IJBPAS, January, 2016, 5(1): 75-86

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

# AN INVESTIGATION INTO BODY MASS INDEX, PICTOGRAM OF BODY SIZE AND FAT PROFILE AMONG THE PATIENTS WITH GASTRIC CANCER AND THE RELATIONSHIP BETWEEN THESE FACTORS AND CLINICAL AND PATHOLOGICAL STAGES OF DISEASE

**REZA EGHDAM ZAMIRI[1], FARBOD RADMAND[2], KARIM SAADATI[3], SAEIDEH MAZLOOM ZADEH[4], SAHAR BABA ALI[5], ZAHRA GHADIMI[6], BAHMAN TALEBIPOUR[7], SATTAR JAFFARI[8i], MINOOSH MOGHIMI[9*]**

[1]Radiation oncologist, Department of Hematology Valiasr Hospital-Zanjan, Iran

[2]Internal Medicine Specialist, Internal Department of Valiasr Hospital-Zanjan, Iran

[3]Professor of Thoracic Surgery, Department of Surgery, Mousavi Hospital, Zanjan, Iran

[4]Assistant professor, Department of Medical Statistics, university of medical science, Zanjan, Iran

[5]Medical Student, university of medical science, Zanjan, Iran

[6]Medical Student, university of medical science, Zanjan, Iran

[7,8,9]Professor of Gastroenterology, Internal Department of Valiasr Hospital-Zanjan, Iran

[*]**Corresponding author: Minoosh Moghimi**

## ABSTRACT

Introduction: gastric cancer has been regarded as the most common cause of death due to cancer in Iran. Obesity has been mentioned as an average risk factor for gastric cancer that cardia gastric cancer has been more likely witnessed than non-cardia gastric cancer. Low levels of HDL in gastric cancer have been mentioned as another factor which is mentioned as a prognostic factor for increased morbidity and mortality. Hence, the present research intended to examine the relationship between pictogram as a symbol of body mass and a variety of gastric cancers and compare levels of lipid profile with patients' body status.

Method: 100 patients with gastric cancer who had been confirmed with endoscopic biopsy and 100 healthy individuals were attended in this study. At the early inclusion of each group,

individuals were evaluated in terms of body mass index and pictogram at two age groups 15 and 30 years old. Further, blood sample was taken from the individuals before starting treatment so as to measure level of lipids. Resample was taken from 67 patients after treatment course so as to evaluate serum lipid levels and their results were analyzed statistically.

Results: in this study, no relationship was witnessed between the risk of gastric cancer in cardia and non-cardia gastric cancers and pictogram at age group 15 and 30 years old. Average triglyceride before and after treatment has been 114±24.7 and 131±43.9 (P<0.001) and total cholesterol level before and after treatment has been 161±33.9 and 171±44.7 (P<0.048), that both indicated increasing significance level followed by treatment. Average triglyceride has been 124±338 and 108±208 among patients with and without metastatic cancer (P<0.009), respectively. 52 patients with gastric cancer (62.1%) had low level of HDL at the beginning of study that a significant increase has been witnessed in HDL level in 44 patients among 52 patients with gastric cancer after treatment than before treatment (P<0. 02).

Conclusion: this study failed to represent a significant relationship between pictogram at age group 15 and 30 years old under the increase of probability for gastric cancer, yet we came to the conclusion that low levels of triglyceride, total cholesterol and HDL have been witnessed among patients with gastric cancer that the aforementioned factors kept increasing after receiving treatment, indicating probable outcomes of treatment among these patients. In addition, increasing level of HDL after treatment can raise gastric cancer as a factor which can contribute in reducing serum HLD.

