

POTATO CULTIVATION AND STORAGE IN SOUTH WALES AND ITS RELATION TO NEURAL TUBE MALFORMATION PREVALENCE

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The prevalence of neural tube malformations at birth is higher in the coalmining valleys of South Wales than anywhere else in England and Wales. In the eastern mining valleys of Glamorgan rates exceeded 1% of all births in the period 1964-66 (Richards, Roberts, and Lloyd, 1972). The prevalence in the coastal regions of South Wales is only half that in the mining valleys and this is not due to area differences in social class, parity, maternal age, migration or Welshness (Richards, Roberts, and Lloyd, 1972). Recently Renwick (1972) has claimed that potato blight may be responsible for 95% of all neural tube malformation prevalence, and that this hypothesis is consistent with the high prevalence in the coalmining areas of South Wales because many miners have allotments, and in the absence of cellars or other cool storage places, keep their harvested homegrown potatoes indoors in temperatures which are high throughout the year because of free or low-cost coal, conditions ideal for rapid deterioration.

A recent study by Clarke, McKendrick, and Sheppard (1973), based on 83 Liverpool schoolchildren with spina bifida, found no significant differences in the amount of potatoes eaten by their mothers compared with a matched control group. We have available to us the names and addresses of each of the 40,032 infants born in Glamorgan between 1964 and 1966, of whom 26,114 were born into coalmining communities. Also available are the names and addresses of all such infants discovered by their second birthdays to have had neural tube defects. In this paper we have confined our attention to that group of potatoes considered by Renwick to provide the greatest risk to mothers in South Wales (*viz.*, homegrown potatoes) but we have also collected additional information on length and site of storage and allotment status of parents, factors considered by Renwick to be critical in the explanation of the very high prevalence of neural tube defect in the South Wales mining valleys.

MATERIAL AND METHOD

For the three years beginning 1 January 1964 we had already collected information about all infants born to women resident in a defined area in South Wales and about all the congenital defects identified in that birth population. The scope of the investigation and the methods used are described elsewhere (Richards and Lowe, 1971). During the period of the study 743 singleton infants were ascertained as having neural tube malformation (out of a total birth population of 90,921 singletons), of whom 336 lived in Glamorgan. One control for each Glamorgan case was selected and matched for social class, parity, place of birth, and month of birth; maternal age had not been found to be related significantly to the prevalence of neural tube malformations (Lowe, 1972).

A short questionnaire was prepared asking about the amount of homegrown potatoes eaten, length of time potatoes were stored before being eaten, and whether the child's father or grandfather had an allotment. The questions were asked in relation to the time of the infant's birth (1964-66). Questions were put to the mothers of the study subjects by the local health visitors who were given a handout which contained information on the objectives of the study and the method and sequence of interview, and which also provided guidelines about how questions should be phrased in order to minimize bias. One further question was included which enabled the interviewer to express her own views concerning the reliability of the information given by the mother. The fieldwork was supervised centrally by the office of the Medical Officer of Health for Glamorgan. The project was begun on 1 March 1973 and completed six weeks later.

RESULTS

From a total of 672 survey subjects (336 cases and 336 controls) completed interviews were obtained on 471 (240 cases and 231 controls). Of the

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201 not completed, 195 had removed to either an unknown address or to one outside the county, and 6 refused to cooperate. The social class, parity, and maternal age structure of the 94 cases for whom interviews were incomplete was found to be not significantly different from that of the 240 cases whose interviews were complete. This suggests that our sample can be regarded as representative of the total population of neural tube defect births in Glamorganshire for the period 1964-66.

The proportion of the population owning an allotment was low—18% of fathers of cases compared with 13% of fathers of controls, and 21% of grandfathers of cases compared with 20% of grandfathers of controls (Table I). Neither difference is statistically significant.

Sixty-one per cent of cases and 60% of controls were not exposed to homegrown potatoes—defined as potatoes from own or relative's garden or allotment or direct from local farmer, and among those who ate homegrown potatoes for two or more weeks of the year there was no evidence of longer storage in cases compared with controls (Table II), or that the place of storage differed significantly between cases and controls (Table III).

