"Nutrition Newsletter" aims at periodically presenting and stimulating exchange of information in the field of human nutrition. The articles provided will be derived primarily from the IDF Groups of Experts concerned with nutrition, or constitute the account of special IDF events in the field, such as the Nutrition Week. The views expressed are those of the authors and not necessarily of IDF.

The newsletter is issued in English and is sent to the National Committees of IDF, to subscribers of the IDF Bulletin, to IDF groups of experts and other interested parties.

The International Dairy Federation (IDF) is a non-profit, non-governmental organization, created in 1903 in order "to promote, through international co-operation, the solution of scientific, technical and economic problems in the dairy field". 36 countries, in all parts of the world, are members of the IDF.

Information on IDF and its activities can be obtained from:

The General Secretariat of IDF
41, square Vergeze
B-1040 Brussels, Belgium
Tel +32 2 733 98 88
Fax +32 2 733 04 13

Editorial

A nutrition strategy for IDF is still a hot issue. Many nutritional problems which are under discussion today, for example, the effect of protein quality, lipid composition, calcium content and fermented dairy products on public health, all may have an impact on the use of dairy products.

It is obvious that questions around protein quality and requirement are of interest for the dairy industry. This is illustrated by the fact that during the Spring and early Summer 1994 the protein problems were discussed at two IDF meetings. The Nutrition Week in Helsinki, June 6-8, had protein quality and evaluation as a main topic with invitation of outstanding scientists to give keynote lectures. Three weeks later, June 22-24, two symposia on Milk Protein; Definition and Standardization were held in Aarhus, Denmark. In this issue of the Nutrition Newsletter material from the Nutrition Week is presented.

The experience from the discussions held in Helsinki and Aarhus illustrate that there are communication problems between scientists within the nutrition and dairy fields regarding the qualitative and quantitative aspects on human protein requirement and its impact on the definition and standardization of milk protein in dairy products. This seems to call for a more active role played by IDF's Nutrition Coordination Group to get representatives from these two fields to meet for further discussions in order to form a consensus on the IDF strategy on the protein issue. But such actions need economic support and unfortunately economic constraints are usually the major reason for the limited outcome of the work within the various IDF committees. This is further commented on by Professor Barth in his article how to enforce an IDF Nutrition Strategy, "Arguments for a budget to attract experts from outside the dairy industry on nutrition matters."

Leif Hambraeus, MD, Dr Med Sci
Professor of Human Nutrition, University of Uppsala, Sweden
Chairperson of IDF Nutrition Coordination Group
EDITORIAL - Prof. L. Hambraeus, University of Uppsala, Sweden 1

Arguments for a budget to attract experts from outside the dairy industry on nutrition matters - Prof. Dr. Chr. Barth, Deutsches Institut für Ernährungsforschung, Potsdam-Rehbrücke, Germany 3

Nutrition Task Force for IDF - Mr. E. Hopkin, International Dairy Federation, Bruxelles, Belgium 3

THE PROTEIN ISSUE

Protein quality and evaluation: Summary - Prof. L. Hambraeus and Prof. Chr. Barth 4

Impact of analytical methods on quantitative determination of proteins in milk and milk products - Mr. R. Grappin, INRA-SRTAL (Station de Recherches en Technologie et Analyses Laitières), Poigny, France 4

Cow milk proteins and type 1 diabetes - Prof. H.K. Åkerblom, Department of Pediatrics, University of Helsinki, Finland 6

Impact of recent FAO/WHO recommendations for the nutritive value of milk protein as compared to vegetable proteins: Summary of round table discussion - Prof. L. Hambraeus and Prof. Chr. Barth 7

Differential Intestinal effects of casein and soybean protein - Dr. R. van der Meer, Department of Nutrition, NIZO, Ede, Netherlands 8

FERMENTED DAIRY PRODUCTS, INTESTINAL MICROFLORA AND HEALTH

Introduction - Prof. S. Salminen, University of Turku, Finland 10

Lactic Acid Bacteria and the immune response - Prof. E. Isolauri, University of Tampere, Finland 10

Bioactive compounds in fermented milks - Prof. H. Korhonen, Agricultural Research Centre of Finland, Jokioinen, Finland 10

Fermented dairy products and colon-cancer-related enzymes - Prof. H. Mykkänen, University of Kuopio, Finland 11

Lactobacillary probiotics and intestinal microecology - Prof. M. Mikelsaar, University of Tartu, Estonia 11