**Keywords: Gastric cancer, body mass index, pictogram, fat profile**

## INTRODUCTION

Gastric cancer has been regarded as the fourth common cancer and the second cause of death throughout the world [1]. Despite descending trend of gastric cancer in recent decades, this disease has kept increasing in north and north-west of Iran, considered as the high risk regions [2]. Gastric cancer has been mentioned as the third common cause of mortality in Iran [3][4]. Large variations in the occurrence of different geographic regions and high cardia gastric cancer percent have been introduced as two features of gastric cancer in Iran [2]. Concerning pathological types of gastric cancer, it must say that about 85% of cancers are of adenocarcinoma type and 15% are of

lymphomas, gastrointestinal stromal tumor and leiomyosarcom. Gastric adenocarcinoma is generally witnessed in younger individuals throughout the gastric, mentioned with worse prognosis [5,6]. Underlying cause of diseases generally associates to genetic and environmental factors. A variety of environment factors contribute in gastric cancer, including adverse health status such as eating too much , eating too much fat and salt , inadequate dietary fiber , smoking and eating too much of hyperoxidant that is mentioned with increasing risk in patients with malignancy[7]. A cause for decrease in incidence of gastric cancer in Japan is due to people's eating habits and turning to Western eating habits which have caused increasing fat consumption under which an increase is witnessed in serum cholesterol levels[7][8]. Obesity can be an average risk factor for adenocarcinoma of the esophagus in some individuals not all of them, which this has been evaluated and examined based on different studies by means of examination of pictogram at different ages and body mass index(BMI), so that obesity in adenocarcinoma of the esophagus and gastric adenocarcinoma has been assumed as a strong and average risk factor, respectively[9][10], which this relationship in cardia gastric cancer has been more likely witnessed than non-cardia gastric cancer[10][11]. Curbing obesity can raise a probable reduction in mortality due to digestive system cancer [12]. The linkage between increase of fat in cholesterol or diet has been reported with increase of incidence of a variety of cancers including prostate, colon, and breast cancer[13][14]. Increase in LDL uptake by means of cancer cells as the result of increasing number of LDL receptors has been considered as assumptive mechanism for creation of Hypercholesterolemia. According to this assumption, LDL uptake depends of size of tumor, undergone reduction during growth of tumor [7]. Nevertheless, there is a little recognition about the linkage between TG, LDL and HDL [15]. Now, with regard to high extent of gastric cancer in Iran especially in north belt of Iran and important principle of prevention prior to treatment and influential effect of curbing obesity in reducing incidence of mortality as well as effects of level of blood lipids, we intended to examine the relationship between body size, obesity and blood lipids on pathological and clinical stages of cancer and take a step for increasing lifetime of patients with gastric

cancer and reducing treatment costs under reaching to favorable results.

**PROCEDURE**

In this study, 100 patients with gastric cancer referred to Valiasr Hospital-Zanjan were attended and called with patient group. Diagnosis of cardia gastric cancer and/or non-cardia gastric cancer based on histopathologic examination and confirmation of diagnosis based on obtained endoscopic reports were made through upper endoscopy, that these patients were included in the study. 100 healthy individuals at the age group 15 and 30 years old were selected concurrently to examine body mass index and pictogram as control group for study. After taking the patients' status, the prepared questionnaire was filled by the patient and control group based on demographic information and personal characteristics including age, gender, place of birth, place of residence, Smoking ( at least once a week for 6 months and more), history of diabetes disease , hypothyroidism and cardiovascular ischemic diseases and alcohol use ( at least once a week for 6 months and more). Then BMI pertaining to each person was recorded. The individuals who had the recent history about weight loss through diet and sports were removed from study. With regard to aim of this study, body size of each patient at age group 15 and 30 years old based on standard pictogram images which had been extracted from previous studies was calculated. Concerning pictogram form completion, images were taken from them at the aforementioned age groups and adjusted with pictogram images by the researcher. Due to lack of images, explanations and information were given to the patient. In interpretation of pictogram images regarding authentic studies, it can say that images 1, 2, 3 with normal body size, image 4 with overweight and images equal to or above 5 with excess body size and obesity have been represented[16]. Further, pictogram 1 with average BMI about 198 in men and 21.5 in women, pictogram 5 with BMI about 28.4 in men and 29.7 in women and the last pictogram with BMI about 32.4 in men and 36.1 in women have been represented. Chest-abdomen-pelvis CT scans were prepared and interpreted to determine local tumor invasion, vascular invasion, Lymphatic invasion, lymph node metastasis, liver metastasis and ascites in the abdomen. In the study, 100 individuals were examined as control group who were collected among family members of patient, his brothers and sisters at age range ±5. All the stages

