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<td>Gormley, T. R. (Thomas Ronan); Kevany, J.; O'Donnell, B.; et al.</td>
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INVESTIGATION OF THE POTENTIAL OF PORRIDGE AS A HYPOCHOLESTEROLAEMIC AGENT

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ABSTRACT

Fifty eight male and 10 female free living volunteers were paired in two groups based on similar cholesterol levels. Each individual in one group ate 43 g of oatmeal daily in the form of porridge, over the period January 31 to March 15, while the corresponding individuals in a control group ate 43 g of cornflakes daily.

Serum cholesterol levels and α-lipoprotein fractions were measured twice at 3-week intervals during the experiment and no significant differences were found between the groups. Gain in weight of volunteers was minimal during the experiment with an increase of 0.5 kg per person for males on cornflakes, and 1 to 1.5 kg per person for females on porridge.

The results suggest that porridge did not have a hypocholesterolaemic effect in the quantities consumed for the time period of this experiment.

INTRODUCTION

A programme of research was started at Kinsealy Research Centre in 1976 to identify foods of plant origin which have a hypocholesterolaemic (cholesterol lowering) effect when consumed in normal dietary quantities. It was considered that in the context of longterm modification of dietary patterns in relation to heart disease risk, an educational
programme emphasising a positive approach, involving increased intake of foods of plant origin, might be more successful than traditional negative approaches recommending decreased intake of fat and protein of animal origin. The first component of this programme was completed in 1977 when two apples per day, in addition to the normal diet, had a hypocholesterolaemic effect in free-living male volunteers (1).

In view of the cholesterol reducing effect obtained by de Groot et al (2) using rolled oats incorporated into a special bread, it was decided to investigate the hypocholesterolaemic effect of porridge as the second component of the programme. Cornflakes was used as a control cereal and an experiment was carried out for 6 weeks in January—March, 1978 with matched pairs of volunteers. One group was obliged to consume porridge and the other cornflakes and thus the experiment investigated the comparative effect.

EXPERIMENTAL

Volunteers for study
Male and female volunteers under the age of 50 years in three Research Centres and the Administrative Centre of the Agricultural Institute in Dublin participated in the study. Their weight, height, smoking habits and approximate intake of dietary fibre were measured at the start of the experiment and their weight was recorded again at the end of the experiment. Approximate dietary fibre intake of the subjects was obtained by basing it on their weekly intake of fruit, vegetables, and cereal products. A weight/height index \( \frac{W}{H^2} \), as used by Goldbourt and Medalie (3), was used in this test as an index of general nutritional status and build. \( W \) is expressed in grams and \( H \) in cm.

Experimental design
Fifty-eight male volunteers and 10 females were obtained for the study giving a total of 29 pairs for males and 5 pairs for females — males being paired with males and females with females. All the volunteers were in the age group 30—50 years with the exception of 7; 5 of these were less than 30 and 2 were over 50 years.

Six of the volunteers smoked cigarettes, 5 smoked cigars and 3 were pipe smokers. Smokers and non-smokers were equally distributed between the two groups.

All the volunteers were required to eat cornflakes daily (43 g) for the control period January, 10—30, 1978, during which two preliminary blood samples were taken. Values for the two samples were averaged and volunteers were paired on the basis of similar total cholesterol levels into two groups. The results for males and females are presented separately in the experiment. The decision as to which person in each pair would be on the porridge or cornflakes was decided in a random fashion.
Cereal intake
One group consumed porridge (43 g oatmeal daily) and the other cornflakes (43 g daily) for breakfast, starting on January 31 and further blood samples were taken on February 23 and March 15. Volunteers were allowed use milk and sugar on their cereals as required and no other dietary control was exerted. The experiment was terminated on March 15. Each person completed a weekly log sheet indicating whether he or she had consumed the required quantity of cereal.

Analytical procedures
Blood samples were tested for cholesterol and high density lipo-protein (HDLP cholesterol) according to the procedures used by Gormley et al (1). HDLP cholesterol is expressed as a percentage of total cholesterol. The analyses were blind in that each sample was allotted a different number on each occasion and laboratory identification was impossible until the survey was completed.

