Nutrition support is an evolving field, and modern clinical nutrition practice should actively incorporate strategies to enhance various clinical outcomes. In surgical patients, clinical benefits can be maximised by nutritional support protocols that minimise and manage the perioperative fasting period. This approach, which includes the perioperative provision of clear carbohydrate-containing fluids, has been shown to be safe, is evidence based, and is supported by many professional societies. Such a strategy has been shown to aid the anaesthetic process and maintain an optimal metabolic state, including improved insulin sensitivity and blunted muscle catabolic activity. Some important consequences of this improved metabolic control include shorter hospital stay and fewer postoperative complications. A proactive multidisciplinary team approach is essential to use this nutrition support strategy with success across a hospital’s surgical service.

The past decade has seen an evolution in clinical practices and protocols governing perioperative fasting for elective surgical procedures. Various professional associations for both surgery (Enhanced Recovery After Surgery (ERAS)) and anaesthesiology (Canadian, American, European, and South African (SA) society guidelines) (Table 1) support more modern nil per mouth guidelines of 6 hours for solids and only 2 hours for clear fluids, even in some instances for some patient subgroups known to have delayed gastric emptying. It has been suggested that minimising the perioperative fasting period, by allowing the consumption of oral carbohydrate-containing clear fluids with or without protein, has a number of clinical advantages, including more stable haemodynamics during induction of anaesthesia, greater glycaemic stability, reduced lean tissue catabolism, and a more positive patient experience.

Nevertheless, consistent compliance of anaesthetists with the updated recommendations to allow carbohydrate-containing clear fluids in the immediate preoperative period is low. This short review addresses the issues of permitting preoperative free fluids in view of lack of associated risk, and actively encouraging preoperative consumption of carbohydrate-containing free fluids due to the associated clinical benefits.

### Aspiration risk

The main rationale for maintaining patients in a preoperative fasted state is the purported risk of pulmonary aspiration upon induction of anaesthesia. In fact, the incidence of aspiration is very low – perhaps 1/45 000 elective anaesthetics in stable, otherwise healthy patients – and clinically important consequences of such an event are even rarer. It has been shown that gastric residual volume is a very poor marker of...
aspiration risk, and that, with the exception of meals with a high fat content, intake of non-particulate meals such as carbohydrate-based drinks has no significant bearing on increasing gastric residual volume. In fact, the opposite may be true: judicious use of appropriate oral fluids during the preoperative hours may actually reduce volume residue in the stomach. The emphatic, traditional practice of prolonged preoperative fasting as a risk-reduction approach is therefore unnecessary and is a dogma not founded upon good evidence.

The metabolic response to surgery
The typical physiological response to surgery includes a well-described stress hormone- and cytokine-induced hyperglycaemic and catabolic metabolic profile. This occurs in part as a result of poor movement of GLUT4 glucose transporters to the cell membrane, leading to insulin resistance, along with low muscle glycogen synthetase activity, leading to poor glycogen storage, in a counter-regulatory hormonal environment that enhances muscle protein degradation due to gluconeogenesis. The response can persist for days to weeks after surgery, and its amplitude is influenced by the magnitude and duration of the surgery and the extent of intraoperative blood loss. Both nutritional compromise going into surgery and the fasting state worsen the response, owing to underlying glycogen and lean tissue depletion.

In the SA clinical setting, poor nutritional status of surgical patients is common. It is generally advocated that purposive nutritional support of such patients in the pre- and perioperative period is of clinical benefit. However, the intentional use of nutrition-providing clear fluids in the acute preoperative phase, regardless of nutritional status, may not be practised as uniformly. This is despite the support for such practice by both the American and European societies for parenteral and enteral nutrition, as outlined in their guidelines.

The carbohydrate loading concept
Control of the metabolic response is understood to improve clinical outcomes. One of the recommended methods of control is the provision of isotonic, carbohydrate-containing clear fluids until 2 hours preoperatively, so that patients enter surgery in a fed rather than fasted state. This has been called ‘carbohydrate loading’. The principle of the approach is the provision of an energy-containing liquid meal, which will result in insulin secretion necessary to alter the fasted metabolic state. Since fat and hypertonic fluids inhibit gastric emptying, for safety reasons the preferred energy source is carbohydrate in an isotonic solution.

An amount of 50 g is sufficient to produce an insulin response similar to that of a mixed solid meal. Recommendations for preoperative carbohydrate loading have therefore been based around this amount and include 100 g carbohydrate on the evening prior to surgery and a further 50 g 2 hours prior to induction of anaesthesia. There is now more than one commercially available sip drink oral supplement that can provide this amount in the form of complex carbohydrate polymers without providing excessive fluid or producing a hyperosmolar product. The isotonic nature of the sip drink is important, as hyperosmolar solutions may delay gastric emptying or provoke other gastrointestinal symptoms such as diarrhoea. Several thousand patients in clinical trials and several million patients in routine clinical practice worldwide have used these commercial carbohydrate-rich drinks without adverse events. The use of such products is therefore safe.

Both carbohydrate and protein produce the desired insulin response. It has therefore been postulated that the addition of protein to carbohydrate-rich sip drinks would enhance the clinical benefits of carbohydrate loading. Importantly, by using non-particulate, fat-free, lactose-free protein sources, carbohydrate drinks containing medical nutrition therapy-grade protein still meet the characteristics of a ‘clear’ fluid.

Clinical benefits
Benefits of the above approach to preoperative fasting are both physiological and patient orientated. The physiological consequences of intake of carbohydrate-rich sip drinks up to 2 hours before surgery are an up to 50% reduction in insulin resistance, which in turn shortens hospital stay and reduces postoperative complications; lower muscle catabolism; improved intraoperative haemodynamic stability, particularly in children, as a result of more favouring fluid balance status; reduced days to discharge fitness; and superior handgrip strength, a sensitive marker of early muscle protein loss. Perrone et al. in a small study in 2011, showed that the addition of whey protein to a carbohydrate drink further improved insulin sensitivity and reduced acute-phase markers compared with carbohydrate alone. In addition, benefits on various aspects of patient comfort (such as thirst and anxiety), co-operation, compliance and overall subjective satisfaction have been reported.

Conclusion
There has been a distinct shift in the clinical approach to optimally preparing patients for surgery. There is mixed but good evidence that preoperative oral carbohydrate delivery up to 2 hours before induction should be part of this optimising, and improves outcomes. This practice is widely supported by professional societies for nutrition, surgery and anaesthesiology, and therefore requires co-operative participation from the relevant members of the clinical team. However, it appears that compliance may not be ideal. A change in culture is still necessary so that practice is based on evidence rather than the beliefs or fears of individual practitioners working defensively. Better implementation may depend not only on increasing awareness of modern fasting guidelines but also on packaging nutrition interventions like this one into audit bundles in order to incentivise compliance through a systems-based approach. The time has come for consistent metabolic preparation of patients in the preoperative period through delivery of carbohydrate loading in order to improve surgical outcomes.

Disclosures. LH received an unrestricted writing grant from Nestlé Healthcare, SA.