pertaining to filling the questionnaire were made in this group. The tests about fat profile were taken from all the patients under study after approving the cancer at the early stage. neoadjuvant therapy was given to the non-metastatic patients for in next sampling and then they went under surgery, which blood sample was taken three weeks after surgery. In metastatic patients that cannot apply surgery, resample was taken for the tests after 6 courses chemotherapy. Ultimately, the information was collected and their relationship in terms of BMI, body size, level of blood fat profiles regarding age and gender in both groups, staging based on definition of TNM, serum concentrations of high-density

lipoprotein (HDL) under 40 mg per deciliter was defined. Findings were analyzed and their relationship before and after surgery and chemotherapy was discussed and examined.

**RESULTS**

According to comparison of quantitative variables between patient and control groups, mean ±standard deviation for criterion of age has been equal to 67.5±11 and 61.8±11.3, respectively; mean of BM in patient and control group has been equal to 21±3.6 and 24±3.9, respectively. Mean of 15 years pictogram in patient and control group has been equal to 2.9±1.6 and 3.9±1.6, respectively. Mean± standard deviation of 30 years pictogram in patient and control group has been equal to 3.7±1.4 and 4.4±1.3, respectively (table 2).

According to comparison of 15 and 30 years pictogram variables in two metastatic and non- metastatic groups, the results below were obtained; mean of 2.9±1.4 with median (3) in metastatic group and mean of 2.9±1.8 with median (2) in non- metastatic group have been obtained, which this difference is not significant. At age group 30 years old, mean of 3.8±1.4 with median (3) in metastatic group and mean of 3.7±1.3 with median (3) in non- metastatic group have been obtained, without a significant difference. Concerning BMI, mean of 21±3.7 with median (20) in metastatic group and mean of 21.5±3.5 with median (20) in non-metastatic group have been obtained, which this difference is not significant(table 3).

According to 15 years pictogram, mean of 2.8±1.7 with median (2) in patients with cardia gastric cancer and mean of 3±1.6 with median (3) in patients with non-cardia gastric cancer have been obtained, which this difference is not significant. According to 30 years pictogram, mean of 1.3±3.6 with

median (3) in patients with cardia gastric cancer and mean of 3.8±1.4 with median (3) in patients with non-cardia gastric cancer have been obtained, which this difference is not significant. Concerning BMI, mean of 20.5±3.5 with median (19.6) in patients with cardia gastric cancer and mean of 21.4±3.7 with median (21.6) in patients with non-cardia gastric cancer have been obtained, which this difference is not significant(table 4).

In the present research, results from lipid profiles were examined and analyzed that the mean ±standard deviation at criterion of serum triglyceride (TG) in patient group before and after treatment was obtained equal to 114±24.7 and 131±43.9, respectively($P<0.001$). mean of serum levels of triglycerides(TC) in patient group before and after treatment of patients with gastric cancer has been equal to 161±33.9 and 171±44.7, respectively; yet mean of Lp with high density(HDL-C) before and after treatment has been equal to 39±9.2 and 40±1.4, respectively; mean of Lp with low density(LDL-C) before and after treatment has been equal to 99.7±27.3 and 105±31, respectively($p=0.249$)(table 5).

