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This document has been written for CBF by Nutriscan Ltd, a non-profit making food and nutrition consultancy company of Trinity College Dublin, raising funds for nutrition research.
The Purpose of this Report

This report is designed to provide health professionals, and all those involved in the area of diet and health education, with an appraisal of the role of red meat in the Irish diet.

The subject of diet and health in general is one which interests many people. At the same time there is a wealth of advice on diet and health which is often confusing.

Individual foods have been singled out to receive particular attention over the years, much of it conflicting. Red Meat is one such food and, as a result, there exists a demand for accurate, up-to-date nutritional advice in relation to meat and meat products.

This report addresses issues such as how much meat an average Irish person eats, the composition of that meat, what contribution this meat makes to overall nutrient intakes and what simple dietary changes can be made to keep diets within the recommended guidelines for healthy eating as issued by the Department of Health.
The Irish Diet

The results of the Irish National Nutrition Survey were published in March 1990 by the Irish Nutrition and Dietetic Institute (INDI). This survey was undertaken to provide comprehensive up-to-date information on the Irish diet, both food and nutrient intakes, for many age groups and subgroups in the population. The last National Nutrition Survey carried out in Ireland prior to the present one was in 1948. Obviously there have been huge changes in food availability and intake since then.

From the results of the National Nutrition Survey recommendations for suggested dietary changes to improve the Irish diet were made. These recommendations are as follows:

1. ReducE FAT INTAKE
This recommendation is made because mean fat intakes exceeded the suggested level of 35% of calories per day from fat. Although mean fat intakes were not much above 35% of calories, the survey claims that “a considerable portion of this fat is likely to be saturated and it is therefore possible that further reductions in fat consumption may be beneficial”. Ways to reduce fat intake will be discussed in detail later.

2. INCREASE FIBRE INTAKE
Fibre intakes in the study population generally fell below the lower limit of the recommended range, which is 25-30g per day. This level of fibre intake may be difficult to achieve, especially for females, as it does not take into account energy intakes, and women have a lower energy intake than men and therefore a smaller food intake. To increase fibre intake, the INDI recommends we eat more wholemeal bread, high fibre cereals, fruits and vegetables and potatoes (especially for females).

3. INCREASE IRON INTAKE FOR FEMALES AGED 12 - 50 YEARS
The recommended iron intake for women in this age group is 14mg per day. No group achieved this level and therefore an increase would be beneficial. Ways to achieve this higher iron intake will be detailed later.

4. INCREASE CALCIUM INTAKE FOR ALL TEENAGE FEMALES
Calcium is a mineral which is essential for bone growth and bone strength, and therefore the body has a high requirement for calcium during periods of growth such as teenage years and pregnancy. If calcium intake during adolescence is low, the bone density will be affected. From the age of 35 onwards bones slowly lose calcium and if they are not at their peak density at this age, calcium losses can make the individual susceptible to osteoporosis, particularly post-menopausally in women. Therefore a good calcium intake for female adolescents is important. Calcium intake can be increased by using more milk and milk-based foods. Meat can play an important role in helping to achieve two of these recommendations – reducing fat intake and increasing iron intake.
THE ROLE OF MEAT IN THE IRISH DIET

When choosing foods one should aim to eat a wide variety to help achieve a balanced diet. No single food, by itself, provides every nutrient we need. Most meals should be based around a starchy food (e.g., bread, potatoes, rice or pasta) and include a selection from the following: meat or an alternative protein source (fish, chicken, egg or pulses), fruit, vegetables and dairy products. Meat is no exception in that it does not contain all nutrients (it does not contain carbohydrate or dietary fibre) but the following results from the INDI survey show that meat is an important source of many essential nutrients in the Irish diet (Fig 2).

In the case of 5 of the above nutrients (Fig 2), meat provides > 20% (one fifth) of the daily intake and is therefore a major source in the diet. These nutrients are protein, vitamin B12, niacin, iron and zinc and, we shall look at each in turn.

PROTEIN

Protein is an essential nutrient for the growth and repair of tissues providing the “building blocks” for body tissues as amino acids. Children need protein in order to grow and adults need it to repair and replace existing body tissues.

Meat is the major source of protein in meat-containing diets, providing 35% of daily intake. Milk and dairy products provide 19% and bread provides 17%. Lesser sources include eggs (5%), potatoes (6%) and breakfast cereals (2%) (Fig 3).

