allow penetration of chemicals through itself; (g) be able to prevent heat-insulating effects by providing low-surface tension and a capacity to mix with water; (h) if possible be to some slight extent absorbed into the skin, and *must* certainly fill the hair follicles with inert but easily removed substance; (i) should be easy to remove without the use of scrubbing-brushes or a detergent *other than good soap*. The HEB as originally supplied appeared to possess many of the above characteristics, but its use was contraindicated because of its "stiff" nature; there was thus difficulty in producing a rapid and even spread over a workman's arms and hands.

HEB protective (normal), as now produced, is a thin, pleasant, adherent cream which can be rapidly and easily massaged into the skin, and is not transferable to paper or fabrics. The film, a *true emulsion*, readily spreads over the skin surface, and, penetrating into the follicles, holds up within itself the smallest particles. On reapplication of water, or *good soap* and water, an immediate re-emulsion is produced which throws back such particles without difficulty. A simple experiment to demonstrate this can be carried out as follows. The back of one hand is massaged with HEB protective until apparently normal in appearance. The backs of both hands are then rubbed heavily with colloidal carbon particles. The most thorough washing of the hands follows. The unprotected hand shows an adhering film of black matter. Even after the use of soaps, pumice-stone, and scrubbing-brushes, moderate magnification shows the particles of carbon firmly lodged within the mouths of the hair follicles.

Non-transferability is demonstrated by handling white paper immediately after massage of the fingers with HEB protective. In order to meet the need for protection against wet irritant media a modification of "HEB protective (normal)" had to be made, *introducing lanolin, which leaves a film that will resist water but easily re-emulsify*. Such modification lay in the alteration of relative proportions of wax and fat so as to leave a film of the latter to resist aqueous solutions by its high surface tension. It has been termed "HEB protective (waterproof)," and acts by the addition of high surface tension to the phenomenon of barrier production as possessed primarily by "HEB protective (normal)." The constitution of these two preparations is as follows:

Normal.—Higher fatty alcohols (palmityl and stearyl); acid esters of these higher fatty alcohols; liquid paraffin; paraffin wax; water; perfume.

Waterproof.—As above, with lanolin replacing the paraffin wax.

It is too early to claim much for these preparations, since they have not yet received an extensive trial under working conditions involving the factors of prolonged perspiration, continued friction, personal idiosyncrasy, and conscientious application. It can, however, I think, be stated that in experiment they represent a real advance in preventive medicine, the indications being that tar, oil, and dyestuffs in particular are resisted. Against soaps and oil soluble irritants they would appear theoretically less useful, though after exposure highly remediable. Research on these points is proceeding.

I would be very grateful if any who are disposed to give the preparation a trial would report their findings, especially regarding the capacity to reduce the incidence of occupational dermatitis, whether that of housewife or workman.

I wish to express my gratitude to Messrs. Halden of Manchester for their continuous help, and to Mr. J. Holden, their chief research chemist, for his co-operation in interpreting the chemical and physical data involved.

REFERENCE

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CLINICAL AND SOCIAL SURVEY OF MALE LINEN WEAVERS

BY

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Lurgan in Northern Ireland is one of the chain of small linen-manufacturing towns stretching south-west from Belfast. The population of the urban district increased by 10 per cent. between 1926 and 1937—a rapid development which suggests that conditions there have been as attractive as in most places in Northern Ireland. In the same period the increase in the number of houses was sufficient to reduce the density of occupation from 4.5 to 4.1 persons per private house, which latter figure is as low as the figure for all Northern Ireland and lower than the figure for all urban areas in Northern Ireland. The crude death rate is slightly below that for Northern Ireland as a whole, and the infantile mortality rate is low, particularly when considered in conjunction with the high birth rate. On the basis of the 1937 population the figures are as follows:

	1933 to 1937	Northern Ireland	Lurgan
Crude birth rate		19.7	23.3
Crude death rate		14.4	14.2
Infant mortality rate		78	71

Of the population insured under the Unemployment Insurance Acts 70 per cent. is dependent on the textile industry, and in particular upon linen weaving. During 1937 30 per cent. of the insured population of Lurgan was unemployed, while in the first six months of 1938 a very great increase in the number registered as unemployed brought the percentage to 40. Of the insured population nearly one-half consists of females. For this survey men of Lurgan were invited to present themselves for examination provided they were normally employed as weavers, were able-bodied, and were under 47 years of age. A man was regarded as able-bodied if he did not consider himself to be sufficiently ill to attend his doctor for medical treatment, although as a panel patient he could have obtained it freely. Altogether 202 men were examined (by J. D.), and it is thought that they were typical of the male weavers in Lurgan.