Samples of oatmeal and cornflakes were tested for fat content, using a Soxhlet extraction procedure with 40—60°C petroleum spirit. The samples of fat, thus isolated, were tested for polyunsaturated fatty acid content (PUFA) by gas chromatography. The 1 m glass column, 4 mm i.d., was packed with 10% SP-216-PS on 100/120 Supelcoport and was fitted in a Pye Series 104 gas chromatograph coupled to an LDC-304 integrator. Nitrogen gas flow rate was 80 ml/min and the oven was programmed at 130 to 200°C x 16°C/min (4).

RESULTS AND DISCUSSION
The weekly fibre intake of the porridge and cornflakes groups was similar at the start of the experiment. The mean daily intake of porridge was 100% of target and cornflakes 98% according to log records which indicated that the participants were consuming the required amounts of cereal.

Serum cholesterol levels
The results (Tables 1 and 2) show that there was no significant difference between % HDLP cholesterol levels or cholesterol levels for groups on porridge or cornflakes. In the case of males there was a small effect in favour of porridge on the March 15 analysis date but it was not significant (Table 1). There were differences apparent in females (Table 2) but these were neither consistent nor statistically significant. It should be noted that there were only 5 pairs in the female part of the experiment compared with 29 pairs in the male part which means that the group values for females must not be interpreted rigidly as one high individual value can inflate the group value.

These results show that there was no difference between porridge or cornflakes in terms of cholesterol lowering in humans at the particular levels consumed over the time
TABLE 1: Group values for % HDLP cholesterol \(^a\) and cholesterol \(^b\) — MALES

<table>
<thead>
<tr>
<th></th>
<th>Prelim. (Jan. 19 and 26)</th>
<th>Feb. 23</th>
<th>Mar. 15</th>
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<tbody>
<tr>
<td><strong>% HDLP cholesterol</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Porridge group</td>
<td>23</td>
<td>21</td>
<td>26</td>
</tr>
<tr>
<td>Cornflakes group</td>
<td>23</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Paired t – test</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>SE</td>
<td>0.61</td>
<td>0.77</td>
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<tr>
<td><strong>Cholesterol</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Porridge group</td>
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<td>243</td>
<td>233</td>
</tr>
<tr>
<td>Cornflakes group</td>
<td>240</td>
<td>243</td>
<td>238</td>
</tr>
<tr>
<td>Paired t – test</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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<tr>
<td>SE</td>
<td>0.61</td>
<td>2.92</td>
<td>4.20</td>
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\(^a\) HDLP cholesterol expressed as a percentage of total cholesterol
\(^b\) expressed as mg per 100 ml serum

TABLE 2: Group values for % HDLP cholesterol \(^a\) and cholesterol \(^b\) — FEMALES

<table>
<thead>
<tr>
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<th>Prelim. (Jan. 19 and 26)</th>
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<th>Mar. 15</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>% HDLP cholesterol</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Porridge group</td>
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<td>29</td>
<td>34</td>
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<tr>
<td>Cornflakes group</td>
<td>32</td>
<td>29</td>
<td>36</td>
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<tr>
<td>Paired t – test</td>
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<td>NS</td>
<td>NS</td>
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<tr>
<td>SE</td>
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<tr>
<td><strong>Cholesterol</strong></td>
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<td>Porridge group</td>
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<td>201</td>
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<tr>
<td>Cornflakes group</td>
<td>191</td>
<td>222</td>
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<td>Paired t – test</td>
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<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>SE</td>
<td>4.37</td>
<td>7.71</td>
<td>15.16</td>
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</table>

\(^a\) HDLP cholesterol expressed as a percentage of total cholesterol
\(^b\) Expressed as mg per 100 ml serum

period of this experiment. The data also suggests that neither porridge nor cornflakes reduce cholesterol levels at all, though in the case of cornflakes this cannot be fully established as the volunteers were placed on a cornflake diet for 3 weeks prior to the start of the experiment to enable preliminary cholesterol analyses to be carried out for the purpose of pairing the volunteers. These results contrast with those of de Groot et al (2)
who showed a significant cholesterol lowering effect in 21 healthy male volunteers due
to the daily consumption of 300 g of an experimental bread containing 140 g of rolled
oats. The effect took place over a 3 week period.

The lack of a hypocholesterolaemic effect in the porridge experiment could be due to
a number of factors e.g. oatmeal differs from rolled oats in that the hulls have been
removed in the former; the quantity of oatmeal consumed may have been too small to
produce an effect. However, there would seem to be little benefit in increasing the
porridge intake further as 43 g of oatmeal can be considered as the upper limit of a
“normal” porridge intake. The daily intake of rolled oats (140 g) in the experiment of
de Groot et al (2) was very large and was achieved by incorporation in a special bread.
This could not be considered as a normal intake which would be acceptable to a wide
range of a population. These workers claim that both the fat and non-fat materials
contribute equally to the hypocholesterolaemic effect of rolled oats.