The type of protein provided by meat is also important. Proteins are made up of amino acids, of which there are about 20. Eight of these are termed “essential” as they cannot be made by the body and must come from food. Protein from meat and other animal sources is good quality protein because it contains most of these essential amino acids and is particularly useful in the body. Such protein is termed “High Biological Value”. Protein from plant foods is of lower biological value because each is limited in one or more of these essential amino acids. However, because different plant foods are lacking in different amino acids, simple combinations, such as baked beans on toast, can provide all the amino acids required. People who eat no animal foods (vegans) can get the protein they need in this way.
VITAMIN B₁₂

Vitamin B₁₂ is an essential vitamin for the normal development of red blood cells and a deficiency can lead to a condition called pernicious anaemia. Vitamin B₁₂ is also necessary for normal functioning of the nervous system. This vitamin is found solely in animal foods, but is now also added to fortified breakfast cereals.

Meat and meat products provide 44% of the daily B₁₂ intake, with milk providing 30% and the remainder coming from eggs, seafood and fortified cereals.

Strict vegans are at risk of developing vitamin B₁₂ deficiency because they avoid all animal foods. Often this group of the population need to take a dietary supplement of B₁₂ to prevent pernicious anaemia.

NIACIN

Niacin, also known as nicotinic acid, is a member of the “B group” of vitamins. It is essential for health, and deficiency can lead to a condition called Pellagra. Pellagra is rarely seen in most parts of the world nowadays, but is still endemic in parts of South Africa. Niacin, when first discovered, was called the “Pellagra Preventing” factor.

The human body is not entirely dependent on dietary sources of nicotinic acid, as it may also be made in the body from another nutrient called tryptophan, found in all protein-rich foods including meat. Meat and meat products provide 34% of the daily niacin intake with the other main sources being bread (10%), breakfast cereals (10%) and milk (10%).

ZINC

Zinc is a mineral which is essential for many biochemical reactions in the body and also for optimum wound healing. A deficiency of zinc is rarely seen in healthy people consuming a balanced, varied diet. Meat and meat products provide 41% of Zinc per day with the next most important sources being milk and milk products (18%) and bread (16%).

IRON

Iron is a mineral which is necessary for healthy blood as it is part of the haemoglobin molecule in red blood cells which carries oxygen from the air we breathe to the tissues which utilise it. Iron is also involved in storing oxygen in the muscles.

Red meat is an excellent source of iron, providing 25% of the daily intake of the Irish population. Bread accounts for 23% of iron intake and breakfast cereals 11%. The remainder comes from a wide variety of foods, including potatoes, eggs, biscuits, cakes and vegetables (fig 4).

A deficiency of iron in the diet can lead to a condition called anaemia. Symptoms of anaemia are tiredness and lack of energy. Meat has an important role to play in the prevention of anaemia because it is a rich source of iron and the iron it contains is well absorbed by the body. The next section deals specifically with the role of meat in achieving adequate iron intakes.
The 2 suggested dietary modifications with which lean red meat can play a role are: ‘increase iron intake for all females aged 12 - 50 years’ and ‘reduced fat intake’.

1. INCREASE IRON INTAKE
Women of reproductive age have an increased requirement for iron because of their monthly menstrual losses. The results of the INDI nutrition survey show a mean iron intake of 11mg/d for females aged 12 - 50 years which falls 3mg short of the recommended 14mg. This does not necessarily mean that the individuals studied were deficient, but it does suggest a high risk of deficiency among the group. This result led the INDI to recommend increased iron intake for all females between the ages of 12 - 50 years. To achieve this they recommend this group eat more “lean red meat”, and other iron containing foods such as wholegrain breakfast cereals and bread (Table 1).

The iron provided by animal foods such as lean red meat, liver, kidney, other offal and black pudding is made up of 40% haem iron and 60% non-haem iron. These two types of iron differ slightly in their structure and the haem iron is more easily absorbed than the non-haem iron. Non-haem iron on the other hand accounts for 60% of iron in meat and meat products and 100% of the iron in pulses, cereals, bread and vegetables. Non-haem iron absorption can be improved by other components of the diet:

1) VITAMIN C - if a food containing non-haem iron is eaten in a meal with a vitamin C containing food, the vitamin C acts with the non-haem iron and increases its absorption. Examples of vitamin C containing foods are fruits and vegetables, potatoes and orange juice.

