

Gastro-Intestinal Complaints Related to Various Eating Behaviors

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Abstract: *Background:* Many studies report a beneficial health effect as well as a lower mortality rate for individuals following diets containing lots of fruits and vegetables. Results of studies on abdominal, and colon diseases are, however, inconsistent. Therefore, the aim of our study was to analyze differences between various eating behaviors and the incidence of gastro-intestinal complaints.

Methods: The sample used for this study was taken from the Austrian Health Interview Survey ATHIS 2006/07 (N=14 318). Logistic regressions were calculated controlling for age, BMI, and physical activity to analyze differences regarding the incidence of gastric or intestinal ulcer, abdominal pain, and specific medication taken due to these complaints.

Results: A lacto-/ovo-, as well as a semi-vegetarian diet is associated with a higher risk for gastrointestinal complaints. The odds ratio for gastric or intestinal ulcer, and the intake of specific medication is significantly higher for these diets.

Conclusion: A carnivorous diet containing also lots of fruits and vegetables is recommended to avoid abdominal complaints. Furthermore, public health programs are needed in order to reduce the health risk due to nutritional factors.

Keywords: Nutrition, diet, gastric or intestinal ulcer, abdominal pain, medication.

INTRODUCTION

Previous studies showed vegetarian diets to be associated with lower rates for hypertension, high cholesterol levels, specific chronic degenerative diseases, coronary artery disease, type II diabetes, gall stones, stroke, and certain cancers [1-7]. Overall, vegetarians have a lower body mass index [1, 4, 5, 7-11] a higher socioeconomic status [12], and a better health behavior, i.e. they are more physically active, drink less alcohol, and smoke less [8, 12, 13]. Therefore, a vegetarian diet is often recommended as a method to manage weight [9] and health [14]. On the other hand, vegetarians are more likely to consult alternative medical care and to take more medication [8].

However, evidence concerning lower rates of diseases of the colon is inconsistent [5, 7, 15, 16]. Austin *et al.* [17] have found the odds ratio of getting a colorectal adenoma to be significantly higher in subjects who eat high amounts as well as in those consuming moderate amounts of meat. Many studies have shown that red meat consumption is associated with a higher risk for health, including diabetes, colon adenomas and colon cancer [18-22]. On the other hand, diets which allow small amounts of red meat, fish and dairy products seem to be associated with a reduced risk of coronary heart disease as well as type II diabetes [20]. Not only special nutrients are

associated with increased health risk, most of all caloric intake plays a crucial role [19, 23]. Moreover, physical activity might be a stronger lifestyle factor for lowering disease rates, stronger than individual eating behavior [15, 24, 25].

In conclusion, most studies have found a vegetarian diet to be associated with better health and lower mortality rates for certain diseases. Nevertheless, effects on gastrointestinal adenomas and colorectal cancer are inconsistent. Therefore, the aim of this study was to investigate the incidence of gastric or intestinal ulcer, abdominal pain for more than three months, and medication taken due to abdominal complaints, depending on various eating behaviors among Austrian adults.

MATERIAL AND METHODS

Study Population

The sample for this study was taken from the Austrian Health Interview Survey ATHIS 2006/07 [26]. The analyzed data were obtained from adults aged 20 years and older (14 318 participants; 55.1% female). The study was conducted through home-based personal interviews with interviewees representative for the Austrian population. The interviewees were chosen from the central population register and stratified by geographic region. The age distribution of the sample is shown in Table 1.

Overall, only 0.2% of the interviewees were vegan (N=22; 54.5% female), 0.8% were vegetarians

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Table 1: Age Distribution According to the Form of Nutrition

Form of nutrition	Age (years)				
	20 - 29	30 - 39	40 - 49	50 - 59	≥ 60
	N=1955	N=2421	N=2958	N=2359	N=4625
Vegans	23.1%	15.4%	11.5%	11.5%	23.1%
Lacto-/Ovo-Vegetarians	21.9%	19.5%	16.4%	7.8%	11.7%
Semi-Vegetarians	23.3%	18.0%	18.5%	10.6%	18.5%
Meat diet combined with lots of fruit and vegetables	11.7%	16.2%	19.4%	15.9%	29.8%
Meat diet with moderate meat intake	10.3%	14.0%	18.3%	15.4%	36.4%
Meat diet with heavy meat intake	17.0%	18.0%	20.5%	14.8%	18.9%

