



RESEARCH ARTICLE

EFFECT OF DATES ON BLOOD ELEMENTS, GLUCOSE AND LIPID IN HUMAN
POPULATION HAIL, KSA

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ARTICLE INFO

Article History:

Received 22nd January, 2016

Received in revised form

14th February, 2016

Accepted 21st March, 2016

Published online 26th April, 2016

Key words:

Dates, Elements, Glucose,
Liver functions,
Kidney functions,
Lipid.

ABSTRACT

The intake of dates being the most important source in hail populations. These dates have been studied their effects on human health in this area. The dates have been used by humans for thousands of years. Although several adverse health effects of dates have been known for a long time. A strong relationship between intake of dates and its effect on blood elements, glucose and lipid in population of hail, kSA has been identified in this study. The effect of dates on blood glucose showed that no significant increase on blood glucose. Also, there were no significant increase in blood elements (na, k, cl and ca) in the population of hail that consume dates. On the other hand there were a significant increase on blood urea, creatinine and uric acid. The liver enzymes ast, alt and alp were a significant decrease in blood of human that consume the dates. Concerning lipid profile, we noted that variety induced no significant variation of different lipid parameters while the variety reduced the ldlc level (bad cholesterol), thus improving the lipid profile. The effect of dates on blood glucose showed that only the variety Tamesrit had a significant decrease on blood glucose. Results generally showed that dates intake by the population of hail were always no significant increase in their blood elements Na, K, Cl and Ca. Also, there is no significant variation in liver functions and kidney functions in this population and no significant variation of different lipid parameters while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA.

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Citation: Elsayed A. M. Shokr and Anwer Mohamed, 2016. "Effect of dates on blood elements, glucose and lipid in human population Hail, KSA", *International Journal of Current Research*, 8, (04), 29845-29848.

INTRODUCTION

The date is a source of carbohydrates, dietary fiber, polyphenols, having antioxidant activity that would protect against free radicals and cancer 7. Regarding their effect on lipid profile and blood glucose rate and improvement of circulating lipids and blood glucose. This positive result on blood glucose should be assessed with consumption of date. It can improve the lipid profile or blood glucose levels in patients with type 2 diabetes or with a disorder of lipid profile. This study has allowed us to correct the misconception of our imagination, we believe that all varieties of dates were as a generic product, whereas, each variety has characteristics which make it suitable for a particular purpose or a particular target. The liver functions enzymes AST, ALT and ALP, there is no significant variation in liver functions in this population

may be due to the date contained ethanol-induced the expected actions in the stomach of rats, and those included severe histological damages (necrosis, haemorrhages), and a significant increase in plasma concentrations of the gastric hormone gastrin, reduction in mucin and an increase in the histamine concentrations in the gastric mucosa. The liver functions enzymes AST, ALT and ALP were selected for study because of their relevance to the pathogenesis of liver serousis as reported by (Elsayed Shokr *et al.*, 2016, Elsayed A. M. Shokr, 2015_{a,b,c,d} and Walsh, 1993). Date palms (*Phoenix dactylifera* L., Palmae) have been cultivated in the Middle East over at least 6000 years ago (Copley *et al.*, 2001). For the natives in this region, dates are considered a staple carbohydrate food (Al-Shahib and Marshall, 2003). Date fruits are also used in the production of local beverages and spirits. In local medicinal practices dates are considered a "tonic" and "aphrodisiac", and in some communities they are thought to be useful against ulcer (Rasheed, personal communication). In fact, Muslims believe that "He who eats seven dates every morning will not be affected by poison or magic on the day he eats them" (cited by