Method of Examination

The method of examination was planned after a visit (by J. D.) to the Rowett Institute at Aberdeen and to the areas where the Carnegie Research on Nutrition was being conducted by Sir John Orr and his staff; the clinical part of the present survey is based on similar methods, modified for adults. The social part is based on a survey carried out in 1933 in Vienna by Götzl, Kornfeld, and Nobel. To reduce subjective assessments to a minimum, certain standards were adopted.

Height.—Measured in shoes or boots, to the nearest quarter of an inch.

Weight.—Measured to the nearest pound, each man wearing only shoes, socks, trousers, and underclothing, the average weight of these being 4½ lb. Except where specifically stated the weights given include the weight of clothes worn.

Trochanteric Height.—Measured from the instep to the upper palpable limit of the great trochanter, to the nearest half-inch.

Bisacromial Width.—Measured by a "pelvimeter" from the tip of one acromion process to the other, to the nearest quarter of an inch.

Haemoglobin.—The haemoglobin content of the blood was estimated by means of a "Dare" haemoglobinometer and expressed as a percentage. For comparison with the results of other investigators the values have also been converted into Haldane equivalents.

Winging of Scapulae.—Recorded as present when the angle between the horizontal and a line joining the lower angle of the scapula and the greater tuberosity of the humerus was less than 45 degrees.

Complexion.—Recorded as normal unless marked pallor was present.

Follicular Hyperkeratosis.—Recorded as present when papillation and keratinization of hair follicles was seen in at least two areas of the body and with at least six obvious papillae to the square centimetre in one area.

Pyogenic Infections.—These included pimples, furuncles, carbuncles, impetigo, styes, and septic wounds and abrasions.

Frontal Bossing.—Only diagnosed if there was a separate boss on each frontal bone.

Harrison's Sulcus.—Diagnosed with arms stretched above head to lift thorax.

Cervical Adenitis.—Recorded as acute or tuberculous.

Chronic Upper Respiratory Catarrh.—Diagnosed on examination of the condition of the nasal mucous membrane and (a) in the first hundred cases, on the presence of any post-nasal discharge; (b) in the second hundred cases, only when the discharge was purulent.

Tuberculosis.—Only pulmonary tuberculosis was recorded, and this was diagnosed on the detection of moist adventitious sounds persisting on coughing and associated with other definite signs and symptoms.

Teeth.—Classified as (1) excellent; (2) caries (gross caries present in three or more teeth); (3) pyorrhoea; (4) extractions (more than eight teeth extracted); and (5) dentures.

Adenoids.—Diagnosed only when breathing was obstructed or facial appearance affected by post-nasal growth.

Finally, an opinion was formed as to whether the man was suffering from clinical malnutrition.

It is not claimed that this method divides the men in any objective way. It is claimed that it effectively divides them into two groups, the men of one group being apparently in a much better physical condition than those of the other group. In the whole inquiry 110 out of 202 cases were classified as suffering from malnutrition, and the principal use made of the figures is to find what clinical and social conditions are associated with this classification of malnutrition. The men were examined in the period March to May, 1938, and in order to show that the subjective valuation of borderline cases did not vary materially during the period of the investigation a comparison is made between the first 100 cases and the remaining 102. The majority of the results are remarkably consistent, an exception being the haemoglobin content of the blood, which is significantly higher in the second hundred cases. As the other differences are all of a size which might be expected from the operation of elements of pure chance it is felt that this variation must be an involuntary modification of the assessment by the investigator. Cumulatively there is some evidence that the second hundred cases were slightly more healthy than the first hundred. This evidence consists in the slightly greater trochanteric height and bisacromial width, and in fewer periods under the doctor's care. In addition the proportion of cases with defects is lower in fifteen out of twenty-three items in the second hundred cases. As great a proportion of the second hundred is classified as suffering from malnutrition as in the first hundred.

Comparison between British and Lurgan Men (allowing in Each Case for the Weight of Clothes worn and for the Height of Footwear)

	Weight	Height
<i>Great Britain:</i>	st. lb.	ft. in.
Men in industry	9 9	5 6½
Unemployed men	9 1½	5 5½
<i>Lurgan Weavers:</i>		
All cases	9 2	5 6½
Cases not malnourished	9 6½	5 6½
Malnourished cases	8 12	5 6½
<i>Standard Deviations:</i>		
Men in industry (G.B.)	22 lb.	2.7 in.
Lurgan weavers	14 lb.	2.1 in.