Role of cultured and culture-containing dairy products in health - Prof. S. Salminen, University of Turku, Finland and Dr. R. Tanaka, Yakult Central Institute for Microbiological Research, Tokyo, Japan 12

MILK LIPIDS IN THE DIET AND HEALTH

- Prof. M. Gurr, St Mary’s, Isles of Scilly, UK 16

CONSUMER RESPONSE AND KNOWLEDGE

Problems with the recommendation to consume diets with less than 30% of calories from fat - Mrs H. Bishop MacDonald, Dairy Bureau of Canada, Toronto, Canada 20

Food and health - What do Finns think? - Mrs U. Urho and T. Luova, Dairy Nutrition Council, Helsinki, Finland 21
ARGUMENTS FOR A BUDGET TO ATTRACT EXPERTS FROM OUTSIDE THE DIARY INDUSTRY ON NUTRITION MATTERS

Prof. Dr. Chr. Barth
Deutsches Institut für Ernährungsforschung
Potsdam-Rehbrücke
Arthur-Scheunert-Allee 114/116
D-14558 Bergholz-Rehbrücke

The diary industry is going through a profound transition which will finally lead to a state of affairs where this branch of the food industry will operate competitively among others on the market. This necessarily will cause growing pressure on the diary industry not only to guarantee the safety and sensoric quality of the food offered on the market, but also to emit a coherent message on the healthiness of dairy products.

Whereas there is undoubtedly high qualified expertise available in the permanent committees and the experts groups of IDF on such matters like food technology, food safety, food hygiene, economics, legislation and agricultural production, it becomes more and more difficult to convince experts of high standing in human nutrition to collaborate with IDF. This has to do with the fact that experts in the former areas often work in institutions devoted to dairy research or in the dairy industry and are therefore more or less intimately linked to IDF, whereas nutrition experts are mostly working in university hospitals and research departments of universities.

If IDF wishes to send out a strong message on the healthiness and nutritional quality of dairy foods on a continuous basis it is therefore undoubtedly necessary to provide travel funds and in some cases honoraria for experts in human nutrition for the following occasions:

a) Visit of physicians and nutrition experts to collaborate in expert groups of IDF.

b) Invitation of high-ranking speakers on different occasions of IDF meetings, particularly at the IDF international conferences and nutrition weeks.

c) Participation of nutrition experts in PC functions.

d) Participation of nutrition experts in task forces when more or less qualified statements about the healthiness of dairy products are issued from other sides and a scientifically sound statement on behalf of IDF is mandatory.

Topics of particular interest for IDF related to dairying and human nutrition are:

- Calcium and osteoporosis
- Milk protein and its biological value
- Fermented dairy products and their health aspects
- Micronutrients in milk
- Oxidative and anti-oxidative components in milk
- Milk lipids and oxidative stress related to atherogenesis
- Milk vitamins and their utilization and importance for health
- Enrichment of milk with substances related to human health by feeding practices
- Lactose and human health
- Lactose intolerance and food technology in dairying
- Health aspects of lactobacilli

Budget consideration:

It is strongly recommended to make funds available running up to 10 x 1500 U.S. Dollars per year for 10 experts invited to meetings or task forces. This fund can be given to the president of PC-F who then could decide how to spend the money on the basis of proposals made by the chairman of the Nutrition Coordination Group.

This sum of 15 000 U.S. Dollars should be supplemented with a sum of about 5000 U.S. Dollars for honoraria if necessary.

NUTRITION TASK FORCE FOR IDF

E. Hopkin,
Secretary General of IDF, Brussels

The views expressed below are my own and not necessarily those of IDF.

A further step in "sharpening up" IDF's nutrition work will be the establishment of a Nutrition Task Force as is being proposed to the 1994 Annual Sessions in Adelaide, Australia.

The budgetary considerations developed by Prof Chr. Barth have to be treated at the level of IDF's Executive Committee. It is evident, however, that to find funding IDF has to have a convincing programme, comprising a very few of the most topical items to be carried in the necessary depth and as quickly as possible.

The Nutrition Task Force, if approved in Adelaide, will have the following objectives:
- to identify all subjects associated with nutrition in which IDF should take active interest
- to give advice on which nutrition-related activities should be continued and in which manner, and
- to propose objectives for new subjects to be taken up by IDF.