2) MEAT - Meat helps the absorption of iron from other foods. When meat is digested, the breakdown products help to increase the amount of iron absorbed from other foods consumed at the same time eg. vegetables and cereals. So in addition to the iron in the meat itself, you will obtain more iron from a meal containing meat than one without.

**FIGURE 4**. CONTRIBUTION OF FOODS TO IRON INTAKES FOR IRISH ADULTS 18+ YEARS

![Figure 4. Contribution of foods to iron intakes for Irish adults 18+ years](image-url)
Non-haem iron absorption can also be inhibited by dietary constituents such as tea, coffee and phytate (from bran and pulse vegetables) when they are eaten in the same meal. These inhibitors do not influence haem iron.

One of the main factors affecting iron absorption is the iron status of the individual. A person with low body iron stores will absorb more iron from their food than someone whose iron stores are adequate. This is an adaptation response by the body to try to improve iron stores when the body is low in iron. However, when continuous high losses in menstruating females are matched by low iron intakes (perhaps of low bioavailability), the adaptation may not be enough to ensure adequate iron status.

Although clinical anaemia (iron deficiency) is not a common condition, certain population groups with inadequate iron stores may be at an increased risk of anaemia. Foremost among these are women of reproductive age as highlighted in the National Nutrition Survey 1990. The elderly may also be at risk as a DHSS report on Nutrition and Health in the elderly found the overall incidence of anaemia to be 12.5% (17% of men and 9% of women) in this group. It is not essential to eat red meat in order to get all the iron you need, but it certainly does help make it easier to reach requirements.

Red meat is a very rich source of iron, and can make a large contribution towards achieving the RDA (recommended dietary allowance) for iron. The RDA for men is 10mg per day and for women is 14mg per day.

2 REDUCE FAT INTAKE

The INDI survey recommends a reduction in fat intake and outlines suggested dietary changes to achieve this end. These are:

- Avoid frying foods.
- Use butter, margarine and oil sparingly.
- Eat less cakes, pastries and biscuits.
- Trim excess fat from meat.
- Eat fish frequently.

People may be surprised to see that the recommendation concerning meat does not say "cut out" or "cut down". In fact, meat is not inherently high in fat and when trimmed of excess visible fat, lean red meat has a similar fat content to chicken.

Throughout this report, when looking at the fat contents of meat, we have tried to use figures from the most up-to-date, representative data available. The current food composition tables which are widely used for nutritional analysis, McCance & Widdowson's 'Composition of Foods', contain data on the fat content of meat which is based on analyses carried out in the late 1970s. However, we know that meat produced nowadays is leaner than that which was available in the seventies, due to changes in farming practice, genetic improvements and increasing use of carcass classification schemes. Therefore, the figures quoted in the McCance and Widdowson's food composition tables tend to overestimate the fat content of the meat which we use today.

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**TABLE 1: IRON CONTENT OF MEAT PORTIONS IN (mg)/PORTION, AND AS A % OF RDA FOR MEN AND WOMEN**

<table>
<thead>
<tr>
<th>FOOD</th>
<th>PORTION</th>
<th>Iron (mg)</th>
<th>% RDA for Men</th>
<th>% RDA for Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef</td>
<td>2 slices lean near (90g) silverside beef</td>
<td>2.9</td>
<td>29</td>
<td>21</td>
</tr>
<tr>
<td>Lamb</td>
<td>2 slices lean near (90g) leg of lamb</td>
<td>2.4</td>
<td>24</td>
<td>17</td>
</tr>
<tr>
<td>Pork</td>
<td>Lean pork chop (90g)</td>
<td>1.1</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Bacon</td>
<td>2 grilled back slices (60g)</td>
<td>0.9</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Liver</td>
<td>2 slices (180g)</td>
<td>10.0</td>
<td>100</td>
<td>71</td>
</tr>
<tr>
<td>Chicken</td>
<td>Grilled breast (90g)</td>
<td>0.5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Fish</td>
<td>Grilled Cod Fillet (180g)</td>
<td>0.6</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

| Non-haem Sources                 |            |            |               |                 |
| Whiskey Bread | 2 slices (60g) | 1.5 | 15 | 11 |
| Orange Juice | 1 bottle (60g) | 1.2 | 12 | 9 |

(Data: McCance & Widdowson(2), Davies et al. (1990))
The National Food Centre carried out analyses of Irish meats for CBF and it is these results which we will use for total fat and fatty acid contents for beef, lamb, pork and chicken. In the case of all four meats, various cuts were analysed. Four samples of each cut were purchased — two from supermarket butchers and two from independent butchers. The meat was analysed when trimmed of visible fat and cooked without the addition of any fat. The results obtained are used throughout this report as they represent the most up-to-date figures available for lean Irish meats. Comparing the results with other values for fat content of meats, the pork values are very similar to those recently published by MAFF and the Meat and Livestock Commission in the UK, following extensive analysis of pigmeat. They also compare well with the figures from McCance and Widdowson’s ‘Composition of Foods’ for chicken, beef and lamb.

