

## FOOD CONSUMPTION AND DIGESTIVE CANCERS IN THE PROVINCE OF BATNA

Aldjia Mihoubi\*, Ourida Alloui-Lombarkia, Bariza Zitouni

Food Science Laboratory. Institute of the Veterinary Sciences and Agronomic Sciences  
Hadj Lakhdar University, Batna1.Batna.05000 Algeria

\*E-mail: [mihoubialdjia@yahoo.fr](mailto:mihoubialdjia@yahoo.fr)

### Abstract

*The aim of this study is to determine some food factors role on different stages of digestive carcinogenicity. The case-control study was carried out in Batna province (Algeria). 115 cases incidents of digestive cancers(60 men and 55 women),with median age of 59 years, were diagnosed between 1<sup>st</sup> January 2011 and 31 December 2012, compared to 230 cancers witnesses(83 men and 147 women).*

*The respondents were subjected to a semi-quantitative food questionnaire. The bi-varied and multi-varied results analysis shown a significant link with risk decrease between the breakfast consumption of tea (OR=0.50) and milk (OR=0.42), also the raw vegetables consumption (OR=0.56) and studies cancers.*

*On the other hand, a significant relationship with a risk increase between digestive cancers and some factors related to food stuff such as the consumption of "gueddid"(OR=4.91), adding salt to cooked foods (OR=4.18), cooking modes, frying (OR=12.90), preservation modes, the use of butter or "smen" in cooking food, the use of oils in frying for 4 times with re-using it (OR=3.98) and the number of meals that are more than 3 a day.*

*For that, the Batna inhabitants need to change their food habits by decreasing the consumption of certain traditional food (gueddid and smen) and increasing fruits, vegetables, milk and tea consumption.*

**Keywords:** Prospective study, colon cancer, stomach cancer, food, cooking modes, preservation modes, frying oil.

Received: 02.11.2017

Received in revised form: 09.01.2018

Accepted: 12.01.2018

## 1. INTRODUCTION

Cancer is a multifactor chronic disease. Genetic, hormonal, environmental factors may contribute in cancer development and act at different carcinogenicity phases (WCRF/AICR, 2007). Worldwide, the digestive cancers present a major public health problem for their frequency and their severity.

The environment responsibility in some cancers especially the digestive ones, is a fact that is well established today (Berrino et al., 1999). The descriptive epidemiology and the experimental studies suggest that, among the environment factors, food plays an important role in the digestive cancers etiology. Since about twenty years, numerous analytical epidemiological studies tried to specify what the food factors occurring in the digestive carcinogenesis (Fraser, 1999).

Doll et al. (1981) have admits that 60-80% of all the cancers are owed to environmental factors. The temporal and geographical variations in the incidence of the human cancers majority support strongly this

hypothesis. Food and nutritional factors have a role established in several examples of cancer appearance (nitrosamines and gastric cancers, low consumption of fibers, high consumption of fats, proteins and colorectal cancers, alcoholic consumption and Upper aérodigestive tract cancers.

A case-control study in Switzerland showed the food groups influence on the oesophagus cancer where more associations were apparently stronger in the case of the heavy alcohol drinkers and suggesting an interaction between poor diet and alcohol drinking in oesophageal carcinogenesis (Levi et al., 2000). Most studies on diet and gastric cancer have considered the various food items role. Inverse relations with fruit and vegetable consumption and positive associations with starchy foods and meats were found (La Vecchia et al., 2000; Adami et al., 2008). An Italian case-control study established a significant inverse association between various measures of food diversity, particularly of vegetables and fruit diversity, and gastric cancer risk (La Vecchia et al., 1997). Some evidence suggests that diets

high in animal fat or red meat may increase the colon cancer risk, whereas high intake of fiber or vegetables may be protective. Frequently, red meat intake has been a stronger risk factor than total fat (Giovannucci et al., 1994).

Comparing the incidence rates between various world countries, considerable differences are noticed. When the subjects migrate from a country at low risk to a country at high risk, their rate of cancer joins that of the host country in one or two generations according to the cancerous locations (IARC, 2004; Olshansky et al, 2005).

In order to study the relationship between food consumption and some digestive system cancers and to ameliorate their prevention in Batna province, a case-control study based on detailed questionnaire in function of the subjects-age and sex, was conducted.

The aim of this survey is to identify food risk factors related to digestive cancers development and then to study the epidemiological association between these factors and some cancer types. The relation studied between certain food factors and the some digestive cancers appearance (stomach, gall-bladder and colon) reveals the existence of different risk factors according to the tumor location. Batna city is the most prevailing city of the digestive cancers at the national level. Also, any study was realized in this region to establish the link between the food risk factor and the digestive cancers.