In Britain an allowance of 8 lb. was made for the weight of clothes; in Lurgan, where the men were weighed with fewer clothes on, the allowance was 4½ lb. In Britain the height was taken while the men were wearing very thin heelless slippers, for which there was no allowance; in Lurgan an allowance of three-quarters of an inch was made for footwear. The homogeneous nature of the Lurgan sample is illustrated by the smaller standard deviations.

Cathcart, Hughes, and Chalmers's (1935) survey in Britain showed that men who had been continuously unemployed for at least six months were markedly shorter as well as lighter than those employed. The average height of the Lurgan men was equal to that of the British employed, and there was no difference in height between malnourished cases and those not malnourished. The average weight of the malnourished Lurgan men was less than that of those not malnourished, and even those not malnourished were lighter than the British employed.

Age and Weight

In Britain the average weight of employed men increased with age, but among the unemployed over 23 the average weight increased only very slightly with age. Among the Lurgan weavers below the age of 40 there is no indication of increasing weight with increasing age, from which we infer tentatively that the condition of Lurgan weavers approximates to that of the British unemployed. In the cases classified as malnourished there is a slight fall in the average weight as age increases from 25 to 40 years. This small negative correlation between weight and age leads us to think the condition of these weavers is worse than that of the average of the British unemployed examined by Cathcart and his co-workers.

Comparison of Age and Weight

Age	All Cases		Malnourished		Not Malnourished	
	No. of Cases	Average Weight	No. of Cases	Average Weight	No. of Cases	Average Weight
Under 20	21	st. lb. 8 13½	13	st. lb. 8 10	8	st. lb. 9 5
20 and under 25	22	9 7	11	9 4	11	9 11
25 and under 30	39	9 8	20	9 5½	19	9 10
30 and under 35	51	9 6½	28	9 4	23	9 10
35 and under 40	40	9 6	23	9 2	17	9 10
40 and over	29	9 12	15	9 8½	12	10 2
20 and under 30	61	9 7½	31	9 5	30	9 10½
30 and over	120	9 7½	66	9 4½	52	9 11

It may be that lack of a positive correlation between weight and age in a population of men in the physical prime of life is a good indication that the population is suffering from long-standing malnutrition.

Comparison of Malnourished Cases and Cases not Malnourished

	Cases 1-100	Cases 101-202	All Cases	Mal- nourished Cases	Cases not Mal- nourished
Number of Cases ..	100	102	202	110	92
<i>Average—</i>					
Age in years and months (Standard deviation)	31 5	31 3	31 4 (7 6)	31 2	31 6
Weight in stones and lb. (Standard deviation)	9 6.2	9 6.3	9 6.3 (14.0 lb.)	9 2.5 (13.5 lb.)	9 10.7 (13.9 lb.)
Height in feet and inches (Standard deviation)	5 7.3	5 7.2	5 7.3 (2.1 in.)	5 7.3 (2.2 in.)	5 7.2 (2.0 in.)
Trochanteric height in inches	40.9	41.2	41.1	41.1	41.0
Bisacromial width in inches	14.8	15.2	15.0	14.9	15.2
Haemoglobin (Dare) ..	85.9%	90.9%	88.6% (8.1%)	88.2% (8.1%)	89.1% (8.1%)
(Standard deviation) (Haldane) ..	99.6%	105.4%	102.8%	102.3%	103.4%
Illnesses receiving medi- cal attention in three years (1935-7)	4.0	3.3	3.7	3.6	3.8
<i>Percentage of Cases with—</i>					
Winging of scapulae ..	36	39	38	46	27
Listlessness	27	25	26	40	9
Pallor	46	38	42	52	30
Dry skin	40	42	41	63	15
Dry and lustreless hair..	29	35	32	51	10
Follicular hyperkera- tosis	46	48	47	65	25
Pyogenic infections ..	16	16	16	24	6
Chronic conjunctivitis ..	8	4	6	5	8
Blepharitis	7	5	6	6	5
Frontal bossing	5	2	3	5	2
Harrison's sulcus ..	13	10	11	14	9
Beading	15	10	12	15	9
Inverted pigeon chest ..	18	14	16	19	12
Tuberculosis of bones and joints	1	1	1	2	0
Tuberculosis	10	3	6	11	1
Palpable cervical glands	44	38	41	47	34
Cervical adenitis ..	5	1	3	5	1
Coryza	4	5	4	5	3
Chronic upper respiratory catarrh	66	50	58	55	61
Bronchitis, including smokers' bronchitis	34	27	31	28	34
Enlarged tonsils ..	37	30	34	35	32
Adenoids	9	8	8	12	4
Marked pyorrhoea ..				29	15
Malnourished	54	55	54	100	Nil

