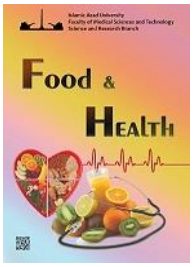

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Association of fast food intake and high-grade brain tumors: Primary evidence among a subset of Iranian patients

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ABSTRACT

Human brain tumors are the leading cause of cancer induced death owing to the late diagnosis in higher grades and failure to be successfully controlled. Determining the main risk factors toward higher grades of the tumor can dramatically decrease the mortality rate of benign brain tumor patients. The present study was conducted to compare the dietary habits between benign and malignant brain tumor patients. Three demographic, physical activity and dietary regimen's specific questionnaires were filled for 50 high grade glioma and 50 meningioma patients. Obtained data were analyzed using SPSS 22.0 (SPSS Inc, IL, USA). A p-value less than 0.05 was considered as significant. There was a significant association between using of fast foods and high-grade glioma tumors (p-value=0.007). In contrast, the frequency of using dairy products, sea foods, fruits, and vegetables besides physical activity was not meaningfully different between two malignant and benign patient groups. Finding of this study regarding the association of fast foods with malignant brain tumors is further support on the role of Trans and saturated fatty acids in the rate of cancer evolution. However, further investigations are required to determine whether disruption in blood brain barrier induced by frequent consumption of saturated fatty acids enriched food occurs before or after malignant cellular transformation.

1. Introduction

Human brain tumors constitute only 2-3% of all adult cancers and have the highest mortality rate among human cancers due to late diagnosis and poor response to various strategies of treatment. Progression from benign to malignant status is usually the major concern of various types of cancer especially in brain tumors with difficult accessibility of chemo- and radio therapeutic treatment options (1). There are some reported risk factors that have been introduced as inducers malignant transformation including dietary regimen, physical activity, smoking and, etc. According to the last update on risk factors reported by Doll and Peto (2), the diet has the most contribution in malignant transformation (35%) and therefore determining its constituents and type of dietary habits may decrease the burden of malignancies among different human populations. However, there are limited investigations on the correlation between dietary habits or regimens and cancer evolution. Consumption of nuts has been shown to be meaningfully associated with lower risk of lung cancer among Italian and USA populations (3). Another well-known example would be the significant correlation between low fiber/high fat diets and higher risk of colon carcinogenicity which has been replicated among American and African populations (4, 5). To the best of our knowledge, investigation on the effect of diet on different types of human cancers especially in the transition of benign tumors toward malignant stages is limited to dietary components. It was described that long-term using of Trans fatty acids increases the risk of cancer and malignancy through impairing accessibility of cells to oxygen and therefore making hypoxia (6). Mentor-Marcel et al. (7) demonstrated that dietary genistein could increase the survival of prostate cancer cells and delayed the transition from benign to malignant stages through downregulation of osteopontin. In the other study, it was revealed that ß-oxidation of fatty acids was shown to be

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associated with higher benign prostatic cells viability compared to cancer cells which may indicate that modulating dietary fatty acids can prevent of cancer cell progression (8). Fast and processed foods are usually enriched by saturated fatty acids (SFA). Albuquerque et al. (9) demonstrated that fast foods have the highest level of Trans fatty acids compared to snacks, potato, bakery products and processed foods.

In this regard, we aimed to compare the frequency of using fast foods besides some other Iranian routine dietary habits in two benign and malignant brain tumors to primarily define the role of fatty acids enriched foods in the progression of brain tumors.

2. Materials and methods

Fifty patients affected by meningioma as a benign brain tumor and 50 patients affected by glioblastoma multiform as a malignant brain tumor were selected to be enrolled in a retrospective cohort study. Participants aged 19-70 years old and three demographic, physical activity and dietary regimen's specific questionnaires were filled for all of them according to the previous study (10). The informed consent form was filled for all the enrolled samples as stated by the Declaration of Helsinki guidelines. To more exactly define the role of risk factors in the pathogenesis of benign or malignant status of the tumor, questioners were filled based on the patients provided information related to dietary and physical activity habits at least during three years before the first diagnosis of the tumor. It is also noted that the sodium intake of patients was determined considering native sodium in foods and the salt added to foods during cooking. The questionnaires with missing data were excluded from further analysis. Statistical analysis was performed using SPSS software (Version 22, USA). Fisher's exact and Chi-square tests beside T-test were used to compare the qualitative and quantitative variants between two patients' groups. A p-value less than 0.05 was considered as significant.

