

**TUBERCULOSIS IN THE HEBRIDES: THE RARITY OF
TUBERCLE BACILLI IN THE MILK OF COWS—WITH
A NOTE ON THE VITALITY OF TUBERCLE BACILLI
PRESERVED IN FROZEN MILK.**

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THE serious problem presented by the high prevalence of severe pulmonary tuberculosis in early adult life in the Highlands and Islands of Scotland is exemplified by the figures in the following table, for which we are indebted to the Department of Health and the Registrar-General for Scotland.

*Death rate from tuberculosis of the respiratory tract per 100,000 of the population,
according to districts, in the period 1920-4.*

Age group in years	Lewis	Shetland	Inverness	All Scotland
15-24	366	295	162	108
25-34	315	256	210	129

In connection with this question information was required as to the occurrence of bovine tuberculosis in these districts. Accordingly, an investigation of the milk of cows in various parts of the Hebrides was carried out in the summer of 1928 at the request of the Department of Health for Scotland with the aid of a grant from the Treasury. The specimens of milk were obtained by Drs Ralph Begbie and Harley Williams (1931). The procedure adopted in their collection was as follows. The teats of the cow having been cleansed with soap and water followed by spirit, about half a pint of milk was withdrawn into a sterile bottle. The sample was then centrifuged for half an hour at 3000 revolutions per min. in an electric centrifuge or for three-quarters of an hour in a hand machine. The cream and deposit of each specimen were removed by a pipette, mixed and forwarded to Glasgow in a glass container. In the course of about a month 252 specimens were received, these being distributed among the various areas as follows:

	No. of samples		No. of samples
Stornoway	9	N. Uist	3
Lewis	167	S. Uist	24
Harris	30	Barra	17
Benbecula	2		

As it was impossible to examine all the specimens immediately, they were kept continuously frozen at about -8° to -20° C. before further treatment.

Of each specimen, after thawing, 5–10 c.c. were treated with an equal volume of 15 per cent. solution of antiformin for about 20 min., centrifuged, and the sediment washed twice with sterile distilled water and finally resuspended in a small amount of water—the whole procedure from the addition of antiformin being completed within 30 min. From the suspension of sediment finally obtained films and cultures were made on glycerine egg medium prepared with “long digest” of trypsinised horse heart (Muir and Ritchie, 1932) and guinea-pigs inoculated. Most of the animals were killed and examined 8 weeks later, although a few were kept for between 6 and 8 weeks. In no case were acid-fast organisms found in the films or were tubercle bacilli demonstrated either by cultivation or the production of tuberculous lesions in the animals. Sixteen further specimens (thirteen from Inverness-shire mainland, and three from Stromness, Orkney), constituting the milk supply of tuberculous patients, were also examined similarly for tubercle bacilli, but with negative results in every case.

As the last specimens had been kept frozen for 1 year and 9 months before examination, it was necessary to exclude the possibility that the vitality of any tubercle bacilli present might have been damaged under such conditions. Accordingly, a specimen of tuberculous cow's milk¹ was procured which showed scanty acid-fast bacilli on examination of the sediment obtained after treatment with antiformin. The milk was distributed in test-tubes which were stored in the refrigerator, and ten guinea-pigs were inoculated at intervals, each receiving subcutaneously the sediment obtained from 10–15 c.c. of milk which, after thawing, had been treated with antiformin as described above. The first portion used for inoculation had been kept frozen for 6 weeks and the last for over 2 years and 8 months. All the guinea-pigs developed tuberculous lesions. The last animal inoculated died after nine and a half weeks and showed *post mortem* a subcutaneous mass of the size of a hazel-nut at the site of inoculation, along with numerous nodules in the lungs and other organs, in which acid-fast bacilli were found. This result is in agreement with other findings, *e.g.* Shope (1926) recorded that suspensions in physiological saline of cultures of human and bovine type were both still virulent for guinea-pigs after having been kept in a refrigerator at a temperature fluctuating about 0° C. for 310–330 days. We have also cultivated a bovine strain after treating with antiformin a specimen of tuberculous meat which had been kept frozen for 2 years. The culture so obtained caused generalised tuberculosis in a guinea-pig.

DISCUSSION.

According to Harley Williams (1931), the occurrence of human tuberculosis in the Hebrides is a relatively recent event. Also the housing conditions are such as to favour in high degree the spread of infection from person to person.

¹ We are indebted to Professor Renwick Leitch, West of Scotland Agricultural College, for this material.

The results of the present investigation indicate clearly that there is a noteworthy absence of bovine tuberculosis as determined by the examination of cows' milk; and this corresponds with the available evidence from meat inspection (Harley Williams). Accordingly, bovine infection appears to play practically no direct part in the causation of human tuberculosis in this area. The question therefore arises as to the possible relationship of the findings in cattle to the high fatality of human tuberculosis, especially in young adults. The possibility cannot be excluded that the absence of bovine tuberculosis may play an indirect part in conducing to a severe form of human disease owing to the lack of immunity conferred in man against the latter by bovine infection. In this connection it should be noted that the association of high mortality from human tuberculosis together with low incidence of the disease in cattle has also been recorded in Norway, Northern Sweden (Lichtenstein, 1924), Finland, the Faroe Islands, Iceland and Greenland. Höyer Dahl (1932) quotes Andvord's early observations in Norway regarding the great prevalence of human tuberculosis where the cattle are practically unaffected by the disease and also the converse condition, namely the relative freedom from tuberculosis where the cattle are extensively tuberculous, so that human and bovine tuberculosis would appear to be mutually exclusive. Dahl goes so far as to relate causally the high incidence of tuberculosis in young adults to the absence of bovine tuberculosis. Although the results are very suggestive, at present this must be left an open question.

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