

Short Communication

Inuit Are Protected Against Prostate Cancer

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Abstract

Incidence and mortality rates for prostate cancer are reported to be low among Inuit, but this finding must be additionally supported given the difficulty of obtaining a precise medical diagnosis in the Arctic. We conducted an autopsy study in 1990–1994 among 61 deceased males representative of all deaths occurring in Greenland and found only one invasive prostate cancer. Histological data were available for 27 autopsies and revealed no latent carcinoma. Our results suggest that *in situ* carcinoma is rare among Inuit and that their traditional diet, which is rich in omega-3 polyunsaturated fatty acids and selenium, may be an important protective factor.

Introduction

Inuit display an extremely low incidence rate of prostate cancer. Incidence data collected from 1969 to 1988 for the Inuit populations of Alaska, Canada, and Greenland show an age-standardized incidence rate of 7.8/100 000, constituting only 2.4% of all cancers for these countries during this period. This rate corresponds to a standardized incidence ratio between 0.2 and 0.3 when compared with rates in Connecticut, Denmark, or Canada (1). In Greenland, the age-standardized incidence rate for the 1969–1988 period was 1.7/100 000, and only four cases were diagnosed. Although considerable differences in incidence and mortality rates are observed among populations worldwide, with the highest incidence occurring in the African-American black population and the lowest in Asian countries, the prevalence of latent carcinoma is similar in countries where autopsy studies have been conducted. It is therefore believed that the variation in the incidence of prostate cancer among populations does not reflect differences in initiation but rather differences in exposure to promoting factors.

Several factors have been proposed as protective agents against prostate cancer. Among those, *n*-3 PUFA² and Se² are

probably the most promising. Fish consumption and *n*-3 PUFA intake were recently reported to protect against prostate cancer in a prospective cohort of 6272 Swedish men (2). Se has been associated with a low incidence of prostate cancer in several epidemiological studies and is now under evaluation in large preventive trials (3, 4). The objective of the current study was to assess the prevalence of latent prostate carcinoma among Greenlandic Inuit based on autopsy examination and to investigate the role of potential protective factors in the Inuit diet.

Population and Methods

The population of this study was described in a previous report (5). Briefly, 107 autopsies were carried out among the 342 Greenlanders who died between October 1990 and mid-October 1994 at the hospitals of Nuuk and Ilulissat (west coast, Greenland). Among the 198 male deaths, 61 were autopsied (32.4%). The major reason for being included or not in the autopsy group was the availability of the doctors to conduct autopsies. Autopsied males were adults (≥ 18 years of age) with a mean age of 58 years (SE, 1.8) and a body mass index of 23.7 (SE, 0.48). Causes of death included cancer (28%), cardiovascular diseases (15%), violence (33%), and other causes (24%) and were comparable with the 137 nonautopsied male deaths (mean age, 59 years) with respective percentages of 20.5, 12.5, 38, and 20.5% of all deaths. Concentrations of *n*-3 PUFA in adipose tissue and Se in liver were measured respectively by thin-layer/gas chromatography and atomic absorption.

Results and Discussion

All but one prostate specimens were macroscopically benign. Macroscopic examination conducted among the 61 autopsies showed normal mean values for weight and size of the prostate specimens (mean weight of 23.2 g, excluding the carcinoma sample of 112 g). Adenoma-free prostates weighted 19.8 g on average. Because this specific study started in the course of the Greenland autopsy study, histopathological examination was available for only 27 prostate specimens and was performed by two different pathologists in Denmark. This subgroup had the same mean age (58 years) and similar causes of death as compared with the entire study group. Benign prostatic hyperplasia was found in 10 of the 27 samples examined, and unexpectedly, no latent noninfiltrative-type carcinoma was found during the histological examinations.

n-3 Fatty acids and Se concentrations measured in this study were previously reported to be high in comparison with other populations (4). It is interesting to note that the prostate carcinoma case was a 73-year-old male with a low *n*-3 PUFA concentration, *i.e.*, 0.9% of all fatty acids in adipose tissue samples, compared with 1.79% (95% confidence interval, 0.83–3.86) for the entire autopsy group. The omega-6/omega-3 ratio was 12.1 in this prostate cancer case compared with 4.56 (95% confidence interval, 1.98–10.5) for the entire group.

