

ISSN: 2322-4568



World's Veterinary Journal

Scienceline Publication

An international peer-reviewed journal which publishes in electronic format

Volume 8, Issue 2, June 2018

Editorial Team

Editors-in-Chief:

Fikret Çelebi, PhD, Professor of Veterinary Physiology; Atatürk University, **TURKEY**

Daryoush Babazadeh (ORCID ID; Publons; Full Member of WAME; Member of IAVE; Email: daryoush.babazadeh@shirazu.ac.ir); DVM, DVSc, PhD of Avian/Poultry Diseases, School of Veterinary Medicine, Shiraz University, Shiraz, **IRAN**

Managing Editor:

Alireza Sadeghi, DVM, Faculty of Veterinary medicine, Tabriz Branch, Islamic Azad University, Tabriz, **IRAN**; Email: alirezavet86@gmail.com

Associate Editors

Anjum Sherasiya, Ex-Veterinary Officer, Star, Gulshan Park, NH-8A, Chandrapur Road, Wankaner - 363621, Dist. Morbi (Gujarat), **INDIA**

Arman Moshaveri, DVM, Faculty of Veterinary Medicine, Karaj Branch, Islamic Azad University, Karaj, **IRAN**

Ashraf Fathy Said Awad, PhD, Genetics and Genetic Engineering, Animal, Wealth Development Department, Faculty of Veterinary, Medicine, Zagazig University, **EGYPT**

Konstantinos Koutoulis, DVM, PhD; Avian Pathology; Faculty of Veterinary Science, University of Thessaly, Terma Trikalon 224, 43100 Karditsa, **GREECE**

Mahendra Pal, PhD. Ex-Professor of Veterinary Public Health, Department of Microbiology, Immunology and Public Health, College of Veterinary Medicine, Addis Ababa University, **ETHIOPIA**

Saeid Chekani Azar, PhD, Animal Physiology; Faculty of Veterinary Medicine, Atatürk University, Erzurum, **TURKEY**; [ORCID ID](#), [Google Scholar](#)

Thakur Krishna Shankar Rao, PhD, Assistant professor, Vanabandhu College of Veterinary Science & Animal Husbandry, Navsari Agricultural University, Navsari Gujarat, **INDIA**

Thandavan Arthanari Kannan, PhD, Full professor, Centre for Stem Cell Research and Regenerative Medicine Madras Veterinary College Tamil Nadu Veterinary and Animal Sciences university Chennai-600007, **INDIA**

Tohid Vahdatpour, PhD, Assistant Prof., Physiology; Dep. Animal Sciences, Shabestar Branch, Islamic Azad University, Shabestar, **IRAN**

Wesley Lyeverton Correia Ribeiro, MSc, DVM, Animal Health, Veterinary Parasitology, and Public Health, Animal welfare; College of Veterinary Medicine, State University of Ceará, Av. Paranjana, 1700, Fortaleza, **BRAZIL**

Language Editor:

Ali Fazel, Master of arts in T.E.S.O.L. University of Nottingham, Semenyih, Selanger, **MALAYSIA**

Faezeh Modarresi-Ghazani, Drug Applied Research Center, Tabriz University of Medical Sciences, Tabriz, **IRAN**

Reviewers

Ahmed Mohamed Ammar, Professor of Microbiology, Faculty of Veterinary Medicine, Zagazig University, **EGYPT**

Alireza Koochakzadeh, DVM, PhD of Bacteriology, Faculty of Veterinary Medicine, University of Tehran, Tehran, **IRAN**

AKM Mostafa Anower, PhD, Patuakhali Science and Technology University, Department of Microbiology and Public Health, Faculty of Animal Science and Veterinary Medicine, **BANGLADESH**

Ali Halajian, PhD, DVM, Parasitology; Dep. Biodiversity, School of Molecular & Life Sciences, Faculty of Science and Agriculture, University of Limpopo, **SOUTH AFRICA**

Ghader Najafi, PhD in Animal Physiology, Ankara University, Ankara, **TURKEY**; Assistant Prof. in Faculty of Veterinary Medicine, Islamic Azad University, Urmia Branch, Urmia, **IRAN**

Hazim Jabbar Al-Daraji, PhD, Professor of Avian Reproduction and Physiology; University of Baghdad, College of Agriculture, Abu-Ghraib, Baghdad, **IRAQ**

KARAMALA SUJATHA, MVSc, PhD, Associate Professor, Department of Veterinary Pathology, College of Veterinary Science, Sri Venkateswara Veterinary University, Tirupati - 517502, Andhra Pradesh, **INDIA**

Khalid Mohammed Elamin Osman, PhD, Associate Professor of Animal Production; University of Gezira, Faculty of Animal Production, **SUDAN**

Kuastros Mekonnen Belaynehe, Seoul National University, South Korea/ National Animal Health diagnostics and Investigation Center, **ETHIOPIA**

Mahdi Alyari Gavaher, DVM, DVSc, Faculty of Veterinary Medicine, Karaj Branch, Islamic Azad University, Karaj, **IRAN**

Manish Kumar, Prof. Dr. Pharmacology, Ethnomedicine, Society of Education (SOE), **INDIA**

Mojtaba Mohseni, DVM, DVSc (PhD) Student of Large Animal Internal Medicine, Faculty of Veterinary Medicine, Urmia University, Urmia, **IRAN**

Muhammad Abdullahi Mahmud, DVM, MSc, SENIOR LECTURER, Department of Animal Health and Production Technology, Niger State College of Agriculture, Mokwa, Niger State, **NIGERIA**

Muhammad Moin Ansari, BVSc & AH, MVSc, PhD (IVRI), NET (ICAR), Dip.MLT, CertAW, LMIVA, LMISVS, LMISVM, MHM, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Faculty of Veterinary Sciences and Animal Husbandry, Division of Veterinary Surgery and Radiology, Shuhama, Alastang, Srinagar-190006 Jammu & Kashmir, **INDIA**

Muhammad Saeed, PhD (Student), Animal Nutrition and Feed Science, College of Animal Sciences and Feed technology, Northwest A&F University, Yangling, 712100, **CHINA**

Nunna Veera Venkata Hari Krishna, PhD, Assistant Professor, Dept. of Veterinary Surgery and Radiology NTR College of Veterinary Science, Gannavaram – 521 102, A.P., **INDIA**

Osman Erganiş, PhD. Professor of Microbiology; Department of Microbiology, Faculty of Veterinary Medicine, Selcuk University, Konya, **TURKEY**

Rafiqul Islam, Animal Scientist, Krishi Vigyan Kendra, Dhubri, Assam Agricultural University, Bilasipara, PO: Bilasipara, District: Dhubri, State: Assam, **INDIA**

Shewangzaw Addisu Mekuria, BSc, MSc, Instructor, department of Animal Production and Extension, University of Gondar, P. O. Box 196, Gondar, **ETHIOPIA**

Siamk Sandoughchian, PhD, Immunology; Department of Immunology, Faculty of Medical Sciences, Juntendo University, **JAPAN**

Terry Ansah, PhD., Nutrition - Ruminants; University for Development Studies-Ghana and Harper Adams University College, **UNITED KINGDOM**

Tesfaheywet Zeryehun Shiferaw, DVM, MSc, Associate Professor, College of Veterinary Medicine Haramaya University, P.O.Box-301, Dire Dawa, **ETHIOPIA**

Thakur Krishna Shankar Rao, PhD, Assistant professor, Vanabandhu College of Veterinary Science & Animal Husbandry, Navsari Agricultural University, Navsari Gujarat, **INDIA**

Vassilis Papatsiros, Professor, Dietary input, Animal and Feed interactions; Porcine Medicine, Faculty of Veterinary Medicine, University of Thessaly, Trikalon str 224, GR 43100, **GREECE**

Wafaa Abd El-Ghany Abd El-Ghany, PhD, Assistant Prof. of Poultry and Rabbit Diseases; Poultry and Rabbit Diseases Department, Faculty of Veterinary Medicine, Cairo University, Giza, **EGYPT**

Varij Nayan, BVSc, MVSc, PhD Scientist (Animal Biochemistry), Animal Physiology and Reproduction Division, ICAR-Central Institute for Research on buffaloes (ICAR-CIRB), Hisar-125001 (Haryana) **INDIA**,

Yagoob Garedaghi, Assistant professor, PhD of Parasitology; Department of Veterinary Parasitology, Tabriz Branch, Islamic Azad University, Tabriz, **IRAN**

Sesotya Raka Pambuka, MSc, Sinta Prima Feedmill, Poultry and Aqua Feed Formulation, Sulaiman Rd 27A, West Jakarta, **INDONESIA**

Advisory Board

Ferdaus Mohd. Altaf Hossain, DVM, Microbiology, Immunology, Poultry Science, and Public Health; Sylhet Agricultural University, Bangladesh; not shah Jalal University of Science & Technology, **BANGLADESH**

Paola Roncada, PhD, Associate Prof., Pharmacokinetics, Residues of mycotoxins in food and in foodproducing species, Residue depletion studies; Veterinary Pharmacology and Toxicology, Faculty of Veterinary Medicine, University of Bologna, **ITALY**

Sina Vahdatpour, DVM-DVMS, Faculty of Veterinary medicine, Tabriz Branch, Islamic Azad University, Tabriz, **IRAN**

Tohid Vahdatpour, PhD, Assistant Prof., Physiology; Dep. Animal Sciences, Shabestar Branch, Islamic Azad University, Shabestar, **IRAN**

Volume 8 (2); June 25, 2018

Research Paper

Management of Short Bowel Syndrome in Nigerian Dogs.

Kisani AI, Adeyanju JB, Elsa AT and Sonfada ML.

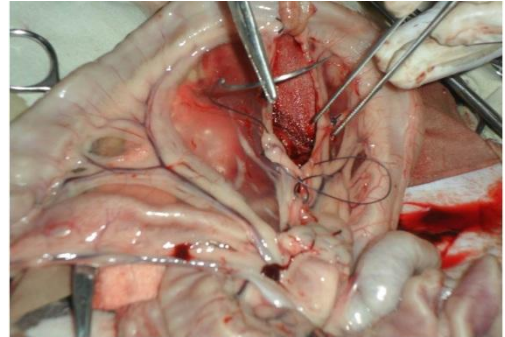
World Vet. J. 8(2): 34-47, 2018; pii:S232245681800004-8

ABSTRACT

The effects of glutamine, honey, ascorbic acid and glutamine, honey, ascorbic acid combination on small bowel adaptation following 70% small intestinal resection in local Nigerian dogs were investigated. Thirty adult dogs with a median weight of 12.4kg (range 7-18 kg) were used in this study. The dogs were randomized into five groups of six dogs each following resection. Group 1 is the control group. The dogs here were not placed on any treatment. Group 2 dogs were placed on glutamine. Group 3 dogs were placed on honey. Group 4 dogs were placed on ascorbic acid and group 5 dogs were placed on glutamine, honey and ascorbic acid combination. Intestinal biopsy samples were collected at day 0, 4 weeks, 6 weeks and 8 weeks for histomorphometric study. Intestinal morphology was evaluated using light microscopy. The body weights of the dogs were monitored weekly for 4, 6 and 8 weeks in the five groups. Small intestinal adaptive response was evaluated at 4, 6 and 8 weeks post surgery. The animals treated with glutamine, honey, ascorbic acid and glutamine/ honey/ ascorbic acid combination experienced increase in intestinal villus height, villus width, crypt depth and wall thickness. The control group experienced a fall in intestinal villus height, villus width, crypt depth and wall thickness. The animals treated with glutamine, honey, ascorbic acid combination showed better therapeutic response followed by glutamine, honey and ascorbic acid in that order. There was a gradual increase in the body weight of animals in these groups. The control group did not show any appreciable adaptive response and the animals in this group progressively lost weight. It was concluded that dogs presented with short bowel syndrome could benefit from the supplementation of glutamine, honey and ascorbic acid in food.

Keywords: Short bowel syndrome, Total parenteral nutrition, Intestinal resection, Small intestinal adaptive response

[Full text-[PDF](#)] [[MOBI](#)] [[ePUB](#)] [[AZW3](#)]



Kisani AI, Adeyanju JB, Elsa AT and Sonfada ML (2018). Management of Short Bowel Syndrome in Nigerian Dogs. World Vet. J. 8(2): 34-47. www.wvj.science-line.com

[Archive](#)



World's Veterinary Journal

ISSN: 2322-4568

Frequency: Quarterly

Current Issue: 2018, Vol: 8, Issue: 2 (25 June)

Publisher: [SCIENCELINE](#)

World's Veterinary Journal (ISSN 2322-4568) is an international, English language, peer reviewed open access journal aims to publish the high quality material from veterinary scientists' studies

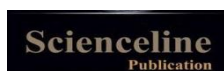
[... View full aims and scope \(www.wvj.science-line.com\)](http://www.wvj.science-line.com)

Editors-in-Chief:

Prof. Dr. Fikret Çelebi, Veterinary Physiology; Atatürk University, TURKEY;

Dr. Daryoush Babazadeh, DVM, DVSc (PhD) of Avian/Poultry Diseases, Shiraz University, Shiraz, IRAN

- WJ indexed/covered by [SCOPUS](#), [NLM Catalog \(NLM ID: 101688928\)](#), [ScopeMed](#), [RiCeST-ISC](#), [Ulrich's™/ProQuest](#), [NAAS \(Score: 3.96\)](#), [UBTIB](#), [SHERPA/RoMEO](#), [Genamic](#), [INFOBASE](#), [Index Copernicus International \(ICV 2014= 5.73\)](#) (visit [full index information](#))
- Open access full-text articles is available beginning with Volume 1, Issue 1.
- Full texts and XML articles are available in [E-Journals Database \(RiCeST\)](#).
- This journal is in full compliance with [Budapest Open Access Initiative](#) and [International Committee of Medical Journal Editors' Recommendations \(ICMJE\)](#).