## 2. MATERIALS AND METHODS

It is an epidemiological survey carried out on 115 case incidents of digestive system cancers; oesophagus, stomach, colon, pancreas, liver and gall bladder, diagnosed between 1<sup>st</sup> January 2011 and 31 December 2012, living in Batna compared to 230 witnesses. The case and their witnesses have been respondent in the same period in the Batna Hospital (CHU). The participants to this survey were submitted to a semi quantitative questionnaire about food history. The first describes the subject civil status (age and sex) and the second one describes their food consumption. The cases

and their witnesses were investigated for the same period or at the level of the University Hospital of Batna either at the level of the residence places of witnesses. A questionnaire is established according to the same structure of that used during both inquiries led in Algeria: step survey by the WHO, (2006) as well as the forward-looking study on the environmental factors of the cancer of Rhinopharynx, Prevention and early screening to Sétif (Laouamri, 1998) and the study of the relation between certain food factors and the colorectal tumors risk in France (Kesse, 2002). Three analysis types are made, a uni-variate analysis (study distribution population according to their sex and age), a bi-variate analysis (food consumption frequencies during day meals, cooking and preservation modes, the use of fats in cooking food stuffs and frying oils, also the number of day meals) and multivariate analysis (factorial analysis of correspondences). The statistical analysis was carried out with the help of Epi info software and XLSTAT 2009.

## 3. RESULTS AND DISCUSSION

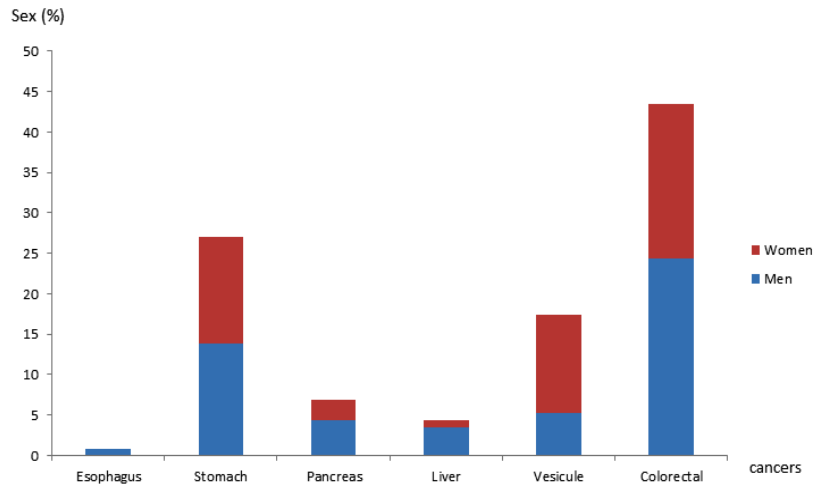
### 3.1 Univariate analysis

#### ➤ Participants sex's and age's distribution

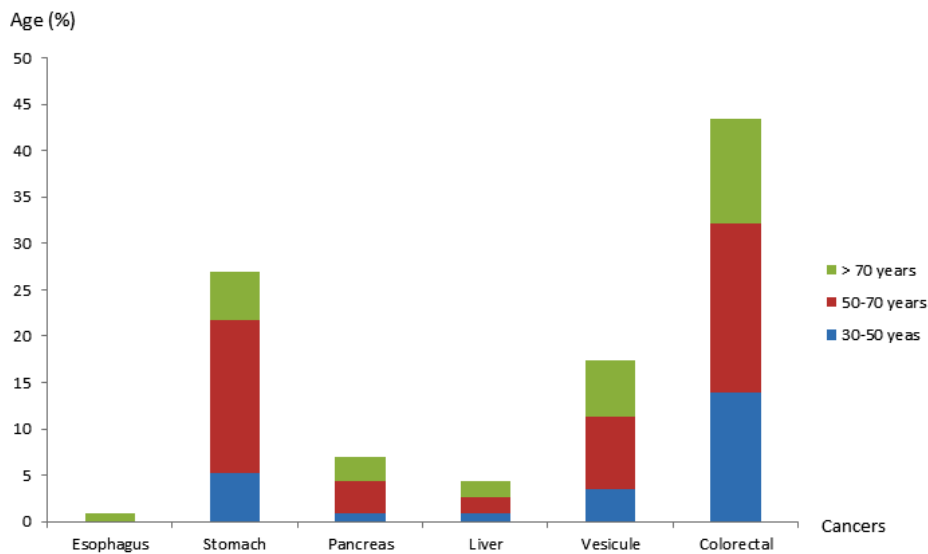
The 115 digestive cancer cases present, 43% colorectal cancer, 26,95% stomach cancer, 17,93% vesicle cancer, 6,95% pancreas cancer, 4,37% liver cancer and 0,87% oesophagus cancer. The digestive cancer cases were distributed between 60 men (52,18%) and 55 women (47,81%). The colorectal cancer has a masculine predominance with 24,34% cases against 19.13% of feminine cases. For the gall bladder (vesicle), there is a clear feminine predominance with 12.17% versus 5.21% of men (Figure 1).

