Journal of Sustainable Veterinary & Allied Sciences
P-ISSN-2695-2661 e-ISSN: 2811-1346
JoSVAS 2022, Vol 2, Issue 2:114-118

Original Research Article

Early oral feeding following duodenal resection and anastomosis: stressor or succour – a dog model

[*1]Jeremiah, K. T., [2]Eze, C. A., [2]Udegbunam, R. I. & [2]Ugwu, N. E.

[1]Department of Veterinary Surgery & Radiology, Michael Okpara University of Agriculture, Umudike, [2]Department of Veterinary Surgery, University of Nigeria, Nsukka, Nigeria.

*Corresponding author: jeremiahkelechi@gmail.com, +2348037575024

ABSTRACT

The effects of early oral feeding (EOF) on vital parameters and some stress markers after intestinal surgery was the focus of this study. Sixteen (16) Nigerian indigenous dogs were randomly assigned to 4 groups (n=4) which underwent duodenal resection and end-to-end anastomosis. Post operatively, group I animals were maintained on total parenteral nutrition (TPN) for 3 days while groups II-IV animals had parenteral nutrition with oral feeding instituted at 8, 12 and 24 hours respectively. The animals were monitored for side effects of TPN and EOF and post-operative complications. Vital parameters and some stress markers like the glucose and cortisol levels were monitored. The Mean heart and pulse rates of group I (TPN) animals were significantly (P <0.05) higher than those of the EOF groups. The EOF groups had higher body weight post-operatively. On post-surgery day (PSD) 1, the mean glucose level of group I animals was significantly lower than those of group IV, while the mean cortisol values in all the groups showed a similar increase post-operatively which declined gradually after PSD 1. Therefore, EOF given 8, 12 or 24 hours after intestinal surgery is feasible, safe and more convenient, and improves nutritional status of dogs.

Key words – Early oral feeding, parenteral feeding, intestinal resection, Nigeria indigenous breed of dog.

INTRODUCTION

Stress is a state of increased fitness or any external agent which challenges the homeostatic power of any organism or threatens its survival (Colombo et al., 1990). It is a physical or psychological response of the body towards external or internal stimuli, i.e., the symptom resulting from exposure to a situation or environment that is not normal for an animal.

Stress response is considered as the increasing activity in the sympathetic branch of autonomic system and activation of the hypothalamic-pituitary-adrenal axis (Beerda et al., 1998). The main purpose of physiological changes during stress is increasing the efficiency of delivering energy (oxygen and glucose) to vital organs, thereby increasing their efficiencies (Alina, 2008). The physiological parameters can be used for effective monitoring of stress. This is done to prepare the body for immediate response because any kind of stress directly affects the functioning of the body's vital organs.

Indicators of stress in animals are valuable tools for assessing their welfare. Physiological indicators of stress in animals include measures of heart rate, blood pressure, respiratory rate, pulse rate, body temperature, evaluations of the immune status of the disease incidence and various hormonal measures which include catecholamines, glucocorticoids, prolactin, gonadotrophins, thyroid-stimulating hormones and insulin (Alina, 2008).

Gastrointestinal tract (GIT) surgeries are done in an attempt to solve numerous clinical problems caused by the diseases of the digestive tracts (Ellison, 2010). Substantial unrecognized malnutrition exists in patients that underwent upper GI surgery due to impaired food intake (Buzby et al., 1980). Generally, a period of starvation (nil-by-mouth) is common after GI surgery during which an intestinal anastomosis is formed (Catchpole, 1989). This is the post-operative period when an operated animal is not allowed to take anything per os but maintained only on parenteral

http://doi.org/10.54328/covm.josvas.2022.060

nutrition. The rationale is to prevent post-operative nausea and vomiting and to protect the anastomosis, allowing it time to heal before being stressed by food (Stephen et al, 2001). The practice of delaying enteral nutrition (EN) until the passing of flatus or stools in humans is a conservative practice that arose out of valid concern about stressing a fresh anastomosis (Brenna *et al*., 1994; Seung *et al*., 2014). There are controversies regarding the benefits of this practice.

The objective of this study was to evaluate the success rate of early oral feeding (EOF) in Nigerian indigenous breeds of dog following intestinal resection; to evaluate the differences in the stress response of EOF and total parenteral nutrition (TPN) groups of dogs after intestinal resection and to determine the optimal time to institute the EOF after surgery.