[ABOUT US](#)

| [CONTACT US](#)

| [PRIVACY POLICY](#)

ScienceLine Offices:

Atatürk Univ., Erzurum 25100, Turkey, www.science-line.com

Maragheh Univ., East Azerbaijan, Iran, www.science-line.ir

Tel: +90-538 770 8824; +98-914 420 7713

Email: administrator@science-line.com



Management of Short Bowel Syndrome in Nigerian Dogs

Aboh Iku Kisani^{1*}, John Bayo Adeyanju², Abdullahi Teleh Elsa¹ and Mamman Legbo Sonfada³

¹Department of Veterinary Surgery and Theriogenology, College of Veterinary Medicine, University of Agriculture, Makurdi Benue State, Nigeria

²Department of Veterinary Surgery and Radiology, Faculty of Veterinary Medicine University of Ilorin, Nigeria

³Department of Veterinary Anatomy, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto, Nigeria

*Corresponding author's Email: abohkisani@yahoo.com

ABSTRACT

The effects of glutamine, honey, ascorbic acid and glutamine, honey, ascorbic acid combination on small bowel adaptation following 70% small intestinal resection in local Nigerian dogs were investigated. Thirty adult dogs with a median weight of 12.4kg (range 7-18 kg) were used in this study. The dogs were randomized into five groups of six dogs each following resection. Group 1 is the control group. The dogs here were not placed on any treatment. Group 2 dogs were placed on glutamine. Group 3 dogs were placed on honey. Group 4 dogs were placed on ascorbic acid and group 5 dogs were placed on glutamine, honey and ascorbic acid combination. Intestinal biopsy samples were collected at day 0, 4 weeks, 6 weeks and 8 weeks for histomorphometric study. Intestinal morphology was evaluated using light microscopy. The body weights of the dogs were monitored weekly for 4, 6 and 8 weeks in the five groups. Small intestinal adaptive response was evaluated at 4, 6 and 8 weeks post surgery. The animals treated with glutamine, honey, ascorbic acid and glutamine/ honey/ ascorbic acid combination experienced increase in intestinal villus height, villus width, crypt depth and wall thickness. The control group experienced a fall in intestinal villus height, villus width, crypt depth and wall thickness. The animals treated with glutamine, honey, ascorbic acid combination showed better therapeutic response followed by glutamine, honey and ascorbic acid in that order. There was a gradual increase in the body weight of animals in these groups. The control group did not show any appreciable adaptive response and the animals in this group progressively lost weight. It was concluded that dogs presented with short bowel syndrome could benefit from the supplementation of glutamine, honey and ascorbic acid in food.

Key words: Short bowel syndrome, Total parenteral nutrition, Intestinal resection, Small intestinal adaptive response

INTRODUCTION

Extensive resection of the small intestine can result in a condition known as Short Bowel Syndrome (SBS) (Gorman et al., 2006; Hasosah et al., 2008; Seetharam and Rodrigues, 2011; Mayeur et al., 2016; Vagholkar et al., 2016) and it occurs in both humans and animals. It is a disorder characterized by an intestinal absorptive surface area that is insufficient to support the host. This intestinal loss results in the malabsorption of fluid, electrolytes and other essential nutrients, severe diarrhea, dehydration and progressive malnutrition. Intestinal failure results when the residual bowel length cannot meet the patient's nutritional requirement thus necessitating dependence on parenteral nutrition (PN) (Donohoe and Reynolds, 2010; Norholk et al., 2012; Winkler and Smith, 2014; Mayer and Kerner, 2017). It is this dependence on parenteral nutrition that is responsible for the majority of morbidity and mortality associated with short bowel syndrome (Wales and Christison-Lagay, 2010; Vipperla and O'keefe, 2014). In dogs, intestinal resection is done because of linear foreign bodies, mesenteric volvulus, direct traumatic damage to the small bowel wall, solitary foreign body with perforation of the intestine, intussusceptions, dehiscence of a previous gastrointestinal tract surgery site and gastrointestinal tract tumor (Gorman et al., 2006). Long-term survival of patients with SBS is dependent on the adaptation of the remaining small intestine and response to pharmacological and nutritional management (Wall, 2013, Cunha-Melo and Costa, 2014; Rodriguez-Montes et al., 2016).

Managing short bowel syndrome is challenging as the medications are expensive and patients have to use them for a very long time and there is no guarantee that the response will be favourable (Hrbaty et al., 2004).

ORIGINAL ARTICLE
pII: S232245681800004-8
Received: 04 Apr 2018
Accepted: 08 May 2018

MATERIALS AND METHODS

Experimental animals

Thirty dogs under 2 years of age with a mean weight of 12.4 kg (range 7-18 kg) were used for this study. They were stabilized for 4 weeks by being boarded in kennels within the teaching hospital and were dewormed and treated against ectoparasites and hemoparasites. They were fed daily and water was provided ad libitum. Each animal was fasted for 12 hours prior to surgery. They were premedicated with Atropine sulphate (Jiangsu Huayang pharmaceutical, China) at a dose rate of 0.04 mg/kg and xylazine hydrochloride (XYL-M2®, VMD, Belgium) at a dose rate of 1 mg/kg body weight intramuscularly. Induction was done with thiopentone sodium (Rotexmedica, Germany) at a dose rate of 10 mg/kg body weight intravenously. The total small intestinal length in each dog was calculated and recorded as described by Kisani et al. (2017).

Surgical procedure

Each animal was aseptically prepared and a ventral midline abdominal incision was made. The intestinal tract was exteriorized. Seventy per cent of the small intestinal tract (from the result of the preliminary study) was resected beginning from a point 7cm from the duodeno-jejunal flexure (treitz ligament). The residual intestinal tract was sutured using end to end anastomosis with polyglactin 910 (vicryl® Ethicon, USA) size “0” as described earlier. A full thickness biopsy sample of the small intestinal tract (Jejunum and ileum) were collected and fixed in 10% formalin (pretreatment sample). The anastomotic site was covered with omentum and returned to the abdominal cavity. The abdominal incision was closed using standard surgical technique (Fossum, 2014). Procain penicillin (Shuazhuang co ltd, China) 20,000 iu/kg and Streptomycin (North China pharmaceutical co ltd, China)(10 mg/kg) was administered intramuscularly for 5 days post operative. Pentazocin (Bharat Parenterals ltd, India) was administered intramuscularly at the dose rate of 5mg/kg for 7 days to relieve pain.

The dogs were given 5% dextrose infusion intravenously at 10 mls/kg/hr on the second and third day post operative. They were fed bland diet gruel on the fourth post operative day and returned to normal solid diet on day five post surgery. After surgery, the animals were randomized into five groups that each group contained six animals. Group 1 was the control group. The animals in this group were not treated. They were left to attend to their normal daily ration throughout the period of experiment. Group 2: Animals in this group were placed on orally administered glutamine. The dogs were given 9.0 mg/kg/day for 4 weeks (two dogs), 12.0 mg/kg/day for 6 weeks (Two dogs) and two15.0 mg/kg/day for 8 weeks (two dogs).

Group 3: The animals in this group were placed on orally administered honey. Two dogs were placed on honey at 7.5 mls/day for 4 weeks, two dogs consumed 10mls/day for 6 weeks and two dogs were administered 12.5 mls/day for 8 weeks. Group 4: The animals in this group were placed on orally administered Ascorbic acid (vitamin C). Two dogs were administered ascorbic acid 150 mg/day for 4weeks, two dogs administered on ascorbic acid 250mg/day for 6 weeks and two dogs administered 350 mg/day for 8 weeks. Group 5: The animals in this group were placed on combine dose of glutamine (9 mg/kg/day), honey (7.5 mls/day) and vitamin C (150 mg/day). Two animals were placed on this combination for 4 weeks, two animals administered for 6weeks and two animals administered for 8 weeks.

Histomorphometric analysis

Small bowel biopsy specimens were obtained from the jejunum and ileum at day 0 (pre-surgical) and at 4, 6 and 8 weeks post resection-anastomosis. A total of four biopsy specimens were obtained from each patient (at the end of first and second laparotomy) and placed in 10% formalin. After routine formalin fixation, biopsy specimens were embedded in paraffin. Four-micrometer-thick (4 µm) sections were cut perpendicular to the mucosa and stained routinely with H&E. Then using light microscopy and an eye piece micrometer at a magnification of ×100, the villus height, villus width, crypt depth and cross sectional area of the bowel mucosa were measured as explained by Joaquim et al. (2005). Five readings were taken for each parameter and the average value determined. Photomicrograph and interpretation of the slides were done using trinocular microscope and Amscope Toup View 3.7.

Statistical analysis

Data were expressed as descriptive statistics. Differences among the groups were evaluated using one way analysis of variance (ANOVA) followed by a two tailed student's t-test using SPSS version 16. The level of significance was set at 5%.

Ethical approval

This study was approved by the ethical committee of the college of veterinary medicine, university of Agriculture, makurdi, Nigeria with no.001.

RESULTS

Histomorphometry

Villus height

There was an increase in villus height for all the groups except the control group which experienced a fall in jejuna villus height in week 6 and 8 (Table 1) and a fall in ileal villus height in week 4 and 6. Group 5 also experienced a fall in jejuna villus height in week 6 (Table 5). The animals in group 4 showed a fall in ilea villus height in week 6. Groups 2, 3, and 5 showed statistically significant increase in villus height (Tables 2, 3 and 5) ($P < 0.05$) while groups 1 and 4 did not cause statistical increase in villus height (Tables 1 and 4) ($P > 0.05$).

Villus width

There was increase in villus width in all the groups. The control group and glutamine treated groups had greater increase in jejuna villus width at week 4 and a decrease in week 6 and 8 (Table 1). The control group also experienced a decrease in ilea villus width in week 4 and 6. Glutamine, honey and ascorbic acid treated groups had shown a statistically significant increase in villus width (Tables 2, 3 and 4) ($P < 0.05$). Ascorbic acid treated group had also shown significant increase in ilea villus height.

Crypt Depth

There was an increase in crypt depth in all the groups except the control group (Tables 1-5). Glutamine, honey and glutamine honey and ascorbic acid treated groups caused a significant increase in crypt depth ($P < 0.05$). Ascorbic acid treated animals significantly enhanced ilea crypt depth while the control group did not show any significant changes.

Wall thickness

All the groups experienced increase in wall thickness except the control group which experience increase only in the ilea wall thickness in week 8 of experiment (Tables 1-5). Group 2 (glutamine treated), group 3 (honey treated) and group 5 (glutamine/ honey/ ascorbic acid treated) animals had shown a significant increase in wall thickness ($P < 0.05$) (Tables 2, 3 and 5). Ascorbic acids treated group had shown a significant increase in jejunal wall thickness ($P < 0.05$) (Table 4).

Table 1. Jejunal histomorphometric analysis for dogs (Control group) post 70% small intestinal resection

Jejunum	Wks	Number of dogs (n = 6)						Mean \pm SEM	P value
		1	2	3	4	5	6		
Villus Height (VH)	0	1.104	0.937	0.696	0.787	0.814	0.925	0.877 \pm 0.058	0.131
	4	1.024	0.861	-	-	-	-	0.943 \pm 0.082	
	6	-	-	0.638	0.725	-	-	0.682 \pm 0.044	
	8	-	-	-	-	0.772	0.567	0.670 \pm 0.103	
Villus Width (VW)	0	0.979	0.876	0.166	0.192	0.177	0.140	0.422 \pm 0.161	0.138
	4	0.908	0.796	-	-	-	-	0.852 \pm 0.056	
	6	-	-	0.110	0.132	-	-	0.121 \pm 0.011	
	8	-	-	-	-	0.145	0.102	0.124 \pm 0.022	
Crypt Depth (CD)	0	0.426	0.322	0.680	0.799	0.565	0.322	0.519 \pm 0.080	0.216
	4	0.357	0.248	-	-	-	-	0.303 \pm 0.055	
	6	-	-	0.622	0.744	-	-	0.683 \pm 0.061	
	8	-	-	-	-	0.528	0.282	0.405 \pm 0.123	
Wall Thickness (WT)	0	1.250	0.840	1.021	0.765	0.918	0.826	0.937 \pm 0.072	0.812
	4	1.038	0.597	-	-	-	-	0.818 \pm 0.221	
	6	-	-	0.961	0.699	-	-	0.830 \pm 0.131	
	8	-	-	-	-	0.887	0.795	0.841 \pm 0.046	

Wks= Weeks; n= Number of dogs

Table 2. Jejunal histomorphometric analysis for dogs post 70% small intestinal resection