The participant's age varied between 30 to 70 years old and up with the average age of 59 years (Figure 2).

These results are similar to those of developed countries where the colorectal cancer ranks the first among digestive cancers.



**Figure 1.** Distribution of the study population according to the sex and the site of the tumor localization



**Figure2.** Distribution of the study population according to the age and the site of the tumor localization

In France, for example, this cancer type presents about 15% of malignant tumours (Giacosa, Hill, 1998); its frequency is raised in most of occidental countries with a life good level. In the United Kingdom, it linked to colorectal cancer mortality come second at the man's and in third at the women (La Vecchia, 2004). There is only very modest one socioeconomic gradient for the colorectal cancer and little difference between cities and countryside, although somewhere else in

Europe, the disease tends to be more frequent in urban area (Hill et al., 1994). Concerning the gastric cancer, our results were near to those found by cancers register in Oran, Algiers and Serif, where it is ranked third after bronco-pulmonary cancer and bladder cancer (Laouamri et al., 2002). Its importance in Africa is linked to diet and to pre-cancerous lesions. Salted, fried and smoked foods are favoring factors of gastric cancer (Peghini et al., 1990).

### 3.2 Bivariate analysis

#### ➤ Frequent Foodstuff consumption

The disease risk estimation showed a significant risk decrease relationship with 50% for the tea and 42% for milk and its derivatives consumption. In an ecologic study comparing twenty countries, a protecting effect of tea consuming on gastric cancer risk was put in evidence. According to Meta-analysis made by WCRF/AICR in 2007, the milk consumption is associated in a probable way with colorectal cancer risk reduction (Boutron-Ruault et al., 1996).

For the mutton, the analysis shows a non-significant link with the risk increase from 33 to 38%. Even though for beef, poultry and fish, the results are significant with a risk reduction and agree with the others studies (Table1).

Several definitions were used to characterize meats (red and others), integrating cooked or prepared meats. In addition, it is difficult to know if the effect is caused either by meat itself or its cooking mode.

About one hundred surveys case-witnesses and cohort study examined the relation between the meat consumption and the colorectal cancer risk. The half of the studies highlighted a relative risk of colorectal cancer upper to 1, 5 (that is a risk increased by 50 %) at the important meat consumers compared with the low consumers. In thirty studies, this relative risk was between 0.75 and 1.5, and statistically non-significant (Norat et al., 2002).

Raw vegetables frequent consumption (crudités) by the participants is significant with a decrease of digestive cancer risk with 56%.

**Table1. Association between digestive cancer risk and food consumption with different day meals**

	Cases	Control	X <sub>2</sub>	p	OR	IC for 95%
<b>Tea</b>						
Never	68	118	-	-	-	-
Less frequent	15	52	4.49	0.05	<b>0.50</b>	0.25-1.00
More frequent	18	60	4.55	0.05	<b>0.52</b>	0.27-0.99
<b>Guessed</b>						
Never	44	144	-	-	-	-
Less frequent	15	58	0.25	NS	0.85	0.41-1.71
More frequent	42	28	30.74	<0.001	<b>4.91</b>	2.63-9.92
<b>Poultry</b>						
Never	13	26	-	-	-	-
Less frequent	22	105	4.60	0.05	<b>0.42</b>	0.17-1.02
More frequent	66	99	0.59	NS	1.33	0.60-2.97
<b>Fish</b>						
Never	47	19	-	-	-	-
Less frequent	32	159	73.98	<0.001	0.07	0.03-0.15
More frequent	34	52	20.52	<0.001	<b>0.70</b>	0.05-0.44
<b>Mutton</b>						
Never	8	24	-	-	-	-
Less frequent	47	102	0.53	NS	1.38	0.54-3.63
More frequent	46	104	0.41	NS	1.33	0.52-3.49
<b>Cooked vegetables</b>						
Never	19	73	-	-	-	-
Less frequent	16	61	0	NS	1.01	0.45-2.26
More frequent	66	96	10.63	<0.001	<b>2.64</b>	1.40-5.01
<b>salt addition</b>						
Yes	84	60	41.28	<0.001	<b>4.18</b>	2.61-6.70
No	57	170				

X<sub>2</sub>= Chi two squared, P= Error probability, OR= Odds Ratio, IC= Confidence interval, NS= no significant  
Never: no consumption, less frequent consumption: once to three times a month; more frequent consumption: once to seven times a week

The vegetables or fruits protecting role is found in eighteen control case studies per 22 made in different region of the world. Some studies suggest that the protecting role is due to cruciferous via their wealth in phenolic components (Cottet et al., 2004). The protecting role seems to be clear in raw vegetables, the alliaceous, green vegetables, and citreous fruits because they are rich in antioxidant, vitamins, folates, high fiber food, phytates and in indoles.