According to the results under study in two metastatic and non-metastatic groups, mean±standard deviation in metastatic group at TG level has equaled to 128±33.8 with median (123) and mean±standard deviation in non-metastatic group at TG level has equaled to 108±20.8 with median (107), which this difference is not significant. Mean of Serum total cholesterol (TC) 157±32.5 with median (158) in metastatic group and mean of 162±32.7 with median (162) in non-metastatic group have been obtained, which this difference is not significant. Mean of HDL-C in metastatic group has equaled to 37.8±8.6 with median (37); mean of HDL-C in non-metastatic group has equaled to 41.5±1.3 with median (41), which this difference is not significant. Level of LDL-C in metastatic group has equaled to 100±30.1 with median (100); mean of LDL-C in non-metastatic group has equaled to 100±27.9 with median (100), which this difference is not significant (table 6).

83(87.4%) had triglyceride less than 150mg/dl and 12(12.6%) had triglyceride more than 150 mg/dl; 84(88.4%) had total cholesterol less than 200 mg/dl and 11(11.6%) had total cholesterol more than 200 mg/dl. 59(62.1%) had HDLC less than 40 mg/dl and 36(37.9%) had HDLC more than 40 mg/dl. 56 individuals(58.9%) had LDL-C less than 100 mg/dl and 39

individuals(41.1%) had LDL-C more than 100 mg/dl, indicating low level of HDL and lack of increase in level of TC and TG in most of patients with gastric cancer at the early and before treatment(table 7).

**Table 1: Comparison of the qualitative variables under study in two patient and control groups**

| GROUP / VARIABLE | | Patient(%) | Control(%) | P-Value |
|---|---|---|---|---|
| **Gender** | **Male** | 18 (18) | 60 (60) | 0/001 |
| | **Female** | 19 (19) | 40 (40) | |
| **IHD** | **Yes** | 5 (5) | 6 (6) | 0/75 |
| | **No** | 95 (95) | 94 (94) | |
| **Cigarette** | **Yes** | 17 (17) | 16 (16) | 0/84 |
| | **No** | 83 (83) | 84 (84) | |
| **Alcohol** | **Yes** | 0 (0) | 2 (2) | 0/15 |
| | **No** | 100 (100) | 98 (98) | |

**Frequency of gender in patient and control groups has been represented with 81 men(81%) and 19 women(19%) and 60 men(60%) and 40 women(40%), respectively, mentioned with significant difference(table 1)**

**Table 2: Comparison of mean and standard deviation of quantitative variables in two patient and control groups**

| Group / Variable | Patients Mean ±standard deviation | Control Mean ±standard deviation | P-Value |
|---|---|---|---|
| **Age** | 67/5 ± 11 | 61/8 ± 11/3 | 0/001 |
| **BMI** | 21 ± 3/6 | 24 ± 3/9 | 0/001 |
| 15 **years pictogram** | 2/9 ± 1/6 | 3/9 ± 1/6 | 0/001 |
| **30 years pictogram** | 3/7 ± 1/4 | 4/4 ± 1/3 | 0/001 |

**Table 3. Comparison of mean of variables under study in two metastatic and non-metastatic groups**

| Variable | metastatic | | non-metastatic | | P-Value |
|---|---|---|---|---|---|
| | Mean ±standard deviation | Median(25%-75%) | Mean ±standard deviation | Median(25%-75%) | |
| 15 **years pictogram** | **2/9±1/4** | **3** | **2/9±1/8** | **2** | **0/921** |
| **30 years pictogram** | **3/8±1/4** | **3** | **3/7±1/3** | **3** | **0/598** |
| **MBI** | **21±3/7** | **20** | **21/5±3/5** | **21** | **0/205** |

**Table 4. Comparison of mean of variables under study in two cardia gastric cancer and non-cardia gastric cancer groups**

| Variable | cardia gastric cancer | | non-cardia gastric cancer | | P-Value |
|---|---|---|---|---|---|
| | Mean ±standard deviation | Median(25%-75%) | Mean ±standard deviation | Median(25%-75%) | |
| 15 **years pictogram** | **2/8±1/7** | **2** | **3±1/6** | **3** | **0/494** |
| **30 years pictogram** | **3/6±1/3** | **3** | **3/7±1/4** | **3** | **0/474** |
| **MBI** | **20/5±3/5** | **19/6** | **21/4±3/7** | **21/6** | **0/18** |

