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REVIEW

Nutrition, metabolism and colorectal cancer

G. Misciagna · M. G. Caruso · M. Trevisan

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Abstract Colorectal cancer and myocardial infarction are associated at population level and in autoptic studies. Furthermore, they share many blood variables: cholesterol, triglycerides and HDL cholesterol, fructosamine, glycated haemoglobin and glycated apolipoprotein B. These blood variables are intermediates between dietary, mainly saturated fats and high glycemic index and load diets, and colorectal cancer and myocardial infarction. Blood intermediate variables can be used in dietary trials as outcomes, and even to throw light on the pathogenesis of both diseases.

Keywords Diet · Glycated protein · Cancer · Cardiovascular disease

Introduction

Mortality for colorectal cancer (CRC) and for myocardial infarction (MI) are associated at population level [39]. Correa et al. [7] found in an autopsy study on 842 autopsies, that the most extensive atherosclerotic involvement of the aorta was in subjects with adenomatous polyps of the colon, and even more in subjects with adenonomatous and hyperplastic polyps together. Furthermore, Stemmerman [35] in an autopsy study on 288 autopsies found that the degree of the atherosclerosis of the coronary arteries and aorta was positively and significantly related not only to the presence of adenomatous polyps, but also to their size, multiplicity and degree of atypia as well.

MI and CRC can share a common cause, a common intermediate factor or both. In this review we explore the possibility that MI and CRC not only share some common cause, but also some common intermediate factors.

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It is known that MI is associated with high blood cholesterol, LDL cholesterol and triglycerides and low HDL cholesterol [22], however these associations are weaker and even uncertain in old people [29]. Furthermore, MI is associated with the metabolic syndrome and with diabetes [15].

In non-diabetic subjects, MI is associated with HbA1c [16], as well as with fructosamine, an index of glycated proteins in the blood, at least in women [4], and with glycated apolipoprotein B [28].

Several studies have evaluated the association between serum cholesterol and colorectal adenomatous polyps or carcinoma in situ [1, 2, 8, 13, 19, 20, 24, 40]. Most but not all of these studies found an association of colorectal adenoma or cancer in situ with serum cholesterol. Serum triglycerides were associated with colorectal adenoma [25, 32], and with colorectal cancer in situ [40]. CRC was found associated with the metabolic syndrome [6, 37]. CRC and adenomas are associated with diabetes or prediabetes [14, 17, 18, 21, 23, 30, 33, 38, 41]. We found that fructosamine is associated with colorectal adenoma [27], as well as

G. Misciagna (✉)
Laboratory of Epidemiology, IRCCS De Bellis,
Castellana Grotte, Bari 70013, Italy
e-mail: gmisciag@libero.it

M. G. Caruso
Laboratory of Biochemistry, IRCCS De Bellis,
Castellana Grotte, Bari 70013, Italy

M. Trevisan
University of Nevada, Health Sciences System,
Las Vegas, NV, USA

glycated apolipoprotein B with colorectal adenoma and cancer (Misciagna et al., unpublished data).

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The association of both MI and CRC with blood lipids and non enzymatic glycated serum proteins also in non diabetic subjects allows to study the effects of diet on MI and CRC through the effects of diet on these intermediate variables. Cholesterol, triglycerides and HDL cholesterol are influenced by both saturated fats and sugars in the diet [5, 9], glycated haemoglobin is influenced by saturated fats in the diet [3, 11, 12], fructosamine by glycemic index and load [26], as well as glycated apolipoprotein B (Misciagna et al., unpublished data). All these results show that MI and CRC are associated with a diet rich in saturated fats and at high glycemic index and load.

Conclusions

The results of many epidemiological studies show that MI and CRC share many intermediate variables: cholesterol, cholesterol HDL, triglycerides, glycated haemoglobin and apoliprotein B, fructosamine. Furthermore, using the relationship of diet with these intermediate blood variables, it is possible to deduce that dietary saturated fats, glycemic index and load are associated with CRC and MI. The discovery of blood intermediate variables between diet and MI and CRC can open the way to trials of the effects of diet on these variables, to add evidence to the results of the observational epidemiological studies on diet and cardiovascular diseases or colorectal cancer.

Myocardial infarction and colorectal cancer share some dietary causes and intermediate variables, do they share also some pathogenetic mechanisms ?

Glycated ApoB has been found in the macrophages of the arterial wall, in the fatty streaks of atherosclerotic vessels [36]. In fact, macrophages prefer glycated, oxidized or glyco-oxidized lipoproteins for their scavenger receptors, not the normal ones [34].

It is known that neoplastic cells behave like a macrophage and have a strong phagocytic activity [10, 31], so may be colorectal cancer too, like the macrophages of the arterial wall in atherosclerosis, “eats” glycated lipoprotein.

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