A Japanese study suggests that the reduction of the gastric cancer incidence is due to the fresh fruit and vegetables consumption without an overput of salt (WCRF/AICR, 1997).

The cooked vegetables consumption shows a risk increase of 2.64. This risk is higher in association with vegetables cooking mode. In a study carried out in France in Marseille, the protective role of vegetables was noticed only for the colon cancer (Sandler et al, 1993), while in Belgium, at the same time, it was noted for the colon cancer and the rectum (Tuyns et al., 1988). In this study, the effect seems to exist as well with the raw vegetables as with the cooked vegetables. A number of studies found an inverse relation marked enough with the vegetables consumption or the vegetable fibers consumption (Francheschi et al., 1997; Ghadirian et al., 1997; Levi et al., 1998).

A significant relationship between digestive cancers and salt addition to cooked food with a risk of 4.18 times is noticed. This result is similar to different studies where the salt specific role was studied. It has been admitted as a risk factor of stomach cancer jointly or independently of salted food consumption.

The stomach cancer risk was increased from 1.5 to 6.2 for subjects who often add salt to their food (La Vecchia et al., 1987). Concerning the frequent starchy food consumption such as dried vegetables and rice, the relationship is significant with risk reduction (22 to 50%. The frequent pasta and potatoes consumption is no significant, with risk increase from 2 to 3 times. According to studies made in Latin countries, most of the control cases shown positive relationship between refined cereal products and the risk of colorectal cancer. According to these studies, there is an increased risk when consuming pasta, rice, bread, cereals and pastry (Boutron-Ruault et al., 1999).

#### ► Cooking and food stuff preservation modes

Meats cooking modes in oven and in grillers are significant with risk reduction of 39 to 49%. Cooking vegetables in sauce and frying is significant and multiplies the risk of the disease by 4 to 12 times (Table 2).

**Table2. Cooking, food preservation methods and digestive cancers risk**

	Case	Control	X <sub>2</sub>	p	OR	ICfor95%
<b>Cooking mode</b>						
<b>In sauce</b>						
Yes	87	137	22.65	<0.001	<b>4.22</b>	2.18-8.27
No	14	93				
<b>In oven</b>						
Yes	9	54	9.87	<0.001	<b>0.32</b>	0.14-0.70
No	92	174				
<b>Frying</b>						
Yes	93	109	58.93	<0.001	<b>12.90</b>	5.74-30.15
No	8	121				
<b>Preservation mode</b>						
<b>Brining</b>						
Yes	71	69	35.69	<0.001	<b>4.14</b>	2.50-6.89
No	40	161				
<b>Curing</b>						
Yes	66	68	5.93	0.02	<b>4.49</b>	0.25-0.91
No	35	162				

X<sub>2</sub>= Chi two squared, P= Error probability, OR= Odds Ratio, IC= Confidence interval, NS= no significant

Several epidemiological studies indicate a positive association between the food consumption prepared by high temperature mode (grill, barbecue, frying and so on) and stomach, colon and rectum cancers. The studies having examined the cooking mode are among 12 (9 studies case-witnesses and 3 cohort studies) (Lang, 1994 ; Sinha, 1999).

The results concerning the association between the occurrence of the colorectal cancer and the consumption of boiled or fried meat presented heterogeneous results but the consumption of smoked or barbecued meats (3 studies case-witnesses) seems associated with an increase of the risk of colorectal tumors. The risks were respectively 2,08 (IC 95 % = 1,05-4,12) and 1,29 (IC 95 % = 1,08-1,54) for an increase of

10g intake (Lang et al., 1994; Sinha et al., 1999).

Cooking vegetables in boiling in water destroys 66% of phenolic components, steaming conserves better the anti-oxidant substances (Rungapamestry, 2006). The consuming of preserved food by curing of brining, especially salted and dried meat “Gueddid” on the occurrence of digestive cancers is significant with risk increases in odds ratio respectively 4.14, 4.49 and 4.9 (Table 2). In reverse, using freezing to preserve food reduces the risk of disease of 48%. In fact, most studies have shown that the frequent fish consumption, meat and vegetables conserved by salting are associated to a risk increase of a stomach cancer development (Riboli, Norat, 2001).