Other Differences

The other objective differences between the malnourished cases and those not malnourished are slight. The average trochanteric height, like the total height, is similar in each group; in fact in each case the average is very slightly greater in the malnourished group. In contrast is the bisacromial width, which does seem to be connected with the state of nutrition; the malnourished cases are not so broad, as well as not so heavy, as those not malnourished. The haemoglobin content of the blood is slightly lower in the malnourished cases. The malnourished cases are not the more frequent attenders at the doctor's for treatment. This suggests that they were not conscious of ill-health and under-nourishment, or that if conscious they were too inert to have the condition rectified, or perhaps they had little faith in the ability of the doctor to rectify the condition.

When we consider the subjective valuations the evidence of malnutrition is much more marked. Of the malnourished cases, 40 per cent. were classified as listless;

63 per cent. as having a dry skin; 51 per cent. as having dry and lustreless hair; 65 per cent. as having follicular hyperkeratosis; and 24 per cent. as having pyogenic infections. The figures should be compared with 9, 15, 10, 25, and 6½ per cent. respectively for the same conditions among the weavers not called malnourished. Most of the other items also show to the disadvantage of the malnourished cases, but there are some exceptions. In particular it is noticeable that the proportions of men with chronic conjunctivitis, with chronic upper respiratory catarrh, and with bronchitis are higher among cases not malnourished. There is very little difference in the proportions with enlarged tonsils in the two groups. The proportion with marked pyorrhoea is nearly twice as high in the malnourished cases as among cases not malnourished, while 12 per cent. of the malnourished cases have adenoids as compared with only 3 per cent. of those not malnourished.

Income and Size of Family

The average size of families from which the weavers came was 5.2 persons, but this does not mean that on an average ten families contained fifty-two persons, for the census showed only forty-two persons per ten private houses. The apparent discrepancy is due to the greater chance of choosing a man from a large family than from a small one, thus giving greater weight to large families. In the four years 1934 to 1937, inclusive, the number of national health insurance stamps on the cards of the weavers showed that the malnourished cases worked on the average in thirty-five weeks in each year, as compared with forty weeks for those not malnourished. Thus there is some evidence against the hypothesis that the warm humid atmosphere necessary for linen weaving, combined with small earnings, makes the health and physical condition of employed weavers inferior to that of the unemployed with current rates of benefit and unemployment assistance.

Social Environment of Lurgan Weavers

	Malnourished Cases	Cases not Malnourished
<i>All Cases :</i>		
Number	110	92
Average number of health insurance contri- butions per year (1934-7 inclusive)	35	40
Persons per family	5.24	5.16
Weekly income per family	53s. 5d.	67s. 4d.
Weekly income per person	10s. 4d.	13s. 0d.
Proportion married	72%	74%
<i>Single Weavers :</i>		
Number	31	24
Persons per family	5.5	6.1
Weekly income per family	73s. 0d.	94s. 1d.
Weekly income per person	13s. 4d.	15s. 0d.
<i>Married Weavers :</i>		
Number	78	67
Persons per family	5.1	4.8
Dependent children per family	2.6	1.9
Weekly income per family	45s. 6d.	58s. 7d.
Weekly income per person	8s. 11d.	12s. 1d.
Weekly income per person in families :		
Without children	13s. 0d. (15)	18s. 10d. (19)
With 1 child	12s. 7d. (8)	16s. 2d. (8)
With 2 children	9s. 1d. (11)	11s. 8d. (16)
With 3 children	8s. 11d. (18)	9s. 5d. (11)
With 4 or more children	6s. 10d. (26)	8s. 2d. (13)

The figures in parentheses give the number of cases to which the incomes apply.

