant aspects of fasting abbreviation and early refeeding using multimodal perioperative care protocols.

2 METHODS

The present study is an integrative and retrospective literature review of scientific publications on multimodal perioperative care protocols with an emphasis on preoperative fasting and early refeeding. The keywords were used in the search platform of PubMed\textsuperscript{®} and Google Scholar\textsuperscript{®}: Fasting abbreviations with supplements, with 5031 articles being observed; Fast track fasting benefits - was observed in 4273 articles; Perioperative fasting – has 8411 publications; Enhanced recovery after surgery programs (ERAS) – suggests at least 14305 publications; ACERTO (Acceleration of total postoperative recovery) – contains 54 articles; Early enteral feeding after surgery - has 13840 publications. The accepted languages were Portuguese and English. After identifying the theme, by title, the articles were evaluated by abstract and full text, observing the inclusion and exclusion criteria.

The inclusion criteria were: preoperative fasting; early postoperative refeeding, fasting abbreviation in elective surgeries, use of nutritional supplements in surgery. As exclusion criteria, scientific productions prior to the period of 2009; articles that did not address the
preoperative period and surgery; use of supplements and nutrition in periods prior to hospitalization for surgery; late nutritional aspects, after hospital discharge. The studies identified in the previously cited databases were manually evaluated by three evaluators who performed the selection of studies, first removing duplicate studies, then checking the relevance based on the title and abstract and finally based on the full text. A total of 239 articles were selected, of which, after reading the title and abstract, 218 were excluded, remaining 29. After the complete reading of the articles, 8 articles were excluded because they were reports on surgical results different from the research topic, and in total, 21 articles composed the review.

3 RESULTS AND DISCUSSION

3.1 EVIDENCE OF THE BENEFITS OF PREOPERATIVE FASTING ABBREVIATION

Preoperative fasting, historically established in order to avoid complications resulting from aspiration of gastric contents, advocates a prolonged routine of 6 to 8 hours of “nothing by mouth”, to ensure the patient's gastric emptying. However, through evidence-based medicine, several studies have reported that the mean preoperative fasting time is generally longer than prescribed, from 12 hours to 20 hours depending on the time of the procedure; including surgical delays, scales of operations, and inadequate communication with patients themselves.\(^9\) Thus, new protocols, such as ERAS and the ACERTO project, implemented measures to optimize and reduce hospital stay and postoperative morbidity, such as shortening the fasting period, since there is no evidence that, compared to the traditional regimen, determines the increased risk of complications related to bronchoaspiration; in addition to the fact that prolonged fasting potentiates the response to surgical trauma.\(^10,11\)

The fasting period plus exposure to operative trauma result in metabolic reactions to maintain the patient's baseline status, such as increased catabolic hormones, catecholamine secretion and inflammatory response.\(^13\) Thus, the proposed regimen of abbreviation of solid fasting of 6 hours before anesthetic induction, maintaining the ingestion of liquids containing carbohydrates (\textit{maltodextrin}) up to 2 hours before the elective surgical procedure, has its benefits supported by the improvement of insulin sensitivity, functional capacity, higher glutathione production and lower acute phase inflammatory reaction.\(^13\) In a randomized clinical trial, patients underwent the fasting abbreviation to 6 hours of solid food and administration of 50g of \textit{maltodextrin} 2 hours before the surgical procedure; and another group underwent prolonged fasting of solids and liquids for 12 hours before surgery.\(^12\) Comparative laboratory results between the two groups showed a reduction in insulin resistance in subjects with abbreviated fasting.
The gastric emptying is a complex process that involves multiple factors and, according to the literature, the results of several investigation methods demonstrate that the gastric residual volume after 120 minutes of ingestion of a carbohydrate solution (50g in approximately 400ml) returns to basal levels rapidly, through the regulatory and integrative processes of the digestive system. In a non-randomized clinical intervention study, patients in the group who underwent fasting abbreviation did not experience any complications during anesthetic induction, such as regurgitation or aspiration, validating the safety of the fasting shortening protocol in elective surgeries. In this study, the group presented aspects of improved well-being in the perioperative period, showing less sensation of thirst and discomfort, which corroborates the humanization of care.