"LEAN MEAT IS NOT HIGH IN FAT"

Available research indicates that many doctors advising patients on cholesterol-lowering diets restrict or exclude red meat consumption. In light of recent evidence, this advice is difficult to understand. Lean red meat contains no more fat than chicken.

Unlike foods such as pastries and cheese, you can actually see most of the fat in meat as a band around the edge (eg. on a pork chop) or running through the meat in a meat joint. If this fat is trimmed away and the meat looks lean, it is lean! Visible fat is made up of 95% fat, and it is roughly the same whether it is red meat fat or chicken skin (fig 5).

The bottom line is that contrary to popular opinion, lean red meat is a low-fat food not dissimilar to lean chicken.

![TABLE 2. FAT AND CALORIE VALUES FOR AVERAGE PORTIONS OF MEAT](image)

<table>
<thead>
<tr>
<th>Food</th>
<th>Portion</th>
<th>Calories (g)</th>
<th>Fat (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>2 slices lean silverside (90g)</td>
<td>152</td>
<td>1.6</td>
</tr>
<tr>
<td>Chicken</td>
<td>Breast - meat only (90g)</td>
<td>128</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Leg - dark meat only (90g)</td>
<td>170</td>
<td>6.8</td>
</tr>
<tr>
<td>Pork</td>
<td>2 slices - leg of pork (90g)</td>
<td>148</td>
<td>3.2</td>
</tr>
<tr>
<td>Lamb</td>
<td>Lean lamb, chop - lean only (90g)</td>
<td>149</td>
<td>6.5</td>
</tr>
<tr>
<td>Sausages</td>
<td>2 pork sausages (90g)</td>
<td>256</td>
<td>9.7</td>
</tr>
<tr>
<td>Beefburgers</td>
<td>2 beefburgers (packets) (90g)</td>
<td>241</td>
<td>15.6</td>
</tr>
</tbody>
</table>

Source: National Food Centre
McCance and Widdowson’s ‘Composition of Foods’[2]

"LEAN MEAT CONTAINS A MIXTURE OF TYPES OF FAT"

A reduction in total fat intake is recommended to less than 35%, with no greater than 10% of fat to be contributed by saturated fat. Comparisons between populations clearly show a relationship between dietary saturated fat and serum cholesterol levels.

Dietary fats can be saturated, monounsaturated or polyunsaturated, with the latter two types being most desirable as they do not raise blood cholesterol levels. A high blood cholesterol level is associated with an increased risk of coronary heart disease.

Lean red meat, as we have shown, is as low in fat as chicken, and what fat is present is a mixture of saturated, monounsaturated and polyunsaturated fats.
LEAN RED MEAT CAN FORM AN IMPORTANT PART OF A LOW FAT DIET. MEAT IS AN IMPORTANT SOURCE OF ESSENTIAL VITAMINS AND MINERALS AND CAN BE PART OF A BALANCED, VARIED DIET. MEAT IS VERY VERSATILE AND CAN BE THE BASIS FOR MANY DELICIOUS, LOW-FAT MEALS WHEN TRIMMING AND COOKING METHODS ARE CONSIDERED.

1 TRIM VISIBLE FAT FROM MEAT

Most of the fat in meat can be easily trimmed away and discarded, and doing so reduces the fat content considerably. Many butchers and supermarkets are now making it easier for shoppers to choose lean meat. Meat may be trimmed of visible fat before being displayed and prepacked meats may have nutritional information on the pack highlighting the low fat content. Figure 6 shows the difference that trimming away visible fat can make.

![Figure 6: Difference in Fat and Calorie Content Between Trimmed and Untrimmed Meats](image)

Data: McCance & Widdowson[46] - this source was used as it provides us with extensive data on "Lean & Fat" and "Lean only" figures for the various meats. However, the "Lean only" figures quoted here are higher than the most recent data, as outlined earlier, due to changes in farming practices and genetic improvement in stock.