Note. Data source: Austrian Health Interview Survey (ATHIS) 2006/07; n=14 318.

following an lacto-/ovo-diet (N=99; 77.8% female), and 1.2% semi-vegetarians (N=168; 76.2% female). 23.7% reported to eat a carnivorous diet with lots of fruit and vegetables (N=3 394; 67% female), 49.5% preferred a carnivorous diet with little meat (N=7 084; 60.6% female), and 24.8% a carnivorous diet with a lot of meat (N=3 551; 31.1% female).

Measurements

Face-to-face interviews conducted in private homes and long-term care facilities included questions regarding socio-demographic characteristics, diseases, health-related behavior, and psychological aspects.

The independent variable in this study was eating behavior. The participants were asked "How would you describe your eating behavior?". They described themselves as (1) vegan, (2) lacto-/ovo-vegetarians, (3) semi-vegetarians, (4) eating a carnivorous diet with lots of fruit and vegetables, (4) eating a carnivorous diet with little meat, or (6) eating a carnivorous diet with a lot of meat.

Dependent variables concerning gastro-intestinal complaints were: an incidence of gastric or intestinal ulcer, abdominal pain for more than three months, and medication taken due to these complaints.

Statistical Analyses

To analyze the differences and variation between individuals according to their eating behavior, in terms of gastro-intestinal complaints, Chi-square test, as well as logistic regression controlling for age, BMI, and physical exercise (total MET score) [27] was calculated for all variables. *P*-values <0.05 were considered as statistically significant. All analyses were calculated using IBM SPSS software (version 19.0) for Windows.

RESULTS

Gastric or Intestinal Ulcer

Overall, 7.1% (48% women) of all study subjects suffer from a gastric or intestinal ulcer. While 13.6% (N=3; 33% female) of the vegans, 5.1% (N=5; 80% female) lacto-/ovo-vegetarians, and 4.2% (N=7; 86% female) of the semi-vegetarians suffer from gastric and intestinal ulcers, 5.8% (N=197; 63% women) of those eating a carnivorous diet with lots of fruits and vegetables, 6.9% (N=244; 24% women) of those eating a carnivorous diet with heavy meat intake, and 7.8% (N=555; 52% women) of the moderate meat eaters suffer from ulcers ($\chi^2=19.03$, $p=.002$). The results of logistic regression controlling for age, BMI, and physical exercise, showed that the odds ratio for the incidence of ulcers is 2.42 (CI 1.01-5.78) for lacto-/ovo-vegetarians compared to those eating a carnivorous diet with heavy meat intake ($p=.047$), and 2.42 (CI 1.25-4.69) for semi-vegetarians ($p=.009$).

Since a significant difference concerning the incidence of ulcer was found depending on the age of participants, the different age groups were analyzed separately. Only in the group of 20- to 29-year olds, and 50 to 59 year-old individuals the incidence of a gastric or intestinal ulcer is related to the eating behavior.

The 20- to 29-years-olds 17% of the vegans (1 woman), none of the lacto-/ovo-vegetarians and semi-vegetarians suffer from gastrointestinal ulcers, 2.1% (N=9; 78% women) of those eating a carnivorous diet with lots of fruits and vegetables, 2.1% (N=16; 56% women) of those eating a carnivorous diet with moderate meat intake, and 2.8% (N=19; 26% women) of the heavy meat eaters have ulcers. The results of

logistic regression analyzes showed that the odds ratio for the incidence of ulcer is 9.37 (CI 1.02-86.02) for vegans compared to those eating a carnivorous diet with heavy meat intake ($p=.048$).

