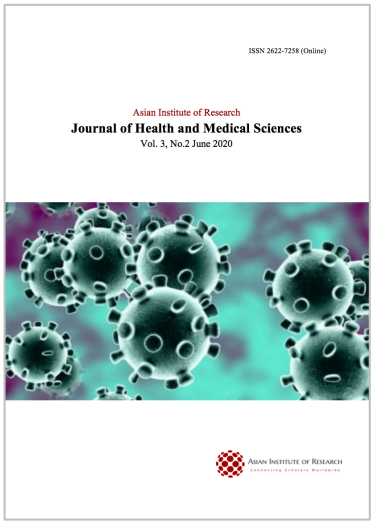

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Emblica Officinalis (Amloki) – Could Be the Remedy for Side Effects of Iron Supplementation in Pregnancy

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Abstract
Background: Iron deficiency anemia (IDA) is the most common nutritional disorder in pregnancy in developing countries. Different iron preparations are supplemented to treat IDA in pregnancy, which can lead to different side effects like nausea, vomiting, decreased appetite, constipation or diarrohea, hyperacidity. Emblica officinalis is a well known traditional fruit to reduce these side effects. Aim: To determine the side effects of iron supplementation and beneficial role of amloki in pregnancy to reduce these side effects.Methods and materials: This interventional study was done in the Department of Physiology, Dhaka Medical College, Dhaka from July 2016 to June 2017. From the Outpatient Department of Obstetrics and Gynaecology, Dhaka Medical College and Hospital, 46 pregnant women were selected purposively on the basis of inclusion and exclusion criteria. Anaemic pregnant women supplemented with oral iron and amloki were considered as study groups (Group A) and pregnant women supplemented with only iron for 45 days were considered as control group (Group B). A previously formed structured questionnaire was used to evaluate the subjective complaints. Chi-square test was performed to compare between the groups. The test of significance was calculated & p value < 0.05 was accepted as level of significance. Results: Significant improvement in different subjective parameters nausea, vomiting, decreased appetite, constipation, hyperacidity ($p<0.001$), were seen in iron and amloki supplemented group. Conclusions: It can be concluded that, amloki supplementation along with iron can reduce the side effects of iron and improve the subjective complains of the iron deficient anemic pregnant women.

Keywords: Iron Deficiency Anaemia, Pregnancy, Amloki, Constipation, Acidity

Introduction

Anemia is a worldwide public health problem. Among different types of anaemia iron deficiency anemia is the most common type (Layeeq & Thakar, 2015). In developing countries, multi-parity, prolonged lactation, dietary deficiency and worm infestation are the causes of development of IDA in women of reproductive age (Khot, Patil & Kakad, 2013). Again, during pregnancy maternal blood volume increases and there is increased demand of iron for the growth of the fetus. Pregnancy also reduces the erythropoietic function of bone marrow. All these factors make a pregnant women iron deficient, though she was previously healthy (Roy & Dwivedi, 2014; Sharma, Jain, Rani, Jaitawat & Kantawa, 2015).

The common clinical presentations are pallor of the skin, pale nail, pale tongue, glossitis, stomatitis, lassitude, fatigue, anorexia, indigestion, palpitation, weakness, tiredness, shortness of breath (dysnoea), giddiness, oedema and pica in pregnancy with IDA (Nirali & Shankar, 2015).

Several studies have done about iron deficiency anemia in pregnancy in Bangladesh and worldwide. Iron and folic acid supplementation are the WHO recommended standard treatment for IDA in pregnancy (Klemn et al., 2011). But, it has several side effects, like heartburn, nausea, upper gastric discomfort, constipation and diarrhea. Recently it has been shown to generate free radicles, which cause damage to the intestine (Khot, Patil & Kakad, 2013). About, 20-30% of total iron is absorbed in subjects with IDA, when it is administered orally. The remainder travels through the gut lumen and causes free radical-mediated damage to the gut mucosa (Evans and Halliwell, 2001; Idoate Gastearena, Gil, Azqueta, Coronel & Gimeno, 2003;Hutchinson, Al-Ashgar, Liu, Hider, Powell & Geissler, 2004; Erichsen, Ulvik, Grimstad, Berstad, Berge & Hausken, 2005). It also causes destruction of beneficial colonic microflora (Zimmermann et al., 2010; Werner et al., 2011; Dostal et al., 2012). But if the Amloki is added with iron pills it raises its absoption and decreases the side effects (Sharma et al., 2015).