2 COOKING METHODS

To keep the fat content of the meal low, cooking methods must also be taken into consideration. Food should be fried less frequently as this method adds extra fat to the meal. If you do fry now and again, it is preferable to use a poly- or monounsaturated cooking oil.

However, the more preferred methods of cooking should be grilling, boiling, braising or baking because they do not increase the overall fat content of the meal, and allow the fat to leech from the meat. When meat is boiled and left to cool, the fat will float to the top.

When meat is grilled on a rack the fat loss can be easily appreciated. This illustrates how cooking can make a difference to the fat content of meat.
POSSIBLE REDUCTIONS IN FAT INTAKE WHICH COULD BE ACHIEVED IF LEANER MEATS WERE USED IN THE IRISH DIET

TABLE 3. RECORDED INTAKES OF MEAT AND MEAT PRODUCTS AND ADJUSTED INTAKES OF FAT FROM THESE FOODS FOR MALES AND FEMALES > 18 YEARS

<table>
<thead>
<tr>
<th>Meat &amp; Meat Products</th>
<th>Current Average Intake in (g/d)</th>
<th>Lowest Cut Corresponding Fat Intake from Lean Cuts in (g/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacon and Ham</td>
<td>18</td>
<td>Boiled Ham</td>
</tr>
<tr>
<td>Beef and Veal</td>
<td>50</td>
<td>Lean Sirloin Beef</td>
</tr>
<tr>
<td>Lamb</td>
<td>10</td>
<td>Lean Leg Chop</td>
</tr>
<tr>
<td>Pork</td>
<td>14</td>
<td>Lean Bone Shoulder of Pork</td>
</tr>
<tr>
<td>Poultry</td>
<td>25</td>
<td>Chicken Breast</td>
</tr>
<tr>
<td>Biohamburgers</td>
<td>4</td>
<td>Frozen Biohamburger</td>
</tr>
<tr>
<td>Sausages</td>
<td>15</td>
<td>Pork Sausage Reduced fat 3.9</td>
</tr>
<tr>
<td>Meat Pie/Patties</td>
<td>12</td>
<td>Steak and Kidney Pie</td>
</tr>
<tr>
<td>Other Meat Products</td>
<td>15</td>
<td>Turtleback Meat</td>
</tr>
<tr>
<td>All Meat and Meat Products</td>
<td>112</td>
<td>Total</td>
</tr>
</tbody>
</table>


At present, meat and meat products in the Irish diet provide 27% of the total adult fat intake, with milk and dairy products being the next largest contributor with 20%. By calculations involving the total intake of meat and meat products, and the amount of fat coming from these foods, a figure of 15.6% fat emerges as the mean fat content of Irish meat. However, we know that if meat is trimmed and lean meat is used, this percentage could be substantially decreased and, as we have shown, lean meat can contain as little as only 2% fat.

Present fat intake from meat is 24 g/day. Theoretically, this figure could be more than halved by changing over to lean meat and reduced fat meat products. If this alone were done, our 3% energy from fat in the Irish diet would fall from 34.9% of calories to 30%, assuming that calorie intakes remained constant (Table 4). This illustrates the possible scope which exists for reducing fat intake by choosing lean meat and low-fat meat products.

On a practical note, however, it may be argued that lean meat is considerably more expensive than fatty meat and people may be discouraged from buying lean meat for cost reasons. However, the message should be that by purchasing a smaller amount of lean meat at the same price as a larger piece of more fatty meat, you will be still buying all the nutrients you need but less fat. Lean meat can go further by making more use of vegetables, potatoes, pulses, rice, pasta and bread. This will increase the dietary fibre and carbohydrate content of the diet and maintain energy intakes.

TABLE 4. EFFECT ON FAT AND ENERGY PROFILES OF CHANGING OVER TO LEAN MEAT AND MEAT PRODUCTS FOR MALES AND FEMALES > 18 YEARS