Jejunum	Wks	Number of dogs (n = 6)						Mean \pm SEM	P value
		1	2	3	4	5	6		
Villus Height (VH)	0	0.753	0.876	0.922	0.730	0.684	0.779	0.791 \pm 0.037	0.0002
	4	1.026	1.162	-	-	-	-	1.094 \pm 0.068	
	6	-	-	1.317	1.117	-	-	1.217 \pm 0.100	
	8	-	-	-	-	1.341	1.431	1.386 \pm 0.045	
Villus Width (VW)	0	0.141	0.156	0.133	0.129	0.143	0.138	0.422 \pm 0.161	0.138
	4	0.182	0.602	-	-	-	-	0.852 \pm 0.056	
	6	-	-	0.204	0.197	-	-	0.121 \pm 0.011	
	8	-	-	-	-	1.068	1.029	0.124 \pm 0.022	
Crypt Depth (CD)	0	0.555	0.676	0.492	0.472	0.394	0.478	0.511 \pm 0.039	0.0037
	4	0.606	0.731	-	-	-	-	0.669 \pm 0.063	
	6	-	-	0.794	0.768	-	-	0.781 \pm 0.013	
	8	-	-	-	-	0.805	0.896	0.851 \pm 0.046	
Wall Thickness (WT)	0	0.580	0.767	0.804	0.814	0.961	0.607	0.756 \pm 0.058	0.0003
	4	0.815	0.999	-	-	-	-	0.907 \pm 0.092	
	6	-	-	1.152	1.168	-	-	1.160 \pm 0.008	
	8	-	-	-	-	1.922	1.559	1.741 \pm 0.182	

Wks= Weeks; n= Number of dogs

Table 3. Jejunal histomorphometric analysis for dogs pre and post 70% small intestinal resection and anastomosis

Jejunum	Wks	Number of dogs (n = 6)						Mean \pm SEM	P value
		1	2	3	4	5	6		
Villus Height (VH)	0	0.866	0.940	0.879	0.761	1.230	0.720	0.899 \pm 0.074	0.042
	4	1.047	1.102	-	-	-	-	1.075 \pm 0.028	
	6	-	-	1.173	1.073	-	-	1.123 \pm 0.050	
	8	-	-	-	-	1.631	1.124	1.378 \pm 0.254	
Villus Width (VW)	0	0.152	0.126	0.163	0.134	0.192	0.141	0.151 \pm 0.010	0.030
	4	0.190	0.158	-	-	-	-	0.174 \pm 0.016	
	6	-	-	0.214	0.183	-	-	0.199 \pm 0.016	
	8	-	-	-	-	0.249	0.201	0.225 \pm 0.024	
Crypt Depth (CD)	0	0.558	0.708	0.658	0.620	0.774	0.490	0.635 \pm 0.042	0.027
	4	0.589	0.742	-	-	-	-	0.666 \pm 0.077	
	6	-	-	0.870	0.920	-	-	0.895 \pm 0.025	
	8	-	-	-	-	1.084	0.802	0.943 \pm 0.141	
Wall Thickness (WT)	0	0.636	0.800	0.798	0.669	0.724	0.972	0.767 \pm 0.049	0.0001
	4	0.787	0.984	-	-	-	-	0.886 \pm 0.099	
	6	-	-	1.047	0.881	-	-	0.964 \pm 0.083	
	8	-	-	-	-	1.636	1.834	1.735 \pm 0.099	

Wks= Weeks, n= Number of dog

Table 4. Jejunal histomorphometric analysis for dogs pre and post 70% small intestinal resection and anastomosis

Jejunum	Wks	Number of dogs (n = 6)						Mean \pm SEM	P value
		1	2	3	4	5	6		
Villus Height (VH)	0	0.873	0.796	0.992	0.693	0.694	0.772	0.803 \pm 0.047	0.093
	4	0.994	0.972					0.983 \pm 0.011	
	6			1.131	0.872			1.014 \pm 0.138	
	8					1.039	1.113	1.076 \pm 0.037	
Villus Width (VW)	0	0.114	0.163	0.134	0.174	0.153	0.137	0.146 \pm 0.009	0.132
	4	0.132	0.178					0.155 \pm 0.023	
	6			0.166	0.210			0.188 \pm 0.022	
	8					0.197	0.178	0.188 \pm 0.010	
Crypt Depth (CD)	0	0.790	0.438	0.702	0.511	0.545	0.603	0.598 \pm 0.053	0.356
	4	0.81	0.456					0.633 \pm 0.177	
	6			0.842	0.691			0.767 \pm 0.076	
	8					0.747	0.807	0.777 \pm 0.030	
Wall Thickness (WT)	0	0.700	0.840	0.629	0.608	0.588	0.494	0.643 \pm 0.048	0.005
	4	0.776	0.924					0.850 \pm 0.074	
	6			0.979	0.928			0.954 \pm 0.026	
	8					1.091	0.993	1.042 \pm 0.049	

Wks= Weeks; n= Number of dog

Table 5. Jejunal histomorphometric analysis for dogs pre and post small intestinal resection and anastomosis

Jejunum	Wks	Number of dogs (n = 6)						Mean \pm SEM	P value
		1	2	3	4	5	6		
Villus Height (VH)	0	1.333	0.981	0.788	0.765	1.080	0.965	0.985 \pm 0.085	0.002
	4	1.646	1.298					1.472 \pm 0.174	
	6			1.318	1.305			1.312 \pm 0.007	
	8					1.941	1.821	1.881 \pm 0.060	
Villus Width (VW)	0	0.135	0.127	0.132	0.164	0.130	0.152	0.140 \pm 0.006	0.0001
	4	0.191	0.187					0.189 \pm 0.002	
	6			0.212	0.265			0.239 \pm 0.027	
	8					0.271	0.321	0.296 \pm 0.025	
Crypt Depth (CD)	0	0.574	0.961	0.413	0.592	0.536	0.882	0.660 \pm 0.087	0.070
	4	0.639	1.023					0.831 \pm 0.192	
	6			0.812	0.997			0.905 \pm 0.093	
	8					1.05	1.402	1.226 \pm 0.176	
Wall Thickness (WT)	0	0.716	0.786	0.890	0.597	0.882	0.943	0.802 \pm 0.053	0.0001
	4	1.100	1.175					1.138 \pm 0.038	
	6			1.355	1.053			1.204 \pm 0.151	
	8					1.912	1.994	1.953 \pm 0.041	

Wks= Weeks; n= Number of dog

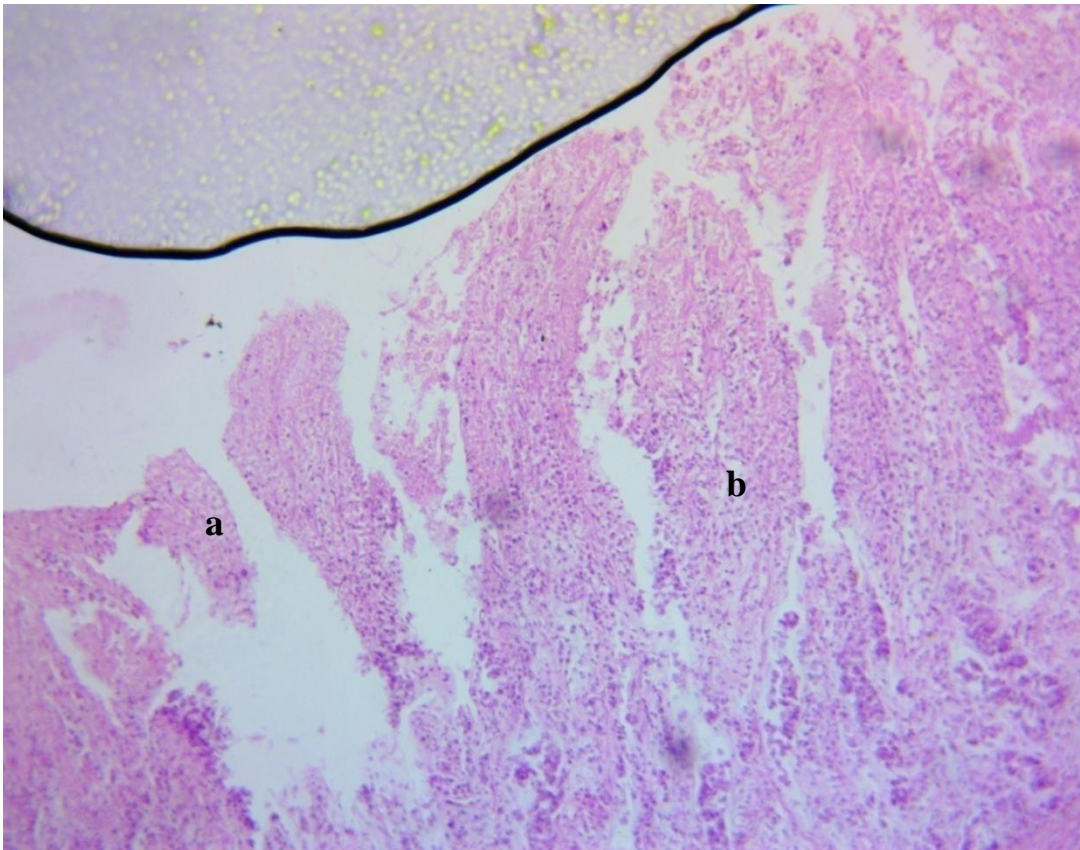


Figure 1. The jejunum of dogs at eight weeks post resection showing (a) Necrosis of villi and (b) leucocytes infiltration of laminal propria. (H&E) $\times 100$

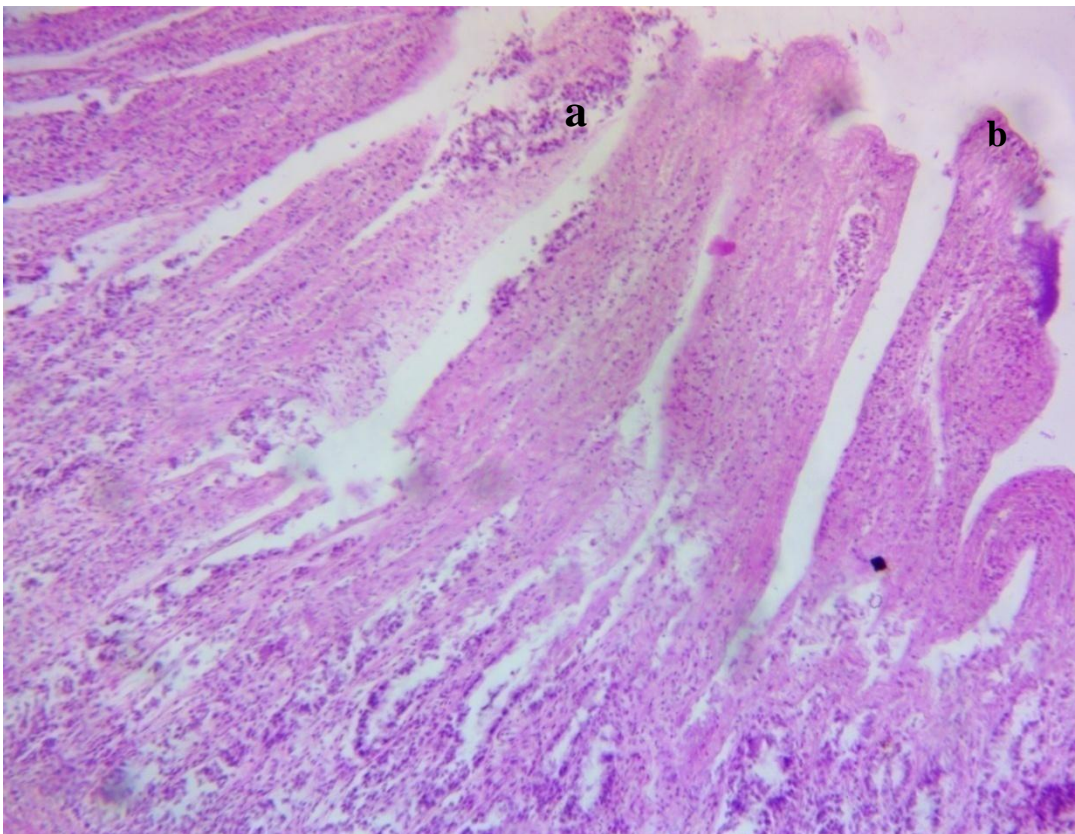


Figure 2. The Ileum of dogs at eight weeks post resection showing (a) mild necrosis and (b) moderate hyperplasia of villi (H&E) $\times 100$