In addition to the already reported and proven metabolic benefits, the abbreviation of the fasting routine implies immediate benefits to patients, such as a lower incidence of hunger, thirst, dry mouth, nausea and weakness. This relation is of great clinical importance, since, physiologically, the state of prolonged deprivation of food and drink tends to activate the fibers of the sympathetic nervous system, causing anxiety and irritability in the patient. And, shortening the preoperative fasting time improves the metabolic response to trauma and brings comfort to the patient.

3.2 INTRODUCTION OF CARBOHYDRATES/PROTEINS IN PREOPERATIVE FASTING ABBREVIATION DRINKS

Prolonged preoperative fasting promotes a state of catabolism in the body, which is related to complications in the patient's recovery process. Surgical trauma and increased fasting time alter the endocrine-metabolic response with increased insulin resistance and consumption of substrates, in addition to the immunosuppressive effect, making the patient susceptible to infections and predisposing to tissue repair and healing difficulties. In order to minimize these effects, preoperative care protocols were instituted and, among the main recommendations, the use of beverages containing carbohydrates stands out. Furthermore, the possibility of adding other energy sources such as proteins, vitamins, trace elements, and more recently whey protein, has been recommended in recent publications. Most of the studies carried out based on the ERAS protocol employ the use of carbohydrate-enriched liquids. And more recently, one of the recommendations of the ACERTO project is the addition of protein to beverages, based on its effects on the production of glutathione, which is a source of enterocytes, and due to the high degree of digestibility. The addition of nitrogen sources such as whey protein in liquids to shorten fasting is based on the fact that whey protein contains high
levels of essential amino acids, mainly branched-chain amino acids (leucine, isoleucine and valine), which are quickly used by the musculoskeletal system to stimulate protein synthesis in a stressful situation, in addition to being precursors of glutamine, a source of energy for enterocytes. Furthermore, *whey protein* is a source of cysteine, a substrate for glutathione synthesis, which acts as an antioxidant agent.4 Thus, the use of these substances in the preoperative period maintains the body in an anabolic state, providing glycemic control, muscle protection, shorter the hospital stay and reduction of preoperative discomfort.

In this context, the increase in insulin resistance is of significant importance, as it is responsible for intensifying the inflammatory response to surgical trauma in a way that is directly proportional to the degree of surgical stress.14 The result, then, is hyperglycemia, a marker with high sensitivity to the damage of operative trauma.7,16 Thus, the main objective of the preoperative supplement containing carbohydrates is to enable the endogenous release of the insulin hormone, and to mimic the body's physiological response to food intake after the fasting period,7 improving surgical recovery. One study carried out with elderly people who underwent prostatectomy surgery17 found a significant drop in the amount of pro-inflammatory factors such as IL-6, IL-8 and TNF. In addition, there was an improvement in the symptoms of discomfort, thirst and hunger.17 A randomized study with primiparous pregnant women compared the use of carbohydrates with placebo and obtained similar results to previous studies, that is, there was a reduction in discomfort, thirst and hunger.7 In this study, a significant reduction in insulin resistance and an increase in neonatal glucose level were observed, avoiding hypoglycemia in the newborn.7 Furthermore, the positive effects of fasting abbreviation in association with carbohydrate loading can be used to promote the humanization of care in gynecological surgeries. In that study, there was an improvement in pain after cesarean section, with a significant difference when compared to the placebo group.15 This factor is particularly important when considering that pain relief facilitates favorable outcomes, such as early mobilization and discharge, and reduced costs and morbidity and mortality.17

Perrone et al.,16 in a study involving seventeen patients who would undergo cholecystectomy or inguinal herniorrhaphy, found the safety of shortening preoperative fasting with the use of a drink enriched with carbohydrates and whey proteins, evidencing its role in reducing of insulin resistance and the acute-phase response to trauma. In this study, it was possible to observe higher titers of alpha 1 acid glycoprotein, CRP and the CRP/albumin ratio in the control group, suggesting a more intense inflammatory response compared to the group with abbreviated fasting with carbohydrates associated with whey proteins.16
A similar result was found by Dock-Nascimento et al.\textsuperscript{19} in female patients submitted to laparoscopic cholecystectomy. This study divided thirty-six adult patients into three groups: conventional fasting group, carbohydrate and glutamine group, with fasting time shortened to two hours in the last two. In the postoperative period, individuals with abbreviated fasting with carbohydrates and proteins had normal insulinemia, while 33.3\% of patients operated on under conventional fasting for 8 hours had increased serum insulin.\textsuperscript{19}