TABLE I
ALLOTMENT STATUS OF FATHERS AND GRANDFATHERS OF STUDY SUBJECTS

Relationship to Study Subjects	Proportion with Allotments		
	NTD Subjects	Controls	χ^2
Father	18% (42)*	13% (30)	ns
Grandfather	21% (50)	20% (45)	ns

NTD = neural tube defects
*Actual numbers in parentheses

TABLE II
CONSUMPTION OF 'HOMEGROWN' POTATOES AMONG STUDY POPULATION, AND AMOUNTS OBTAINED AT ANY ONE TIME

	NTD Subjects	Controls	χ^2
Never consumed homegrown potatoes ..	61% (147)*	60% (138)	} ns
Consumed homegrown potatoes for up to one week only of the year ..	6% (15)	7% (16)	
Amount of homegrown potatoes obtained at any one time by those who ate homegrown potatoes for two or more weeks of the year			
Sufficient for one week at a time	24% (57)	21% (48)	
Sufficient for one month at a time ..	4% (10)	6% (15)	
Sufficient for more than one month at a time ..	5% (11)	6% (15)	
	100% (240)	100% (231)	

*Actual numbers in parentheses

TABLE III
STORAGE SITE OF HOMEGROWN POTATOES AMONG CONSUMERS WHO OBTAINED SUPPLIES FOR MORE THAN ONE WEEK AT A TIME

Storage Site	NTD Subjects	Controls	χ^2
House	5% (11)*	6% (15)	ns
Garden shed	4% (10)	6% (15)	ns
Never stored, or stored for less than one week ..	91% (219)	88% (201)	ns
	100% (240)	100% (231)	

*Actual numbers in parentheses

Eighty-seven per cent of answers given by mothers of cases were assessed as likely to be reliable by interviewers (who were usually well acquainted with the family) compared with 91% of control answers.

DISCUSSION

This investigation has been unable to find evidence of an association between the consumption and storage of homegrown potatoes and allotment status of parents on the one hand, and the prevalence of neural tube defects on the other. This finding may have arisen because there is truly no association, or just possibly because answers given by mothers of infants with neural tube defects were so heavily biased against the suspected causal factor that a true association has been obscured. For two reasons, however, we think that the most likely explanation is that no association exists. First, if consumption and storage of homegrown potatoes is the explanation for the appearance of neural tube defects in the case group—since 33% of the control group were exposed to this factor (group III, Table II) it must be assumed that virtually all the case group were also exposed. However, only 33% of the case group (i.e., the same figure as for the control group) admitted eating and storing homegrown potatoes. Furthermore, if the case group answers were biased, it is remarkable that they came to be identical with those given by the (presumably unbiased) control group. Secondly, if consumption and storage of homegrown potatoes is such a high-risk factor it is difficult to account for the absence of neural tube defects among those control subjects who were exposed.

In our view, the findings presented in this paper suggest that in South Wales there is no association between neural tube defect and homegrown potato consumption and storage. Although this does not provide direct evidence to invalidate the potato blight neural tube defect hypothesis it does suggest that the view that the high prevalence in South Wales is due to potato blight is largely unjustified.

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Renwick has suggested that the only effective way of testing his hypothesis is by way of a prospective potato avoidance trial. In view of the findings of the present study, which add general support to those of Clarke *et al.* (1973), perhaps there is a real need first of all to verify the existence of an association between blight and neural tube defect by appropriate *ad hoc* observational studies designed specifically for this purpose before attempts are made to establish causality by experiments on the population.

SUMMARY

A retrospective case control study of 240 infants born with neural tube malformation in Glamorgan-shire between 1964 and 1966 failed to find any evidence of an association between the consumption and storage of homegrown potatoes by, and the allotment status of, their parents compared with a group of matched controls. Although these findings do not provide direct evidence to invalidate the potato blight neural tube defect hypothesis they do suggest that the view that the high prevalence in

South Wales is due to potato blight, is largely unjustified. It is suggested that perhaps there is a real need to verify the existence of an association between blight and neural tube malformation by appropriate *ad hoc* observational studies designed specifically for this purpose before attempts are made to establish causality by experiments on the population.

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