POLISH JOURNAL OF FOOD AND NUTRITION SCIENCES

www.pan.olsztyn.pl/journal/
e-mail: joan@pan.olsztyn.pl

Pol. J. Food Nutr. Sci.
2008, Vol. 58, No. 4, pp. 511-515

DIETARY TRENDS AND CANCER MORBIDITY RATES IN POLAND IN THE YEARS 1960–2005

Mirosław Jarosz, Włodzimierz Sekuła, Katarzyna Figurska, Ewa Rychlik

National Food and Nutrition Institute, Warsaw

Key words: dietary trends, cancer, relationship

The aim of the study was to examine associations between stomach, colorectal and pancreatic cancer morbidity rates and dietary trends in the long time period covering years since 1960 to 2005.

The source for cancer morbidity rates was data of the National Cancer Registry. Information on dietary pattern was derived from the National Food and Nutrition Institute database.

A negative correlation was found between vegetables, fruits and vitamin C consumption and stomach cancer incidence rates. The same applied to the refrigerators used by the households. A decline in these rates could also be linked to reduction in the use of the salt, although due to the scarcity of the data estimates of the correlation coefficients were not possible. Growing colorectal cancer incidence was related to increasing consumption of edible fats and decline in dietary fibre content. Growing pancreatic cancer incidence rate up to the half of the 1990s was probably associated with the increasing consumption of alcohol, edible fats and sugar.

INTRODUCTION

Malignant neoplasms, taken together, constitute, after cardiovascular diseases, the second most important cause of the mortality and morbidity in our country: a standardised cancer mortality rate for the total population amounted to 219.6/100,000 in 2005 and it contributed in over 25% to overall mortality whereas the proportion of deaths due to cardiovascular diseases was 45% [CSO, 2006a].

In contrast, however, to the mortality caused by the cardiovascular diseases which rate was subjected to decline since 1992 and was in 2005 approx. 37% lower in comparison to 1991, a death rate resulting from all types of malignant neoplasms taken together did not show a similar trend but its dynamics slowed down compared to the earlier time period [Zatonski *et al.,* 2008].

According to data derived from the National Cancer Registry, a standardised total cancer morbidity rate in men and women in 2005 was 253.6/100,000 and 191.8/100,000, respectively [National Cancer Registry, 2000]. It was over twofold higher for men in comparison to the beginning of the 1960s, while for women it increased by nearly 70%.

According to our hypothesis, the trends in the cancer mortality and morbidity rates were related, among other factors, to the trends in the diet of the Polish population and its evident improvement in the period of the political, social and economic transformation initiated in 1989 affected the dynamics of these rates.

The aim of the study was thus to examine associations between cancer morbidity rate and diet taking into consideration long time period and selected cancer types for which the effect of the food and nutrition is well documented and universally accepted, *i.e.* cancers of the stomach, colon and pancreas [Jarosz *et al.,* 2006].

MATERIAL AND METHODS

Data on cancer morbidity were derived from the National Cancer Registry administered by the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology in Warsaw [National Cancer Registry, 2000; Wojciechowska *et al.,* 2005]. They showed standardised cancer incidence rates for men and women covering individual years since 1960 to 2005.

The source of information on the dietary trends in the same time period was the database maintained for several decades by the Food Economics Department (now Independent Laboratory of the Economics of Food and Nutrition) of the National Food and Nutrition Institute [Sekuła *et al.,* 1996, 2005; Sekuła, 2001]. This database covers data derived from the national food balance sheets showing food quantities available for consumption per capita/year and resulting original calculations on the amounts of energy and nutrients available per capita/day.

The Pearson product moment correlation coefficients (*r)* were used as a measure of the degree of linear relationship between morbidity rates and selected dietary parameters.

RESULTS AND DISCUSSION

Stomach cancer

Its incidence already at the beginning of the observed period was much higher among men than women and

Author's address for correspondence: Prof. Mirosław Jarosz, National Food and Nutrition Institute, 61/63 Powsińska St., 02-903 Warsaw, Poland; tel. (48 22) 842 21 71; fax. (48 22) 842 11 03; e-mail: jarosz@izz.waw.pl

in 1960 the standardised rate for men was 25.1/100,000, exceeding over twice that for women (10.4/100,000) [National Cancer Registry, 2000].