3. Results

The means of age were 47.52±12.92 and 45.48±2.06 in malignant and benign tumor patients, respectively. There was no significant association with the consumption of alcohol and smoking between two benign and malignant brain tumor groups (p-value= 0.9 and 1.1, respectively). In addition, the frequency of dairy products, sea foods, fruits, and vegetable consumption were not meaningful between the two studied groups. However, the frequency of fast foods consumption mainly as dinner meal was strongly associated with malignant tumor status (p=0.007) (Table 1). Among the main factors behind the selection of fast foods especially as a dinner meal, being delicious was superior to others including the price and availability. Fast foods consumers whether as benign or malignant patients used to eat unhealthy diet pattern for more than three years. Moreover, there was no significant association between grade of tumor and physical activity.

Table 1. Frequency of using food categories in two benign and malignant brain tumor patients.

Patient's group/Food group	Fast foods	Fruits	Vegetables	Seafood	Dairy products	Alcohol	Smoking
Benign tumor patients (50)	>1 time/week: 0 Weekly:24 2times/month:2 3 times/month:14 Monthly:9 <monthly:1	Weekly: 31 Biweekly:15 Never:4	Weekly: 23 Biweekly: 27 Never:0	Weekly: 21 Biweekly: 26 Never:3	Weekly: 2 Biweekly: 5 Never:0 >2 times/week: 43	Yes: 3 No: 47	Yes: 8 No: 42
Malignant tumor patients (50)	>1 time/week: 1 Weekly: 41 2times/month:0 3 times/month:6 Monthly:2 <monthly:0	Weekly: 31 Biweekly:11 Never:8	Weekly: 26 Biweekly: 24 Never:0	Weekly: 23 Biweekly: 22 Never:5	Weekly: 1 Biweekly: 4 Never:1 >2 times/week: 44	Yes: 2 No: 48	Yes: 6 No: 44
P-value	0.007	0.85	0.72	1.2	0.5	0.9	1.1

4. Discussion

Herein, it was found that the frequency of using fast food was significantly higher in malignant brain tumor group than benign ones. To the best of our knowledge, this is the first investigation on comparing the dietary habits between malignant and benign groups of brain tumor cases. However, previous reports didn't demonstrate direct association between risk of brain tumors and the consumption of processed foods as well as processed meats. Studies on three independent American populations did not find any association between the risk of glioma and either healthy or unhealthy diet (11-13).

However, one of the most important events occurred during the transition from benign brain tumors with malignant state is a disruption in normal blood-brain barrier's (BBB) function. It was described that long term using saturated and trans fatty acids can destroy the integrity of BBB which is not normally amenable to be infiltrated by albumin bound fatty acids (14). In the other hand, alteration or disruption of BBB has been found in most of the higher grades of brain tumors as well as anaplastic astrocytoma (15). This phenomenon could be consistent with our finding that long term using of trans fatty acids frequently found in fast foods may contribute to disruption of BBB and leads to invasion of brain tumor cells. Although the exact mechanism behind higher risk of cancer in impaired BBB warrants further in-vitro and in-vivo investigations, lessens from other human endothelial barriers as well as a blood-testis barrier (BTB) are indicating that inflammation induced by SFA foods may cause dysfunction in major tumor suppressor genes including adenomatous polyposis coli (APC) (16, 17). Frequency of using healthy diet including fruits and vegetables, seafood and dairy products was not significantly different between benign and malignant groups (18). Terry et al. (19) have described that except cruciferous types, the risk of malignant brain tumors as well as glioma can be attenuated by using leafy green and yellow-orange vegetables. Owing to the limited using of various types of vegetables, classification of them was not performed in the present study and therefore findings of the aforementioned study may be in contrast to our results. In addition, the association between consumption of fresh fish and risk of benign and malignant brain tumors was only meaningful for meningioma patients under 55 years old which can be in line with our findings with the exception of no association even after adjusting for sex and age. Regarding using dairy products, our finding is consistent with the other study performed on an American childhood population which was not different between malignant and benign brain tumor types (18). However, Terry et al. (19) have found strong association with risk of glioma. The role of consumption of dairy products remained controversial among various types of human cancers (20-23). The most important element of dairy products is calcium which its high serum level causes decrease in calcitriol hormone as an antiproliferative agent. Moreover, the presence of insulin-like growth factor-1 as a mitogenic factor and SFA maybe another reason behind the carcinogenic effect of dairy product which has been found in some of the prostate cancer studies (22). However, it is worth to note that the direction of this association is strongly dependent on the dose, time and the type of dairy product especially low or high fat ones which are the other limitation of the present study which was not considered to be filled in the dietary questionnaires (24).

5. Conclusion

Since we had no control group in the present study, we couldn't show the overall risk of brain tumor with each of the dietary factors which would be considered as one of the major limitations. Of note, the critical aim of the present work was to find the dietary role in the progression of benign tumors toward malignant state to improve the survival rate of benign tumor patients through diet modifications. Further study is required to exactly define the role of each dietary element with the risk of brain tumors among different grades to shed light on the role of diet on the pathogenesis of human malignancies and therefore their control.

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