General wellbeing of individuals depends on Gastrointestinal symptoms (Schultink, van der Ree, Matulessi & Gross, 1993; Jeong et al., 2008; Lutsey, Dawe, Villate, Valencia & Lopez, 2008).So, it can affect compliance with oral iron therapy and, therefore, treatment efficacy (Lutsey, Dawe, Villate, Valencia & Lopez, 2008; Seck & Jackson, 2008).

To evaluate gastrointestinal symptoms before and after iron supplementation self-reporting questionnaires may be used (Talley, Boyce, Owen, Newman & Paterson, 1995; Quan et al., 2003; Brunner et al., 2005; Foster JM & van der Molen, 2008; Varma et al., 2008).

Methods and materials

This interventional study was done in the Department of Physiology, Dhaka Medical College, Dhaka from July 2016 to June 2017. This study conformed to the Helsinki Declaration and was approved by the concerned departments, Research Review Committee and Ethical Review Committee of Dhaka Medical College, Dhaka. From the outpatient department of Obstetrics and Gynaecology, DMCH, 46 pregnant women in between 18 to 36 years of age having 13^{th} to 20^{th} weeks of gestation were recruited with the clinical signs and symptoms of Anaemia along with blood Hb level 8≥ to <11 gm/dl. After recruitment, the benefit, purpose and procedures of the study were explained to each subject in detail. Their voluntary participations were encouraged. They were free to withdraw themselves whenever they wanted from the study. Informed written consent was taken from the participants. Their socio economic condition, food habit, parity, menstrual history was taken along with subjective complaints and clinical examination. All the informations were recorded in a prefixed questionnaire. Amloki capsules and iron tablets were given in boxes for 45 days and participants were encouraged to continue the supplied medicine daily. Compliance to the supplementation was monitored by regular telephonic communications. After 45 days, again clinical examination was done and subjective complaints were taken from the subjects. Subjective complaints were graded in the previously formed structured questionnaire (table I) at the beginning of the study (baseline) and after 45 days of study period. Participants were divided into two groups, 25 pregnant women with IDA, were supplemented with oral amloki capsules (1.072 gm) thrice daily and iron tablet [ferrous fumarate (200mg) + folic acid (0.02 mg)] once daily for 45 days, were considered as study group

(Group A). Again, 21 pregnant women with IDA, supplemented with only iron tablet once daily for 45 days were considered as control group (Group B). After 2 weeks of study period one subject was excluded from study group due to reluctance. After 4 weeks of study, 2 subjects from control group left Dhaka. So, finally 24 subjects of study and 19 subjects of control groups completed the study.

The amloki capsule (Amlahills) used in this study was manufactured by Isha Agro Developers PVT.LTD, India and authentified by the Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Dhaka.
For statistical analysis, Chi-square test was performed to compare between the groups using SPSS Version 22.0. Data were expressed as n (%). The p-value < 0.05 was taken as the level of significance.

Table I: Preformed Grading pattern for subjective complaint

Sl. No.	Presenting Clinical Features	Grade Before & After Treatment		Severity
1.	Nausea and vomitting	0	0	Absence of nausea.
		1	1	Occasional feeling of nausea.
		2	2	Regular feeling of nausea without vomiting.
		3	3	Regular feeling of nausea with occational vomiting.
		4	4	Regular feeling of nausea with regular vomiting.
2.	Loss of appetite	0	0	Very good appetite.
		1	1	Irregular appetite.
		2	2	Persistent poor appetite.
		3	3	Persistent very poor appetite.
		4	4	Complete loss of appetite.
3.	Constipation /diarrhoea	0	0	No constipation/diarrhea.
		1	1	Passes hard & soft stool regularly.
		2	2	Pass hard stool all the time/soft stool ≤ thrice a day
		3	3	Need of laxative to pass stool /pass soft stool > thrice a day.
		4	4	have to stop iron intake
4.	Hyperacidity	0	0	No heart burn
		1	1	Occasional heart burn on spicy food intake
		2	2	Regular heart burn but no need of antiulcerant
		3	3	Irregular use of antiulcerant
		4	4	Regular use of antiulcerant