Stomach cancer morbidity rates in both sex groups were growing through the decade of the 1960s. For men, this rate reached the record level in 1970 and was higher by 38% compared to 1960. In the same year, the record morbidity level was observed among women; the rate was higher by 39% than in 1960.

The incidence rate both in men and women followed declining trends after 1970. In consequence, in 2005 it was over twofold lower among women in comparison to 1960 while the rate among men decreased nearly two times.

Taking into account that stomach cancer is "one of the two major cancers, the risk of which is commonly agreed to be modified mainly by food and nutrition" [WCRF/AICR, 1997], authors examined correlations between incidence rates and consumption of these food products and nutrients which have either positive or negative impact on this type of cancer. In the first place, considering a convincing evidence that diet rich in vegetables and fruits protects against stomach cancer, attention was focused on these food groups.

A Pearson correlation coefficient was estimated taking into account the consumption of vegetables per capita in the years 1960-2005 and standardised stomach cancer incidence rates in the same time period. The value of this coefficient, r=-0.71 for males and r=-0.74 for females, confirms a very high inverse correlation between the two variables (Figure 1). Calculations in which trends in fruits consumption and in stomach cancer incidence rates were considered showed an equally high correlation, *i.e.* r=-0.71 and –0.70 for males and females, respectively. It was important to stress that still higher correlations, r=-0.80 both for men and women, were found in the case of vitamin C content in the diet.

Association between fruit and vegetable consumption was examined in quite numerous studies elsewhere. For example, in a prospective study of Swedish women and men, consumption of vegetables was inversely associated with the risk of gastric cancer [Larsson *et al.,* 2006b]. In a Canadian study, that evaluated associations between dietary pattern and gastric cancer risk, increased consumption of fruit and vegetables was associated with lessened risk [Campbell *et al.,* 2008].

A convincing evidence that "refrigeration protects against stomach cancer by facilitating year-round consumption of vegetables and fruits and probably by reducing need for salt as preservative" [WCRF/AICR, 1997] inclined the authors to focus their attention on the trend in the number of refrigerators in Polish households. Information in this respect used to be collected, among others, through the household budget surveys conducted annually in Poland. It was found that still at the beginning of the 1960s they were nearly uncommon as their number was 1.8 per 100 households. By 1970 their number increased to 37/100 households, meaning that they were owned only by approximately 1/3 of all households. Not earlier than at the beginning of the 1980s refrigerators were owned by over 90% of all households. Our estimates confirmed a very high inverse correlation, r=-0.69 and r=-0.79 for men and women, respectively, between the considered variables.

Evidence of the negative effect of the diet high in salt on stomach cancer resulted in attention of the authors focused on this substance [WCRF/AICR, 1997]. Unfortunately, data on its consumption per capita, covering individual years in the analysed time period were lacking. Such data were only available for the pre-war time period as they had been pub-