The average income per family was nearly £3 per week, and per person 11s. 4½d. The family income of the malnourished weavers averaged 14s. per week less than that of weavers not malnourished. Usually it is stated that poor families tend to spend a greater proportion of their income on food than richer families, and in general this is true. It may not be true of a homogeneous group of workers living near the poverty line. In this Lurgan area all families tend to live in similar types of houses, and hence to pay similar rents and rates whether the family income is 50s. or 70s. per week. Similarly with other items of expenditure, though perhaps not to so great a degree as with household accommodation. Workers living in a homogeneous group, such as these Lurgan weavers, tend also to preserve a similar outward appearance of well-being even when incomes differ. Thus expenditure on food is often among the first to be reduced when income falls. Fixed charges tend to be very similar among these Lurgan families, and as the men will rarely sacrifice their cigarettes they amount to about 20s. a week.

	s. d.
Rent and rates	6 0
Light	2 0
Gas	6
Coal	3 0
Weekly payments for insurance and clothes	5 6
Tobacco	2 0
Sundry	1 0
	<hr/> 20 0

What is left may be called "free expenditure," and from this free expenditure food must be bought. Thus, though the income of families of men not malnourished is 26 per cent. higher than that of malnourished men, the "free expenditure" is 42 per cent. higher. Among the families of married men only the discrepancy is even more marked.

Family Incomes in the Two Groups

	All Weavers		Married Weavers	
	Mal-nourished	Not Mal-nourished	Mal-nourished	Not Mal-nourished
Average income per family ..	s. d. 53 5	s. d. 67 4	s. d. 45 6	s. d. 58 7
Ratio	(100)	(126)	(100)	(129)
Income minus fixed expend. of £1	33 5	47 4	25 6	38 7
Ratio	(100)	(142)	(100)	(151)
Average number of persons per family	5.24	5.16	5.1	4.8
"Free expenditure" per person	6 4	9 2	5 0	8 1

When the cases, married and single, were grouped together very little correlation was seen between malnourishment and family size. When the division is made it is revealed that married men who belong to large families tend to be malnourished, and that single men who belong to large families tend to be well nourished.

Persons per Family

	Malnourished Cases	Cases not Malnourished
Married weavers	5.1	4.8
Single weavers	5.5	6.1

The income per person in the families of the single men examined was greater than that for married men. This is presumably because the children have grown up, are working, and are making some contribution to the family income. There is every reason to suppose that these families, before the children started working, were in a position much inferior to their present condition, and

that the large families at present in the more favourable position were then the poorer.

Families of Married Weavers

	Families	Persons	Children	Total Income	Income per Family	Income per Person
<i>With 0 to 2 Children :</i>						
Malnourished	34	129	30	£1,490	£43.8	£11.6
Not Malnourished	43	169	40	2,585	60.1	15.3
Total	77	298	70	4,075	52.9	13.7
<i>With 3 or more Children :</i>						
Malnourished	44	272	176	2,063	46.9	7.6
Not Malnourished	24	155	91	1,344	56.0	8.7
Total	68	427	267	3,407	50.1	8.0

It may be noted that 65 per cent. of the married weavers with three or more children were classified as malnourished, compared with only 44 per cent. of those with none, one, or two children. The average income in families with three or more dependent children is only 8s. per person per week, but it is 13s. 8d. per person in families with two or fewer children. There is a further point to be considered. Only sixty-eight out of 145—less than half—of the married weavers belonged to families with three or more dependent children. There were 337 children dependent on these 145 weavers, and 79 per cent. of these children lived in families with three or more children dependent and where the family income averaged only 8s. per person per week. Expressed another way, more than half of the income of these families went to families which contained only one-fifth of the children. The best way to overcome this difficulty is probably by the granting of family allowances, not by individual firms but by the public authority.

Summary

A total of 202 male linen weavers living under similar conditions and thought to be typical of many linen workers in Northern Ireland were examined; 54 per cent. were classified as malnourished.

These malnourished men are no shorter, but are considerably lighter and slighter, than those not malnourished. The most marked differences, however, between the two groups appear among items which one would like to ignore as not being sufficiently objective; for instance, a large proportion of the malnourished cases are classified as being listless and having a dry skin and lustreless hair.

The malnourished men work less regularly and have a lower income per family and per person than those not malnourished. The men who are well nourished consulted the doctor rather more often than those badly nourished. Married weavers with large families are more liable to malnourishment than those with small families, but when the children start earning and making contributions to the family expenditure the single men then belonging to the large families are less likely to be malnourished. As those single men who belong to large families are just the ones most likely to have been malnourished as children the inference is that malnourishment is a transient phase, leaving few permanent effects and being easily overcome by an increased family income.

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