MATERIALS AND METHODS:

EXPERIMENTAL ANIMALS

Sixteen (16) clinically healthy Nigerian indigenous breed of dogs between 7-12 months of age were randomly assigned to 4 groups of 4 animals each. They were all subjected to duodenal resection and end-end anastomosis according to the technique described by Slatter, (2003).

INDUCTION OF INTESTINAL INJURY

They were aseptically prepared and draped. The celiotomy incision of about 5cm was made through the linea alba avoiding the muscles on the either side. In male dogs, a para preputial skin incision was made and the penis reflected while the abdomen was entered through a standard ventral midline incision as described by Slatter, (2003).

The stomach and the segment of intestine to be transected were isolated from the remaining viscera and the peritoneal cavity by exteriorization, the stomach was packed off with moistened gauze. The pyrolus was located and measurement was taken about 6.0cm from the pyrolic sphincter. Blood vessels to the segment were ligated and resected. The mesentery was incised near the ligated vessels; leaving 1.5cm from the proposed site of transection (about 6.0cm from the pylorus). The intestinal contents were milked away from the proposed transection site to allow easy placement of sutures. The intestine was then occluded approximately 1.5cm proximal and distal to the area to be transected using intestinal forceps and transected with a scapel in between the clamps.

Two separate sutures of swaged-on material were placed at the mesenteric and antimesenteric borders and tied leaving 3- to 4- cm-long ends for stay sutures to maintain orientation. A single layer, simple interrupted approximating suture pattern using 2/0 chromic catgut was carried out for end-to-end anastomosis. Tension was placed on the stay sutures to help appose the intestinal ends and appositional suture pattern was advanced from one stay suture end to the other. The needle was inserted 3 to 5 mm from the edge of one segment of the intestine, through the serosa and passed through the muscularis and submucosa. The needle was inserted into the end of second intestinal segment at the mucosa-submucosa junction and passed through the submucosa, muscularis, and serosa in an arc to exit 3 to 5 mm from the cut surface. The suture was pulled just taut enough to appose the tissues to avoid too tight sutures cutting through the muscularis. The remaining sutures were placed 3 to 5 mm apart round the intestine.

Post suturing, the anastomotic site was leak-tested using a 10ml syringe with physiologic saline while still occluding the intestinal lumen with forceps at about 3mm apart and also to ascertain the patency of the intestinal lumen.

The intestines after cleaning with sterile gauze soaked in warm normal saline were gently returned to the peritoneal cavity in the absence of any blockage, leakage or bleeding. The peritoneum, muscles and subcutis were closed with size 2/0 chromic catgut using a simple continuous suture pattern while the skin incision was closed with size 2/0 silk using a horizontal mattress pattern. Treatment: Post-operatively, Gentamycin 5mg/kg was given IM for 5 days; Ketoprofen was administered subcutaneously at the dose of 4mg/kg at 1 hour and daily for 3 days post-surgery to all groups to manage post-operative pain, while skin sutures were removed after complete wound healing.

After the surgery, the animals were divided into four groups of four animals each;

Group I animals were placed on total parenteral nutrition for 72 hours, group II animals were placed on parenteral nutrition with the introduction of enteral feeding 8 hours postoperatively, group III animals were placed on parenteral nutrition with the introduction of enteral feeding 12 hours postoperatively while group IV animals were placed on parenteral nutrition with the introduction of enteral feeding 24 hours postoperatively

Parenteral nutrition was achieved using intravenous infusion of 5% dextrose saline at 10ml/kg/hr while enteral feeding was achieved using a cereal-based meal (Nutrend®)) orally, using feeding plates once a day at the company's recommended rate.

STATISTCAL ANALYSIS

The following parameters were collected using standard methods and analysed using one way analysis of variance (ANOVA) and the mean separated using statistical package for social sciences: Heart rate, pulse rate, rectal temperature, body weight, blood glucose level and serum cortisol level.

RESULTS

The mean heart rate of group I animals was significantly ($p < 0.05$) higher than those of groups II, III and IV on PSD1. However, the animals in all the groups showed no significant

($p \geq 0.05$) difference in their mean heart rate values during the remaining period (Figure I).

The mean pulse rate of the animals in group I was significantly ($p < 0.05$) higher than those of groups II, III, and IV on PSD1. On PSD 3, animals in group II had a significantly ($p < 0.05$) higher values than those in groups I, III and IV, while on PSD 5, groups II and III animals had a significantly ($p < 0.05$) higher values than those in group I (Figure II)

On PSD 1, the mean temperature for group IV was significantly ($p < 0.05$) lower than those of groups I, II, and III while groups I and III values were on the other hand significantly ($p < 0.05$) lower than group II value. However, the values for all the groups on PSDs 3, 4, 5, 6, and 7 showed no significant ($p \geq 0.05$) difference (Figure III).