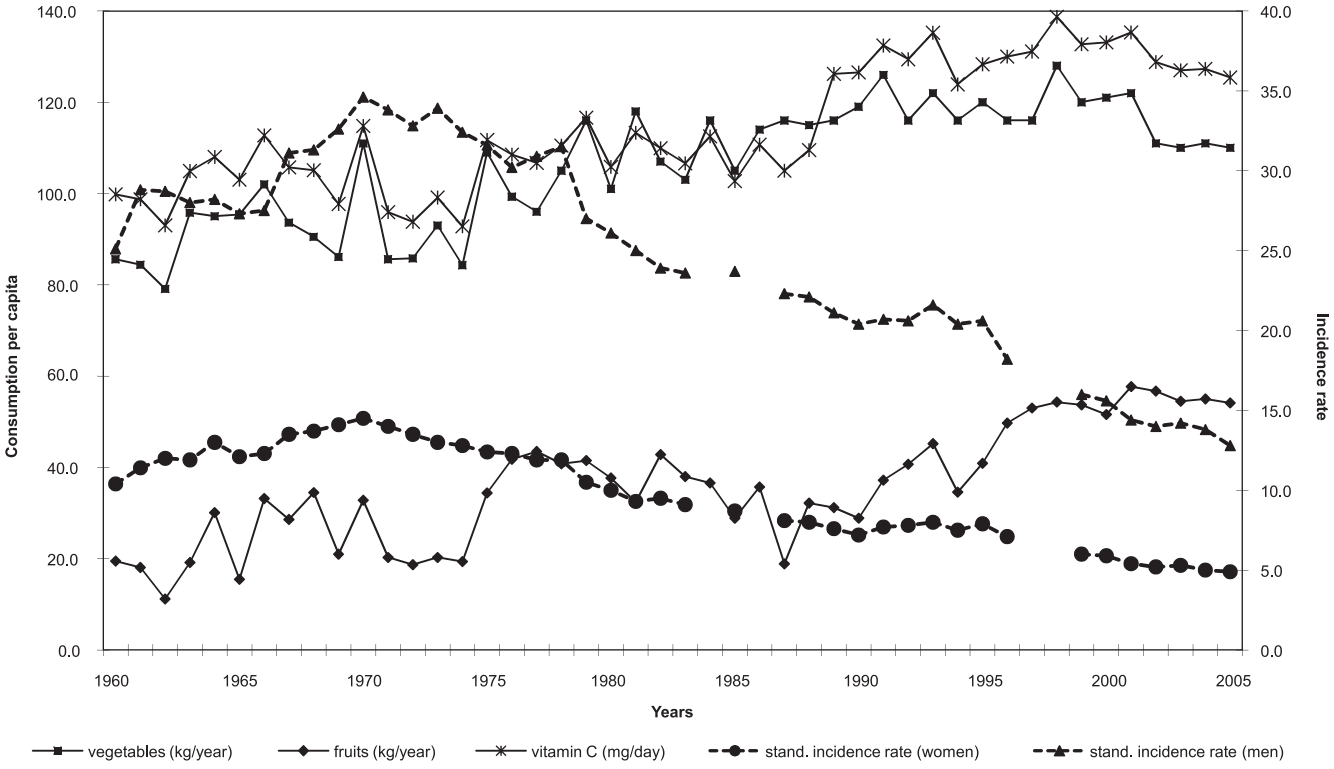

FIGURE 1. Vegetables, fruits and vitamin C consumption and stomach cancer incidence rates in the years 1960-2005.

lished then in the statistical yearbooks. This practice was discontinued after the war.

According to the information source mentioned above, average salt consumption was very high, amounting to 9.9 kg per capita in 1929 (27 g/day), and by 1938 declined somewhat to 8.4 kg [CSO, 1939]. It could be assumed that salt consumption remained for some post-war years at this very high level and then was subject to decline. It was shown in the household budget surveys conducted annually in Poland through the use of the representative method, due to which their results could be generalized to all households. According to these results, average salt consumption amounted to 3.0 kg per household member (8.2 g/day) in 2005 [CSO, 2006b]. It would be nearly three times lower compared to 1938. It should be explained, however, that data on food availability per capita, derived with the use of the food balance sheets methodology and with the use of the methodology of the household budget surveys are not fully comparable. In spite of this, a significant decline in the use of salt could not be questioned.

Colorectal cancer (colon and rectum)

This cancer type was rather not common at the beginning of the 1960s: the standardised incidence rate was 5.8/100,000 and 4.5/100.000, for men and women, respectively, in 1960 [National Cancer Registry, 2000].

Since that year, however, a constant growing trend has been observed in this rate both in men and women. It was more rapid in this first group. In consequence, the incidence rate for men reached 29.2/100,000 in 2005 while for women it amounted to 17.3/100,000.

It could be seen, in analysing dynamics of this trend, that it was subject to deceleration over the years 1991-2005 in comparison to the years 1961-1990: the average growth rate during these first three decades was 6.3% per year among men and 5.4% among women; over the next period, this rate declined to 5.0% and 3.1% per year for men and women. Still more significant deceleration, *i.e.* 2.8% and 1.2% per year among males and females, respectively, could be observed between 2000 and 2005. In our opinion, the course of these trends in the colorectal cancer incidence rates was associated with beneficial changes in the diet in the period of political, social and economic transformation initiated in 1989. They were manifested by the dramatic increase in the consumption of fruits, vegetable fats and oils accompanied by a considerable decline in the consumption of animal fats [Sekuła *et al.,* 1996, 2005; Sekuła, 2001].