**Table3. Association between digestive cancer risk, fatty substance used in cooking and the number of used frying oils**

	Cases	Control	X <sub>2</sub>	p	OR	ICfor95%
<b>Fats</b>						
<b>Vegetable oil</b>						
Never	3	8	-			
1 year ago	13	26	0.34	NS	1.33	0.25-7.68
20 years ago	84	156	0.02	NS	1.14	0.27-5.58
<b>Salted butter</b>						
Never	58	109	-			
1 year ago	2	3	0.19	NS	<b>2.40</b>	0.27-18.20
20 years ago	41	18	52.14	<0.001	<b>8.21</b>	4.12-16.13
<b>Smen</b>						
Never	52	197				
1 year ago	4	23	0.45	NS	<b>0.60</b>	0.17-1.94
20 years ago	45	28	39.10	<0.001	<b>5.53</b>	3.04-10.12
<b>Frying oils</b>						
<b>1 time</b>						
Yes	19	54	0.89	NS	0.76	0.40-1.40
No	82	176				
<b>2 times</b>						
Yes	26	78	3.89	NS	0.60	0.34-1.03
No	85	152				
<b>4 times</b>						
Yes	32	26	22.54	<0.001	<b>3.98</b>	3.98-7.57
No	69	206				
<b>More than 4 times</b>						
Yes	16	34	0.06	NS	1.09	0.54-2.16
No	85	196				

X<sub>2</sub> - Chi two squared, P - Error probability, OR - Odds Ratio, IC - Confidence interval, NS - no significant  
1 year ago: consumption for 1 year, 20 years ago: consumption during 20 years

➤ **Fat substances and frying oils used in cooking food**

The results of this analysis show that the use of salted butter or vegetable fat “smen” is significantly related to the disease especially in case of extended use with respectively odds ratios 8.21 and 5.53 (Table 3).

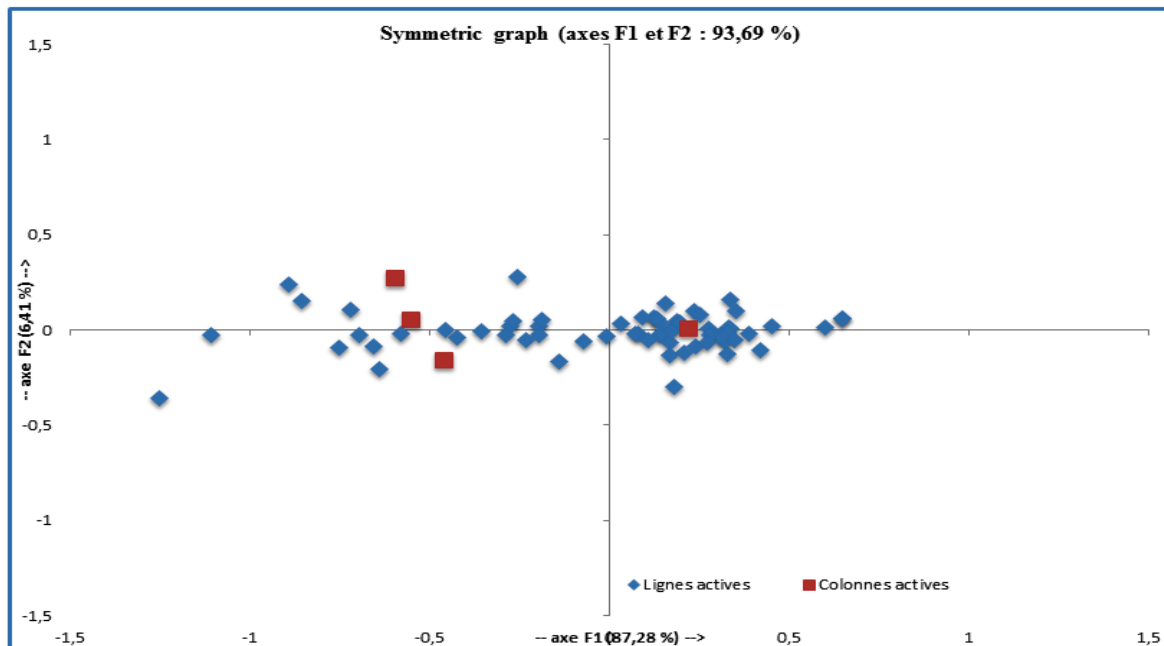
The accumulated epidemiological data suggest that high consumption of fats would be a possible risk factor of colon and rectum cancers (Lipkin et al., 1999). The prospective study of Willet showed a strong causal effect of the animal fat, a not significant effect of the vegetable fat and a protective effect of the consumption of fishes on the appearance of cancer (Willett et al., 1990).

It is noticed that the use of frying oils 4 times with the re-using them in cooking other food is related with disease risk increase by 4 times more (Table 3). Higginson reported at the sick reached of a stomach cancer an important consumption of fried food and less fruits and

vegetables (Higginson, 1988). The formation of harmful component in frying oils is important with the rise of temperature and time of cooking, these generate the aromatic molecules and flavors that give birth to Maillard component that are carcinogenic. The excessive use of the same frying oil for several times may also provoke rankness and generate the formation of acryl amides known for their carcinogenic effects (Birlouez, 2008; Boutron-Ruault et al., 2001).