On PSDs 2-7, the group I animals showed a significant ($p < 0.05$) reduction in the mean body weight when compared to groups II and III animals, while there was no significant ($p \geq 0.05$) difference between groups II, III and IV on the same days (Figure IV).

The mean glucose level of group I animals was significantly ($p < 0.05$) lower than those of group IV on PSD 1 while no significant ($p \geq 0.05$) difference in glucose values was noted in all the groups on PSD 3 and 7 (Figure V).

There was no significant ($p>0.05$) difference in the mean cortisol values in all the groups on PSD 1, 3 and 7. Following surgery, there was an increase in the mean cortisol values which declined gradually after PSD 1 in all the groups (Figure VI).

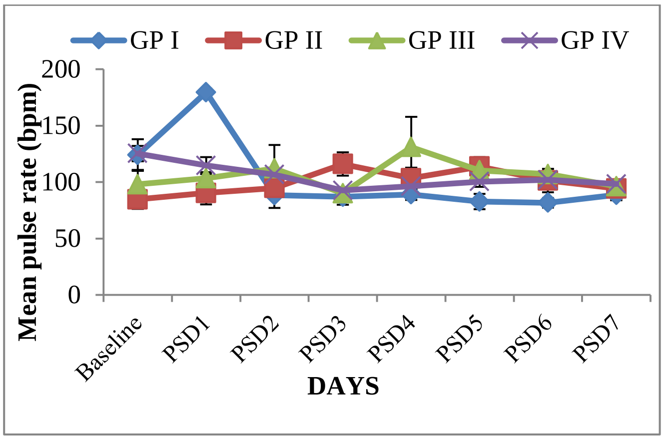

Figure I. Mean heart rate of the control and the EOF groups on PSDs 1-7. Group I: TPN alone; Group II: PN + EOF after 8h; Group III: PN + EOF after 12h; Group IV: PN +EOF after 24h.

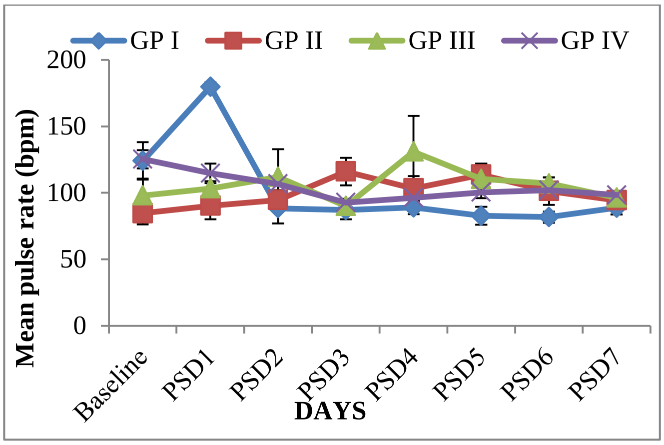

Figure II. Mean pulse rate of the control and the EOF groups on PSDs 1-7. Group I: TPN alone; Group II: PN + EOF after 8h; Group III: PN + EOF after 12h; Group IV: PN +EOF after 24h.

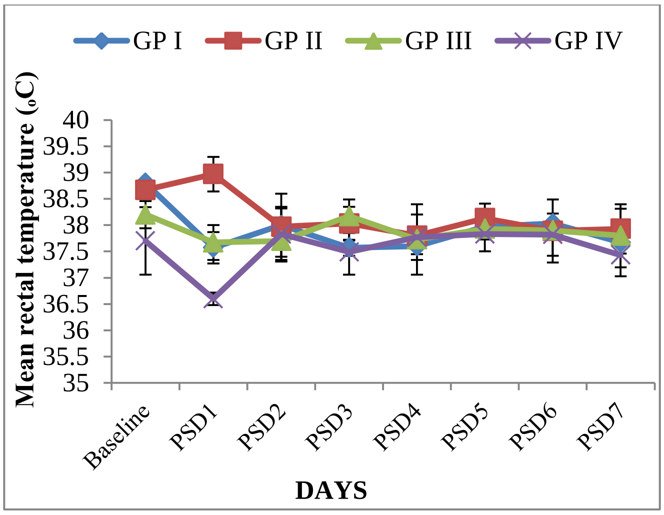

Figure III. Mean rectal temperature of the control and the EOF groups on PSDs 1-7. Group I: TPN alone; Group II: PN + EOF after 8h; Group III: PN + EOF after 12h; Group IV: PN +EOF after 24h.