Result and Discussion

Results are showing (table II, table III) significant improvements in different side effects nausea and vomiting, loss of appetite, constipation/diarrhoea, and hyperacidity (p < 0.001). At the beginning of the study about 50% patients had the symptoms of nausea in both groups. After supplementation, in group A only 20% patients had the symptoms of nausea with or without vomiting, while 68% patient developed nausea with or without vomiting in group B. Most of them (>95%) had poor appetite in both groups before supplementation. But after supplementation about 88% patients had developed good appetite in group A, while in group B about 85% patients were suffering from persistent poor appetite. Before supplementation all patients had regular or irregular bowel habits in both groups. But after supplementation, no one developed diarrhea or constipation in group A, while about 90% patients developed constipation and 10% developed diarrhea in group B. Before supplementation none of them had the history of taking antiulcerant in both groups. After supplementation, only about 9% patients had hyperacidity in group A, while about 85% patients in group B were suffering from hyperacidity.

Table II: Subjective complaints of the study subjects at baseline in both groups (n=43)

Parameters	Group		p value
	Group A (n=24) [n(%)]	Group B (n=19) [n(%)]	
Nausea and vomitting			
Absence of Nausea	2 (8.3)	2 (10.5)	0.936 ns
Occasional feeling of nausea	10 (41.7)	7 (36.8)	
Regular feeling of nausea without vomiting	12 (50.0)	10 (52.6)	
Appetite			
Irregular appetite	1 (4.2)	0 (0.0)	0.638ns
Persistent poor appetite	7 (29.2)	5 (26.3)	
Persistent very poor appetite	16 (66.7)	14 (73.7)	
Constipation/diarrhoea			
No constipation/diarrhoea	2 (8.4)	1 (5.3)	0.094ns
Passes hard & soft stool regularly	17 (70.8)	8 (42.1)	
Pass hard stool all the time /soft stool ≤ thrice a day	12/3 (62.5)	8/2 (52.6)	
Hyperacidity			
No heart burn	2 (8.4)	1 (5.3)	0.094ns
Occational heart burn on spicy food intake	17 (70.8)	8 (42.1)	
Regular heart burn but no need of antiulcerant	5 (20.8)	10 (52.6)	

Results are expressed as n (%). Chi-square test was performed to compare between groups. The test of significance was calculated & p value < 0.05 was accepted as level of significance.
n = number of subjects; ns = non significant.

Table III: subjective complaints of the study subjects after intervention in both groups (n=43)

Parameters	Group		p value
	Group A (n=24) [n(%)]	Group B (n=19) [n(%)]	
Nausea and vomiting			
Absence of Nausea	6 (25.0)	0 (0.0)	<0.001***
Occasional feeling of nausea	13 (54.2)	6 (31.6)	
Regular feeling of nausea without vomiting	3 (12.5)	9 (47.4)	
Regular feeling of nausea with occasional vomiting	2(8.3)	4(21.0)	
Appetite			
Very good appetite	10 (41.7)	1 (5.3)	<0.001***
Irregular appetite	11 (45.8)	2 (10.5)	
Persistent poor appetite	3 (12.5)	12 (63.2)	
Persistent very poor appetite	0 (0.0)	4 (21.0)	
Constipation/diarrhoea			
No constipation/diarrhoea	24 (100.0)	0 (0.0)	<0.001***
Need of laxative to pass stool/pass soft stool>thrice a day	0 (0.0)	17+2 (100.0)	
Hyperacidity			
No heart burn	7 (29.2)	0 (0.0)	<0.001***
Occational heart burn on spicy food intake	15 (62.5)	3 (15.9)	
Regular heart burn but no need of antiulcerant	1 (4.2)	7 (36.8)	
Irregular use of antiulcerant	1 (4.2)	9 (47.4)	

Results are expressed as n (%). Chi-square test was performed to compare between groups. The test of significance was calculated & p value < 0.05 was accepted as level of significance.
n = number of subjects; *** = significant
Group A: Study group (treated with Amloki powder and Iron tablet)
Group B: Control group (treated with Iron table)