➤ **Number of meals a day**

A number of meals superior to 3 a day is related significantly to digestive cancers and increases the risk by 4.88 (IC at 95% = 1.87 - 12.93). The colorectal cancer risk increases with caloric supply in 20 case control studies per 26 studies. The caloric excess and the sedentarily life could act as a promoting factor of carcinogenicity via hyper-insulinism and resistance to insulin (Giovannucci, 1995).



**Figure 3.** The projection of the modalities of variables on factors 1 and 2 of the A.F.C associated to the digestive cancers (stomach cancer, gall-bladder cancer and colorectal cancer) according to the grouping of three cancers and witnesses

**Active line.** Represent on the graph the individuals (variables studied)

**Active columns.** Represent on the graph the observations (witnesses and three studied type of cancers)

**Table 4. 3D visualization of variables used in the factorial analysis of the correspondences made on 101 cases and 230 witnesses with XLSTAT.**

Type	Denomination	F1	F2	F3	Sum of the contributions
Column	Witnesses	0,218	0,005	0,001	29,861
	Stomach cancer	-0,551	0,057	0,238	90,883
	Vésicule cancer	-0,598	0,270	-0,198	94,355
	Colorectal cancer	-0,458	-0,160	-0,074	84,901
Line					
	Tea consumption (Less frequent)	0,168	-0,064	0,113	2,364
	Tea consumption (More frequent)	0,178	-0,299	-0,092	14,408
	Milk consumption (More frequent)	0,602	0,017	-0,009	2,085
	Butter consumption (More frequent)	0,422	-0,104	-0,027	2,863
	Egg consumption (More frequent)	0,335	0,007	-0,079	2,407
	Beef meat consumption (More frequent)	0,331	0,016	-0,046	1,831
	Poultry consumption (less frequent)	0,274	0,006	0,052	1,931
	Gueddid consumption (More frequent)	-0,655	-0,084	0,066	5,536
	Fish consumption (less frequent)	0,328	-0,010	0,005	2,754
	Fish consumption (More frequent)	-0,071	-0,060	0,018	0,624
	Cooked green vegetables consumption (More frequent)	-0,234	-0,053	-0,024	2,202
	Potatoes consumption (less frequent)	0,279	-0,027	-0,040	1,543
	Salt addition	-0,276	0,019	0,085	2,543
	Cooking of meat fries	-0,188	0,051	0,070	3,203
	Cooking of meat in the oven	0,207	-0,118	-0,025	3,425
	Cooking of meat in the railing	0,272	-0,064	0,065	2,446
	Cooking of vegetables in sauce	-0,195	-0,023	0,006	1,385
	Cooking of vegetable in the oven	0,347	-0,049	-0,020	1,356
	Fried foods	-0,355	-0,004	0,019	3,584
	Fat consumption	-1,108	-0,025	-0,138	14,615
	Number of meal / day Less than 3 meals	0,389	-0,018	-0,049	1,248
	Number of meal / day More than 3 meals	-0,857	0,151	0,385	10,466
	Brine	-0,456	-0,001	-0,098	6,475
	Curing	-0,423	-0,040	0,082	5,316
	Freezing	0,070	-0,019	0,019	0,542
	Salted butter consumption For 20 years ago	-0,892	0,240	-0,003	12,609
	Margarine consumption For 20 years ago	0,352	0,102	0,093	3,907
	Vegetable fat « Smen » consumption (20 years ago)	-0,695	-0,024	-0,008	4,857
	Use of frying oils 4 times	-0,580	-0,018	0,021	2,583
	Raw vegetables consumption (More frequent)	0,125	0,065	0,014	1,170



### 3.3 Multivariate analysis (factorial analysis of correspondences)

For the purpose of studying the dependence between different risk factors, and in order to present subjects graphically according to food habits, we have submitted the table of these frequencies to a factorial analysis of correspondences (FAC).

Its principle is to calculate, from the data matrix expressing the different modality frequencies of studied variables. The values taken in the hypothesis or their distributions are independent. The gap between the matrix of data and the matrix of obtained independence supplies a matrix of écarts (residual matrix) which expresses the first factor of the analysis (factor1).

By repeating the previous algorithm, this gap can also get close by another proportional second factor matrix (factor 2). These two factors represent 93.96% of the total dispersion. 'Factor 1' representing 87.28% of inertia, essentially based on the following variables: butter and salt use in cooking since 20 years (-0.892), more than three meals a day (-0.857), using smen in cooking for 20 years (-0.695), more frequent consumption of gueddid (-0.655), the use of frying oil for 4 times with re-use (-0.580), food conservation by brine (-0.456) and preserving food by curing (-0.423). The factor 2 is representing 6.41% of total inertia. On the global FAC, it is noted that the individual's projection of the total sample in function of the following observations: gall bladder cancer (-0.598), stomach cancer (-0.551) and the colorectal cancer (-0.458) that are associated and oppose the witnesses (0.218) and the factors of the risk identified oppose the other factors with regard to the axis 1 (Fig. 3).