<table>
<thead>
<tr>
<th>Actual Results INDI Survey</th>
<th>Possible Results if Leaner Meats Chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy intake Andrew</td>
<td>222.4</td>
</tr>
<tr>
<td>Energy intake MJol</td>
<td>85</td>
</tr>
<tr>
<td>Fat intake g/d</td>
<td>8.5</td>
</tr>
<tr>
<td>% total calories from fat containing saturated fat</td>
<td>46.3</td>
</tr>
<tr>
<td>% total calories from fat containing polyunsaturated fat</td>
<td>33</td>
</tr>
<tr>
<td>Intake of meat &amp; meat products (g/d)</td>
<td>132</td>
</tr>
<tr>
<td>% Fat intake from Meat</td>
<td>15.9</td>
</tr>
<tr>
<td>Fat intake from meat Fat</td>
<td>10.7</td>
</tr>
<tr>
<td>Reduced % fat content meat</td>
<td>2.6</td>
</tr>
<tr>
<td>% total calories from meat</td>
<td>45.4</td>
</tr>
</tbody>
</table>

We have shown that red meat can contain very little fat when carefully trimmed and cooked without fat. However, people receiving advice on cholesterol-lowering diets may be advised to exclude or restrict red meat from their diets. There is scientific evidence from research groups discounting this advice, having specifically examined the role which lean red meat can play in a low-fat cholesterol-lowering diet.

The first of these studies is from St. Thomas's Hospital in London which recruited fifteen men with high blood lipid levels and allocated them to various experimental diets, differing in total fat content but all containing 180g of lean red meat per day. Diet A contained 42% of calories from fat, Diet B 33% of calories from fat and Diet C 27% and a high fibre content. Favourable reductions in plasma cholesterol and in LDL cholesterol were noted on diets B and C compared to diet A. The authors concluded that "provided that care is taken to reduce the fat content substantially (by trimming all visible fat), a moderate quantity of meat and meat products may be included in a cholesterol lowering diet".

In a later study, a group of Australian scientists examined the effect of three different diets on serum lipids and lipoproteins - a baseline average Australian diet, a low-fat lean meat diet and a vegetarian diet. Each experimental diet was of 6 weeks duration. Serum total and LDL cholesterol fell on the low-fat lean meat diet and the vegetarian diet, the greater fall being seen on the vegetarian diet. The low-fat lean meat diet contained 250g of lean meat per day and although the vegetarian diet may confer the greater benefit, the authors conclude that "a more widely acceptable lean meat containing low fat diet appears to be almost as effective".

A third study addressing the question of lean red meat and cholesterol-lowering diets is from the Royal Melbourne Hospital. The aim of this study was to differentiate between the effects of consumption of "lean beef" and "beef fat" on blood cholesterol levels. There were two study periods, each of 2 weeks duration - a normal diet baseline period and a very low fat diet containing 500g of lean beef per day. The results showed a significant fall in total and LDL cholesterol on going from baseline to low-fat plus lean beef diet. This decrease was then reversed in the following two weeks by the addition of pure beef fat. This study clearly demonstrated "that it was consumption of the beef fat, not the lean beef, which raised blood cholesterol levels".

Finally, the results of a study from the Baylor College of Medicine in Texas corroborate with the conclusions of the 3 previous studies. In this study, the baseline habitual diet was followed by one of two possible test diets. Both test diets contained less than 30% of calories from fat and 6% of calories from saturated fat, but one contained lean beef and the other contained chicken and fish. The changes in total and LDL cholesterol were similar in both groups and the authors conclude that "lean beef and chicken / fish in diets with less than 30% of calories from fat and less than 6% of calories from saturated fat have similar effects on blood cholesterol".

These studies emphasise how it is the distinction between red meat protein and fat which is most often ignored and hence leads to advice which advocates the exclusion or restriction of red meat from cholesterol-lowering diets. Lean red meat can form part of a cholesterol-lowering diet, provided that the total saturated fat content of the diet is kept low. It must also be emphasised that lean red meat can make an important contribution to the overall intake of many essential vitamins and minerals. Vitamin and mineral intakes can be maintained and at the same time the fat intake reduced by choosing lean meats. The authors of these four studies also suggest that the inclusion of lean red meat will increase patient compliance by allowing a greater choice of foods within the constraints of a cholesterol-lowering diet.
There is increasing interest in a Mediterranean-style diet and its beneficial effects on blood cholesterol levels. Individuals aiming to adopt such a diet perceive it to be one based on pasta, olive oil and fish, and low in red meat. However, the reality does not reflect this. The "Mediterranean diet" is that which is consumed in the Mediterranean countries; Italy, Spain, Portugal and Greece. These countries have low rates of cardiovascular disease, and a protective role has been attributed to their dietary patterns. By evaluating available national dietary intake data from these countries, we can evaluate the Mediterranean diet in comparison with our own Irish diet.