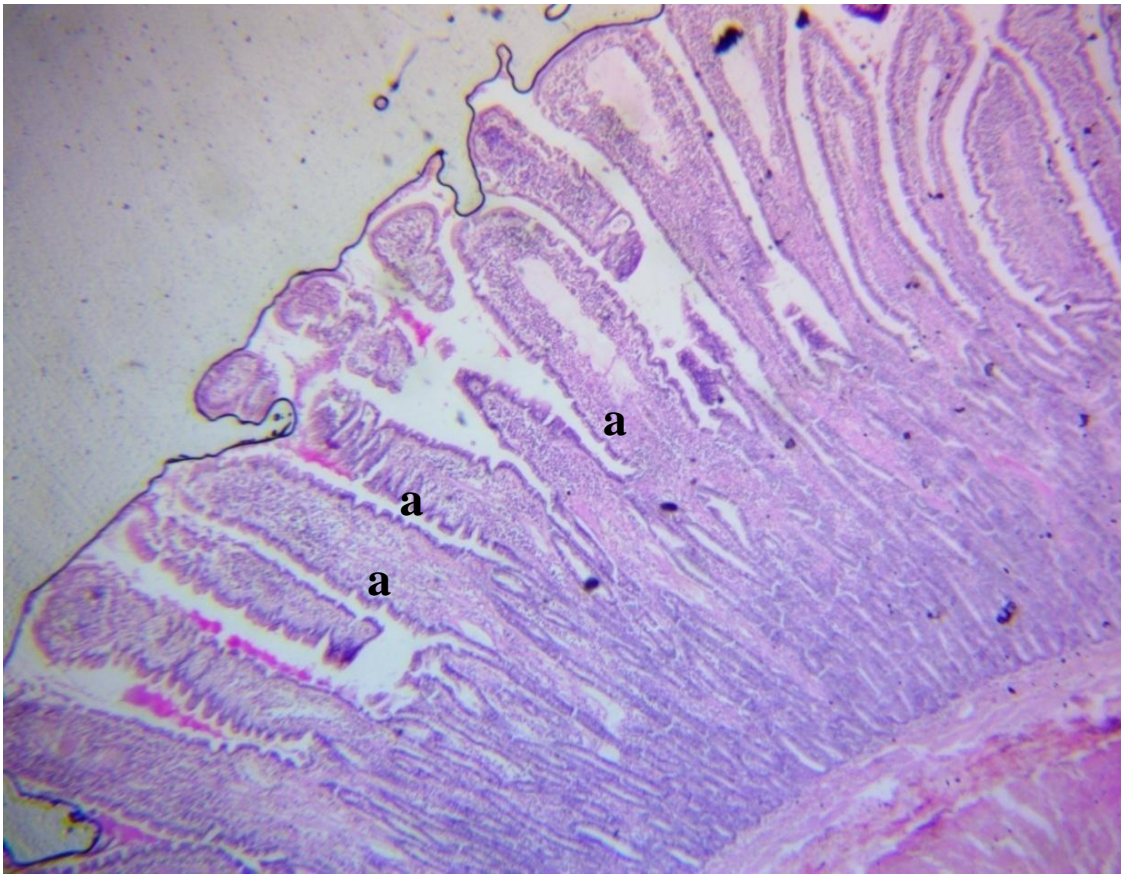


Figure 3. The Jejunum of dogs at eight weeks after treatment with glutamine showing (a) formation of surface epithelium (H&E) ×40

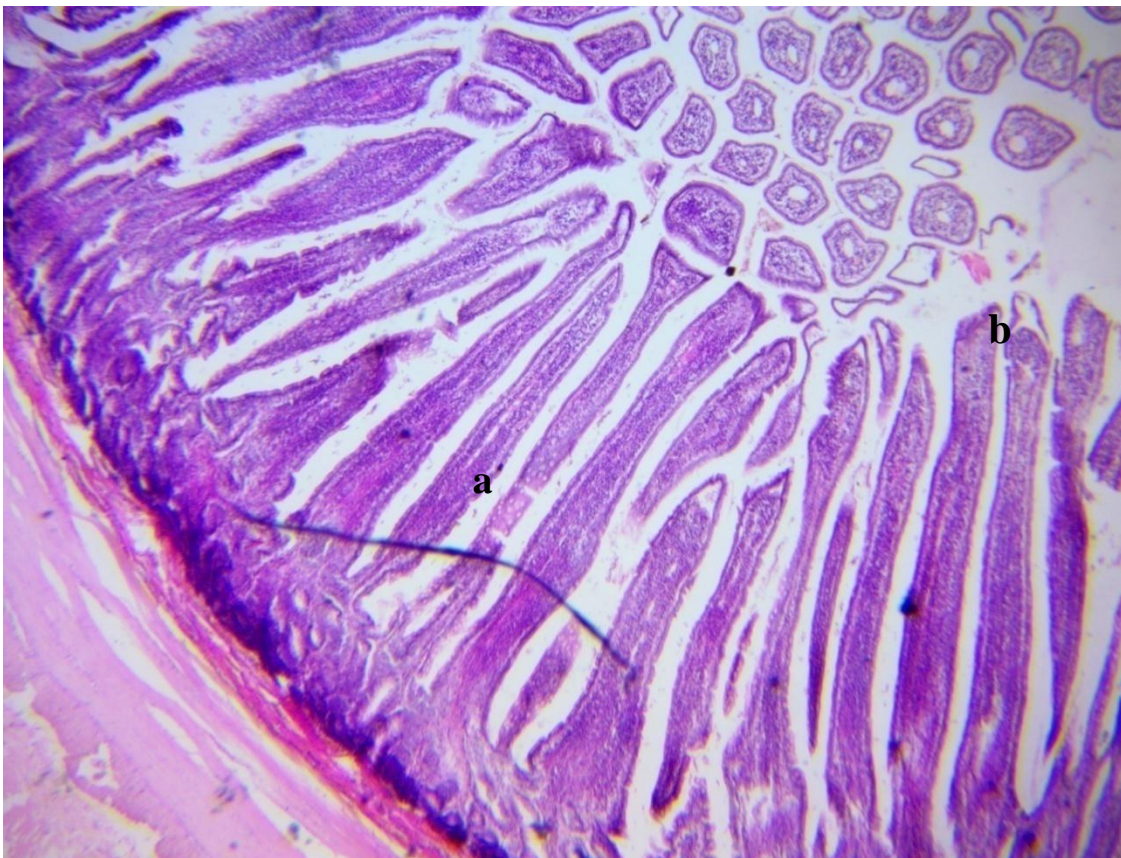


Figure 4. The ileum of dogs at eight weeks after treatment with glutamine showing (a) surface epithelium (b) Hyperplastic villi (H&E) ×100

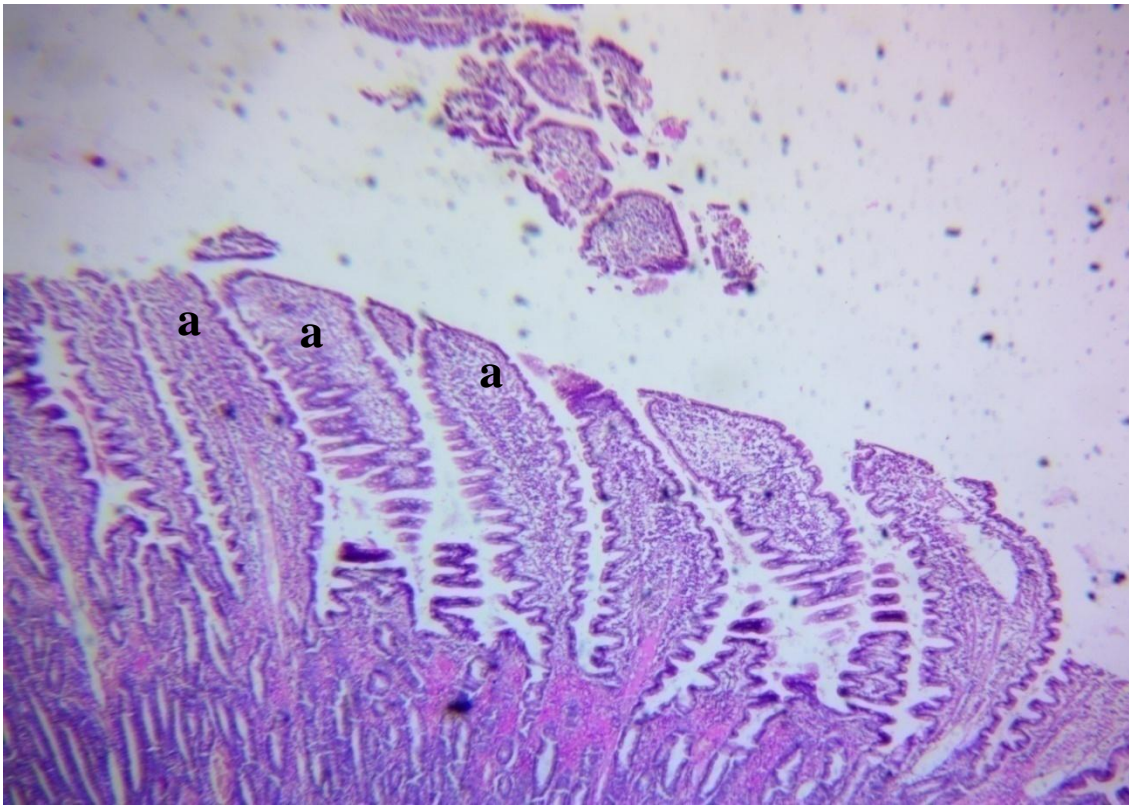


Figure 5. The Jejunum of dogs at eight weeks after treatment with honey showing normal villi – “a” (H&E) ×40

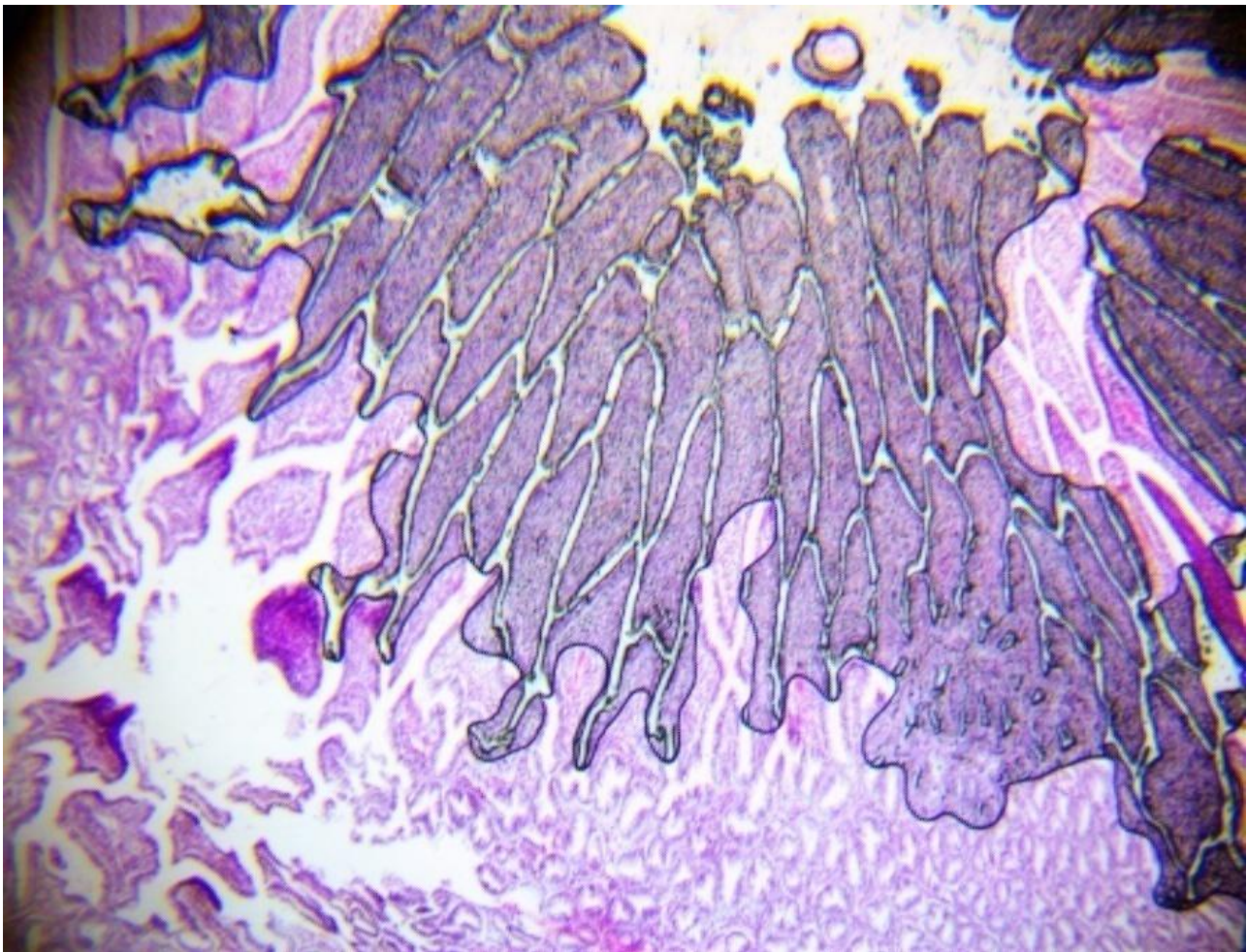


Figure 6. The ileum of dogs at eight weeks after treatment with honey showing complete recovery (H&E) ×40