Significant percentage of women are suffering from nausea and vomiting during pregnancy, which is known as morning sickness. Increased Human chorionic gonadotrophin hormone may be the cause of these symptoms (Verberg, Gillott, Al-Fardan & Grudzinskas, 2005; Festin, 2009; Garshasbi, Ghazanfari, Zayeri & Kamali).Different studies shows that iron deficiency anaemia causes increased oxidative stress (Sevgi, Gönenç & Ciðdem 1986; Ferreira, Machado & Matsubara, 1999; Isler et al., 2002; Binkoski, Kris-Etherton & Beard, 2004; Olivares, Araya, Pizarro & Letelier, 2006). On the other hand iron is a known agent to increase oxidative stress by lipid peroxidation of cell membrane. As a result it causes erosion and damage of the intestinal mucosa leading to gastrointestinal symptoms like nausea, vomiting, constipation, diarrhea, hyperacidity in experimental animal as well as in human being (Jansson, Perkkiö, Willis, Refino & Dallman, 1985; Acharya, Punchard & Taylor, 1991; Srigiridhar & Nair, 1998; Srigiridhar & Nair, 2000; William et al., 2000; Srigiridhar, Nair, Subramanian & Singotamu, 2001; Lund, Wharf, Fairweather-Tait & Johnson, 2003; Gambling et al., 2004; Chen, Le, Shi, Zhang, Jin, 2007; Saha, Pandhi, Gopalan, Malhotra & Saha, 2007). So IDA itself, as well as its treatment with iron, may cause gastrointestinal symptoms, which can be worst in pregnancy for both mother and fetus.

Different components present in amloki have been proven beneficial against oxidative damage of the gastrointestinal mucosa. Phenolic compounds like gallic and tannic acid have strong antioxidant activity. So phenolic compounds present in amloki may reduce oxidative stress produced by iron supplementation by free radical scavenging activity (Muthuraman, Sood & Singla, 2011). Another compound present in amloki known as Tannins also has antioxidant action which promotes tissue repair. Tannin may be the cause of antiulcer property of many natural products (de Jesus et al., 2012). Again, flavonoid substances present in amloki have the property of increasing microcirculation of gastric mucosa. Increased gastric mucosal blood supply is probably related to enhanced neuropeptide expression like, CGRP (calcitonin gene-related peptide) released from sensory afferent nerves (Zayachkivska, Konturek, Brzozowski & Ghegotsky, 2005).So, in this study all these factors may act combindly to reduce gastrointestinal side effects of iron supplementation.

Conclusions

From the results of the study, it can be concluded that oral amloki (Emblica officinalis) can effectively improve different subjective complains like nausea, vomiting, diarrhea/ constipation and hyperacidity in pregnant women with iron deficiency anemia. Therefore oral supplementation of amloki along with iron may be helpful to increase iron tolerability and physical well being in pregnancy.

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References

Acharya J, Punchard NA, Taylor JA, Thompson RP, Pearson TC. Red cell lipid peroxidation and antioxidant enzymes in iron deficiency. Eur J Haematol 1991; 47(4): 287-91.

Binkoski AE, Kris-Etherton PM, Beard JL. Iron Supplementation Does Not Affect the Susceptibility of LDL to Oxidative Modification in Women with Low Iron Status. J Nutr 2004; 134: 99–103.

Brunner HI, Johnson AL, Barron AC, Passo MH, Griffin TA, Graham TB, Lovell DJ: Gastrointestinal symptoms and their association with healthrelated quality of life of children with juvenile rheumatoid arthritis: validation of a gastrointestinal symptom questionnaire. J Clin Rheumatol 2005; 11:194–204

Chen Q, Le GW, Shi YH, Zhang SM, Jin X. Effect of iron supplementation on intestinal function and oxidative stress in piglets with induced colitis. J Animal Feed Sciences 2007; 16: 205–13

de Jesus NZT, Falcao HS, Gomes IF, Leite TJAL, Lima GRM et al. Tanin, peptic ulcers and related mechanisms. Int. J. Mol. Sci. 2012, 13: 3203-3228. Doi: 10.3390/ijms 13033203

Dostal A, Chassard C, Hilty FM, Zimmermann MB, Jaeggi T, Rossi S, Lacroix C:Iron depletion and repletion with ferrous sulfate or electrolytic iron modifies the composition and metabolic activity of the gut microbiota in rats. J Nutr 2012; 142:271–277.