From these data (Table 5) we can see that red meat is an important part of the diet of the Mediterranean countries. Beef and veal intakes in Ireland and Italy are very similar and the overall consumption of meat and meat products does not vary greatly between regions. It is also important to note that there may be quite a difference between one Mediterranean State and the next. Fish intake in Italy for example is so low as here in Ireland while the countries of the Iberian peninsula, Spain and Portugal, have a high fish intake. One big difference between the Northern European diet and that of the Southern countries is the consumption of fruit and vegetables, with most Mediterranean countries having a fruit and vegetable intake at least twice that of Ireland. This is one area where we Irish could improve our diet and clearly we can continue to enjoy lean meat as we shift more towards the diet of Southern Europe.

**TABLE 5. CONSUMPTION, IN GRAMS/DAY, OF A SELECTION OF MEATS AND OTHER COMMON FOODS FROM FIVE EUROPEAN NATIONAL FOOD SURVEYS**

<table>
<thead>
<tr>
<th>Food Product</th>
<th>Ireland</th>
<th>UK</th>
<th>Italy</th>
<th>Spain</th>
<th>Portugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>14</td>
<td>10</td>
<td>16</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Pork</td>
<td>13</td>
<td>10</td>
<td>12</td>
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Source: *Ireland* | *UK* | *Italy* | *Spain* | *Portugal* | n/a - Data Not Available
THE TERM "VEGETARIANISM" COVERS A BROAD SPECTRUM OF DIETS. ALL VEGETARIANS EXCLUDE RED MEAT FROM THEIR DIETS AND MOST ALSO EXCLUDE POULTRY AND FISH. THOSE WHO ONLY EXCLUDE RED MEAT ARE TERMED "SEMI-VEGETARIAN".

A "LACTO-VEGETARIAN" DIET INCLUDES MILK AND MILK PRODUCTS AND AN "OVO-VEGETARIAN" DIET INCLUDES EGGS. THEREFORE, A "LACTO-OVO-VEGETARIAN" DIET INCLUDES BOTH MILK AND EGGS. A STRICT VEGETARIAN OR "VEGAN" DIET EXCLUDES ALL FOODS OF ANIMAL ORIGIN AND OFTEN EXCLUDES THE USE OF ANIMAL PRODUCTS ALSO SUCH AS LEATHER GOODS.

A BALANCED VEGETARIAN DIET
The risk of a nutritionally inadequate diet increases as the vegetarianism becomes more strict. A lacto-ovo-vegetarian diet would most probably be adequate in all nutrients, whereas a vegan diet would usually need supplementation with vitamin B₁₂ and may be low in other vitamins.

To achieve a balanced diet, a vegan must choose a wide variety of foods from the food groups permitted. They should include daily a mixture of cereals and grains, pulses, fruits and vegetables. Complementation of cereals and pulses is also important to achieve a higher protein biological value. To improve iron absorption from the vegetables and cereals, a vitamin C rich food should be consumed in conjunction with these foods.

NUTRITIONAL ADEQUACY OF VEGETARIAN DIETS
In an omnivorous diet, animal foods normally provide appreciable amounts of energy, protein, fat, calcium, iron and vitamins A, D and B₁₂.

1 Energy
Vegan diets in particular can be very bulky. Young children may have difficulty meeting energy requirements. Adult vegetarians and vegans in practice have energy intakes similar to those of meat eaters.

2 Protein
Animal products are the major protein providers and, when removed from the diet, leave vegetarians to rely on poorer sources to achieve adequate protein intake. Most staple foods such as bread and potatoes do contain protein (approximately one tenth of the energy of these foods comes from protein) and any vegetarian diet which is based around these staples will contain adequate protein. Protein complementation is also important to improve the biological value of plant proteins - particularly for vegan children.

3 Fat
Vegetarians consume an average of 35% of energy from fat. Vegans on average eat ≤ 10% of energy from saturated fat. Vegetarian diets of all kinds normally contain more polyunsaturated fats than omnivorous diets.
Calcium
Lacto-vegetarians are likely to have adequate calcium intakes but those who avoid milk and milk products tend to have low calcium intakes. Calcium, however, is also supplied by drinking water, especially hard water. Calcium-fortified soya milk and milk products also contain substantial portions of this mineral. Calcium absorption may be inhibited by oxalates which are present in plant foods and are therefore consumed in large quantities in vegetarian diets. Phytic acid, found in wheat flour and oats, also interferes with absorption of several minerals including calcium and iron.