Estimates of the correlations taking into account colorectal cancer incidence rates and consumption of some food groups and nutrients showed nearly a full inverse correlation, r=-0.89 and r=-0.92 for men and women, respectively, in the case of dietary fibre content in the diet (Figure 2). Similarly high, r=0.90 and 0.91, but positive correlations were found for the total edible fats consumption.

Correlation coefficients estimated taking into account saturated fatty acids, polyunsaturated fatty acids and fruits and vegetables consumption were rather inconclusive.

The effect of the diet on the colorectal cancer has been studied for many decades. For example, in the EPIC study, one of the largest prospective analyses of the association between nutrition and cancer, an inverse relationship was found between dietary fibre content in the diet and incidence of large bowel cancer [Bingham *et al.,* 2003]. The Japan Collaborative Cohort Study supported the potential protective effects of dietary fibre against colorectal cancer, mainly against colon cancer [Wakai *et al.,* 2007].

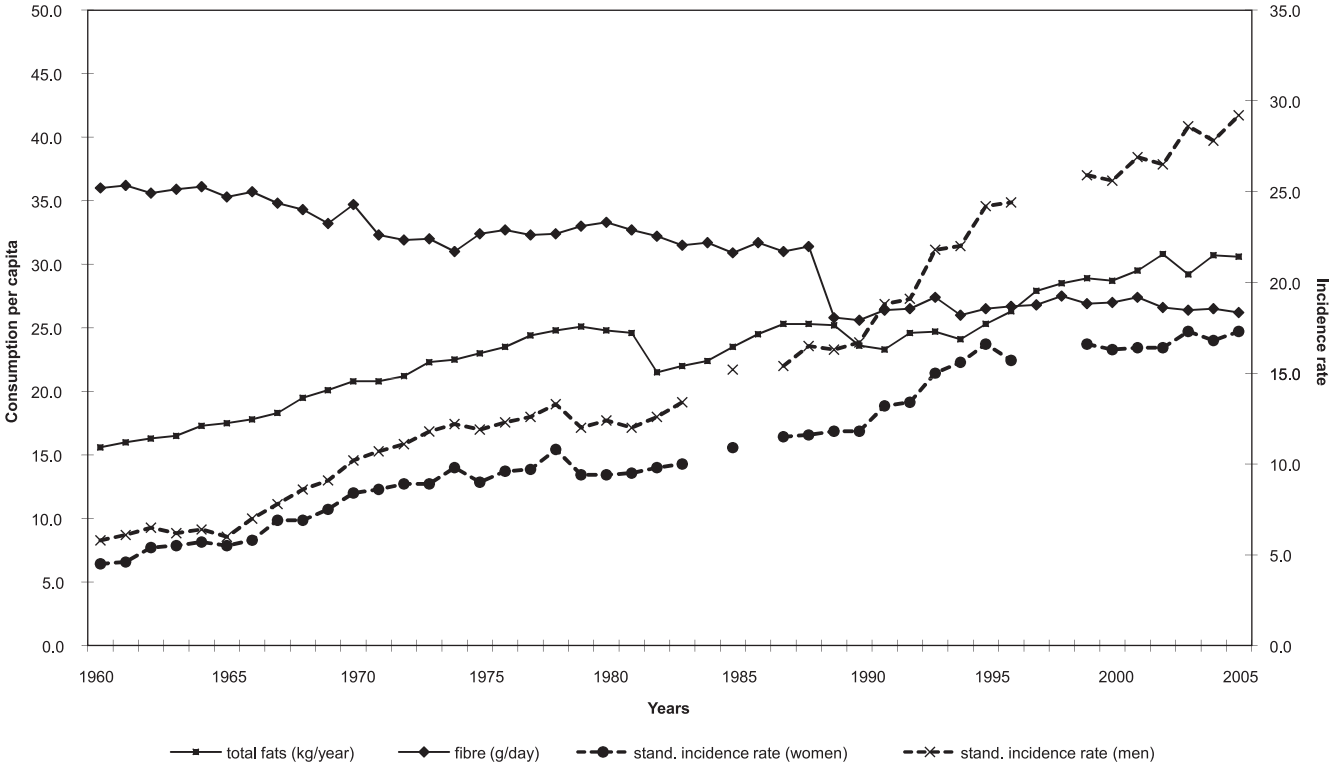

FIGURE 2. Total fats and fibre consumption and colorectal cancer incidence rates in the years1960-2005.

Pancreatic cancer

Incidence rates show that pancreatic cancer is more common in men than in women. Standardised rate for men was 6.3/100,000 in 2005 and was 50% higher in comparison to women [National Cancer Registry, 2000].

Morbidity for pancreatic cancer increased over the examined time period approx. three and half times among men and nearly four times among women. For both sexes, rapid dynamics in morbidity rate over 1960-1990 and its significant deceleration in a few next years could be seen. The rates both for males and females reached the peak levels in 1995 and followed, particularly among males, decline since then.

In identification of the factors responsible for the course of the pancreatic cancer incidence trend attention was focused first on alcohol [Ohba *et al.,* 1996]. Its total consumption registered per capita (spirits, beer, wine) was in the political, social and economic transformation period, initiated in 1989, much lower compared to earlier decades [CSO, 2006b]. Due to that, correlation coefficient, r, estimated for the whole examined period amounted to 0.69 both for males and females. It reflected, however, very high positive correlations, r=0.83 for males and r=0.82 for females in the period 1960-1990 and high negative correlations, r=-0.77 and –0.66 in the period of 1991-2005 (Figure 3).