The Task Force will be expected to present a written report in 1995 and, if its work is not then complete, to produce a final report for the 1996 Annual Sessions.
THE PROTEIN ISSUE

IDF’s 1994 Nutrition Week in Helsinki in June devoted two sessions to the protein issue. The first session comprised two lectures: Protein quality and evaluation by Professor Vernon Young from Laboratory of Human Nutrition, MIT, USA, and Impacts of analytical methods on quantitative determination of protein in milk and milk products by Dr. Remy Grappin from INRA-STAL, Poligny, France.

The second session comprised a Round table discussion with the theme: The impact of the recent FAO/WHO recommendations for the nutritive value of milk protein as compared to vegetable proteins which was held in the same afternoon. A report from the Round table discussion is presented by the organizer, Professor Barth below.

PROTEIN QUALITY AND EVALUATION

SUMMARY
by Prof. L. Hambraeus and Prof. Chr. Barth

Professor Vernon Young in his introductory lecture commented on the present situation regarding evaluation of protein quality and requirements in man. He summarized the background to earlier and present protein recommendations and the methodological problems involved in establishing the optimal protein composition based on amino acid composition in relation to amino acid requirements in man. The rationale and biochemical basis of the recommendations on amino acid and protein requirements issued by the FAO/WHO/UNU in 1990/1991 can be summarized as follows:

1. The biological value of a protein can be assessed on the basis of its true digestibility and its amino acid composition resulting in the Protein-Digestibility Corrected Amino Acid Score (PDCAAS).
2. The requirements for indispensable amino acids are - on a temporary basis - defined according to the metabolic needs for preschool children. This is valid for all age groups except for infants [1].

In his analysis he also questioned the reason for having different amino acid requirements with age and came to the conclusion, based essentially on his own studies on amino acid oxidation, that probably the pattern for the preschool child is most relevant also for adults.

Ref.: See page 8.

IMPACT OF ANALYTICAL METHODS ON QUANTITATIVE DETERMINATION OF PROTEINS IN MILK AND MILK PRODUCTS

R. Grappin
INRA-Station de Recherches en Technologie et Analyses Laitières, BP 89,
39601 Poligny Cedex-France

When assessing the nutritional value of food products, either for experimental purposes or for nutritional labelling, quantitative determination of proteins is always necessary. It seems that a relatively small number of methods of analysis, such as total and specific proteins content and AA analysis, are usually performed. The purpose of this presentation is to provide the nutritionists information on the reliability, or value, of the most common analytical methods, and on the consequences analytical methods may have on the determination of the nutritional value of milk proteins.

After a brief recall of the factors which affect the accuracy of analytical methods, the principle and the analytical performances of reference and routine methods which are currently available for the quantitative determination of proteins in milk and milk products, will be given. The identification of individual proteins or peptides, the determination of the AA composition of products, and will not be considered.

1 General concepts of the analytical process
The most important factors which may influence the measurement for the "true" concentration of an analyte, or accuracy of an analytical results, are:
- the heterogeneity of the analyte and of the products,
- the sample preparation, the specificity of the method, and the matrix effect,
- the calibration procedure,
- and the laboratory performance.

2 Complexity of milk proteins in dairy products
If we exclude enzymes, minor proteins such as lactotransferrin, and AA or peptides, milk contains 6 major proteins synthesized in the mammary gland: 4 caseins associated in micelles (αs1, αs2, β, k) and 2 serum proteins (α la and β lg). Milk contains also other proteins which come directly from blood (BSA and lg).

Original caseins and whey proteins occur at least in 28 different genetic variants corresponding to substitution or deletion of AA. The ratio of these various proteins varies significantly with several biological factors, such as species, breed, individual, health status, stage and number of lactation, feeding, etc. In addition, after processing into dairy products and possible breaking down by hydrolysis, the proportion of these different proteins can be dramatically modified.

This variability means that any analytical method will give only an estimate of the "true" protein content of a milk
product. The degree of accuracy of an analytical result will be directly related to the heterogeneity of the proteins present in the product and of the principle of measurement of the method of analysis.

3 Method of analysis

Except dry-weight or mass determination of pure proteins in solution, which is never used for routine quantitative measurement, all the analytical methods, including the reference method, are based on particular chemical characteristic which are more or less specific to proteins.

The protein properties or characteristics which have lead to the development of quantitative methods include in a decreasing order of specificity:

- antigenicity, presence of nitrogen in protein molecules, peptide bonds, presence of NH2 groups, specific basic or aromatic side chains, buffering capacity of proteins and refractometry.