### 4. CONCLUSIONS

The use of salted butter and "smen" for 20 years in cooking food can cause the appearance of some gastrointestinal cancer (stomach cancer and vesicle cancer).

The "gueddid" consumption is higher among cases than among witnesses with a significant

relationship with the development of gastric and colorectal cancer.

The association between the use of frying oils four times with reuse and colorectal cancer is very linked with a risk of 4 times.

The food conservation by curing and brining has shown a significant link with the appearance of gastric cancer. Thus, use refrigerating and freezing as a mode of conservation of perishable food.

The consuming more than 3 meals a day is linked significantly to a risk increase of stomach and vesicle cancers.

As the conclusion, this study allowed us to show the existence of a relationship between the risk of contracting digestive cancer and exposure with certain food factors. For this we advise the Batna city inhabitants to change their food habits by decreasing the consumption of certain traditional food products.

### 5. REFERENCES

- [1] WCRF/ AICR. Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective. AICR., Washington DC., 2007;517 p.
- [2] Berrino F., Capocaccia R., Estève J. et al., Survival of cancer patients in Europe: The Eurocare-2 study. Lyon, France. IARC Sci. Pub., N° 151, 1999; 320.
- [3] Fraser G.E. Associations between diet and cancer, ischemic heart disease, and all-cause mortality in non-Hispani white California Seventh-day Adventists. Am. J. of Clin. Nutr., **70**(3):1999; 532S-538S.
- [4] Doll R., Peto R. The Causes of Cancer. Quantitative estimates of avoidable risks of cancer in the United States today. New York, NY: Oxford University Press. *J. Natl. Cancer Inst.*, **66** (6): 1981; 1191-1308.
- [5] Levi F., Pasche C., Lucchini F., Bosetti C., Franceschi S., Monnier P., La Vecchia C. Food groups and oesophageal cancer risk in Vaud, Switzerland. Eur. J. Cancer Prev., **9**(4): 2000; 257-263.
- [6] La Vecchia C., Franceschi S. Nutrition and gastric cancer with a focus on Europe. Eur. J. Cancer Prev., **9**: 2000; 291-295.
- [7] Adami H.O., Hunter D., Trichopoulos D., Nyrén O. Stomach cancer. In: Adami HO, Hunter D, Trichopoulos D, editors. Textbook of cancer epidemiology. New York: Oxford University Press; 2008; 239-274.
- [8] La Vecchia C., Muñoz S.E., Braga C., Fernández E., Decarli A. Diet diversity and gastric cancer. Int. J. Cancer., **72**:1997;255-257.