Among dietary factors, edible fats, total and sugar and products consumption were selected for the estimates of the correlation.

Very high positive correlations, r=0.81 and 0.83 for males and females, respectively, were found for fats consumption and pancreatic cancer incidence rate when the whole time period was taken into account. However, there were nearly full positive correlations, r=0.95 (males) and r=0.93 (females) in the subperiod of 1960-1990 and very high, r=-0.89 and –0.88, negative correlations in the later one.

High positive correlations, r=0.68 for both sexes were shown in the case of sugar and products consumption considering all analysed years: they reflected, however, very high correlations, r=0.92 and 0.93 estimated for the years 1960--1990 and a very weak ones, r=0.13 (males) and 0.20 (females) for the years 1991-2005.

Data from a population-based case-control study conducted in California provided some evidence that fat and cholesterol may increase the risk of pancreatic cancer [Chan *et al.,* 2007].

According to the Multiethnic Cohort Study Hawaii, the risk of pancreatic cancer increased with higher intakes of total sugars, fructose, and sucrose [Nöthlings *et al.,* 2007]. Also the results of a prospective study conducted in Sweden confirmed that the high consumption of sugar and high-sugar foods might be associated with a greater risk of pancreatic cancer [Larsson *et al.,* 2006a].

CONCLUSIONS

1. An association was found between dietary trends and stomach cancer incidence rates. Correlation coefficients showed a very high negative correlation between vegetables, fruits and vitamin C consumption and incidence rate. Similar correlation was noted for the equipment of the Polish households in refrigerators. A decline in salt consumption could also have a positive effect on the morbidity decline.

2. Growing colon cancer incidence could result, among others, from increasing consumption of edible fats and from decline in dietary fibre content. Estimates of the correlation coefficient showed nearly a full inverse correlation with re-