Although this autopsy study was conducted among a relatively small population sample (Greenland is inhabited by 56,000 people), it represents one-third of all adult male deaths

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² The abbreviations used are: omega-3 polyunsaturated fatty acids, *n*-3 PUFA; Se, selenium.

that occurred in Ilulissat and Nuuk during the study period. Furthermore, the autopsy population was comparable in terms of age and causes of death to all deaths occurring in Greenland from 1990 to 1994, and the selection of cases for autopsy was not associated with any medical reasons but only driven by the availability of the physicians conducting the autopsies. It is therefore unlikely that our observation might have been affected by a selection bias. The absence of latent carcinoma among the 27 prostate specimens submitted to histological analysis reflects an extremely low incidence compared with incidences of 25–35% that are usually reported in other comparable populations, including Asians (6).

The Inuit diet is composed of traditional seafood (fish and sea mammals) and is rich in Se and *n*-3 PUFA. The essential trace metal Se is found in high concentrations in fish, and Se concentrations as high as 10 mg/kg have been reported in the skin of beluga, minke, and narwhal whales (mattak), which are great delicacies in the Inuit diet. Fatty fish and marine mammal blubber (seals and whales) are major sources of *n*-3 PUFA (7).

This autopsy study conducted in Greenland confirms the low incidence and mortality rates for prostate cancer among Inuit. Moreover, although our sample size was small and a cross sectional design is not optimal, our data suggest that the prevalence of latent carcinoma is extremely low among Inuits compared with other populations and that not only promoting mechanisms but also the initiation of prostate cancer is rare among this population. Considering the recent scientific evidence that both Se and omega-3 fatty acids act as strong protective agents against prostate cancer and given the exceptionally high intake of these nutrients by Inuit through their traditional diet, we conclude that the low incidence of prostate

cancer in this population may be attributable to their high Se and *n*-3 PUFA intakes. It is also possible that other nutrients or lifestyle factors might be involved. This hypothesis will be additionally explored within the planned International Inuit Cohort Study.

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References

1. Prener, A., Storm, H. S., and N. H. Nielsen. Cancer of the genital tract in circumpolar Inuit. *Acta Oncologica*, 35: 589–593, 1996.
2. Terry, P., Lichtenstein, P., Feychting, M., Ahlbom, A., and Wolk, A. Fatty fish consumption and risk of prostate cancer. *Lancet*, 357: 1764–1766, 2001.
3. Duffield-Lillico, A. J., Reid, M. E., Turnbull, B. W., Combs, G. F., Jr., Slate, E. H., Fischbach, L. A., Marshall, J. R., and Clark, L. C. Baseline characteristics and the effect of selenium supplementation on cancer incidence in a randomized clinical trial: a summary report of the Nutritional Prevention of Cancer Trial. *Cancer Epidemiol. Biomark. Prev.*, 11: 630–639, 2002.
4. DeFrancesco, L. Prostate cancer prevention trial launched. *Nat. Med.*, 7: 1076, 2001.
5. Mulvad, G., Pedersen, H. S., Hansen, J. C., Dewailly, É., Jul, E., Pedersen, M., Deguchi, Y., Newman, W. P., Malcom, G. T., Tracy, R. E., Middaugh, J. P., and P. Bjerregaard. The Inuit diet. Fatty Acids and Antioxidants, their role in Ischemic Heart disease, and Exposure to Organochlorines and Heavy Metals. An International study. *Arct. Med. Res.*, 55 (Suppl): 20–24, 1996.
6. Watanabe, M., Nakayama, T., Shiraishi, T., Stemmermann, G. N., and Yatani, R. Comparative studies of prostate cancer in Japan *versus* the United States. A review. *Urol. Oncol.*, 5: 274–283, 2000.
7. Blanchet, C., Dewailly, É., Ayotte, P., Bruneau, S., Holub, B. J., and Receveur, O. Contribution of selected traditional and market food to Nunavik Inuit women diet. *Cancer J. Diet. Prac. Res.*, 61: 50–59, 2000.

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