In 50- to 59-year-olds none of the vegans and lacto-/ovo-vegetarians, 10% (2 female) of the semi-vegetarians, 5% (N=31; 48% women) of those eating a carnivorous diet with lots of fruits and vegetables, 10% (N=110; 57% women) of those eating a carnivorous diet with moderate meat intake, and 11% (N=63; 19% women) of the heavy meat eaters reported having gastric or intestinal ulcers. The results of logistic regression analyzes showed that the odds ratio for the incidence of ulcer is significantly reduced for subjects with a carnivorous diet with lots of fruits and vegetables (OR=0,48; CI 0,30-0,75; $p=.001$) compared to those eating a carnivorous diet with heavy meat intake.

Abdominal Pain

1.2% (67.4% women) of all interviewees reported having abdominal pain for more than three months. None of the vegans, and lacto-/ovo-vegetarians, and 2.4% (N=4; 75%female) of the semi-vegetarians reported suffering from abdominal pain. 1% (N=35; 77% women) of those combining a carnivorous diet with lots of fruits and vegetables, 1.2% (N=32; 41% women) of the heavy meat eaters, and 1.5% (N=107; 72% women) of the moderate meat eaters reported abdominal pain for more than three months ($\chi^2=12.04$, $p=.034$). Results of the logistic regression analyzes revealed that the odds ratio of abdominal pain is 1.54 (CI 1.03-2.31) for subjects with moderate meat intake, compared to heavy meat eaters ($p=.037$).

Gastro-Intestinal Medication

Of all subjects, 3.8% (60% women) reported that they have been taking gastro-intestinal medication

within the past two weeks. While 3.3% (N=112; 65% women) of those combining a carnivorous diet with lots of fruits and vegetables, 2.8% (N=100; 34% women) of those eating a carnivorous diet with heavy meat intake, and 4.4% (N=315; 65% women) of those who reported to eat meat moderately take medications against abdominal complaints. 4.5% (1 men) of the vegans, 6.1% (N=6 women) of the lacto-/ovo-vegetarians, and 6.5% (N=11; 73% women) take specific medication ($\chi^2=24.67$, $p=.000$). The odds ratio for medication is 2.42 (CI 1.01-5.78) for lacto-/ovo-vegetarians compared to those combining a carnivorous diet with heavy meat intake ($p=.047$), and 2.42 (CI 1.25-4.69) for semi-vegetarians ($p=.000$). All results are shown in Table 2 and 3.

DISCUSSION

Our results have shown that, overall, gastro-intestinal complaints occur more often among lacto-/ovo- and semi-vegetarians. Prior studies which analyzed the rates of abdominal diseases for different types of diets reported inconsistent results [5, 7, 15, 17]. Dwyer [5] found that a vegetarian diet is associated with a lower incidence of gallstones, better digestion, and less gastrointestinal diseases. Our study showed that after controlling for age, BMI, and physical activity, the risk of complaints, as well as medication is higher among vegetarians, but not for vegans. Since data bases on a cross-sectional study we cannot state directions of causal relationships. It is unclear whether a vegetarian diet causes gastrointestinal complaints, or if subjects become a vegetarian due to abdominal diseases. Since a vegetarian diet is often recommended as a method to manage weight [9] and health [14], our subjects might eat a vegetarian diet due to their disorders.

We also analyzed the association between the type of diet, and the prevalence of gastric or intestinal ulcer

Table 2: Prevalence of Abdominal Complaints Depending on the Form of Nutrition

Form of nutrition	N	Gastric or intestinal ulcer	Abdominal pain	Gastro-intestinal medication
Vegans	22	13.6% (N=3)	0% (N=0)	4.5% (N=1)
Lacto/ovo-vegetarians	99	5.1% (N=5)	0% (N=0)	6.1% (N=6)
Semi-vegetarians	168	4.2% (N=7)	2.4% (N=4)	6.5% (N=11)
Carnivorous diet combined with lots of fruit and vegetables	3394	5.8% (N=197)	1.0% (N=35)	3.3% (N=112)
Carnivorous diet with moderate meat intake	7084	7.8% (N=555)	1.5% (N=107)	4.4% (N=315)
Carnivorous diet with high meat intake	3551	6.9% (N=244)	1.2% (N=32)	2.8% (N=100)

Note. Data source: Austrian Health Interview Survey (ATHIS) 2006/07; n=14 318.