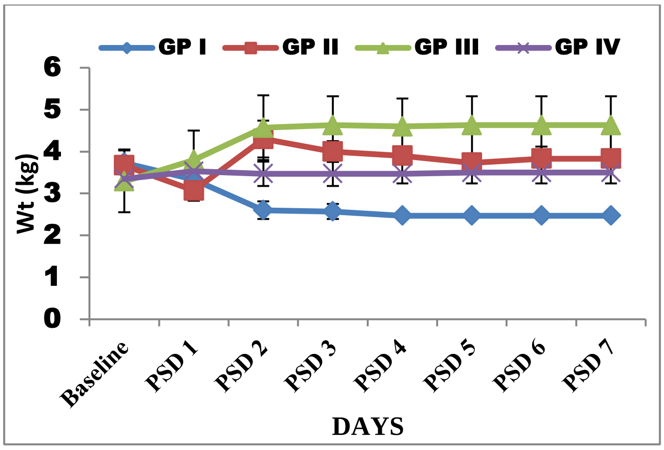

Figure IV. Mean body weight of the control and the EOF groups on PSDs 1-7. Group I: TPN alone; Group II: PN + EOF after 8h; Group III: PN + EOF after 12h; Group IV: PN +EOF after 24h.

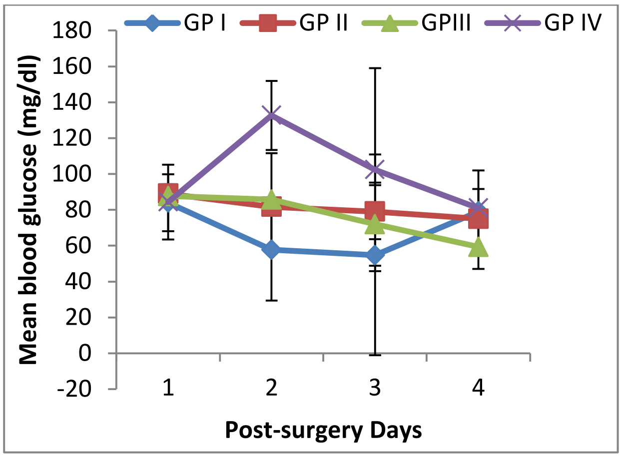

Figure V. Mean blood glucose of the control and the EOF groups on PSDs 1, 3 and 7. Group I: TPN alone; Group II: PN + EOF after 8h; Group III: PN + EOF after 12h; Group IV: PN +EOF after 24h.

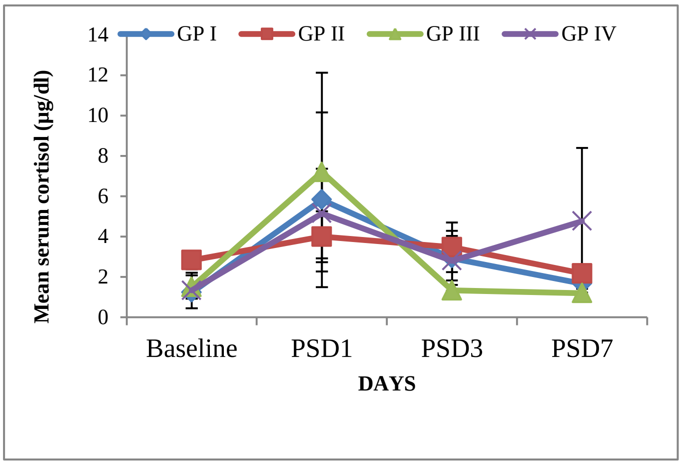

Figure VI. Mean serum cortisol of the control and the EOF groups on PSDs 1, 3 and 7. Group I: TPN alone; Group II: PN + EOF after 8h; Group III: PN + EOF after 12h; Group IV: PN +EOF after 24h.