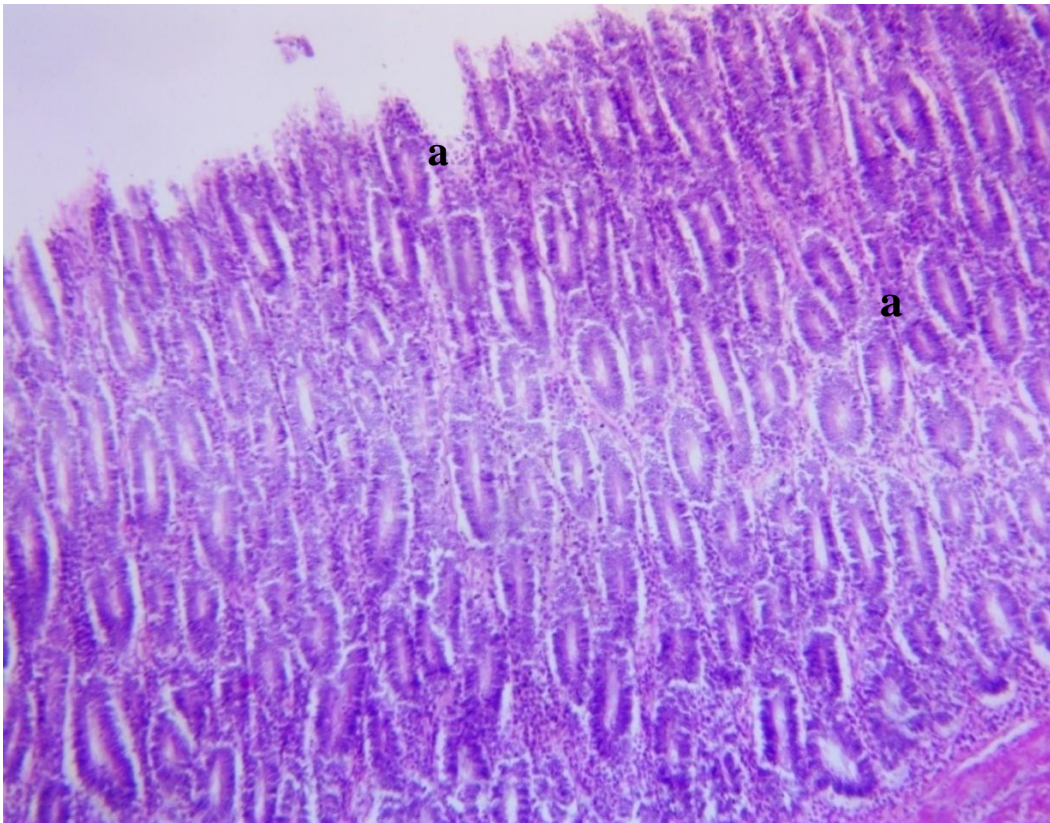


Figure 7. The Jejunum of dogs at eight weeks after treatment with ascorbic acid showing leucocytic infiltration of lamina propria of the intestinal mucosa (a) (H&E) ×100

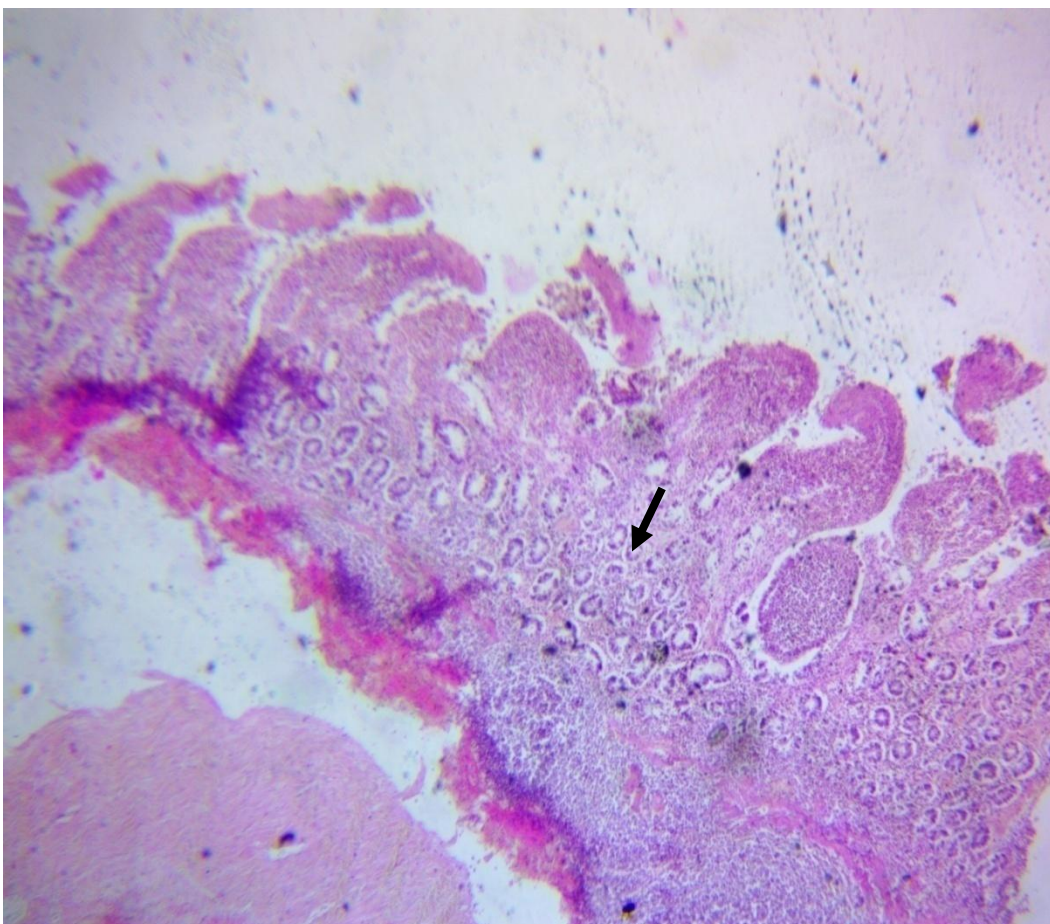


Figure 8. The ileum of dogs at eight weeks after treatment with ascorbic acid showing thickened lamina propria infiltrated by leucocytes (arrow) (H&E) ×40

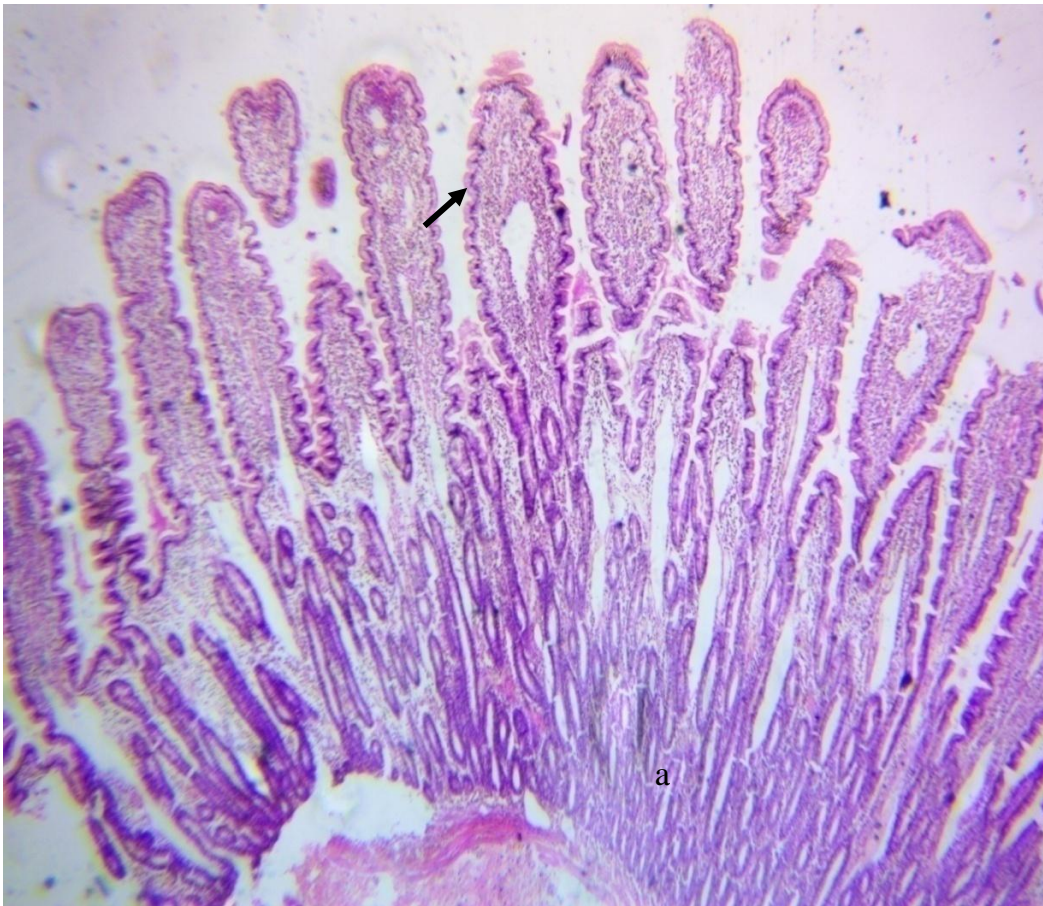


Figure 9. The Jejunum of dogs at eight weeks after treatment showing well formed villi (arrow) (H&E) $\times 40$

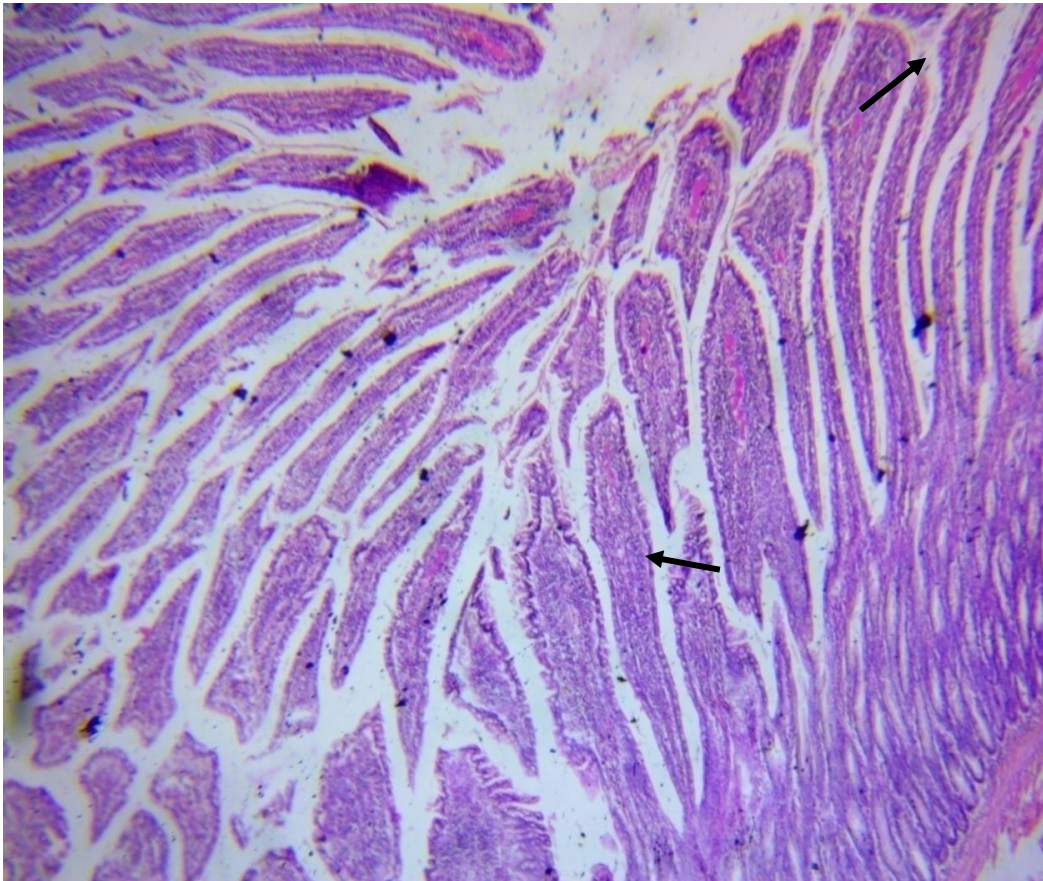


Figure 10. The Ileum of dogs at eight weeks after treatment showing well formed surface epithelium and villi (arrow) (H&E) $\times 40$

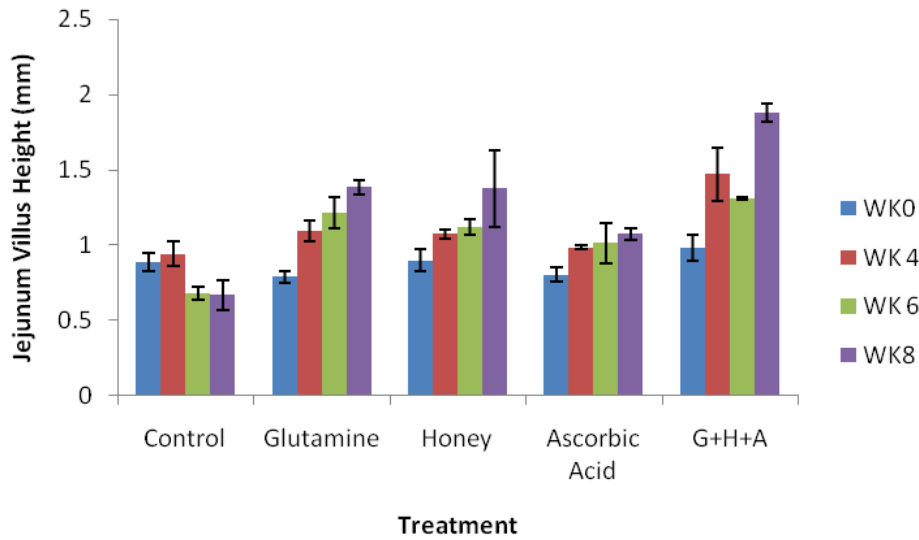


Diagram 1. Pre-resection and post-treatment jejunal villi height of dogs in control, glutamine, honey, ascorbic acid and glutamine/ honey/ ascorbic acid combination treated groups

