LENGTH OF CIGARETTE ENDS AND INHALING

BY

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The suggestion that inhalers might on average leave a greater length of cigarette unsmoked was supported in a study of miners and ex-miners aged 35 to 64 years living in the Rhondda Fach. Non-inhalers, detected in an earlier random sample survey, were matched with inhalers, for age, radiological category of pneumoconiosis, and number of cigarettes smoked daily. Cigarette ends were collected for one day from all the men. The ends were measured by one observer who knew nothing about the smoking habits of the men submitting them. In each ten-year age group, the length of unsmoked cigarette was slightly shorter in non-inhalers than in inhalers, and the difference of 1.28 mm. was just significant ($P = 0.05$). The biological implications of this small difference are discussed.

One of the difficulties in accepting cigarette smoking as the main cause of lung cancer has been the recording by Doll and Hill (1950) of a lower proportion of inhalers among subjects with lung cancer than among controls (Fisher, 1959). Although several later studies (Lickint, 1953; Breslow, Hoaglin, Rasmussen, and Abrams, 1954; Schwartz and Denoix, 1957; Lombard and Snegireff, 1959) have suggested that inhalers are more likely to develop lung cancer than non-inhalers, the anomalous finding in the earlier study requires an explanation. Good (1962) has suggested that if inhalers left on average a greater length of cigarette unsmoked the discrepancy would be resolved. A survey of a random sample of 1,250 miners and ex-miners aged 35 to 64 living in the Rhondda Fach and seen during 1961 (Higgins and Cochrane, 1961) enabled us to test this hypothesis. Smoking habits, which included the question: 'Do you usually inhale?' had been included in the initial investigation. We were therefore able to match men who said they did not inhale with men, seen in the sample, who said they did.

The Study Group

All the non-inhalers found in the sample were used. To match each non-inhaler, an inhaler from

the same five-year age group and the same radiological category of pneumoconiosis, who smoked an approximately similar number of cigarettes daily, was drawn using random numbers.

Methods and Procedure

A home visitor delivered tin boxes to every man with instructions to collect all cigarette ends for one whole day. Cigarette ends were collected from the men on Monday to Thursday, but not on Friday to Sunday because of possible changes in smoking habits over the week-end. The filled boxes were brought to the unit, where the stubs were measured by one observer using calipers. The men in the study did not know the purpose of the investigation, and the person making the measurements did not know if the ends being measured were from inhalers or from non-inhalers.

Results

Ninety-nine per cent of the men co-operated in the investigation. The men aged 35 to 54 were studied about six months, and those aged 55 to 64 about one year, after their smoking habits had been recorded. During this time some changes in smoking habits had taken place (Table 1). A higher proportion of non-inhalers had given up smoking or become pipe smokers, but due to the small numbers the difference is not statistically significant.

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TABLE 1
SAMPLE STUDIED

Age Group (yr.)	Inhaling Category	No. in Original Group	Change in Smoking Habits		Dead	Left Area	Excluded	Refused	Remainder	
			Given up	Changed to Pipe					Total	Complete Pairs
35-44	Non-inhalers	31	4	2	0	0	0	0	25	23
		31	3	0	0	0	0	0	28	23
45-54	Non-inhalers	17	3	1	0	0	0	0	13	13
		17	1	0	0	0	0	0	16	13
55-64	Non-inhalers	60	7	1	0	0	1*	1	50	45
		60	5	0	1	2	0	0	52	45
35-64	Non-inhalers	108	14	4	0	0	1	1	88	81
		108	9	0	1	2	0	0	96	81

*Because of bronchitis.

TABLE 2
MEAN NUMBER OF CIGARETTE BUTTS RECEIVED FROM INHALERS AND NON-INHALERS

Age Group (yr.)	Non-Inhalers	Inhalers
35-44	8.7	10.1
45-54	11.0	12.1
55-64	11.2	10.1
35-64	10.4	10.4

Matching for the quantity of tobacco smoked appears to have been adequate (Table 2). At all ages the mean number of cigarette ends collected was identical for inhalers and non-inhalers. Inhalers under the age of 55 produced an average of approximately one more cigarette end than non-inhalers; but in the 55 to 64 age group there was a similar mean difference in the opposite direction. Twelve men in the sample, four non-inhalers and eight inhalers, used filter tips. Whether they are included or excluded makes little difference to the results, and

they have therefore been included in the present analysis.

Table 3 gives the mean lengths of cigarette ends of the matched pairs by age and inhaling. In each decennial age group, the mean length of cigarette left by the inhalers was slightly longer than that left by the non-inhalers. Considering all ages together, the mean difference of 1.28 is just significant ($P = 0.05$). The differences in each of the three decennial age groups, although in the same direction, do not reach even the 5% level of significance.

Comment

The results in this group of miners and ex-miners support the hypothesis that the length of cigarette unsmoked is slightly shorter for non-inhalers than inhalers. The difference in means between the two, however, does not appear to be large. It was more evident in men under 55 years of age and only trifling

TABLE 3
MEAN LENGTH OF CIGARETTE BUTT BY AGE AND INHALING

Mean Butt Length (mm.)	Age and Inhaling Group							
	35-44		45-54		55-64		35-64	
	Non-inhaler	Inhaler	Non-inhaler	Inhaler	Non-inhaler	Inhaler	Non-inhaler	Inhaler
9-			1				1	
11-			2		2		4	
13-	1		1		2	3	4	3
15-	4	1	2		9	7	15	8
17-	4	2	2	3	11	10	17	15
19-	5	8	2	4	5	12	12	24
21-	3	4	1	2	6	6	10	12
23-	6	6	1	0	5	2	12	8
25-		1		1	4	2	4	4
27-				3	1	1	1	4
29 and over		1	1			2	1	3
Total	23	23	13	13	45	45	81	81
Mean	19.84	21.59	18.08	21.86	19.61	19.93	19.43	20.71
S.D.	3.45	3.19	6.55	4.30	3.95	3.99	4.32	3.89
Difference between inhalers and non-inhalers	+ 1.75		+ 3.78		+ 0.32		+ 1.28	

in men aged 55 to 64 years. A possible explanation for this apparent age effect might be that men with respiratory symptoms or bronchitis, who had once been inhalers, had given up the practice for health reasons. The mean length of 20.07 mm. found in this survey may be compared with the figure of 18.8 mm. recorded by Doll, Hill, Gray, and Parr (1959) for a random sample of men and women in Britain. The agreement is fairly close and suggests that in this respect this mining group is representative of the general community.

How much significance can be attached to a mean difference of this magnitude is hard to say. The temperature of the inhaled smoke has been shown to rise rapidly when the burning cigarette is less than 25 mm. long (Smyth, 1959), and a disproportionately large amount of tar may also be drawn into the respiratory passages because of the reduced efficacy of unburned tobacco as a filter. But the small difference we have found seems unlikely to account for the anomaly in the smoking/lung cancer story pointed out by Fisher.

A more plausible explanation of this might be that it is not the smoke inhaled through the cigarette that is important in the development of lung cancer, but rather the more obviously irritating smoke inhaled

from the burning end. It would be valuable to know more about the way in which people smoke. In any future lung cancer studies, attention should be directed not only to the amount of tobacco smoked, the degree of inhalation and length of cigarette end, but also the manner of holding the cigarette, for example whether mainly in the hand or constantly in the mouth, when engaged in other activities.

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