DISCUSSION

The response to injury, stress and trauma is characterized by tissue and systemic inflammatory response with increased heart rate, pulse rate and rectal temperature which are compensatory responses to pain (Arbour, 2014). Thus the lower heart and pulse rates obtained in the early oral feeding (EOF) groups i.e. groups II, III and IV could be attributed to a reduced stress response. Alina (2008) reported acute heart rate increase in dogs subjected to things that triggers stress; Beerda *et al.* (1998) also documented a non-specific increase in heart rate in dogs following administration of various unpleasant stimuli which returned to normal within 8hrs after stressor disappeared. It can therefore be inferred that EOF had a regulatory effect on the post-operative physiological parameters of the animals that underwent gastrointestinal surgeries. The significant increase in the physiological parameters noted in group II animal on PSD1 could be as a result of postoperative inflammation which was exaggerated by the early introduction of oral feeding. This response was however transient.

The bodyweights of the animals in EOF groups were significantly higher as against the lower bodyweight obtained in the control group from PSD 2. This higher bodyweight in the EOF groups suggests that it is possible that EOF improved the nutritional status of dogs probably by reducing post-operative weight loss. This finding is in agreement with an earlier report that EOF supplies higher amount of nutrient and results in reduced weight loss (Imamura *et al.*, 2016). This improvement in nutritional status could have been achieved through the alteration of post-operative hypercatabolism (Kaufman, 2002; Kumpf, 2006, Luo *et al.*, 2007; Cober & Teitebaum, 2010) or by increasing the intestinal mucosal permeability and protein metabolism (Carr *et al.*, 1996). Post-operative weight loss is of particular concern as it may reduce quality of life, increase susceptibility to complications, extend hospital stay and decrease survival rate of surgical patients (Yu *et al.*, 2016). Weaver *et al.* (2010) attributed the post-operative loss in body weight to decreased food and water intake as well as post-operative catabolism. Mcleod *et al.* (1995) and Jeon *et al.* (2012) documented that patients can maintain a normal body weight after surgery, but it is frequently less than their pre-operative body weight. Our finding did not totally disagree with their report rather it altered it as the group one animals (control) were able to maintain a normal body weight that was actually less than the pre-operative value while the EOF animals were able to maintain a normal body weight higher than their pre-operative values. Groups II and III animals maintained higher body weight post-operatively probably because of early introduction of the enteral feeding in less than 24 hours which reduced post-operative weight loss. Therefore, it can be inferred that EOF could improve nutritional status by reducing post-operative weight loss and influence a metabolic response favouring synthesis of proteins (Takehiro *et al.*, 2006, Sotir *et al.*, 2015). The mean blood glucose levels of groups I, II, and III reduced remarkably by PSD1 while that of the group IV animals were significantly higher. The reason for this increase could possibly be due to marked stress response by the animals in the group and not necessarily due to the experimental treatment since the animals in group IV did not exhibit similar increase even when the two groups were on parenteral nutrition for the first 24 hours. Serum cortisol levels among all the experimental groups exhibited similar trend of initial increase within the PSD 1 followed by gradual reduction thereafter. This variation may be attributed to response to acute pain and stress from the surgery post operation (Bergmann *et al*., 2007).

In conclusion, EOF could have a soothing effect on the vital parameters, though there was transient increase in the inflammatory response in the animals post operatively. Furthermore, EOF improved early and long term post-operative nutritional status and whole body protein kinetics, thereby reducing the morbidity and complication rates. Early oral feeding instituted within the first 8-24 hours can be effectively used with better nutritional outcomes, lower cost and more convenient compared with the conventional method of nil by mouth i.e. the post-operative period when the animal is not allowed access to oral feeding.

REFERENCES

Alina, B. (2008). Indicators of stress and stress assessment in dogs. *Lucran stiintifice Medicina Veterinara, Timisoara*, 51, 20.

Arbour, C. & Gelinas, C. (2010) Are vital signs valid indicators for the assessment of pain in post-operative cardiac surgery ICUAdults? *Intensive and Critical Care Nursing*. 26(2), 83-90.

Beerda, B., Schilder, M. B., Van Hoof, J. A., De Vries, H. W. & Moi J. A. (1998). Behavioural, saliva cortisol and heart rate response to different types of stimuli in dogs. *Applied Animal Behaviour Science*, 58, 365-381.

Brenna, M. F., Pister, P. W., Pooner, M., Quesaela, O. & Shike, M. A. (1994). Prospective randomize trial of total parenteral nutrition after major pancreatic resection for malignancy. *Annals of Surgery, 220*, 436-441.

Buzby, G. P., Mullen, J. L., Matthews, D. C., Hobbs, C. L. & Rosato, E. F. (1980). Prognostic nutritional index in gastrointestinal surgery. *American Journal of Surgery*, 139, 160–7.

