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Effect of vegetarianism on development of gall stones in women

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Abstract

Real time ultrasonography was used to compare the prevalence of gall stones in two groups of women aged 40-69: 632 women recruited from general practice registers and 130 vegetarians. One hundred and fifty six (25%) of the 632 women who ate meat and 15 (12%) of the 130 vegetarian women either had gall stones visible on ultrasonography or had previously undergone cholecystectomy ($p < 0.01$). The prevalence of gall stones was found to increase with age and body mass index. The 2·5 fold increase in risk of developing gall stones in non-vegetarians compared with vegetarians was reduced to 1·9 when controlling for these two potentially confounding factors, but remained significant. A family history of gall stones was reported more often by women with gall stones, but no association was found with parity or use of exogenous oestrogens. Thus the importance of age and obesity to determine the prevalence of gall stone was confirmed, and a dietary factor associated with vegetarianism may prevent this common condition.

Introduction

Most data relating to the prevalence of gall stones are based on studies at necropsy, symptomatic cases, or selected populations.[1-3] Three investigations using oral cholecystectography or ultrasonography showed prevalences ranging from 12% in Welsh women aged 45-69 to 76% in Pima Indian women over the age of 45.[3-5] Many factors have long been thought to be risk factors for gall stones, but of these only obesity, gender, and aging have been confirmed convincingly.[6] This study was designed to obtain a reliable estimate of the prevalence of gall stones in an unselected British population, examine the role of previously suggested risk factors, and, by comparing vegetarians and non-vegetarians, consider further the possible role of dietary factors in the aetiology of gall stones.

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Patients and methods

Between April 1982 and September 1984 an invitation to participate in a study of diseases of the bowel was sent to women aged 40-69 registered at two Oxford general practices. They were asked to complete a questionnaire on medical history and diet and to attend for ultrasound investigation. The estimated sample size was achieved with a response rate of 66% (five vegetarian respondents were excluded). Similar invitations were sent to vegetarian women in the same age range who were members of vegetarian groups in Bradford, Gloucester, Guildford, Nottingham, Oxford, and Reading. Of 141 women contacted, 130 (92%) agreed to participate; three were vegans.

Ultrasound investigations were carried out (by FP and DW) using a Toshiba Sonolayer SAL30A real time 3·5 MHz linear array ultrasound apparatus. The methods used were those described by Cosgrove and McCready and by Metrewelli.[7 8] Volunteers fasted for five hours before examination. The effect of potentially confounding variables was examined using the Mantel-Haenszel test[9] and the trend examined by the χ^2 test for trend.[10]

Results

Of the 632 non-vegetarians, 113 (17·8%) had gall stones but were asymptomatic and 43 (6·8%) had previously undergone cholecystectomy, giving an overall prevalence of 156 out of 632 (25%). Vegetarians had a significantly lower overall prevalence of 15 out of 130 (12%; $p < 0.01$); 13 of these women (10%) were asymptomatic and only two had had cholecystectomies. The odds ratio of developing gall stones in non-vegetarians compared with vegetarians was 2·5:1. The prevalence of gall stones tended to increase with age in both non-vegetarians and vegetarians and with body mass index in non-vegetarians only (tables I and II). In each age group and category of body mass index, except the 55-59 year age group, the difference in prevalence remained between the vegetarians and non-vegetarians.

TABLE I—*Prevalence of gall stones by age*

Age (years)	Non-vegetarian: Total	Non-vegetarian: No (%) with gall stones	Vegetarian: Total	Vegetarian: No (%) with gall stones
40-44	134	21 (16)	26	1 (4)
45-49	92	21 (23)	26	2 (8)
50-54	115	30 (26)	26	3 (12)
55-59	110	22 (20)	23	5 (22)
60-64	101	32 (31)	17	3 (18)
65-69	80	30 (38)	12	1 (8)

For combined groups χ^2 (trend) = 15·75; $p < 0·001$.

TABLE II—*Prevalence of gall stones by body mass index*

Quetelet's index	Non-vegetarian: Total	Non-vegetarian: No (%) with gall stones	Vegetarian: Total	Vegetarian: No (%) with gall stones
15·0-19·9	51	10 (20)	22	4 (18)
20·0-24·9	348	64 (18)	80	6 (8)
25·0-29·9	171	55 (32)	22	4 (18)
30·0-34·9	51	23 (45)	6	1 (17)
≥35·0	11	4 (36)		

For non-vegetarians χ^2 (trend) = 20·41; $p < 0·001$ and for vegetarians χ^2 (trend) = 1·29; NS.

The odds ratio of developing gall stones in non-vegetarians compared with vegetarians after adjusting for the effect of both age and body mass index simultaneously was 1·9:1 (95% confidence limits 1·1-3·3, $\chi^2 = 5·24$, $p < 0·05$). Of the 171 women with gall stones 42 (25%) had a family history of the condition compared with 86 (15%) of the 591 who did not have gall stones. All these trends were apparent when considering only those women with gall stones who were asymptomatic.

No association was detected between gall stones and parity, use of oral contraceptives, social class, cigarette smoking, or coexisting conditions.

Discussion

As the prevalence of gall stones in women is believed to be twice that in men we restricted our study to women. This has been the largest study undertaken on an unselected group of middle aged women. Using a technique believed to be the most satisfactory for diagnosing gall stones we found the prevalence to be twice as high as that reported in South Wales, slightly higher than those found in Rome, and roughly comparable with those in a Tyrolean village (the only other studies using objective measurements in representative population samples).[4 11 12] Reasons for these variations have been speculated on elsewhere.[13]

The finding that more than 70% of women with gall stones were asymptomatic favours conservative management of gall stones in such subjects—an aspect of controversy that has surrounded the management of gall stones for many years.