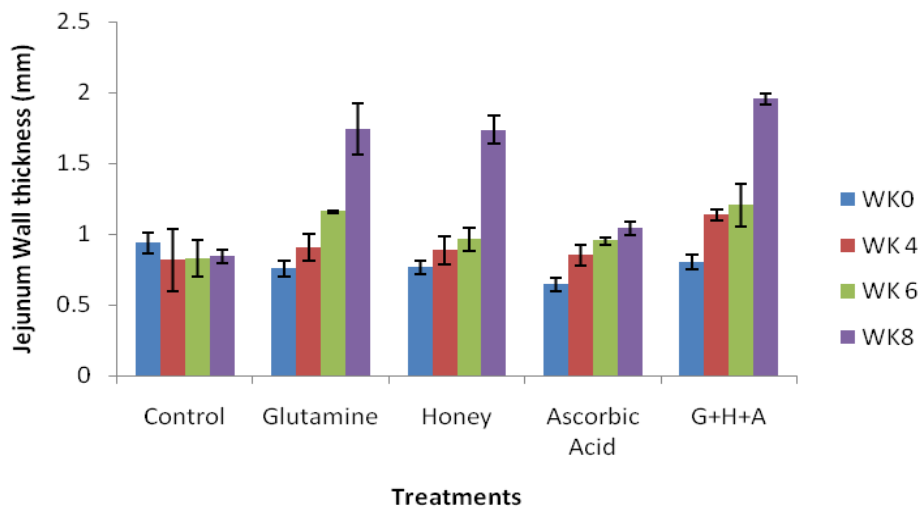


Diagram 2. Pre-resection and post-treatment jejuna wall thickness of dogs in control, glutamine, honey, ascorbic acid and glutamine/ honey / ascorbic acid combination treated groups

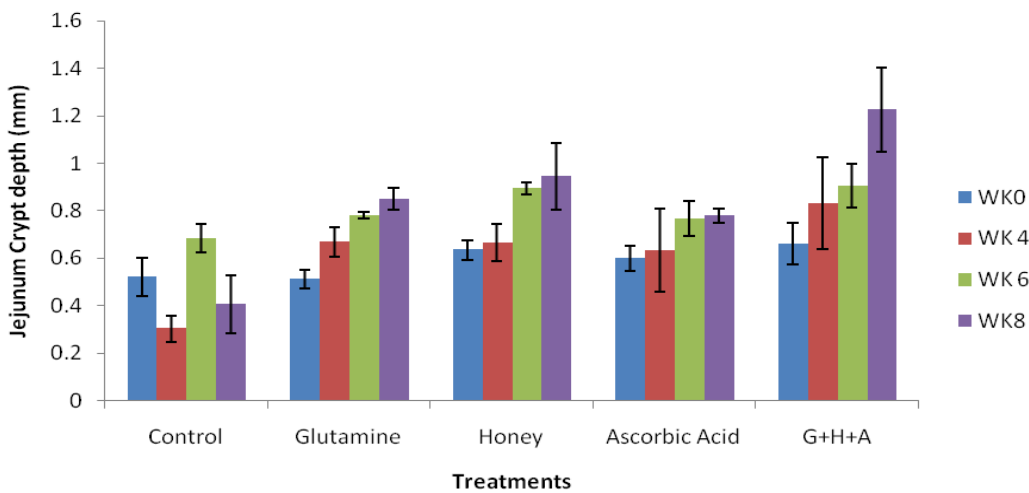


Diagram 3. Pre-resection and post-resection jejunal crypt depth of dogs in control, glutamine, honey, ascorbic acid and glutamine/ honey/ascorbic acid combination treated groups

DISCUSSION

In present study, the effects of glutamine, honey, ascorbic acid and glutamine, honey and ascorbic acid combination on intestinal adaptation in Nigerian dogs suffering from short bowel syndrome following 70% small bowel resection was evaluated. Dogs in all the groups in this study had diarrhea and loss of weight which is in agreement with the findings of Gorman et al. (2006), Shaw et al. (2012) and Tappenden (2014). The reason was due to mal-absorption as a result of the loss of mucosal absorptive surface area associated with short bowel syndrome (Shaw et al., 2012; Cunha-Melo and Costa, 2014; Merritt et al., 2017).

However, there was a reduction in diarrhea in animals treated with glutamine, honey, ascorbic acid and their combination after one week of treatment. This is due to the adaptive changes taking place in the intestinal mucosa that improves absorption and digestion of nutrients (Shaw et al., 2012; Vagholkar et al., 2016; Gillard et al., 2017). This is the reason for the increase in weight observed in animals in these four groups.

Animals in the control group however, continue to experience diarrhea especially after feeding due to inadequate adaptive changes in the intestinal mucosal. Hence the gradual drop in body weight observed in this group. Glutamine is the major nutrient for the bowel. It is the primary substrate used by enterocytes. Supplementation during catabolic states improves structural integrity, function and repair of the intestinal mucosa, decreases bacterial translocation and epithelial apoptosis, improves nitrogen balance and influencing gut immune response (Chandler, 2002; Evans et al., 2003; Grimble, 2005; Larson et al., 2007). Dogs treated with glutamine (group 2) experienced significant increase ($P < 0.05$) in Villus Height (VH), Crypt Depth (CD), Villus Width (VW) and Wall Thickness (WT). The gradual increase in body weight observed in this group may be due to enhanced absorption of nutrients from improved adaptation of the remnant small bowel. Our findings on the use of glutamine in this study, agrees with the previous work by Eyarefe et al. (2012), who used glutamine on dogs with short bowel syndrome following massive small bowel resection and observed a beneficial adaptive response by the remnant small bowel in those dogs. In this study, dogs treated with honey (group 3) showed a significant increase ($P < 0.05$) in VH, CD, VW and WT. There was a gradual increase in body weight. There was also a complete regeneration of the intestinal epithelium. This result is also in agreement with the findings of Eyarefe et al. (2012) who also used honey to treat dogs suffering from short bowel syndrome and observed positive adaptive response.

Dogs treated with ascorbic acid showed marginal increase in VH, VW, CD and WT. It has been reported that malassimilation and increased fluid losses with diarrhea may deplete vitamin C in the body (Chandler, 2002). It may be possible that the dosage of vitamin C used in this study was not enough to compensate for the large losses that had occurred. Though the increase was not statistically significant, it was comparatively better than that of the control group. The action of ascorbic acid (vitamin C) was as a result of its powerful antioxidant property where it scavenges and mopes up reactive oxygen and nitrogen species (free radicals) in the body. These reactive species are generated by normal cell processes as well as environmental stressors and can cause damage to tissues (Halliwell and White man, 1997; Telang, 2013). Oxidative stress also occurred in the intestine in diseases and may cause increased inflammation and permeability (Chandler, 2002). Thus vitamin C reduced potential damage to tissues. All these positive effects may probably be undermined in this study, due to the insufficiency of vitamin C, which may be responsible for the low/gradual villi height, crypt depth, villi width and wall thickness. The evaluation of ascorbic acid in the treatment of short bowel syndrome did not report experimentally and there are not enough published data about this research topic.

Dogs on glutamine, honey and ascorbic acid combination (group 5) showed significant increase in VH, VW, CD and WT. This adaptive response was higher than that observed in glutamine (group 2), honey (group 3) or ascorbic acid (group 4) treated animals respectively. This showed that the combination of these three supplements had synergistic effect that could enhance small bowel adaptation in patients with short bowel syndrome. Similarly, the synergistic effect of these products has not been reported. Animals in the control group did not show any appreciable adaptive response as there was no significant increase in VH, VW, CD and WT. There was also drop in body weight.

The result of this study has revealed that glutamine, honey and their combination have beneficial intestinal adaptive response in patients suffering from short bowel syndrome. However, /glutamine/ honey/ ascorbic acid combination produces higher adaptive response than glutamine, honey or ascorbic acid alone. The higher doses of these supplements produced better adaptive response than the lower doses.

CONCLUSION

Glutamine, honey and ascorbic acid given individually or in combination enhanced residual bowel efficiency and improved outcome in patients suffering from short bowel syndrome. It is therefore recommended that dogs with signs attributable to short bowel syndrome should be given supplement of glutamine, honey and ascorbic acid in food.

DECLARATIONS

Author's contribution

AIK, JBA and ATE performed the surgery. MLS prepared the histopathology slides and reviewed the manuscript.

Competing interests

The authors have declared that no competing interest exists

REFERENCES

- Chandler M (2002). Essentials of nutrition in dogs and cats with gastrointestinal disease. In practice, 528-533.
- Cunha-Melo JR and Costa G. (2014). Intestinal transplantation: evolution and current status. *MedicalExpress*; 1(6):307-322. DOI: <http://dx.doi.org/10.5935/MedicalExpress.2014.06.05>
- Donohoe CL and Reynolds JV (2010). Short bowel syndrome. *Surgeon*, 8(5):270-9. DOI: 10.1016/j.surge.2010.06.004.
- Englard S and Seifter S (1986). The biochemical functions of ascorbic acid. *Annual Review of Nutrition*, 6: 365-406.
- Evans ME, Jones DP and Ziegler TR (2003). Glutamine prevents cytokine-induced apoptosis in human colonic epithelial cells. *Journal of Nutrition*, 133:3065-3071.
- Eyarefe OD, Emikpe BO, Akinloye SO, Alonge TO and Fayemi OE (2012). Effects of honey, glutamine and their combination on canine small bowel epithelial cell proliferation following massive resection. *Niger Journal of Physiology*, 27: 189-193
- Fossum WT (2014). Complications of intestinal surgery. In textbook of small animal surgery, 3rd edition, pp 460-461. Mosby Elsevier.
- Gillard L, Mayeur C, Robert V, Pingenot I, Le Beyec, J, Bado A, Lepage P, Thomas M and Joly F (2017). Microbiota is involved in Post-resection Adaptation in Humans with Short Bowel Syndrome. *Frontiers in Physiology*, 8(224):1-13 DOI: 10.3389/fphys.2017.00224.
- Gorman SC, Freeman LM, Mitchell SL and Chan DL (2006). Extensive small bowel resection in dogs and cats. 20 cases (1998-2004). *JAVMA*, 228 (3): 403-407. DOI: 10.2460/javma.228.3.403.
- Grimble RF (2005). Immunonutrition. *Current Opinion Gastroenterology*, 21:216-222.
- Halliwell B and Whiteman M (1997). Antioxidant and prooxidant properties of vitamin C. In: Packer L, Fuchs J, eds. *Vitamin C in Health and Disease*. New York, NY: Marcel Dekker; 25-94.
- Hasosah M, Lemberg DA, Skarsgard E and Schreiber R (2008). Congenital short bowel syndrome: a case report and review of the literature. *Canadian Journal of Gastroenterology*, 22:71 –74.
- Hrbaty B, Skultety J, Labas P, Reis R and Ziak P (2004). Conditions responsible for small bowel resection. *Bratisl Lek Listy*, 105 (2): 86-88.
- Joaquim MS, Jose EA, Maria HGG, Bruno SN, Priscila ATF, Batista C, Denise MTA (2005). Effects of combined use of glutamine and growth hormone in the intestinal adaptation after massive resection of the small bowel in rats. *Acta Cir. Bras.* 20 (5): 382-389. DOI: <http://dx.doi.org/10.1590/S0102-86502005000500008>.
- Kisani IA, Adeyanju JB, Sonfada ML and Elsa AT (2017). In Vivo Ex-Vivo Measurement of Crown Rump and Small Intestinal Length in Nigerian Dogs: A Surgical Measure for Safe Intestinal Resection and Anastomosis. *Dairy and Vet Sci J* 2(4):001-003. DOI:10.19080/JDVS.2017.02.555591.
- Larson SD, Li J, Chung DH and Evers BM (2007). Molecular mechanisms contributing to glutamine-mediated intestinal cell survival. *American Journal of Physiology- Gastrointestinal Liver Physiology*, G 1262-G 1271. DOI: 10.1152/ajpgi.00254.2007.
- Mandl A, Szarka A and Banhegyi G (2009). Vitamin C: update on physiology and pharmacology. *British Journal of Pharmacology*, 157:1097-1110. DOI: 10.1111/j.1476-5381.2009.00282.x.
- Mayeur C, Gillard I, Beyec JL, Bado A and Joly F (2016). Extensive Intestinal Resection Triggers Behavioral Adaptation, Intestinal Remodeling and Microbiota Transition in Short Bowel Syndrome. *Microorganisms*, 4: 16; DOI: 10.3390/microorganisms40100169)
- Mayer O and Kerner JA (2017). Management of short bowel syndrome in postoperative very low birth weight infants, *Seminars in Fetal & Neonatal Medicine* 22, 49e56 DOI:<http://dx.doi.org/10.1016/j.siny.2016.08.001>
- Merritt RJ, Cohran V, Raphael BP, Sentogo T, Volpert D, Warner BW and Goday PS (2017). Intestinal Rehabilitation Programs in the Management of Paediatric Intestinal Failure and Short Bowel Syndrome. *JPGN*, 65: 588-596. DOI: 10.1097/MPG.0000000000001722.
- Nørhølk LM, Holst JJ and Jeppesen PB (2012) "Treatment of adult short bowel syndrome patients with teduglutide," *Expert Opinion on Pharmacotherapy*, 13 (2): 235–243. DOI:10.1517/14656566.2012.644787.
- Rodriguez-Montes JA, Albero JS and Lopez PJT (2016). Surgical Options in Short Bowel Syndrome. *Journal of Paediatric Care Insight*, 1(1): 1-5. DOI: 10.24218/jpci.2016.01.
- Scolapio JS, McGreevy K, Tennyson GS and Burnett OL (2001). Effect of glutamine in short-bowel syndrome. *Clinical Nutrition*, 20(4): 319-323.
- Seetharam P and Rodrigues G (2011). Short Bowel Syndrome: A Review of Management Options. *Saudi Journal of Gastroenterology*, 17(4); 229-235. DOI. 10.4103/1319-3767.82573.
- Shaw D, Gohil K and Basson MD (2012). Intestinal mucosal atrophy and adaptation. *World J Gastroenterol*, 18(44): 6357-6375. DOI: 10.3748/wjg.v18.i44.6357