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Miller *et al.*, 2003). The dates, fruit of the tree *Phoenix dactylifera* L, considered as a symbol of the Saharan oasis, accounted since the antiquity as an everyday consumed products. They were an essential component of the diet in the majority of arid and semi-arid regions of the world. In Algeria, in southern areas, dates are an important part of the diet. Many studies have shown the nutritional richness of dates in simple carbohydrates, vitamins, minerals, amino acids and dietary fiber (Ali *et al.*, 1999; Al-Qarawi *et al.*, 2003; Al-Shahib and Marshall, 2003; Bandyopadhyay *et al.*, 2001), in addition to their nutritional value, their antioxidant content and their therapeutic effect in the treatment of several affections: anemia, cancer, obesity; continues to be demonstrated (Bauza, 2002; Black, 1993; Bubenik, 2002; Cho and Ogle, 1992). But there are only few numbers of studies concerning the link between the consumption of dates and metabolic responses such as glucose and lipid profile in humans (Corne *et al.*, 1974). In this context, this study consisted in the evaluation of the effect of dates consumption on blood glucose and lipid profile in healthy adults. The pollen grains of date palm have been used in Egyptian local practices to improve fertility in women, and in some locations in Arabia date pits are roasted and used in lieu of coffee as a hot beverage. Relatively few pharmacological studies have been conducted on dates. For example, it has been shown that, depending on the type of extract used, date fruit and pit extracts significantly increase or decrease gastrointestinal transit (GIT) in mice (Al-Qarawi *et al.*, 2003), and that date fruit extract has strong antioxidant and antimutagenic properties (Vayalil, 2002). Date palm kernels have been shown to exhibit antiaging properties and significant reduction in skin wrinkles in women (Bauza, 2002), and natural fats from date palm has been reported to prevent irritant contact dermatitis (Schliemann-Willers *et al.*, 2002). In animals, the pits have been included in the diet of chickens, sheep, fish and rats, and have been shown to enhance growth in these species (see Ali *et al.*, 1999 and references therein).

In view of the wide consumption of dates in our region, the fact that dates are anecdotally reputed to be useful against peptic ulcers, and the fact that Muslims customarily consume more of the dates during the fasting month of Ramadan, possibly to protect the gastric mucosa from the damaging effect of gastric acid, and because of the scarcity of information on the pharmacological properties of date fruits and pits, we considered undertaking this study to assess the influence of date extracts on the incidence and severity of ethanol-induced gastric ulceration. In addition, the effect of date extracts on the gastric concentrations of histamine and mucin, and the plasma concentration of the hormone gastrin has also been investigated. Aim of this work to view of the wide consumption of dates in our region, the fact that dates are anecdotally reputed to be useful against diabetes, and the fact that Muslims customarily consume more of the dates during the fasting month of Ramadan, possibly to protect the muslim from diabete and increase in blood elements. We considered undertaking this study to assess the influence of date on different lipid parameters (total protein, albumin, triglycerides and cholesterol) while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA.

MATERIALS AND METHODS

Blood samples were collected from three hospitals in Hail, KSA. To show the effect of dates intake by the population of hail. These samples were analyzed by using ICP emission instrument on Perkin Elmer ICP-400 at the University of Hail, KSA. Each hospital is represented by 50 blood samples for chemical and blood analysis with a total of 150 samples. Collect the blood samples to determine the Blood elements Na, K, Cl and Ca, liver functions and kidney functions in this population and different lipid parameters were measured. Blood sugar was measured in capillary blood samples with Lifescan One Touch II ® Glucometer, which has been tested for accuracy and precision against a Beckman Synchron CX7 analyzer of a laboratory that uses the glucose oxidase method. The assays of total cholesterol (TC), HDL-cholesterol, LDL cholesterol and triglycerides (TG) were performed by enzymatic colorimetric methods using kits marketed by Bio Systems, Spain. Reference values adopted are those given by the distributors of these kits. Liver functions and kidney functions in this population and different lipid parameters were measured were performed by enzymatic colorimetric methods using kits marketed by Bio Systems, Spain. Reference values adopted are those given by the distributors of these kits.

Statistical Analysis

Data were expressed as $M \pm SD$. The SPSS program version 15 was used in analysis. One way analysis of Variance (ANOVA) followed by Duncan post hoc test and/or t-test were used in analysis. Pearson correlation Coefficient was used to study correlations. P-values less than 0.05 were significant.

RESULTS

The results of this work are shown in Tables 1–4. Table 1 show the effect of date intake on the population of hail was always no significant increase in their blood glucose and blood elements Na, K, Cl and Ca. Table 2 summarizes the liver functions enzymes AST, ALT and ALP, there is no significant variation in liver functions in this population Table 3. Showed that there is no significant variation in kidney functions enzymes creatinine and uric acid in this population that used Date intake was not significantly effective in antagonizing these effects. On the other hand, Table 4 showed that no significant variation of different lipid parameters (total protein, albumin, triglycerides and cholesterol) while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA.