Bergmann, H.M., Nolts, I., & Kramar, S. (2007). Comparison of analgesic efficacy of preoperative or post-operative Carprofen with or without preincisional Mepivacaine epidural Anaesthesia in canine pelvic or femoral fracture repair. *Vetrinary Surgery* 36, 623-632.

Carr, C. S., Ling, K., Boulos, P. & Singer, M. (1996). Randomized trial of safety and efficacy of immediate post-operative enteral feeding in patients undergoing gastrointestinal resection. *British Medical Journal, 312* (7035), 869-871.

Catchpole, B. N. (1989). Smooth muscle and the surgeon. *Australian New Zealand Journal of Surgery*, 59, 199–208.

Cober, M. P. & Teitebaum, D. H. (2010). Prevention of parenteral nutrition associated liver disease: lipidminimization. *Current Opinion in Organ Tranplant, 15*, 330-333.

Colombo, L., Pickering, A. D., Belvedere, P. & Schroch, C. B. (1990). Stress inducing factors and stress reaction in aquaculture. In: Pauw, N. D. & Billard, R. editors Aquaculture European 12, 93-121.

Ellison, G. W. (2010). Complications of Gastrointestinal Surgery in Companion Animals. *Veterinary Clinic of Small Animal*, 41, 915-934.

Imamura, H., Nishikawa, K., Kishi, K., Inoue, K., Matsuyana, J. & Akamru, Y. (2016). Effects of an oral elemental nutritional supplement on post gastrectomy body weight loss in gastric cancer patients; a randonmized controlled clinical trial. *Annals of Surgical Oncology*, 23 (9), 2928-2935.

Jeon, S. P., Hye, K. C., Ho, K. H., Jae, K. K., & Dong, S. Y. (2012). Post-operative nutritional effect of EEF compared to TPN in pancreaticoduodectomy patients: A prospective randomized study. *Journal of Korean Medical Science*, 27(3), 261-267.

Kaufman, S. S. (2002). Prevention of parenteral nutrition assocciated liver disease in children. *Paediatric Transplant, 6*, 37-42.

Kumpf, V. J. (2006). Parediatric patients enteral nutrition - associated liver disease in adult and Paediatric. *Nutriton and Clinical Practice, 21*, 279-290.

Luo, S. C., Guo, J. H., Zhu, W. O. & Zhang, L. P. (2007). Early post-operative enteral versus parenteral nutrition in patients with gastrointestinal cancer : A randomized controlled trial. *Chineese Journal Bases Clinical General Surgery, 14*, 324-328.

Mcleod, R. S., Taylor, B. R., O'connor, B. I., Greenberg, G. R., Jeejeebhoy, K. N. & Royall, D., *et al*. (1995). Quality of life,nutritional status and gastrointestinal hormone profile following the Whipple procedure (169, Ed.). *American Journal of Surgery*, 12, 179-185.

Seung, H. L., Ji, Y. J., Hyung, W. K., Myung, J. J. & Jae, C. L. (2014). Effects of Early Enteral Nutrition on patients after emergency gastrointestinal surgery. *Journal of Korean Medical Science*, 93 (28), e 323.

Sotir, L., Teuta, D., Tatjana, N., Vera, O., Aurel, D., & Roland, X. (2015). Haematological changes in patients undergoing coronarybypass surgery: prospective study. *Medical Archives, 69* (3), 181-186.

Slatter, D. (2003). Small Animal Surgery, 3rd ed. Small intestines: Resection and anastomoses. Saunders, Philadelphia 1, 644-661.

Stephen, J. L., Matthias, E., Paul, A.S. & Steven, T. (2001).Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. *British Medical Journal*, 323, 773.

Takehiro, O., Michiya, K., Isao, N., Tekeki, S., Toyokazu, A. & Tsutomu, N. (2006). Benefits of early post operative jejunal feeding in patients undergoing duodenohemipancreatectomy. *World Journal of Gastroenterology, 12* (1), 89-93.

Weaver, L. A., Blaze, C. A., Linda, D. E., Andrutis, K., L. & Karas, A. Z. (2010). A model of clinical evaluation of perioperative analgesia in rabbits. *Journal of American Association of Laboratory animal Science*, 49 (6), 845-851.

Yu, O., Shusuke, H., Tsuyoshi, T., Masaki, U. & Harushi, U. (2016). Effectiveness of post-operative elemental diet in elderly patients after gastrectomy. *World Journal of Surgical Oncology, 14*, 268.