- [9] Giovannucci E., Rimm E.B., Stampfer M.J. Intake of fat, meat and fiber in relation to risk of colon cancer in men. *Cancer Res.*, **54**: 1994; 2390-2397.
- [10] IARC. Cancer Incidence in Five Continents, Vol. VI. IARC, Cancer Base No. 5. version 2.0, IARC Press, 2004, Lyon.
- [11] Olshansky S.J., Douglas J.P., Ronald C.H., Layden J., Bruce A.C., Brody J., Leonard H., Robert N.B., David B.A., David S.L. A potential decline in the expectancy in the United States in the 21st Century. *N. Eng. J. Med.*, **352** (11): 2005; 1138-1144.
- [12] OMS. Mesure des facteurs de risque des maladies non transmissibles dans deux wilayas pilotes en Algerie (Approche step "wise" de l'OMS), 2005. Rapport final.
- [13] Laouamri S., Etude prospective sur les facteurs environnementaux du cancer du rhino-pharynx. Prevention et depistage precoce. Thèse de doctorat INESSM de Constantine, 1998.
- [14] Kess E. Etude de la relation entre certains facteurs alimentaires et le risque de tumeurs colorectales. Thèse de Doctorat en Nutrition Humaine. INA, Paris, 2002 ; 170p.
- [15] Giocosa M., Hill M., Comportement alimentaire et cancer digestifs: *Rev. Evid. Sci. Acta Endoscopia.*, **28** (3) : 1998.
- [16] La Vecchia C. Mediterranean diet and cancer. *Public Health Nutr.*, **7**(7): 2004; 965-968.
- [17] Hill M.J., Giocosa A., Caygill C.P.J. *Epidemiology of Diet and Cancer*. Ellis Horwood Limited: West Sussex, England, **95**: 1994; 120- 21.
- [18] Laouamri S., Hamdi-Cherif M., Bedadra W., Laouamri A., Laifa L., Mahnane A. Incidence du cancer en Algerie. Données de registres et estimations, 2002.
- [19] Peghini M., Barabe P., Touze J. E., Morcillor J. Epidémiologie des Cancers du tube digestif au Sénégal : apport de 18000 endoscopies effectuées à l'Hopital principal de Dakkar. *Médec. Tropic.*, **50** (2): 1990; 205-208.
- [20] Boutron-Ruault M.C., Faivre J., Marteau P. Calcium, phosphorus, vitamin D, dairy products and colorectal carcinogenesis: A French case-control study. *Br. J. Cancer.*, **74**: 1996; 145-151.
- [21] Norat T., Lukanova A., Ferrari P., Riboli E. Meat consumption and colorectal cancer risk: dose-response metaanalysis of epidemiological studies. *Int. J. Cancer.*, **98**: 2002; 241-56.
- [22] Cottet V., Bonithon K., Faivre J. Prévention primaire des cancers du tube digestif. *EMC-Chirurgie.*, **1**: 2004; 32-46.
- [23] WCRF/ AICR. Food and Nutrition and Cancer Prevention: A global perspective. Washington DC, 1997.
- [24] Sandler R.S., Lyles C.M., Peipins L.A., McAuliffe C.A., Woosley J.T., Kupper L.L., Diet and risk of colorectal adenomas: macronutrients, cholesterol, and fiber. *J. Natl. Cancer Inst.* Jun 2; **85**(11): 1993; 884-891.
- [25] Tuyns A.J., Kaaks R., Healterman M. Colorectal cancer and the consumption of foods : a case-control study in Belgium. *Nutr. Cancer.*, **6** (11): 1988; 189-204.
- [26] Francheschi S., Favero A., La Vecchia C., Negri E., Conti E., Montella M. Food groups and risk of colorectal cancer in Italy. *Int. J. Cancer.*, **72**: 1997; 56-61.
- [27] Ghadirian P., Lacroix A., Maisonneuve P., Perret C., Potvin C., Gravel D., Bernard D., Boyle P., Nutritional factors and colon carcinoma: A case-control study involving French Canadians in Montreal, Quebec, Canada. *Cancer.*, **80** (5): 1997; 858-864.
- [28] Levi F., Pasche C., La Vecchia C., Lucchini F., Franceschi S. Food groups and colorectal cancer risk. *Br. J. Cancer.*, **79**(7-8): 1998; 1283-1287.
- [29] La Vecchia C., Negri E.O., Decarli A., D'Avanzo B., Franceschi S. A case-control study of diet and gastric cancer in northern Italy. *Int. J. Cancer.*, **40**: 1987; 484-489.
- [30] Boutron-Ruault M.C., Senesse P., Faivre J., Chatelain N., Belghiti C., Meance S. Foods as risk factors for colorectal cancer: A case-control study in Burgundy (France). *Eur. J. cancer Prev.*, **8**: 1999; 229-235.
- [31] Lang N.P., Butler M.A., Massengill J. Rapid metabolic phenotypes for acetyl transferase and cytochrome P4501A2 and putative exposure to food-borne heterocyclic amines increase the risk for colorectal cancer or polyps. *Cancer Epi. Biomarkers Prev.*, **3**: 1994; 675-82.
- [32] Sinha R., Chow W. H., Kulldorf M. Well-done, grilled red meat increases the risk of colorectal adenomas. *Cancer Res.*, **59**: 1999; 4320-4324.
- [33] Rungapamestry V. Changes in glucosinolate concentrations, myrosinase activity, and production of metabolites of glucosinolates in cabbage (*Brassica oleracea* Var. capitata) cooked for different durations. *J. Agric. Food. Chem.*, **54**(20): 2006; 628-637.
- [34] Riboli E., Norat T. Cancer prevention and diet: opportunities in Europe. *Public Health Nutr.*, **4** (2B): 2001; 475-484.
- [35] Lipkin M., Reddy B., Newmark H., Lamprecht S. A. Dietary factors in human colorectal cancer. *Annu. Rev. Nutr.*, **19**: 1999; 545-586.
- [36] Willett W.C., Stampfer M. J., Colditz G. A., Rosner B. A., Speizer F. E. Relation of meat, fat, and fiber intake to the risk of colon cancer in a prospective study among women. *N. Engl. J. Med.*, **323**: 1990; 1664-1672.
- [37] Higginson J. Etiological factors in gastrointestinal cancer in men. *J. Natl. Cancer Inst.*, **37**: 1988; 527-545.

- 
- [38] Birlouez I. Impact de la preparation et de la cuisson sur l'alimentation. Résumé de conférence, *Agora Nutrition, SIAL* Paris, France, 2008.
- [39] Boutron-Ruault M. C., Senesse P., Meance S., Belghiti C., Faivre J. Energy intake, body mass index, physical activity and the colorectal adenoma-carcinoma sequence. *Nutr.Cancer.*,**39**(1): 2001; 50-57.
- [40] Giovannucci E. Insulin and colon cancer. *Cancer Causes Control.*,**6** (2):1995; 164-179.