Aim of this work to view of the wide consumption of dates in our region, the fact that dates are anecdotally reputed to be useful against diabetes, and the fact that Muslims customarily consume more of the dates during the fasting month of Ramadan, possibly to protect the Muslim from diabetes and increase in blood elements.

We considered undertaking this study to assess the influence of date on different lipid parameters (total protein, albumin, triglycerides and cholesterol) while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA.

Table 1. Effect of date intake on the blood glucose and blood elements Na, K, Cl and Ca

Area / Contents	Hospital 1	Hospital 2	Hospital 3
	Mean ± SE	Mean ± SE	Mean ± SE
Glucose	5.8 ± 0.35294	6.49 ± 0.54655	6.34 ± 0.8529
Na	138.3 ± 0.118	138.56 ± 0.7775	138.1 ± 0.711
K	4.8 ± 0.7882	4.42 ± 0.8125	4.4 ± 0.425
Cl	99.8 ± 0.8941	105.8 ± 0.1875	104.6 ± 0.083
Ca	2.2 ± 0.57059	2.26 ± 0.5445	2.24 ± 0.5113

Table 2. Effect of date intake on the liver functions enzymes AST, ALT and ALP

Area /Contents	Hospital 1	Hospital 2	Hospital 3
	Mean ± SE	Mean ± SE	Mean ± SE
AST	19.2 ± 0.3529	17.98 ± 0.28933	19.28 ± 0.201
ALT	33.4 ± 0.5294	38.374 ± 0.3875	36.83 ± 0.088
ALP	76.3 ± 0.5294	79.62 ± 0.44975	74.8 ± 0.32

Table 3. Effect of date intake on the kidney functions enzymes Creatinine, Uric acid and Urea

Area /Contents	Hospital 1	Hospital 2	Hospital 3
	Mean ± SE	Mean ± SE	Mean ± SE
Creatinine	67.58 ± 0.059	64.73 ± 0.2005	68.70 ± 0.469
Uric acid	298.1 ± 0.75	335.68 ± 0.9175	307 ± 0.09
Urea	3.6 ± 0.85	4.19 ± 0.975	3.81 ± 0.1652

Table 4. Effect of date intake on the total protein, albumin, triglycerides, LDL, HDL and cholesterol

Area/Contents	Hospital 1	Hospital 2	Hospital 3
	Mean ± SE	Mean ± SE	Mean ± SE
T protine	70.7 ± 0.5294	71.47 ± 0.0875	71.35 ± 0.017
Albumin	36.9 ± 0.6471	40.10 ± 0.3215	39.74 ± 0.619
Cholesterol	4.4 ± 0.94118	4.53 ± 0.80695	4.31 ± 0.8945
Triglyceride	1.3 ± 0.80588	1.30 ± 0.0408	1.55 ± 0.4965
LDL	3.06 ± 0.1176	3.00 ± 0.905975	2.8 ± 0.06
HDL	1.02 ± 0.2353	1.02 ± 0.401875	0.93 ± 0.42

DISCUSSION

The date is a source of carbohydrates, dietary fiber, polyphenols, having antioxidant activity that would protect against free radicals and cancer [7]. Regarding their effect on lipid profile and blood glucose rate and improvement of circulating lipids and blood glucose. This positive result on blood glucose should be assessed with consumption of date. It can improve the lipid profile or blood glucose levels in patients with type 2 diabetes or with a disorder of lipid profile. This study has allowed us to correct the misconception of our imagination, we believe that all varieties of dates were as a generic product, whereas, each variety has characteristics which make it suitable for a particular purpose or a particular target. The liver functions enzymes AST, ALT and ALP, there is no significant variation in liver functions in this population may be due to the date contained ethanol-induced the expected actions in the stomach of rats, and those included severe histological damages (necrosis, haemorrhages), and a significant increase in plasma concentrations of the gastric hormone gastrin, reduction in mucin and an increase in the histamine concentrations in the gastric mucosa. The liver functions enzymes AST, ALT and ALP were selected for study because of their relevance to the pathogenesis of liver serositis as

reported by (Elsayed Shokr, *et al.*, 2016, Elsayed A. M. Shokr, 2015_{a,b,c,d} and Walsh, 1993).