Erichsen K, Ulvik RJ, Grimstad T, Berstad A, Berge RK, Hausken T: Effects of ferrous sulphate and non-ionic iron-polymaltose complex on markers of oxidative tissue damage in patients with inflammatory bowel disease.Aliment Pharmacol Ther 2005; 22:831–838.

Evans P, Halliwell B: Micronutrients: oxidant/antioxidant status. Br J Nutr2001; 85(Suppl 2):S67–S74.

Ferreira ALA, Machado PEA, Matsubara LS. Lipid peroxidation, antioxidant enzymes and glutathione levels in human erythrocytes exposed to colloidal iron hydroxide in vitro. Braz J Med Biol Res 1999; 32(6): 689-94

Festin M, Nausea and vomiting in early pregnancy.Clinical Evidence 2009; 06:1405. Doi: https://www.researchgate.net/publication/24438790

Foster JM, van der Molen T, Caeser M, Hannaford P: The use of questionnaires for measuring patient-reported side effects of drugs: its importance and methodological challenges. Pharmacoepidemiol Drug Saf 2008; 17:278–

Gambling L, Andersen HS, Czopek A, Wojciak R, Krejpcio Z, McArdle HJ. Effect of timing of iron supplementation on maternal and neonatal pregnant rats. J Physiol 2004; 561 (15): 195-203.

Garshasbi A, Ghazanfari T, Zayeri F, Kamali M, Maternal serum levels of interleukin-6 and β-hCG in women with hyperemesis gravidarum in the first trimester of pregnancy. Journal of Basic and Clinical Pathophysiology 2017; 5(1): 13-18

Hutchinson C, Al-Ashgar W, Liu DY, Hider RC, Powell JJ, Geissler CA: Oral ferrous sulphate leads to a marked increase in pro-oxidant nontransferrin- bound iron. Eur J Clin Invest 2004; 34:782–784.

Idoate Gastearena MA, Gil AG, Azqueta A, Coronel MP, Gimeno M: A comparative study on the gastroduodenal tolerance of different antianaemic preparations. Hum Exp Toxicol 2003; 22:137–141.

Isler M, Delibas N, Guclu M, Gultekin F, Sutcu R, Bahceci M, et al. Superoxide dismutase and glutathione peroxidase in erythrocytes of patient with iron deficiency anemia: effects of different treatment modalities. Croat Med J 2002; 43(1):16-19.

Jansson LT, Perkkiö MV, Willis WT, Refino CJ, Dallman PR. Red cell superoxide dismutase is increased in iron deficiency anemia. Acta Haematol 1985; 74(4): 218-21

Jeong JJ, Choi MG, Cho YS, Lee SG, Oh JH, Park JM, Cho YK, Lee IS, Kim SW, Han SW, Choi KY, Chung IS: Chronic gastrointestinal symptoms and quality of life in the Korean population. World J Gastroenterol 2008; 14:6388–6394.

Khot BM, Patil AJ, Kakad AC. Comparative clinical study of dhatri lauha and navayasa lauha in garbhini panduroga with reference to anemia in pregnancy. Int Org Sci Res J Dental Med Sci 2013; 11(1): 28-33.

Klemn RDW, Sommerfelt AE, Boyo A, Barba C, Kotecha P, Steffen M, Franklin N. 2011. Are we making progress on reducing anemia in women? [Internet] Washington: United States Agency for International Development; [Cited 2017 Jan o9] Available from: http://www.a2zproject.org/pdf/ReducingAnemia_low_res_06212011.pdf

Layeeq S, Thakar AB. Clinical efficacy of amloki rasayana in the management of pandu (iron deficiency anemia). Ayu 2015; 36(3): 290-297.

Lund EK, Wharf SG, Fairweather-Tait SJ, Johnson IT. Oral ferrous sulfate supplements increase the free radicalgenerating capacity of feces from healthy volunteers. Am J Clin Nutr 2003; 78(3): 498.

Lutsey PL, Dawe D, Villate E, Valencia S, Lopez O: Iron supplementation among pregnant women in Bicol, Philippines. Public Health Nutr 2008; 11:76–82.