- Tappenden KA (2014). Pathophysiology of Short Bowel Syndrome: Considerations of Resected and Residual Anatomy, *Journal of Parenteral and Enteral Nutrition*, 38 suppl.1: 14S-22S. DOI: 10.1177/0148607113520005
- Telang P (2013) Vitamin C in dermatology. *Indian Dermatology Online Journal*, 4: 143-146. DOI: 10.4103/2229-5178.110593
- Vipperla K, Stephen J and O'Keef SJ (2014). Targeted therapy of short-bowel syndrome with teduglutide: the new kid on the block. *Clinical and Experimental Gastroenterology*, 7: 489–495. DOI: 10.2147/CEG.S42665.
- Vagholkar K, Iyengar M, Vagholkar S, Pawanarkar A, Ansari S, Pathan S and Bhupatkar A (2016). Short bowel syndrome. *International Surgery Journal*, 3(2):452-455. DOI:http://dx.doi.org/10.18203/2349-2902.isj20160672
- Wales PW and Christison-Lagay ER (2010). Short bowel syndrome: epidemiology and etiology. *Seminars in Pediatric Surgery*, 19(1): 3-9. DOI:10.1053/j.sempedsurg.2009.11.001.
- Wall EA (2013). An overview of short bowel syndrome management: adherence, adaptation, and practical recommendations. *Journal of the Academy of Nutrition and Dietetics*, 113: 1200–1208. DOI:10.1016/j.jand.2013.05.001
- Winkler MF and Smith CE (2014). Clinical, social, and economics impact of home parenteral nutrition in short bowel syndrome. *Journal of Parenteral and Enteral Nutrition*, 38: 32-37. DOI:10.1177/0148607113517717.

Instructions for Authors

Manuscript as Original Research Paper, Short Communication, Case Reports and Review or Mini-Review are invited for rapid peer-review publishing in the *World's Veterinary Journal* (WVJ). Considered subject areas include: Behavior; environment and welfare; animal reproduction and production; parasitology, endocrinology, microbiology, immunology, pathology, pharmacology, epidemiology, molecular biology, immunogenetics, surgery, radiology, ophthalmology, dermatology, chronic disease, anatomy, and non-surgical pathology issues of small to large animals, cardiology and oncology are sub-specialties of veterinary internal medicine. ... [view full aims and scope](#)

[WVJ EndNote Style](#)

[Manuscript Template \(.doc\)](#)

[Sample Articles](#)

[Declaration form](#)

[Policies and Publication Ethics](#)

Submission

The manuscript and other correspondence should be [submit online](#) preferentially. Please embed all figures and tables in the manuscript to become one single file for submission. Once submission is complete, the system will generate a manuscript ID and password sent to author's contact emails: editor@wvj.science-line.com. All manuscripts must be checked (by English native speaker) and submitted in English for evaluation (in totally confidential and impartial way).

Supplementary information:

The online submission form allows supplementary information to be submitted together with the main manuscript file and covering letter. If you have more than one supplementary files, you can submit the extra ones by email after the initial [submission](#). Author guidelines are specific for each journal. Our Word template can assist you by modifying your page layout, text formatting, headings, title page, image placement, and citations/references such that they agree with the guidelines of journal. If you believe your article is fully edited per journal style, please use our [Word template](#) before submission.

[Supplementary materials](#) may include figures, tables, methods, videos, and other materials. They are available online linked to the original published article. Supplementary tables and figures should be labeled with a "S", e.g. "Table S1" and "Figure S1". The maximum file size for supplementary materials is 10MB each. Please keep the files as small possible to avoid the frustrations experienced by readers with downloading large files.

Submission to the Journal is on the understanding that:

- 1.The article has not been previously published in any other form and is not under consideration for publication elsewhere;
- 2.All authors have approved the submission and have obtained permission for publish work.
- 3.Researchers have proper regard for conservation and animal welfare considerations (see [IAVE-Author Guidelines on Animal Ethics and Welfare](#)). Attention is drawn to the '[Guidelines for the Treatment of Animals in Research and Teaching](#)'. Any possible adverse consequences of the work for populations or individual organisms must be weighed against the possible gains in knowledge and its practical applications. If the approval of an ethics committee is required, please provide the name of the committee and the approval number obtained.

Ethics Committee Approval

Experimental research involving human or animals should have been approved by author's institutional review board or ethics committee. This information can be mentioned in the manuscript including the name of the board/committee that gave the approval. Investigations involving humans will have been performed in accordance with the principles of [Declaration of Helsinki](#). And the use of animals in experiments will have observed the Interdisciplinary Principles and Guidelines for the Use of Animals in Research, Testing, and Education by the New York Academy of Sciences, Ad Hoc Animal Research Committee. If the manuscript contains photos or parts of photos of patients, informed consent from each patient should be obtained. Patient's identities and privacy should be carefully protected in the manuscript.

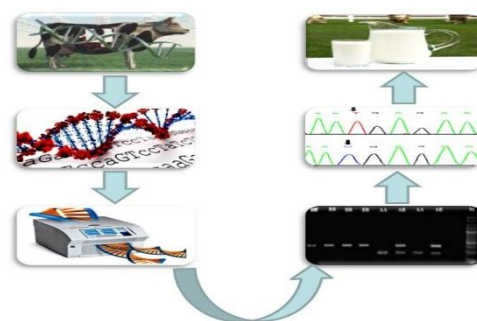
Competing Interests

Competing interests that might interfere with the objective presentation of the research findings contained in the manuscript should be declared in a paragraph heading "Competing interests" (after Acknowledgment section and before References). Examples of competing interests are ownership of stock in a company, commercial grants, board membership, etc. If there is no competing interest, please use the statement "The authors have declared that no competing interest exists."

Graphical Abstract:

Authors should provide a graphical abstract (a beautifully designed feature figure) to represent the paper aiming to catch the attention and interest of readers. Graphical abstract will be published online in the table of content. The graphical abstract should be colored, and kept within an area of 12 cm (width) x 6 cm (height) or with similar format. Image should have a minimum resolution of 300 dpi and line art 1200dpi. **Note:** Height of the image should be no more than the width. Please avoid putting too much information into the graphical abstract as it occupies only a small space. Authors can provide the graphical abstract in the format of PDF, Word, PowerPoint, jpg, or png, after a manuscript is accepted for publication. See more samples from [archive](#).

If you have decided to provide a Professional Graphical Abstract, please click here.



Presentation of the article

Main Format

First page of the manuscripts must be properly identified by the title and the name(s) of the author(s). It should be typed in Times New Roman (font sizes: 17pt in capitalization for the title, 10pt for the section headings in the body of the text and the main text, 9pt for References, double spaced, in A4 format with 2cm margins. All pages and lines of the main text should be numbered consecutively throughout the manuscript. The manuscript must be saved in a .doc format, (not .docx files). Abbreviations in the article title are not allowed.

Manuscripts should be arranged in the following order:

- a. TITLE (brief, attractive and targeted);
- b. Name(s) and Affiliation(s) of author(s) (including post code) and corresponding E-mail;
- c. ABSTRACT;
- d. Key words (separate by semicolons; or comma,);
- e. Abbreviations (used in the manuscript);
- f. INTRODUCTION;
- g. MATERIALS AND METHODS;
- h. RESULTS;
- i. DISCUSSION;
- j. CONCLUSION;
- k. Acknowledgements (if there are any);
- l. REFERENCES;
- m. Tables;
- n. Figure captions;
- o. Figures;

Results and Discussion can be presented jointly if preferred.

Discussion and Conclusion can be presented jointly if preferred.

Article Sections Format

Title should be a brief phrase describing the contents of the paper. The first letter of each word in title should use upper case. The Title Page should include the author(s)'s full names and affiliations, the name of the corresponding author along with phone and e-mail information. Present address (es) of author(s) should appear as a footnote.

Abstract should be informative and completely self-explanatory, briefly present the topic, state the scope of the experiments, indicate significant data, and point out major findings and conclusions. The abstract should be 150 to 300 words in length. Complete sentences, active verbs, and the third person should be used, and the abstract should be written in the past tense. Standard nomenclature should be used and abbreviations should be avoided. No literature should be cited. Following the abstract, about 3 to 10 **key words** that will provide indexing references should be listed.

Introduction should provide a clear statement of the problem, the relevant literature on the subject, and the proposed approach or solution. It should be understandable to colleagues from a broad range of scientific disciplines.

Materials and Methods should be complete enough to allow experiments to be reproduced. However, only truly new procedures should be described in detail; previously published procedures should be cited, and important modifications of published procedures should be mentioned briefly. Capitalize trade names and include the manufacturer's name and address. Subheadings should be used. Methods in general use need not be described in detail.

Results should be presented with clarity and precision. The results should be written in the past tense when describing findings in the author(s)'s experiments. Previously published findings should be written in the present tense. Results should be explained, but largely without referring to the literature. Discussion, speculation and detailed interpretation of data should not be included in the results but should be put into the discussion section.

Discussion should interpret the findings in view of the results obtained in this and in past studies on this topic. State the conclusions in a few sentences at the end of the paper. The Results and Discussion sections can include subheadings, and when appropriate, both sections can be combined.

Conclusion can be presented jointly if preferred.

Acknowledgments of persons, grants, funds, etc should be brief.

Tables should be kept to a minimum and be designed to be as simple as possible. Tables are to be typed double-spaced throughout, including headings and footnotes. Each table should be on a separate page, numbered consecutively in Arabic numerals and supplied with a heading and a legend. Tables should be self-explanatory without reference to the text. The details of the methods used in the experiments should preferably be described in the legend instead of in the text. The same data should not be presented in both table and graph forms or repeated in the text.

Figure legends should be typed in numerical order on a separate sheet. Graphics should be prepared using applications capable of generating high resolution GIF, TIFF, JPEG or PowerPoint before pasting in the Microsoft Word manuscript file. Use Arabic numerals to designate figures and upper case letters for their parts (Figure 1). Begin each legend with a title and include sufficient description so that the figure is understandable without reading the text of the manuscript. Information given in legends should not be repeated in the text.

Declarations section - Please include declarations heading

Please ensure that the sections:

-Ethics (and consent to participate)

-Authors' contributions

-Competing interests

-Availability of data and materials

are included at the end of your manuscript in a Declarations section.

Authors' Contributions

For manuscripts with more than one author, WVJ require an Authors' Contributions section to be placed after the Competing Interests section.

An 'author' is generally considered to be someone who has made substantive intellectual contributions to a published study. To qualify as an author one should 1) have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) have been involved in drafting the manuscript or revising it critically for important intellectual content; and 3) have given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content. Acquisition of funding, collection of data, or general supervision of the research group, alone, does not justify authorship.

We suggest the following format (please use initials to refer to each author's contribution): AB carried out the molecular genetic studies, participated in the sequence alignment and drafted the manuscript. JY carried out the immunoassays. MT participated in the sequence alignment. ES participated in the design of the study and performed the statistical analysis. FG conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

For authors that equally participated in a study please write '[All/Both authors contributed equally to this work.](#)' Contributors who do not meet the criteria for authorship should be listed in an acknowledgements section.

Competing Interests

Competing interests that might interfere with the objective presentation of the research findings contained in the manuscript should be declared in a paragraph heading "Competing interests" (after Acknowledgment section and before References). Examples of competing interests are ownership of stock in a company, commercial grants, board membership, etc. If there is no competing interest, please use the statement "[The authors declare that they have no competing interests.](#)".

World's Veterinary Journal adheres to the definition of authorship set up by The International Committee of Medical Journal Editors (ICMJE). According to the ICMJE authorship criteria should be based on 1) substantial contributions to conception and design of, or acquisition of data or analysis and interpretation of data, 2) drafting the article or revising it critically for important intellectual content and 3) final approval of the version to be published. Authors should meet conditions 1, 2 and 3.

It is a requirement that all authors have been accredited as appropriate upon submission of the manuscript. Contributors who do not qualify as authors should be mentioned under Acknowledgements.

Change in authorship

We do not allow any change in authorship after provisional acceptance. We cannot allow any addition, deletion or change in sequence of author name. We have this policy to prevent the fraud.

Acknowledgements

We strongly encourage you to include an Acknowledgements section between the Authors' contributions section and Reference list. Please acknowledge anyone who contributed towards the study by making substantial contributions to conception, design, acquisition of data, or analysis and interpretation of data, or who was involved in drafting the manuscript or revising it critically for important intellectual content, but who does not meet the criteria for authorship. Please also include their source(s) of funding. Please also acknowledge anyone who contributed materials essential for the study.

Authors should obtain permission to acknowledge from all those mentioned in the Acknowledgements. Please list the source(s) of funding for the study, for each author, and for the manuscript preparation in the acknowledgements section. Authors must describe the role of the funding body, if any, in study design; in the collection, analysis, and interpretation of data; in the writing of the manuscript; and in the decision to submit the manuscript for publication.