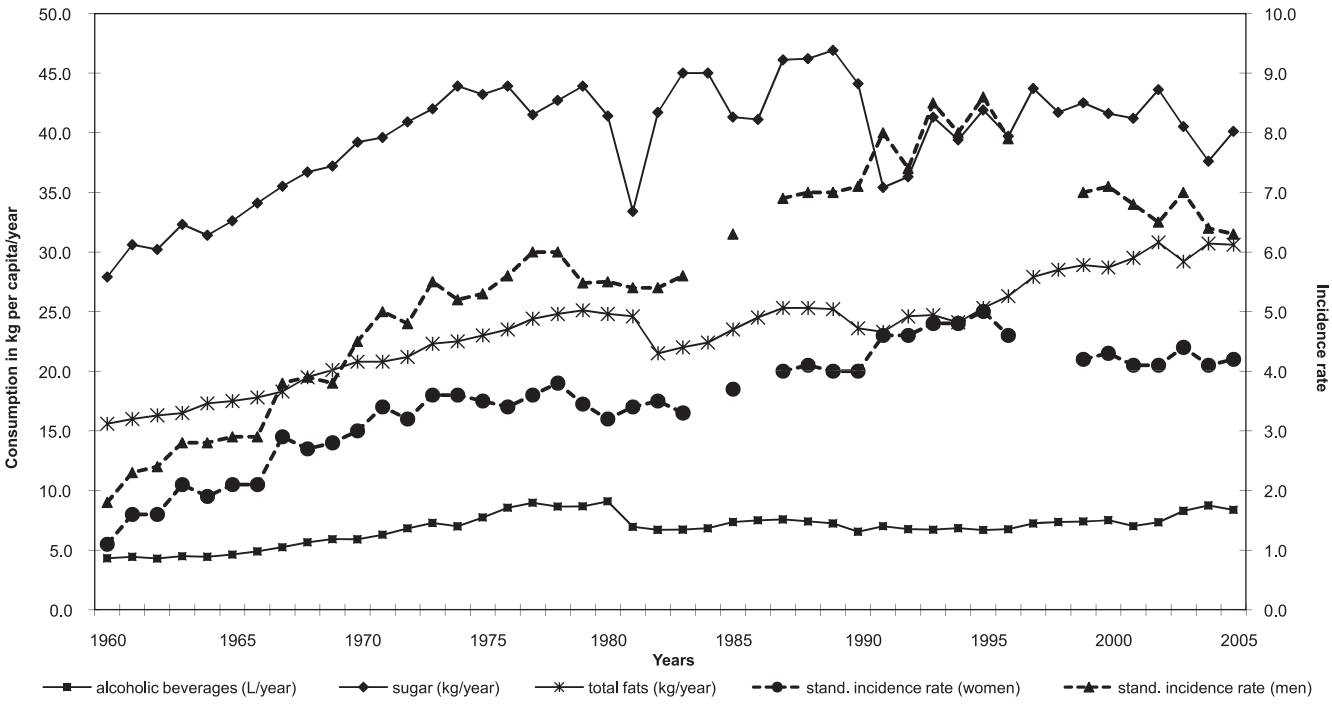

FIGURE 3. Alcoholic beverages, sugar and total fats consumption and pancreatic cancer incidence rates in the years1960-2005.

spect to fibre and a positive correlation with respect to edible fats.

3. Growing pancreatic cancer incidence rate up to the half of the 1990s was probably associated with the consumption of alcohol, edible fats and sugar. A positive correlation with pancreatic cancer incidence was found in the case of the mentioned groups.

4. There were dramatic, positive dietary changes in Poland since 1990, *i.e.* in the period of the political, social and economic transformation. They were seen as an important factor contributing to the significant decline in CVD mortality. Although no such effect could be observed in the trend in mortality and morbidity due to total cancers, dietary improvement was, in our opinion, responsible for the deceleration of the trends in colorectal and pancreatic cancers.