The present study revealed that date fruit intake on the population of hail was always no significant increase in their blood glucose and blood elements Na, K, Cl and Ca. This lends support to the local folk medicinal claim that dates may be useful to humans. This cause of date on the blood sugar may be due to the low content of sugar and contained anti-ulcer effect on ethanol-induced gastric damage as reported by Elsayed Shokr, *et al.*, 2016, Elsayed A. M. Shokr, 2015_{a,b,c,d} and Cho and Ogle, 1992. A significant decrease in blood glucose among the studied population, nine subjects whose blood sugar was at the beginning of the study no significant change was observed in the blood sugar. It has been shown through in vitro studies and in humans that the fibers in the digestive system act as the main factor slowing the absorption of glucose, moderating the rise in blood glucose they are much more effective at lowering blood glucose when hydrated. Similarly fructose of Tamesrit could also be the cause of its hypoglycemic effect; in fact, the fructose with a low glycemic index, when at high concentration in food may result in the reduction of postprandial blood glucose as reported by Sawaya, *et al.*, 1983, Fayadh, *et al.*, 1990, and Stanhope and KL; Havel PJ. 2009.

Concerning the lipid profile, the two groups did not show significant changes in blood levels of total cholesterol at the beginning and the end of dates consumption; whereas we noticed a significant decrease in the LDLChol. This decrease is even more important as the rate of LDLChol was initially high. A non-significant decrease was observed in the rate of HDLChol as well as a tendency in the decrease of the ratio LDLChol / HDLChol for both groups according to Elsayed A. M. Shokr, 2015_{a,b,c}, Stanhope and KL; Havel PJ. 2009 and Rimm, *et al.*, 1996. The absence of significant change in triglyceride levels in both groups was observed. Based on these results, we note that the variety Ghars induces no significant variation in lipid parameters; conversely, the variety Tamesrit reduced the rate of LDLChol (bad cholesterol), thus enhancing the lipid profile. This effect could be related to the intake of soluble fiber, confirmed by several epidemiological studies, showing that the soluble fiber, independently of the fat intake, are dietary component, important in preventing cardiovascular disease Elsayed A. M. Shokr, 2015_{a,b,c}, Wood PJ, 2002, Stanhope and KL; Havel PJ. 2009 and Rimm, *et al.*, 1996. Stimulation of the oxyntic cells by histamine is the final common pathway by which neural and endocrine mechanisms act in inducing acid secretion. Histamine is involved in a cycle of events leading to the production of arteriolar vasodilatation in injured tissues (Black, 1993).

Gastric mucus (mucin) is an important protective factor for the gastric mucosa and consists of a viscous, elastic, adherent and transparent gel formed by 95% water and 5% glycoproteins that cover the entire gastrointestinal mucosa. Moreover, mucin is capable of acting as an antioxidant, and thus can reduce mucosal damage mediated by oxygen free radicals as showed by (Elsayed A. M. Shokr, 2015_{a,b,c,d} and Repetto and Llesuy, 2002). In this work we showed that there is no significant variation in kidney functions enzymes creatinine and uric acid

in this population that used Date intake were not significantly effective in antagonizing these effects. Also, showed that no significant variation of different lipid parameters (total protein, albumin, triglycerides and cholesterol) while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA. Ethanol-induced gastric ulceration is known to be related to an anti-oxidant action, increased lipid peroxidation and generation of free-radicals (Terano *et al.*, 1989). Recently Vayalil (2002) discovered that date extracts possess significant antioxidant action in vitro.

This may, at least partially, be one of the possible mechanisms by which date extracts have ameliorated the ethanol-induced gastric ulceration. Recently we have found that dates contain relatively high concentrations of the anti-oxidants melatonin and vitamin E. It has been reported that treatment with melatonin prevents gastric ulcerogenesis and decreases ulcer index (Bandyopadhyan *et al.*, 2001; Bubenik, 2002). Vitamin E in palm oil has also been shown to reduce ethanol-induced gastric ulcer (Jarrin *et al.*, 1999). Taken together, these results corroborate our present finding of an ameliorative action of dates on ethanol-induced gastric ulceration, possibly due to its relatively high content of antioxidant substances that reduce the bad lipid in the human as reported by Elsayed A. M. Shokr, 2015_{a,b,c,d} and Bandyopadhyan *et al.*, 2001. Aim of this work to view of the wide consumption of dates in our region, the fact that dates are anecdotally reputed to be useful against diabetes, and the fact that Muslims customarily consume more of the dates during the fasting month of Ramadan, possibly to protect the Muslim from diabetes and increase in blood elements. We considered undertaking this study to assess the influence of date on different lipid parameters (total protein, albumin, triglycerides and cholesterol) while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA.