Data Deposition

Nucleic acid sequences, protein sequences, and atomic coordinates should be deposited in an appropriate database in time for the accession number to be included in the published article. In computational studies where the sequence information is unacceptable for inclusion in databases because of lack of experimental validation, the sequences must be published as an additional file with the article.

References

1. A WVJ reference style for [EndNote](#) may be found [here](#).
2. All references to publications made in the text should be presented in a list with their full bibliographical description.
3. In the text, a reference identified by means of an author's name should be followed by the date of the reference in parentheses. When there are more than two authors, only the first author's surname should be mentioned, followed by 'et al'. In the event that an author cited has had two or more works published during the same year, the reference, both in the text and in the reference list, should be identified by a lower case letter like 'a' and 'b' after the date to distinguish the works.
4. References in the text should be arranged chronologically (e.g. Kelebeni, 1983; Usman and Smith, 1992 and Agindotan et al., 2003). The list of references should be arranged alphabetically on author's surnames, and chronologically per author. If an author's name in the list is also mentioned with co-authors, the following order should be used: Publications of the single author, arranged according to publication dates - publications of the same author with one co-author - publications of the author with more than one co-author. Publications by the same author(s) in the same year should be listed as 1992a, 1992b, etc.
5. Names of authors and title of journals, published in non-latin alphabets should be transliterated in English.

6. A sample of standard reference is " 1th Author surname A, 2th Author surname B , 3th Author surname C. 2013. Article title should be regular and 7 pt . *World Vet. J.*, Add No. of Volume (Issue No.): 00-00."

7. The color of [references in the text](#) of article is [dark blue](#). Example: ([Preziosi et al., 2002](#); [Mills et al., 2015](#)).

-Examples (at the text)

Abayomi (2000), Agindotan et al. (2003), (Kelebeni, 1983), (Usman and Smith, 1992), (Chege, 1998; Chukwura, 1987a,b; Tijani, 1993,1995), (Kumasi et al., 2001).

--Examples (at References section)

a) For journal:

Lucy MC (2000). Regulation of ovarian follicular growth by somatotropin and insulin- like growth factors in cattle. *Journal of Dairy Science*, 83: 1635-1647.

Kareem SK (2001). Response of albino rats to dietary level of mango cake. *J. Agric. Res. Dev.* pp 31-38.

Chikere CB, Omoni VT and Chikere BO (2008). Distribution of potential nosocomial pathogens in a hospital environment. *African Journal of Biotechnology*. 7: 3535-3539.

b) For symposia reports and abstracts:

Cruz EM, Almatar S, Aludul EK and Al-Yaqout A (2000). Preliminary Studies on the Performance and Feeding Behaviour of Silver Pomfret (*Pampus argentens euphrasen*) Fingerlings fed with Commercial Feed and Reared in Fibreglass Tanks. *Asian Fisheries Society Manila, Philippine* 13: 191-199.

c) For edited symposia, special issues, etc., published in a journal:

Korevaar H (1992). The nitrogen balance on intensive Dutch dairy farms: a review. In: A. A. Jongebreur et al. (Editors), *Effects of Cattle and Pig Production Systems on the Environment: Livestock Production Science*, 31: 17-27.

d) For books:

AOAC (1990). Association of Official Analytical Chemists. *Official Methods of Analysis*, 15th Edition. Washington D.C. pp. 69-88.

Pelczar JR, Harley JP, Klein DA (1993). *Microbiology: Concepts and Applications*. McGraw-Hill Inc., New York, pp. 591-603.

e) Books, containing sections written by different authors:

Kunev M (1979). Pig Fattening. In: A. Alexiev (Editor), *Farm Animal Feeding*. Vol. III. Feeding of Different Animal Species, Zemizdat, Sofia, p. 233-243 (Bg).

In referring to a personal communication the two words are followed by the year, e.g. (Brown, J. M., personal communication, 1982). In this case initials are given in the text.

Nomenclature and Abbreviations

Nomenclature should follow that given in NCBI web page and Chemical Abstracts. Standard abbreviations are preferable. If a new abbreviation is used, it should be defined at its first usage. Abbreviations should be presented in one paragraph, in the format: "term: definition". Please separate the items by ";".

E.g. ANN: artificial neural network; CFS: closed form solution...

Abbreviations of units should conform to those shown below:

Decilitre	dl	Kilogram	kg
Milligram	mg	hours	h
Micrometer	mm	Minutes	min
Molar	mol/L	Mililitre	ml
Percent	%		

Other abbreviations and symbols should follow the recommendations on units, symbols and abbreviations: in "A guide for Biological and Medical Editors and Authors (The Royal Society of Medicine London 1977).


Papers that have not been published should be cited as "unpublished". Papers that have been accepted for publication, but not yet specified for an issue should be cited as "to be published". Papers that have been submitted for publication should be cited as "submitted for publication".

Formulae, numbers and symbols

1. Typewritten formulae are preferred. Subscripts and superscripts are important. Check disparities between zero (0) and the letter O, and between one (1) and the letter I.
2. Describe all symbols immediately after the equation in which they are first used.
3. For simple fractions, use the solidus (/), e.g. 10 /38.
4. Equations should be presented into parentheses on the right-hand side, in tandem.
5. Levels of statistical significance which can be used without further explanations are *P < 0.05, **P < 0.01, and ***P < 0.001
6. In the English articles, a decimal point should be used instead of a decimal comma.
7. In chemical formulae, valence of ions should be given, e.g. Ca²⁺ and CO₃²⁻, not as Ca⁺⁺ or CO₃.
8. Numbers up to 10 should be written in the text by words. Numbers above 1000 are recommended to be given as 10 powered x.
9. Greek letters should be explained in the margins with their names as follows: Αα - alpha, Ββ - beta, Γγ - gamma, Δδ - delta, Εε - epsilon, Ζζ - zeta, Ηη - eta, Θθ - theta, Ιι - iota, Κκ - kappa, Λλ - lambda, Μμ - mu, Νν - nu, Ξξ - xi, Οο - omicron, Ππ - pi, Ρρ - rho, Σσ - sigma, Ττ - tau, Υυ - ipsilon, Φφ - phi, Χχ - chi, Ψψ - psi, Ωω - omega.

Review/Decisions/Processing

Firstly, all manuscripts will be checked by [Docol@c](#), a plagiarism finding tool. A single blind reviewing model is used by WVJ for non-plagiarized papers. The manuscript is edited and reviewed by the English language editor and three reviewers selected by section editor of WVJ respectively. Also, a reviewer result form is filled by reviewer to guide authors. Possible decisions are: accept as is, minor revision, major revision, or reject. See sample of [evaluation form](#). Authors should submit back their revisions within 14 days in the case of minor revision, or 30 days in the case of major revision.

To submit a revision please [sign in here](#), fill out the form, and mark " Revised" attach the revision (MS word) and submit when completed.

After review and editing the article, a final formatted proof is sent to the corresponding author once again to apply all suggested corrections during the article process. The editor who received the final revisions from the corresponding authors shall not be hold responsible for any mistakes shown in the final publication. Manuscripts with significant results are typically reviewed and published at the highest priority.

Plagiarism: There is a zero-tolerance policy towards plagiarism (including self-plagiarism) in our journals. Manuscripts are screened for plagiarism by [Docol@c](#) a plagiarism finding tool, before or during publication, and if found they will be rejected at any stage of processing. See sample of [Docol@c-Report](#).

Declaration

After manuscript accepted for publication, a [declaration form](#) will be sent to the corresponding author who that is responsible to coauthors' agreements to publication of submitted work in WVJ after any amendments arising from the peer review.

Date of issue

The journal will be issued on 25th of March, June, September and December, each year.

Publication charges

No peer-reviewing charges are required. However, there is a \$95 editor fee for the processing of each primary accepted paper. Payment can be made by credit card, bank transfer, money order or check. Instruction for payment is sent during publication process as soon as manuscript is accepted.

The submission fee will be waived for invited authors, authors of hot papers, and corresponding authors who are editorial board members of the *World's Veterinary Journal* (WVJ). The Journal will consider requests to waive the fee for cases of financial hardship (for high quality manuscripts and upon acceptance for publication). Requests for waiver of the submission fee must be submitted via individual cover letter by the corresponding author and cosigned by an appropriate institutional official to verify that no institutional or grant funds are available for the payment of the fee. Letters including the manuscript title and manuscript ID number should be sent to: editor.wvj@gmail.com. It is expected that waiver requests will be processed and authors will be notified within one business day.

Submission Preparation Checklist

- Authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to the following guidelines.
- The submission has not been previously published, nor is it before another journal for consideration (or an explanation has been provided in Comments to the Editor).
- The submission file is in Microsoft Word, RTF, or PDF document file format.
- Where available, URLs for the references have been provided.
- The text is single-spaced; uses a 12-point font; and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.
- The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

SCIENCELINE PUBLISHING CORPORATION

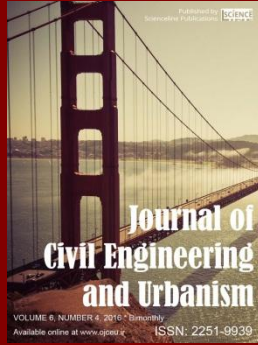
Scienceline Publication Ltd is a limited liability non-profit non-stock corporation incorporated in Turkey, and also is registered in Iran. Scienceline journals that concurrently belong to many societies, universities and research institutes, publishes internationally peer-reviewed open access articles and believe in sharing of new scientific knowledge and vital research in the fields of life and natural sciences, animal sciences, engineering, art, linguistic, management, social and economic sciences all over the world. Scienceline journals include:

Online Journal of Animal and Feed Research



ISSN 2228-7701; Bi-monthly
[View Journal](#) | [Editorial Board](#)
 Email: editors@ojaf.r.ir
[Submit Online >>](#)

Journal of Civil Engineering and Urbanism



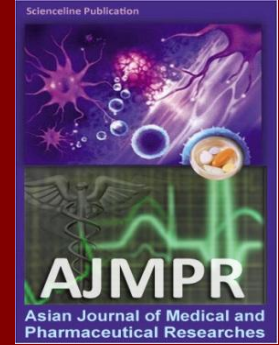
ISSN 2252-0430; Bi-monthly
[View Journal](#) | [Editorial Board](#)
 Email: ojceu@ojceu.ir
[Submit Online >>](#)

Journal of Life Sciences and Biomedicine



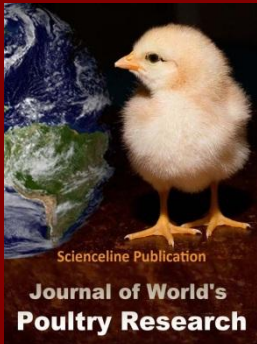
ISSN: 2251-9939; Bi-monthly
[View Journal](#) | [Editorial Board](#)
 Email: editors@jlsb.science-line.com
[Submit Online >>](#)

Asian Journal of Medical and Pharmaceutical Researches



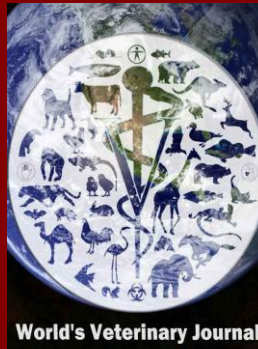
ISSN: 2322-4789; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: editor@ajmpr.science-line.com
[Submit Online >>](#)

Journal of World's Poultry Research



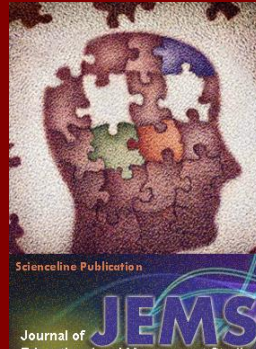
ISSN: 2322-455X; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: editor@jwpr.science-line.com
[Submit Online >>](#)

World's Veterinary Journal



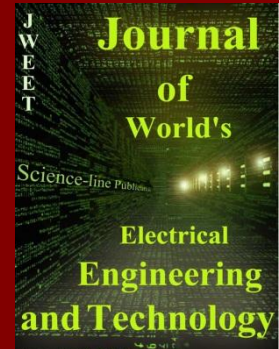
ISSN: 2322-4568; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: editor@wj.science-line.com
[Submit Online >>](#)

Journal of Educational and Management Studies



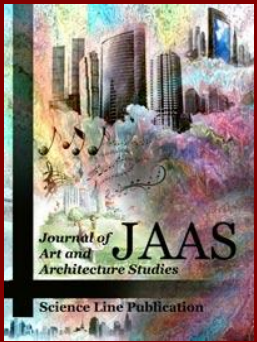
ISSN: 2322-4770; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: info@jems.science-line.com
[Submit Online >>](#)

Journal of World's Electrical Engineering and Technology



ISSN: 2322-5114; Irregular
[View Journal](#) | [Editorial Board](#)
 Email: editor@jweet.science-line.com
[Submit Online >>](#)

Journal of Art and Architecture Studies



ISSN: 2383-1553; Irregular
[View Journal](#) | [Editorial Board](#)
 Email: jaas@science-line.com
[Submit Online >>](#)

Asian Journal of Social and Economic Sciences



ISSN: 2383-0948; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: ajses@science-line.com
[Submit Online >>](#)

Journal of Applied Business and Finance Researches



ISSN: 2382-9907; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: jabfr@science-line.com
[Submit Online >>](#)

Scientific Journal of Mechanical and Industrial Engineering



ISSN: 2383-0980; Quarterly
[View Journal](#) | [Editorial Board](#)
 Email: sjmie@science-line.com
[Submit Online >>](#)