Table 3: Odds Ratio and Confidence Interval for Abdominal Complaints Depending on the Form of Nutrition Controlled for Age, BMI and Physical Activity

Form of nutrition Carnivorous diet with high meat intake compared to	Gastric or intestinal ulcer		Abdominal pain		Gastro-intestinal medication	
	OR ¹ (95% CI) ²	p ³	OR ¹ (95% CI) ²	p ³	OR ¹ (95% CI) ²	p ³
Vegans	1.48 (0.19-11.50)	.707			1.48 (0.19-11.50)	.707
Lacto/ovo-vegetarians	2.42 (1.01-5.78)	.047			2.42 (1.01-5.78)	.047
Semi-vegetarians	2.42 (1.25-4.69)	.009	2.84 (0.98-8.18)	.054	2.42 (1.25-4.69)	.009
Carnivorous diet combined with lots of fruit and vegetables	0.91 (0.68-1.20)	.484	1.09 (0.67-1.77)	.735	0.91 (0.68-1.20)	.484
Carnivorous diet with moderate meat intake	1.10 (0.87-1.39)	.448	1.54 (1.03-2.31)	.037	1.10 (0.87-1.39)	.448

Note. Data source: Austrian Health Interview Survey (ATHIS) 2006/07; n=14 318. ¹OR=Odds Ratio; ²95% -CI=95%-Confidence Interval; ³p=probability.

in different age groups. Interestingly, at younger ages a vegan diet is associated with a higher risk of gastric or intestinal ulcer, while in 50- to 59-year-olds those who eat a carnivorous diet with heavy meat intake have a higher risk compared to those who eat a diet rich in fruits and vegetables. This result is also reported by Austin [17] in a case control study which was conducted at the University of North Carolina. We could show that at all ages, a carnivorous diet rich in fruits and vegetables is associated with a beneficial health effect, and lower incidence of gastro-intestinal complaints.

Our results showed that the two vegetarian groups which have a higher risk of abdominal disorders also have a higher risk for taking medication due to gastro-intestinal problems, which is congruent. Only abdominal pain for more than three months is related to a carnivorous diet with moderate meat intake. Since red meat intake is associated with an increased health risk [18-22], and also caloric intake plays a crucial role for health [19, 23], there is some likelihood that the interviewees in our study who reported eating meat on a sparse basis, eat a high proportion of red meat, and, therefore report more abdominal pain.

Strengths of the study include the large, representative sample of over 14 000 individuals. The cross-sectional design of the study does not allow to state directions of causal relationships. Hence, further longitudinal studies are required to substantiate our results. Potential limitations of our results are that subjects identified themselves as being a vegetarian, or eating a carnivorous diet rich in fruits and vegetables, moderate or heavy meat intake. Additionally, information regarding caloric intake was not covered, and the vegan group was very small (22 subjects), while nearly 50% of Austrian adults (60.8% female) eat

a carnivorous diet with little meat. Therefore, in-depth research into the eating behavior of Austrian adults as well as studies analyzing gastro-intestinal complaints in relation to various eating behaviors is required.

To our knowledge, this is the first representative study which analyzes gastro-intestinal complaints related to nutrition in Austrian adults. Overall, studies report that lifestyle factors, such as physical activity, account for the disease rates stronger than the nutritional status [15, 24, 25]. Therefore our results are reinforced by the fact that we controlled for physical activity, age and BMI.

To sum up, our study shows that a vegetarian diet is associated with more gastro-intestinal complaints, while moderate meat intake combined with lots of fruits and vegetables seems to be beneficial for health. Our findings emphasize the necessity of taking nutritional factors into account as co-factors and possible contributors to abdominal complaints. We wish to highlight that a carnivorous diet combined with lots of fruits and vegetables is associated with a low prevalence of abdominal complaints. Therefore, this diet should be recommended, and public health programs are needed in order to reduce the health risk due to nutritional factors.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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