REFERENCES

1. Bingham S.A., Day N.E., Luben R., Ferrari P., Slimani N., Norat T., Clavel-Chapelon F., Kesse E., Nieters A., Boeing H., Tjønneland A., Overvad K., Martinez C., Dorronsoro M., Gonzalez C.A., Key T.J., Trichopoulou A., Naska A., Vineis P., Tumino R., Krogh V., Bueno-de-Mesquita H.B., Peeters P.H., Berglund G., Hallmans G., Lund E., Skeie G., Kaaks R., Riboli E., European Prospective Investigation into Cancer and Nutrition. Dietary fibre in food and protection against colorectal cancer in the European Prospective Investigation into Cancer and Nutrition (EPIC): an observational study. Lancet, 2003, 361, 1496–1501.
2. Campbell P.T., Sloan M., Kreiger N., Dietary patters and risk of incident gastric adenocarcinoma. Am. J. Epidemiol., 2008, 167, 295–304.
3. Central Statistical Office, Concise Statistical Yearbook 1939. 1939, Warsaw (in Polish).
4. Central Statistical Office, Life Tables of Poland 2005. 2006a, Warsaw (in Polish; English abstract).
5. Central Statistical Office, Statistical Yearbook 2006. 2006b, Warsaw (in Polish).
6. Chan J.M., Wang F., Holly E.A., Pancreatic cancer, animal protein and dietary fat in a population-based study, San Francisco Bay Area, California. Cancer Causes Control, 2007, 18, 1153–1167.
7. Jarosz M., Dzieniszewski J., Respondek W., Rychlik E., Sekuła W., Szponar L., The role of obesity, nutrition and physical activity in cancer's pathogenesis and development. 2006, *in*: Obesity, Nutrition, Physical Activity, Health of the Poles (ed. M. Jarosz). National Food and Nutrition Institute, Warsaw, pp. 375––409 (in Polish).
8. Larsson S.C., Bergkvist L., Wolk A., Consumption of sugar and sugar-sweetened foods and the risk of pancreatic cancer in a prospective study. Am. J. Clin. Nutr., 2006a, 84, 1171–1176.
9. Larsson S.C., Bergkvist L., Wolk A., Fruit and vegetable consumption and incidence of gastric cancer: a prospective study. Cancer Epidemiol. Biomarkers Prev., 2006b, 15, 1998–2001.
10. Nöthlings U., Murphy S.P., Wilkens L.R., Henderson B.E., Kolonel L.N., Dietary glycemic load, added sugars, and carbohydrates as risk factors for pancreatic cancer: the Multiethnic Cohort Study. Am. J. Clin. Nutr., 2007, 86, 1495–1501.
11. Ohba S., Nishi M., Miyake H., Eating habits and pancreas cancer. Int. J. Pancreatol. 1996, 20, 37–42.
12. National Cancer Registry, Reports based on data of National Cancer Registry. Data actual for June 30th, 2000, [http://85.128.14.124/krn/english/index.asp].
13. Sekuła W., Figurska K., Jutrowska I., Barysz A., Changes in the food consumption pattern during the political and economic transition in Poland and their nutritional and health implications. 2005, *in:* Polish Population Review. No. 27. Polish Demographic Society. Central Statistical Office, Warsaw, pp. 141–158.
14. Sekuła W., Niedziałek Z., Figurska K., Morawska M., Boruc T., Food Consumption in Poland Converted into Energy and Nutrients, 1950–1995. 1996, National Food and Nutrition Institute, Warsaw, pp. 12–67.
15. Sekuła W., Political and economic determinants of dietary changes-focus on Poland. Żyw. Człow. Metab., 2001, 2, 146–159.
16. Wakai K., Date C., Fukui M., Tamakoshi K., Watanabe Y., Hayakawa N., Kojima M., Kawado M., Suzuki K., Hashimoto S., Tokudome S., Ozasa K., Suzuki S., Toyoshima H., Ito Y., Tamakoshi A., JACC Study Group, Dietary fiber and risk of colorectal cancer in the Japan collaborative cohort study. Cancer Epidemiol. Biomarkers Prev., 2007, 16, 668–675.
17. Wojciechowska U., Didkowska J., Tarkowski W., Zatoński W., Cancer in Poland in 2003. 2005, the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, Warsaw, pp. 80–84 (in Polish).
18. World Cancer Research Fund/American Institute for Cancer Research. Food, Nutrition and the Prevention of Cancer: A Global Perspective. 1997, WCRF/AICR, Washington, DC.
19. Zatonski W., Campos H., Willett W., Rapid declines in coronary heart disease mortality in Eastern Europe are associated with increased consumption of oils rich in alpha-linolenic acid. Eur. J. Epidemiol., 2008, 23, 3–10.

Received May 2008. Revision received August and accepted September 2008.