### 3.3 IMPORTANCE OF EARLY AND ULTRA-EARLY REFEEDING

Traditionally, postoperative fasting was extended beyond the second day after the surgical procedure as a dogma of “intestinal rest” and protection against fistula formation in patients undergoing intestinal anastomosis.\textsuperscript{20} However, with the implementation of the Multimodal Protocols of perioperative care, it has been verified that early refeeding has the effect of stimulating the gastrointestinal tract, producing propulsive peristalsis; in addition, gastrointestinal and pancreatic secretions pass through the intestinal anastomosis. Therefore, studies have shown positive results in the recovery of patients, based on evidence that the initiation of oral or enteral breakfast within 24 hours after surgery brings important systemic benefits with reduced morbidity and mortality.\textsuperscript{1,5,21}

Among the advantages of early refeeding in elective operations, includes the current understanding that the functional return of the gastrointestinal tract is faster than previously thought after surgical procedures, and the early release of the diet promotes regulation by hormones such as gastrin and motilin, whose functions restore digestive system functioning.\textsuperscript{14}

In this context, the importance of early refeeding is based on the records of cases in which prolonged fasting and, consequently, late refeeding generate changes in metabolism and a higher prevalence of complications in patients undergoing surgery. Delaying the start of refeeding promotes an increase in insulin resistance, which results in the intensification of the inflammatory response to surgical trauma directly proportional to the degree of operative stress. Consequently, the organism enters a catabolic state, causing an increase in the consumption of proteins and lipids, in addition to affecting the immune system and making the patient susceptible to pneumonia, sepsis, paralytic ileus, infections at the surgical site and difficulties in tissue repair and healing.\textsuperscript{2,5}

As an alternative to decrease insulin resistance, it has been shown that, in addition to shortening the preoperative fasting state, the ingestion of a liquid diet early in the postoperative period helps in the regulation of the inflammatory state after surgeries. Glutamine has also
shown promising results when ingested together with a liquid diet containing carbohydrate sources, as it enhances the patient's recovery.  

Recent studies highlight the benefit of ultra-early post-operative feeding while still in the post-anesthetic recovery room, in which the patient has his fasting abbreviated by receiving about 400 ml of clear liquids containing maltodextrin (50g) and, as a result, the promotion of reduction in the need for venous hydration, reduction in the time taken to reintroduce meals and the absence of additional expenses with unnecessary supplies and fluids.  

The combination of the main postoperative elements, such as fasting abbreviation, minimally invasive techniques, early refeeding and mobilization, associated with other intraoperative and preoperative care proposed by ERAS and ACERTO are beneficial in reducing recovery time, volume gastric residual and insulin levels, without exposing the patient to additional risks.  

4 CONCLUSION  

Multimodal Protocols are important recommendations that have been shown to shorten postoperative recovery and reduce postoperative complications in numerous published works. The application of systematic and evidence-based perioperative protocols can help to reduce morbidity and mortality in operated patients, in addition to accelerating their recovery. The highlights of this work were: reduction of fasting time and the benefits of early refeeding.  

The ingestion of beverages enriched with carbohydrates and/or proteins reduces the toxic hyperglycemia of prolonged fasting and reduces the effects of insulin resistance, inflammatory response, contributing to the decrease in hospital stay and complications in the recovery process.  

And early refeeding has positive effects with improvement of energy metabolism: small volumes of diet in the postoperative period promotes propulsive peristalsis, reduces the period of postoperative ileus, helps to reduce insulin resistance, inflammatory mediators and the maintenance of proteins. Proportionally, there is evidence of a decrease in length of stay, as well as in hospital costs.
REFERENCES