In the porridge experiment it could have been expected, on the basis of the findings
of de Groot (2), that porridge would reduce cholesterol or raise HDLP cholesterol to
some extent in view of the fact that samples tested showed that oatmeal contained
8% fat and cornflakes about 0.22% of which about 43% of the former is PUFA compared
with 48% in the latter. Comparable figures are not available for the dietary fibre content
of cornflakes and oatmeal. Southgate et al (5) give a value of 11% total dietary fibre for
cornflakes and Spiller et al (6) shown an indigestible residue level (enzymatic method) of
8.5% for rolled oats, but the analytical procedures used by the two workers are different.

There is little likelihood that the quantities of milk consumed with the porridge and
cornflakes (0.5 pint per person per day at most) would influence cholesterol levels in
view of the result of Howard and Marks (7) which showed a cholesterol reduction of
213 mg/100 ml to 203 mg/100 ml serum in volunteers consuming 4 pints of whole milk
daily over a 3-week period.

Other workers have studied the effects of cereals and cereal products on blood lipids.
Only two have noticed a reduction in plasma cholesterol; Persson et al (8) found a lowering
of 7% after 6 weeks bran consumption and more recently MacLean et al (9) showed
that previously malnourished children consuming a controlled diet of casein, soy-
cottonseed oil blend, and a mixture of sucrose and starch had a serum cholesterol level of
169 ± 42 mg per 100 ml. This decreased significantly to 108 ± 30 mg per 100 ml after 9
days consumption of a isoenergetic-isonitrogenous diet in which whole wheat or white
flour provided all the protein and ± 50% of the carbohydrate.

Kay and Truswell (10), Jenkins et al (11), Connell et al (12), Eastwood et al (13),
Heaton et al (14) all carried out experiments using diets high in wheat fibres and/or
bran and none found any lowering of plasma cholesterol though changes in intestinal
transit times and in faecal bulk were observed.

It would seem therefore that most cereals do not exert a direct hypocholesterol-
semic effect in man and the possibility of achieving a lowering in plasma cholesterol
solely by eating increased quantities of unrefined cereals within the normal range of
western dietary tolerances is small. The consumption of small quantities of a wide range
of fibre sources, including fruit fibre and pectin, may be more important in this respect, as suggested by Leeds and Gassull (15).

**Weight data**

The results (Table 3) show that there was no significant difference in weight/height index between the groups on porridge and cornflakes for either males or females. In the case of males there was no increase in weight during the experiment for the group on porridge while the group on cornflakes increased by less than 0.5 kg per person.

In the case of females there was a disparity in weight between those on porridge and cornflakes at the start of the experiment. This was due to the small number of females who volunteered. Those on porridge increased in weight slightly during the experiment (1–1.5 kg per person) while those on cornflakes showed practically no increase in weight. The calorie content of raw oatmeal and cornflakes is 367 and 404 per 100 g respectively while the protein, and carbohydrate contents are 12.1, 72.8, and 6.6, 88.2 g per 100 g respectively (16).

**TABLE 3:** Weight data \( \left( \frac{W}{H^2} \right)^a \) before and after experiment

<table>
<thead>
<tr>
<th></th>
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<th>Females</th>
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<tr>
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<tr>
<td>SE</td>
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<tr>
<td></td>
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<td>After</td>
</tr>
<tr>
<td>Porridge group</td>
<td>2.38</td>
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<td>Paired t – test</td>
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<td>NS</td>
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<tr>
<td>SE</td>
<td>0.11</td>
<td>0.12</td>
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\(^aW\) in g, \(H\) in cm

**ACKNOWLEDGEMENTS**

We wish to thank the Odlum Group Ltd. for supplying the cereals used in this experiment and Becton Dickinson Ltd. for the syringes used in blood sampling.

Thanks are due to the volunteers in the Agricultural Institute, to Mr. S. Egan for technical assistance, to Dr. D. Harrington for the statistical analyses, to Mr. S. Ahern and Dr. B. Connolly for PUFA analyses, to Mr. T. Flynn who assisted with the blood sampling, and to Dr. N. Hickey for his help with the design and planning of the experiment.
REFERENCES


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