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Review

Are low ultraviolet B and vitamin D associated with higher incidence of multiple myeloma?

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ABSTRACT

Background: The purpose of this study was to determine whether an inverse association exists between latitude, solar ultraviolet B (UVB) irradiance, and incidence rates of multiple myeloma.Methods Associations of latitude and UVB irradiance with age-standardized incidence rates of multiple myeloma were analyzed for 175 countries while controlling for sex-specific obesity prevalence, cigarette consumption, and alcohol consumption using multiple linear regression.Results Incidence rates of multiple myeloma were greater at higher latitudes (R^2 for latitude for males = 0.31, $p < 0.0001$; females $R^2 = 0.27$, $p < 0.0001$). In regression models for males ($R^2 = 0.62$, $p < 0.0001$) and females ($R^2 = 0.51$, $p < 0.0001$), UVB irradiance was independently inversely associated with incidence rates.Conclusions Age-adjusted incidence rates of multiple myeloma were higher in countries with lower solar UVB irradiance. Further investigation is warranted in individuals of the association of prediagnostic serum 25 (OH)D with risk.

Contents

1. Introduction

Worldwide there are an estimated 85,704 cases and 62,534 deaths from multiple myeloma each year [1]. In the United States, multiple myeloma is the second most common cancer of the blood after Non-Hodgkin's lymphoma [2]. In 2008 there were

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19,920 cases and 10,690 deaths expected in the US [2]. However, very little is known about the etiology of multiple myeloma apart from an elevated risk found in the obese, African-Americans, and workers employed in certain industries, although results have been inconsistent [3].

Greater exposure to solar ultraviolet B in areas with high solar irradiance results in greater cutaneous photosynthesis of vitamin D in populations in these areas, resulting in higher levels of vitamin D metabolites that reduce the risk of certain cancers [4]. Previous research has shown that populations living at higher latitudes, or having lower prediagnostic serum 25(OH)D levels, have higher incidence rates of various cancers, including those of breast [5–8], colon [9–12], and ovary [13], raising the possibility that vitamin D might also play a preventive role in the etiology of multiple myeloma.

Multiple linear regression was employed in order to examine the associations of UVB irradiance adjusted for cloudiness with age-standardized incidence rates of multiple myeloma while controlling for sex-specific obesity prevalence, cigarette consumption, and alcohol consumption.

2. Materials and methods

2.1. Data sources

Data were obtained for each country on age-standardized incidence rates of multiple myeloma, latitude of the population centroid, UVB irradiance adjusted for cloudiness, sex-specific obesity prevalence, per capita alcohol consumption, and per capita cigarette consumption. Complete data on all variables were available for 107 countries. Data for latitude, male age-standardized multiple myeloma incidence, and female age-standardized multiple myeloma incidence are available in Appendix A Table A1.

The sources for many of the variables have been described elsewhere [14]. Age-standardized incidence rates of multiple myeloma were obtained for 175 countries using the International Agency for Research on Cancer (IARC) GLOBOCAN database [1]. Per capita alcohol consumption, as energy in kilocalories per day for all countries in 1980, was obtained from the United Nations (UN) Food and Agriculture Organization [15]. Data on cloud cover were obtained from the International Satellite Cloud Climatology Project (ISCPP) [16].

