Abstract

Meat-Based Diet Significantly Affects Risk Parameters for Colorectal Cancer: The MeaTIc Dietary Intervention Study [†]

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Abstract: Background: Colorectal cancer (CRC) is the most commonly diagnosed cancer in Europe and the second most common cause of cancer death. The aim of the MeaTIc study was to determine the impact of three diets associated with different risks of CRC (a meat diet (MBD: high risk), a meat diet with alpha-tocopherol supplementation (MBD-T: medium risk), and a pesco-vegetarian diet (PVD: low risk)) on CRC risk markers and fecal microbiota. Methods: A controlled, randomized, open-label, parallel-group, 12-week dietary intervention was conducted on 113 participants aged 18–50 years. The primary outcome was a change in fecal water (FW) genotoxicity. Secondary outcomes were changes in FW cytotoxicity, bile acids, fecal microbiota, and metabolomic profiles. Results: A total of 103 participants (91%) completed the study. After adjustment for possible confounding factors, a significant increase ($p < 0.05$) in FW genotoxicity (+43%) was observed only in the MBD group. Regarding FW cytotoxicity, a decrease in cell viability (−7%, $p = 0.054$) was observed after MBD, while no changes occurred for the other diets. Bile acid analysis showed an increase in total bile acids during MBD-T (+35%) and a decrease during PVD (−2.3%). Upon correlating changes in bile acids with FW genotoxicity and cytotoxicity, a moderate correlation (R = 0.66; $p < 0.0001$) emerged between changes in total bile acids and changes in FW cytotoxicity. A linear discriminant analysis (LDA) of changes in the gut microbiota revealed no clustering by diet, while metabolomic analysis showed a clear clustering of changes in metabolites. A random forest regression model identified 2-hydroxybutyric acid and cholic acids among the metabolites most correlated with FW genotoxicity ($R^2 = 0.84$ for the model). Conclusion: These results indicate that MBD can lead to a worsening of CRC markers in a relatively short time. Our findings also suggest that intervention diets had a greater impact on the metabolism of the gut microbiota, and thus, its metabolites, than on its taxonomic composition. A correlation between some metabolites and FW genotoxicity was also found.

Keywords: meat-based diet; colorectal cancer; microbiota

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the Tuscany Region, Careggi University Hospital (12390_spe; 09/19/2018).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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