**Table 5. Comparison of mean of lipids in the patients with gastric cancer before and after treatment**

| Variable | Before treatment Mean ±standard deviation | After treatment Mean ±standard deviation | P-Value |
|---|---|---|---|
| **TG** | **114 ± 24/7** | **131 ± 43/9** | **0/001** |
| **TC** | **161 ± 33/9** | **171 ± 44/7** | **0/048** |
| **HDL-C** | **39 ± 9/2** | **40 ± 14** | **0/659** |
| **LDL-C** | **99/7 ± 27/3** | **105 ± 31** | **0/249** |

**Table 6. Comparison of mean of lipids in two metastatic and non-metastatic groups**

| Variable | metastatic | | non-metastatic | | P-Value |
|---|---|---|---|---|---|
| | Mean ±standard | Median(25%-75%) | Mean ±standard | Median(25%-75%) | |

| | deviation | | deviation | | |
|---|---|---|---|---|---|
| **TG** | **124±33/8** | **123** | **108±20/8** | **107** | **0/009** |
| **TC** | **157±32/5** | **158** | **162±32/7** | **162** | **0/605** |
| **HDL** | **37/8±8/6** | **37** | **41/5±13** | **41** | **0/118** |
| **LDL** | **100±30/1** | **100** | **100±27/9** | **100** | **0/980** |

**Table 7. Frequency distribution of Serum lipid profiles in patients with gastric cancer at the early of study**

| Variable | | No | % |
|---|---|---|---|
| **TG** | >**mg / dl**150 | 83 | 87/4 |
| | ≤**mg / dl**150 | 12 | 12/6 |
| **TC** | >**mg / dl**200 | 84 | 88/4 |
| | ≤**mg / dl**200 | 11 | 11/6 |
| **HDL-C** | >**mg / dl**40 | 59 | 62/1 |
| | ≤**mg / dl**40 | 36 | 37/9 |
| **LDL-C** | >**mg / dl**100 | 56 | 58/9 |
| | ≤**mg / dl**100 | 39 | 41/11 |

## DISCUSSION

The present research is an analytical study aiming at examining the relationship between body mass size based on BMI at the early inclusion to study and pictogram at the age groups 15 and 30 years old in the patients with gastric cancer and examining the relationship between level of fat profiles in these patients at the early of inclusion to study and before and after treatment. According to the obtained results, a signification relationship was not obtained between BMI and pictogram at age groups 15 and 30 years old with the risk of gastric cancer. Jesper Lagren et al.(1995-1997) conducted a study on 618 patients with Adenocarcinomas of the esophagus and gastric cardia and esophageal SCC and 820 individuals in control group. The relationship between BMI at 80 years old and pictogram at 20 years old and 20 years before study was examined with the aforementioned cancers, reaching to a strong relationship between BMI at aforementioned age group and risk of esophageal cancer, yet a significant relationship has not existed between height and weight with risk of cardia carcinomas, which this relationship has been significant statistically [9]. Wong-Ho-Chow et al.(1993-1995) conducted a study on 695 patients in control group and 595 patients with esophageal SCC, non- cardia adenocarcinoma and 554 patients with gastric cardia cancer, in which an increase to five times was obtained for risk of cancer of esophagus and increase to two times for risk of gastric cardia cancer in obese individuals, but no relationship was found between BMI and noncardia gastric adenocarcinomas[10]. Mast Lindbladle et al.(1994-2001) conducted the same study on 809 patients with esophageal carcinoma and gastric carcinoma, whereby a positive relationship was found between BMI and esophageal carcinoma and