Conclusion

The present study suggested that date consumption possibly to protect the Muslim from diabetes and increase in blood elements. We considered undertaking this study to show the influence of date on different lipid parameters (total protein, albumin, triglycerides and cholesterol) while the variety reduced the LDLc level (bad cholesterol), thus improving the lipid profile in the population of human being in Hail, KSA.

Acknowledgements

We are grateful to physiology department Faculty of Medicine Hail University, for their support with instruments for analysis of blood samples and funding.

REFERENCES

- Agrawal, A.K., Rao, C.H., Sairam, K., Joshil, V.K., Goel, R.K., 2000. Effect of Piper longum L., Zingiber officinalis L. and Ferula species on gastric ulceration and secretion in rats. *Indian Journal of Experimental Biology* 38, 994–998.
- Ali, B.H., Bashir, A.K., Alhadrami, G., 1999. Reproductive hormonal status of rats treated with date pits. *Food Chemistry*, 66, 437–441.
- Al-Qarawi, A.A., Ali, B.H., Mougy, S., Mousa, H.M., 2003. Gastrointestinal
- Al-Shahib, W., Marshall, R.J., 2003. The fruit of the date palm: its possible use as the best food for the future. *International Journal of Food Science and Nutrition* 54, 247–259.
- Bandyopadhyan, D., Biswas, K., Bhattacharyya, M., Reiter, R.J., Banerjee, R.K., 2001. Gastric toxicity and mucosal ulceration induced by oxygen-derived reactive species: protection by melatonin. *Current Molecular Medicine* 1, 501–513.
- Bauza, E., 2002. Date palm kernel extract exhibits antiaging properties and significantly reduces skin wrinkles. *International Journal of Tissue Reactions* 24, 131–136.
- between stress- and ethanol-induced gastric mucosal damage. *Life Sciences* 51, 1833–1842.
- Black, J., 1993. Reflections on the analytical pharmacology of histamine H₂-receptor antagonists. *Gastroenterology* 105, 963–968.
- Bubenik, K.G.A., 2002. Gastrointestinal melatonin: localization, function and clinical relevance. *Digestive Disease Sciences* 47, 2336–2348.
- Cho, C.H., Ogle, C.W., 1992. The pharmacological differences and similarities Copley, M.S., Rose, P.J., Clampham, A., Edwards, D.N., Horton, M.C., Evershed, R.P., 2001. Detection of palm fruit lipids in archaeological pottery from Qasr Ibrim, Egyptian Nubia. *Proceedings of the Royal Society, London* 268, 593–597.
- Corne, S.J., Morrissey, S.M., Woods, R.J., 1974. A method for the quantitative effect of palm vitamin E and ranitidine on the healing of ethanol-induced gastric lesions in rats. *International Journal of Experimental Pathology* 80, 259–263.
- ELSayed A. M. Shokr (2015) Effect of Ammonia Stress on Blood Constitutes in Nile Tilapia Egypt. *Acad. J. Biolog. Sci.*, 7(1) 2015. Egyptian Academic Journal of Biological Sciences B – Zoology ISSN 2090-0759
- ELSayed A. M. Shokr 2015. Effect of lead on blood hormones measurements of Nile tilapia *Journal of Chemical and Pharmaceutical Research*, 2015, 7(3):1957-1962
- ELSayed A. M. Shokr 2015. Effect of zinc on hematology and biochemistry of Nile Tilapia. *Journal of Chemical and Pharmaceutical Research*, 2015, 7(3): 1943-1950
- ELSayed A. M. Shokr 2015. Heavy Metals (Pb, Fe and Zn) In Fish Due To Water Toxicity Egypt. *Acad. J. Biolog. Sci.*, 7(1) (2015) *Egyptian Academic Journal of Biological Sciences B – Zoology* ISSN 2090-0759 (2015)
- Elsayed A. M. Shokr, *et al.*, 2016. Chronic Renal Failure Associated with Heavy Metal Contamination of Drinking Water in Hail, KSA. *Global Advanced Research Journal of Medicine and Medical Sciences* (ISSN: 2315-5159) Vol. 5(1) pp. 006-013, January, 2016 Available online <http://garj.org/garjmms> Copyright © 2016 Global Advanced Research Journals
- Elsner, P., 2002. Natural vegetable fats in the prevention of irritant contact dermatitis. *Contact Dermatitis* 4, 6–12.