The most interesting findings related to the difference between vegetarians and non-vegetarians. Bias in the response of these two volunteer groups is unlikely to have explained the difference in the prevalence of gall stones: a high proportion of all eligible vegetarians responded to the invitation to participate, and in a comparison of responders and non-responders among non-vegetarians registered with local doctors the proportion of cholecystectomies was similar in the two groups. A higher proportion of vegetarians than non-vegetarians came from social classes I and II, but the difference was not significant, and social class was unrelated to the presence of gall stones. The vegetarians and non-vegetarians were drawn from various parts of the country, but the differences were greater than might have been explained on the basis of regional variations.[14] Furthermore, the significant differences between the groups remained even after controlling for the effect of potentially confounding variables.

As rural Africans, who have a traditional diet, rarely develop gall stones[15] diet, and particularly a deficiency of fibre, may be important in the aetiology of gall stones. Several within population studies have implicated total energy intake, cholesterol, fibre, simple sugars, the ratio of polyunsaturated to saturated fatty acids, and alcohol.[16-20]

In all other studies the effects of dietary factors have been small. By contrast we found a 1·9 fold increase in risk of developing gall stones in non-vegetarians compared with vegetarians after controlling for potentially confounding factors, suggesting a protective effect of some dietary factor or factors associated with vegetarianism. We, and others, found that vegetarians tend to eat less saturated fat in addition to not eating meat and have a higher intake of fibre than non-vegetarians.

Medical textbooks still offer credence to the earliest suggested risk factors for developing gall stones: obesity (fat), parity (fertile), fair, middle aged (40). These and other data confirm the role of obesity, increasing prevalence with age, and a family history of gall stones. Failure to find a relation with parity and use of oral contraceptives in our study may be due to the relatively old age of our population. Numerous other factors may be associated with gall stones—for example, peptic ulceration, vagotomy, Crohn's disease, diabetes, and treatment with clofibrate. Failure to find associations in this study suggests that although risks may apply to selected groups of patients, these factors are not important in determining the prevalence of gall stones in the population.

In summary, despite the fact that the two groups studied were not strictly comparable, these data suggest that some dietary factor associated with vegetarianism affords a strong, independent protective effect against this common condition that results in appreciable morbidity in middle aged and elderly women. A case control study of the cases identified in this study may help to identify the dietary factor.

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References

1 Brett M, Barker DJP. The world distribution of gallstones. *Int J Epidemiol* 1976;**5**:335-41.
2 Friedman GD, Kannel WB, Dawber TR. The epidemiology of gallbladder disease: observations in the Framingham study. *J Chronic Dis* 1966;**19**:273-92.
3 Sampliner RE, Bennett PH, Comess LJ, Rose FA, Burch TA. Gallbladder disease in the Pima Indians. *N Engl J Med* 1970;**303**:1358-64.
4 Bainton D, Davies GT, Evans KT, Huw Gravelle I. Gallbladder disease—prevalence in a South Wales industrial town. *N Engl J Med* 1976;**294**:1147-9.
5 Rome Group for the Epidemiology and Prevention of Cholelithiasis (GREPCO). Prevalence of gallstone disease in an Italian adult female population. *Am J Epidemiol* 1984;**119**:796-805.
6 Bennion LJ, Grundy SM. Risk factors for the development of cholelithiasis in man. *N Engl J Med* 1978;**299**:1161-7, 1221-7.
7 Cosgrove DO, McCready VR. *Ultrasound imaging*. Chichester: John Wiley and Sons, 1982.
8 Metrewelli C. *Practical abdominal ultrasound*. London: Heinemann, 1978.
9 Mantel N, Haenszel W. Statistical aspects of the analysis of data from retrospective studies of diseases. *Journal of the National Cancer Institute* 1959;**22**: 719-48.
10 Armitage P. *Statistical methods in medical research*. Oxford: Blackwell Scientific Publications, 1971.
11 Bateson MC. Gallstone prevalence and cholecystectomy rate are independently variable. *Lancet* 1984;ii:621-4.
12 Rhomberg HP, Judmair G, Lochs A. How common are gallstones? *Br Med J* 1984;**289**:1002.
13 McPherson K, Strong P, Jones L, Britton BJ. Docholecystectomy rates correlate with geographic variations in the prevalence of gallstones? *Journal of Community Health and Epidemiology* (in press).
14 Barker DJP, Gardner MJ, Power C, Hutt MSR. Prevalence of gallstones in nine British towns: a collaborative study. *Br Med J* 1979;ii:1389-92.
15 Burkitt DP, Tunstall M. Gallstones: geographical and chronological features. *J Trop Med Hyg* 1975;**78**:140-4.
16 Sarles H, Chabert C, Pommeau Y, Save E, Mouret H, Gerolami A. Diet and cholesterol gallstones—a study of 101 patients with cholelithiasis compared to 101 matched controls. *American Journal of Digestive Diseases* 1969;**14**:531-7.
17 Denbesten L, Connor WE, Bell S. The effect of dietary cholesterol on the composition of human bile. *Surgery* 1973;**73**:266-73.
18 Smith DA, Gee MI. A dietary survey to determine the relationship between diet and cholelithiasis. *Am J Clin Nutr* 1979;**32**:1519-26.
19 Thornton J, Symes C, Heaton KW. Moderate alcohol intake reduces bile cholesterol saturation and raises HDL. *Lancet* 1983;ii:819-22.
20 Scragg RKR, McMichael AJ, Baghurst PA. Diet, alcohol and relative weight in gallstone disease: a case-control study. *Br Med J* 1984;**288**:1113-9.

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