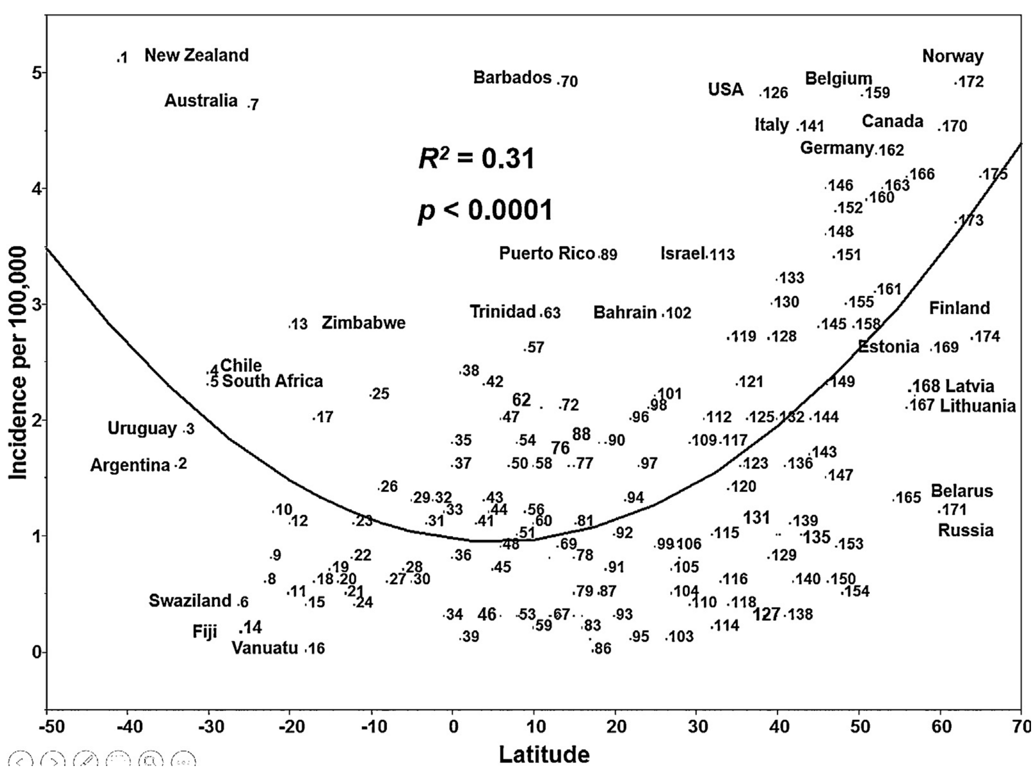

Fig. 1. Age-adjusted incidence rates of multiple myeloma per 100,000 population, males.
1. *New Zealand;* 2. Argentina; 3. Uruguay; 4. Chile; 5. South African Republic; 6. Swaziland; 7. Australia; 8. Paraguay; 9. Namibia; 10. Botswana; 11. Mauritius; 12. Madagascar; 13. Zimbabwe; 14. Fiji; 15. Mozambique; 16. Vanuatu; 17. Bolivia; 18. Polynesia; 19. Zambia; 20. Samoa; 21. Melanesia; 22. Angola; 23. Comoros; 24. Malawi; 25. Peru; 26. Brazil; 27. Solomon Islands; 28. Tanzania; 29. Indonesia; 30. Papua New Guinea; 31. Burundi; 32. Rwanda; 33. Congo Brazzaville; 34. Gabon; 35. Congo; 36. Ecuador; 37. Equatorial Guinea; 38. Kenya; 39. Uganda; 40. Singapore; 41. Malaysia; 42. Colombia; 43. Suriname; 44. Brunei; 45. Guyana; 46. Benin; 47. Cameroon; 48. Liberia; 49. Central African Republic; 50. Sri Lanka; 51. Cote d'Ivoire; 52. Ghana; 53. Togo; 54. Venezuela; 55. Sierra Leone; 56. Ethiopia; 57. Panama; 58. Costa Rica; 59. Nigeria; 60. Somalia; 61. Guinea; 62. Micronesia; 63. Trinidad and Tobago; 64. Djibouti; 65. Guinea-Bissau; 66. Philippines; 67. Burkina Faso; 68. Cambodia; 69. Nicaragua; 70. Barbados; 71. Gambia; 72. Guam; 73. El Salvador; 74. Senegal; 75. Guatemala; 76. Chad; 77. Honduras; 78. Sudan; 79. Thailand; 80. Yemen; 81. Eritrea; 82. Cape Verde; 83. Niger; 84. Mali; 85. Viet Nam; 86. Belize; 87. Lao People Democratic Republic; 88. Jamaica; 89. Puerto Rico; 90. Dominican Republic; 91. Haiti; 92. India; 93. Mauritania; 94. Cuba; 95. Myanmar; 96. Oman; 97. Mexico; 98. Bahamas; 99. Qatar; 100. Saudi Arabia; 101. United Arab Emirates; 102. Bahrain; 103. Bangladesh; 104. Egypt; 105. Libya; 106. Bhutan; 107. Algeria; 108. Nepal; 109. Kuwait; 110. Lesotho; 111. Pakistan; 112. Jordan; 113. Israel; 114. Iran; 115. Morocco; 116. China; 117. Iraq; 118. Afghanistan; 119. Lebanon; 120. Tunisia; 121. Cyprus; 122. Syria; 123. Malta; 124. Japan; 125. South Korea; 126. United States of America; 127. Tajikistan; 128. Greece; 129. Turkey; 130. Portugal; 131. Armenia; 132. North Korea; 133. Spain; 134. Turkmenistan; 135. Azerbaijan; 136. Albania; 137. Kyrgyzstan; 138. Uzbekistan; 139. Macedonia; 140. Georgia; 141. Italy; 142. Bulgaria; 143. Serbia and Montenegro; 144. Bosnia Herzegovena; 145. Croatia; 146. France; 147. Romania; 148. Switzerland; 149. Slovenia; 150. Moldava; 151. Hungary; 152. Austria; 153. Mongolia; 154. Kazakhstan; 155. Slovakia; 156. Ukraine; 157. Czech Republic; 158. Luxembourg; 159. Belgium; 160. Germany; 161. Poland; 162. Netherlands; 163. Ireland; 164. United Kingdom; 165. Belarus; 166. Denmark; 167. Lithuania; 168. Latvia; 169. Estonia; 170. Canada; 171. Russian Federation; 172. Norway; 173. Sweden; 174. Finland; 175. Iceland