gastric carcinoma and no significant relationship was found between BMI and non-cardia carcinoma[11]. Yet, in the present research, no relationship was found in cardia or non-cardia gastric cancer, which this relationship was not significant. With regard to what mentioned above, it can attribute the differences in the present research with rest of studies to the difference in diet, socioeconomic level, racial difference and geographical conditions of the population under study; further low BMI in referral time can be due to weight loss due to Dysphagia and cancer related cachexia. Y.Tomiki conducted a case-control study on 631 patients with gastrointestinal cancer and the same number of control group, in which the relationship between this cancer and serum level of lipids was examined. In this study, level of TC and LDL-C has been lower in patient group than control group showing the level equal to 15 mg/dl, which this decrease has been significant in the groups with stomach and colorectal cancers, yet it has not been significant in esophageal cancer[7]. In the present research, an increase of serum TC and TG level before treatment than after treatment has been obtained about 17 mg/dl and 10 mg/dl which both were significant. An increase has been witnessed in HDL level which has not been significant. This increase in TC and HDL level has been the same with the mentioned study, yet increase in TG level is different from the present study. Concerning level of lipids at the progressive stages of disease in the present research, it was specified that TC and HDL level in groups of metastatic gastric cancer has reduced than groups of non-metastatic gastric cancer, found insignificant. TG level in groups of metastatic gastric cancer was increased to 15 mg/dl than groups of non-metastatic gastric cancer, found different with the present study. In the present research, changes in level of lipids before and after treatment were made similar to the study by Jack PhD, such that TC level increased after treatment with a significant difference and HDL-C and LDL-C levels increased lower, found without a significant difference. In the present research, TG level was shown with a high increase, found with a significant difference. Concerning the linkage between level of lipids and stage of disease, extent of changes in TC and HDL-C in groups of metastatic gastric cancer and groups of non-metastatic gastric cancer has been the same as the study by Jack PhD et al, yet changes in LDL-C have been different from their study, so that level of LDL in both

group was found without a significant difference in this study. Serum level of TG in groups of metastatic gastric cancer has been higher than groups of non-metastatic gastric cancer, found with a significant difference. In the present research, 62.1% of the patients with gastric cancer had a lower HDL level before treatment, which this level was increased after treatment with a significant difference($P<0.02$). yet, with regard to the study by Dr Sharsfi et al among 2941 individuals in the population at the age group above 20 years in west north of Iran in terms of examination of lipid disorders, it was specified that low HDL-C has had the highest prevalence to the level of 73%. Hence, it cannot know the obtained HDL level in the present research as one of the causes for incidence of gastric cancer in this region. Yet, HDL level was increased in a significant level after treating these patients, it can represent outcomes of treatment in gastric cancer. In addition, this change raises gastric cancer as the cause of reduction in HDL. With regard to the aforementioned studies and other similar studies as well as the recent study on the causes for increase in incidence of low TC level among the patients with gastric cancer, it can mentioned the factors below: the results might be random; Hypercholesterolemia might be an inducer of risk of gastric cancer; Hypercholesterolemia can be due to pathological outcome of cancer.

If Hypercholesterolemia is considered as a carcinogenic factor or as a factor contributing in increasing cancer risk, not definite mechanism has been described for this. Low TC levels recorded in most of studies might reflect chancer in a latent or pre-clinical form, which this hypothesis is accepting[7].