Muthuraman A, Sood S, Singla SM. The anti-inflammatory potential of phenolic compounds from Emblica officinalis L. in rat. Inflammopharmacol 2011; 19:327. DOI: 10.1007/s10787-010-0041-9

Nirali JB, Shankar MB. An observational clinical study of navayasa lauha tablets w.s.r to Iron Deficiency Anemia. Int J Ayu Pharm Chem 2015; 3(3): 283-291.

Olivares M, Araya M, Pizarro F, Letelier A. Erythrocyte Cu- Zn superoxide dismutase activity is decreased in irondeficiency anemia. Biological Trace Element Research 2006; 112(3): 193-203.

Quan C, Talley NJ, Cross S, Jones M, Hammer J, Giles N, Horowitz M:
Development and validation of the diabetes bowel symptom questionnaire.
Aliment Pharmacol Ther 2003; 17:1179–1187.

Roy A, Dwivedi M. Dhatrilauha: right choice for iron deficiency anemia in pregnancy. Ayu 2014; 35(3):283-288.

Saha L, Pandhi P, Gopalan S, Malhotra S, Saha PK Comparison of efficacy, tolerability, and cost of iron polymaltose complex with ferrous sulphate in the treatment of iron deficiency anemia in pregnant women. Med Gen Med2007; 9(1):1.

Schultink W, van der Ree M, Matulessi P, Gross R: Low compliance with an iron-supplementation program: a study among pregnant women in Jakarta, Indonesia. Am J Clin Nutr 1993; 57:135–139.
Seck BC, Jackson RT: Determinants of compliance with iron supplementation among pregnant women in Senegal. Public Health Nutr 2008; 11:596–605.
Sevgi Y, Gönenç C, Ciðdem A. Neutrophil glutathione peroxidase activity in iron deficiency anaemia. Scand J Haematol 1986; 36(1): 58-60.
Sharma R, Jain N, Rani D, Jaitawat A, Kantawa SM. Role of Emblica Officinalis and Foeiniculum vulgare during pregnancy and lactation. Int J Adv Multidisciplinary Res 2015; 2(4): 103-113.
Srigiridhar K, Nair KM. Iron-deficient intestine is more susceptible to peroxidative damage during iron supplementation in rats. Free Radic Biol Med 1998; 25: 660–65.
Srigiridhar K, Nair KM. Supplementation with alphatocopherol or a combination of alpha-tocopherol and ascorbic acid protects the gastrointestinal tract of iron-deficient rats against iron-induced oxidative damage during iron repletion. Br J Nutr 2000; 84: 165–73.
Srigiridhar K, Nair KM, Subramanian R, Singotamu L. Oral repletion of iron induces free radical mediated alterations in the gastrointestinal tract of rat. Molecular and Cellular Biochemistry 2001; 219 (1-2): 91-8. 66
Talley NJ, Boyce PM, Owen BK, Newman P, Paterson KJ: Initial validation of a bowel symptom questionnaire and measurement of chronic gastrointestinal symptoms in Australians. Aust N Z J Med 1995; 25:302–308.
Varma MG, Wang JY, Berian JR, Patterson TR, McCrea GL, Hart SL: The constipation severity instrument: a validated measure. Dis Colon Rectum 2008; 51: 162–172.
Verberg MFG, Gillott DJ, Al-Fardan N and Grudzinskas JG. Hyperemesis gravidarum, a literature review,Human Reproduction Update 2005; 11(5): 527–539.
Werner T, Wagner SJ, Martinez I, Walter J, Chang JS, Clavel T, Kisling S,Schuemann K, Haller D: Depletion of luminal iron alters the gut microbiota and prevents Crohn's disease-like ileitis. Gut 2011; 60:325–333.
William B, Aharon R, Itzchak NS, Ayala A, Chaim HZ, Ioav C. The assessment of serum nontransferrin-bound iron in chelation therapy and iron supplementation. Blood 2000; 95: 2975–82.
Zimmermann MB, Chassard C, Rohner F, N'Goran EK, Nindjin C, Dostal A, Utzinger J, Ghattas H, Lacroix C, Hurrell RF: The effects of iron fortification on the gut microbiota in African children: a randomized controlled trial in Cote d'Ivoire. Am J Clin Nutr 2010; 92:1406–1415.
Zayachkivska OS, Konturek PC, Brzozowski T, Ghegotsky MR. Gastroprotective effects of flavonoids in plant extracts. Journal of physiology and Pharmacology 2005, 56(1): 219-231