- Fayadh JM and Al-Showiman SS, Chemical composition of date palm (*Phoenix dactylifera* L.). *J. Chem. Soc. Pak.*, 1990, 12, 84-103.
- Jarrin, K., Renuvathani, M., Nafeeza, M.I., Gapor, M.T., 1999. Comparative estimation of gastric barrier mucus. *Journal of Physiology* 242, 116–117.
- Leclere CJ, Champ M., Boillot J., Guille G., Lecannu G., Molis C., Bornet F., Kempf M., Delort-Laval J. and Galmiche JP, Rôle of viscous guar gums in lowering the glycemia response after a solid meal, *Am. J. Clin. Nutr.* 1994, 59; 914-921.
- Miller, C.J., Dunn, E.V., Hashim, I.B., 2003. The glycaemic index of dates and date/yoghurt mixed meals. Are dates “the candy that grows on trees”? *European Journal of Clinical Nutrition* 57, 427– 430.
- Ou S., Kwok K., Li Y., Fu L., In vitro study of possible role of dietary fiber in lowering postprandial serum glucose, *J. Agric. Food Chem.* 2001, 49; 1026-1029.
- Repetto, M.G., Llesuy, S.F., 2002. Antioxidant properties of natural compounds SAS, 1996. SAS User’s Guide. SAS institute, Cary, NY, USA. Schliemann-Willers, S., Wigger-Alberti, W., Kleesz, P., Grieshaber, R.,
- Rimm EB, Ascherio A, Giovannucci E, Spiegelman D, Stampfer MJ and Willett WC. Vegetable, fruit, and cereal fiber intake and risk of coronary heart disease among men. *Jama – J. Am. Med. Assoc.*, 1996, 275(6), 447-451.
- Sawaya WN, Safi L, Black LT and Al- Muhamed MM, Physical chemical characterization of the major date varieties grown in Saudi-Arabia, *Date Palm J.* 1983, 2(2), 183.
- Shalaby, A.R., 1994. Separation, identification and estimation of biogenic amines in foods by thin layer chromatography. *Food Chemistry*, 49, 305–310.
- Stanhope KL; Havel PJ. Fructose consumption: considerations for future research on its effects on adipose distribution, lipid metabolism, and insulin sensitivity in humans. *J. Nutr.* 2009, 139(6):1236S-1241S.
- Terano, A., Hiraishi, H., Ota, S., Shiga, J., Sugimoto, T., 1989. Role of superoxide and hydroxyl radicals in rat gastric mucosal injury induced by ethanol. *Gastroenterologia Japonica* 24, 488–493.
- transit in mice treated with various extracts of date (*Phoenix dactylifera* L.). *Food and Chemical Toxicology* 41, 37–39.
- used in popular medicine for gastric ulcers. *Brazilian Journal of Medical and Biological Research* 35, 523–534.
- Vayalil, P.K., 2002. Antioxidant and antimutagenic properties of aqueous extract of date fruit. *Journal of Agricultural Food Chemistry* 50, 610–617.
- Walsh, J.H., 1993. In: Walsh, J.H. (Ed.), *Gastrin*. Raven Press, New York, pp. 273–318.
- Wood PJ, Relationship between solution properties of cereal P-glucan and physiological effects- a review, *Trends Food Sci. Tech.* 2002, 13, 313-320.
- Zhu, M., Lew, T.H., Luk, C.T., 1997. Gastric protective effect of *Lentinus edodes* against ethanol-induced ulceration. *Fitoterapia* 68, 537– 542.