Iron
In omnivorous diets, meat is the major iron source and therefore vegetarians must obtain this mineral from alternative sources. Iron from plant foods is poorly absorbed compared with iron from red meat. The absorption of plant iron can be increased by the presence of vitamin C in the diet. The main sources of iron in vegetarian diets are leafy vegetables and unrefined cereals. There is no evidence that vegetarians or vegans have an increased prevalence of anaemia compared with the rest of the population. However, nutritional anemias and inadequate iron stores (serum ferritin) remain a serious problem among women. About 1 in 5 French women15, 1 in 7 UK women16 and 1 in 3 Swedish women17 have iron stores below the acceptable limit. This is largely determined by large losses of iron during menstruation and consequently women, vegetarian or otherwise, should ensure that they have an adequate iron intake.

Vitamins
Generally fruits and vegetables provide pro-vitamin A, vitamins C, E and K, whilst cereals, grains and nuts provide B complex vitamins and vitamin E. Therefore, a balanced vegetarian diet can provide most of the vitamin requirements. Vegan diets are often lacking in vitamins D and B12. Most margarines are now supplemented with vitamin D which contributes appreciable amounts to the overall intake of the vitamin. The main determinant of vitamin D status, however, is the action of sunlight on the skin and this can compensate for the dietary lack of the vitamin.

Vitamin B12 is the vitamin of most concern and vitamin B12 supplements are strongly recommended for vegans. In the UK, all meat substitutes are supplemented with vitamin B12.

ARE VEGETARIANS HEALTHIER THAN MEAT EATERS?
Many studies have compared vegetarians with meat eaters with respect to their health status, but the results are often difficult to interpret due to many confounding factors. Many vegetarian populations also differ from the general population in areas of lifestyle other than diet. For example, Seventh Day Adventists follow a vegetarian diet and studies of this group have shown them to have lower death rates from cancer and heart disease compared to the rest of the population. However, this group of the population also abstain from smoking tobacco and from drinking tea, coffee and alcohol. Studies of Mormons, who do not smoke or drink but who do eat meat, have shown similarly low cancer and heart disease rates. This implies that it is not the vegetarian diet which is providing the protection18.

Vegetarians generally have a higher fibre intake than meat eaters, which is desirable. However, the nutritional and health consequences of vegetarian diets are not necessarily either all good or all bad. The ultimate balance that vegetarian diets strike with respect to health depends on the extent to which they are integrated with current knowledge of nutritional science in dietary planning.

CONCLUSION
A properly planned and well-thought-out vegetarian diet is not hazardous and might offer some health benefits. Great care needs to be exercised to ensure that young children particularly, and women during pregnancy and lactation, receive diets of adequate nutrient content. This is particularly important for those adhering to the more restrictive forms of vegetarian diets.
The study of the relationship between diet and cancer is extremely difficult and the resultant data is often very difficult to interpret. There are a number of reasons for this.

The two main study methodologies used are "case-control" studies and prospective studies, each having its own inherent advantages and disadvantages as outlined here.

Case-control studies identify patients recently diagnosed with cancer and compare them to people who do not have cancer.

They may be compared with regard to any aspect of lifestyle including diet. The problem is that cancers take a long time to develop, so that when they are diagnosed, dietary habits may differ from those prevailing at the time of cancer initiation. This requires retrospective analysis of the diet with all its attendant problems.

The second approach, prospective studies, recruits a large number of healthy people and examines their diet at base-line. In these studies, usually carried out over 5 or more years, the women who develop cancers are compared to those who do not. Using this approach, retrospective dietary analysis is not needed since dietary information is collected at base-line. However, because the number of new cases of cancer per 1000 of the population over a 5 year period is low, this type of study requires the investigators to recruit very large numbers at the outset.

To date there have been three large prospective studies which have looked at the relationship between dietary fat and breast cancer and none have shown a significant association17,23,24. There has been only one major prospective study of diet and cancer of the large bowel24.

The diet survey methodology in this study did not distinguish between the lean part of meat and the surrounding fat and therefore could not draw any conclusion in relation to lean meat and disease.

In considering the entire issue of diet and cancer, a recent UK Government report1 concluded: "The panel concluded that there is currently insufficient evidence on which to base a recommendation for a decrease in fat intakes to prevent cancer, although an increased consumption of any fatty acid should not be encouraged".
REFERENCES