**REFRENCES**

**[1]** A. Etemadi, A. Golozar, F. Kamangar, N. D. Freedman, R. Shakeri, C. Matthews, F. Islami, P. Boffetta, P. Brennan, C. C. Abnet, R. Malekzadeh & S. M. Dawsey. Large body size and sedentary lifestyle during childhood and early adulthood and esophageal squamous cell carcinoma in a high-risk population.Annals of Oncology doi, November 2, 2011:10.1093/annonc/mdr494:1-8

**[2]** Reza Malekzadeh MD•*, Mohammad H. Derakhshan MD**, Zinab Malekzadeh MD* Gastric Cancer in Iran: Epidemiology and Risk Factors. Archives of Iranian Medicine,

Volume 12, Number 6, 2009: 576 – 583

**[3]** Noushin Taghavi, Dariush Nasrollahzadeh, Shahin Merat, Abbas Yazdanbod, Mahshid Hormazdi, Masoud Sotoudeh, Shahriar Semnani, Farhad Eslami, Haji-Amin Marjani, Saman Fahimi, Hooman Khademi, Reza Malekzadeh. Epidemiology of upper gastrointestinal cancers in Iran: A sub site analysis of 761 case .World J Gastroenterol 2007 October 28; 13(40): 5367-5370

**[4]** Naghavi M. Death in eighteen provinces of Iran. In: Annual report of Iran Ministry of Health and Medical Education. Tehran: Ministry of Health and Medical Education, 2001: 127-135.

**[5]** Carcinoma of the stomach: A review of epidemiology, pathogenesis, molecular genetics and chemoprevention.World J Gastrointest Oncol2012 July 15; 4(7): 156-169 ISSN 1948-5204 (online) © 2012 Baishideng. All rights reserved.

**[6]** Robert.j.mayer. Harrison's Principle of Internal Medicine.18 th ed. Vol.2 ,McGraw-Hill, New York, 2012,p: 765.

**[7]** Y. Tomiki1, S. Suda1, M. Tanaka1, A. Okuzawa1, M. Matsuda1. et.al. Reduced Low-Density-Lipoprotein Cholesterol Causing Low Serum Cholesterol Levels in Gastrointestinal Cancer. A Case Control Study. J. Exp. Clin. Cancer Res., 23, 2, 2004:233-240.

**[8]** Health and welfare statistics association: Measures oflifestyle-related diseases. Journal of Health and Welfare Statistics 49:88-98, 2002. (In Japanese)

**[9]** Jesper Lagergren, MD, PhD; Reinhold Bergstro¨m, PhD; and Olof Nyre´n, MD, PhD.Association between Body Mass and Adenocarcinoma of the Esophagus and Gastric Cardia. 1999 American College of Physicians–American Society of Internal Medicine ;130:883-890.

**[10]** *Wong-Ho Chow, William J. Blo,t Thomas L. Vaughan, Harvey A.*et.al. Body Mass Index and Risk of Adenocarcinomas of the Esophagus and Gastric Cardia Journal of the National Cancer Institute, Vol. 90, No. 2, January 21, 1998*:150-155.*,

**[11]** Mats Lindblad1,*, Luis A. Garcı´a Rodrı´guez2 & Jesper Lagergren1,3.Body mass, tobacco and alcohol and risk of esophageal, gastric cardia, and gastric non-cardia adenocarcinoma among men and women in a nested case-control study.Cancer Causes and Control (2005) 16:285–294

**[12]** C. L. Donohoe, G. P. Pidgeon, J. Lysaght and J. V. Reynolds.Obesity and gastrointestinal cancer. *British Journal of Surgery* 2010; 97: 628–642

**[13]** Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of U.S. adults. *N. Engl. J. Med.* 2003; 348: 1625–38.

**[14]** van Duijnhoven FJ, Bueno-De-Mesquita HB, Calligaro M *et al*. Blood lipid and lipoprotein concentrations and colorectal cancer risk in the European Prospective Investigation into Cancer and Nutrition. *Gut* 2011; 60: 1094–102.

**[15]** Takafumi Tamura, Satoshi Inagawa, Katsuji Hisakura, Tsuyoshi Enomoto, Nobuhiro Ohkohchi

**[16]** J Gastroenterol Hepatol. 2012;27(10):1635-1640.

**[17]** Keshtkar AA, Semnani S, Pourshams A et al. Pictogram use was validated for estimating individual's body mass index. J Clin Epidemiol 2010; 63(6): 655–659.