Among the various methods which have been developed for protein determination, only 3 techniques which are commonly used for the quantitative measurement of protein or nitrogen fractions in milk and milk products will be discussed in more detail: nitrogen determination by Kjeldahl, infrared spectrometry and dye-binding method.

3.1 Nitrogen determination

Because nitrogen is the element which essentially characterizes proteins, its determination has always been used as a standard method for the estimation of the protein content of food. In nutrition studies, the measurement of nitrogen has a special interest, particularly in assessing the digestibility of proteins which is defined as the ratio of the nitrogen absorbed vs. nitrogen intake.

Nitrogen can be measured directly by the Kjeldahl and the Dumas methods. The Kjeldahl method is now internationally recognized as the reference method for protein testing. Organic nitrogen is converted quantitatively into ammonium sulfate by heating in concentrated sulfuric acid. Ammonium is then titrated after addition of sodium hydroxide and distillation.

The IDF/ISO/AOAC group of experts has recently revised the IDF standard which is now applicable to milk and dairy products. Several collaborative studies and proficiency studies have been carried out since 1988. The average repeatability, reproducibility and between-laboratory standard deviation for milk protein testing are respectively: 0.015, 0.025 and 0.021 g/100 g. To secure accurate results it is important to carry out frequent accuracy checks: control of the digestion step by analysing hard-to-digest N compounds, and control of the distillation and titration step by analysing pure NH4 salts.

The Dumas and related methods which measure N converted into gas by combustion, can also be used. Compared to Kjeldahl, they have the advantages of measuring theoretically all the nitrogen present in the product, they give results in few minutes rather than in one hour or more, and they are fully automated. The analytical performances is acceptable, providing the calibration is checked against Kjeldahl.

To estimate the amount of protein, nitrogen shall be converted into protein by multiplying the nitrogen content by a factor called the Kjeldahl conversion factor, which corresponds to the average proportion of the mass of nitrogen in proteins. For most food proteins the coefficient used is 6.25. The proportion of nitrogen content of amino acids varying between 7.7 and 32.2% and the AA composition of proteins from different origins (plants, animals) being also extremely variable, the correct conversion factor is therefore also extremely variable. Based upon the AA composition, the conversion factor of the major milk proteins varies from 5.88 to 6.54, the correct coefficient for milk true protein being 6.31.

The situation becomes more complicated when we consider the non-protein nitrogen (NPN) fraction which, in milk, may vary from 3 to 10%, and may reach 25-30% in whey products.

Because protein definition (crude or true protein) and method of analysis cannot be dissociated, a clear understanding of what is exactly measured by the reference method seems particularly important for nutritionists.

3.2 Indirect methods

Only two methods are now used routinely for rapid protein testing: dye-binding and infrared spectroscopy. Dye-binding, mainly the amido black method, was developed in the early 60's and extensively used in Europe for breeding, and later on for milk payment. Progressively mid IR spectroscopy, mainly Foss Electric equipment, has superseded A.B for routine analysis.

- A,B is based upon the interaction between free NH3-1 groups of protein at low pH and SO3- group of the dye. The amount of dye bound is directly proportional to the true protein content in milk. Variation of the ratio casein / true protein slightly influences the accuracy.
- In mid IR, there is strong absorption band at 6.5 mm by the peptide bonds. Although proteins are the major absorbing compounds at this wavelength, the absorbance is also influenced to a greater or lower extent by the other major milk compounds (fat and lactose) and by minor soluble elements, particularly the carboxyl group COO- of citrate and free fatty acids. With modern instruments which make simultaneous measurements of fat, protein and lactose, the influence of fat and lactose is automatically corrected.

Both A.B and IR measure true protein, therefore a calibration in crude protein (total N) introduces a bias which will vary according to the proportion of NPN in total N. Several studies have shown that species, season and region greatly influence the NPN level in milk and the calibration of the instrument.

The analytical performances of these methods are good provided the instruments are correctly calibrated. Depending of the origin of the milk samples, the accuracy standard-deviation varies between 0.030 and 0.060 g/100g.

4 Analysis of milk nitrogen fractions and proteins in dairy products

For the measurement of true protein in milk, the Rowland procedure implies one N determination on milk and one on the 12% TCA filtrate. Recently a direct procedure which requires only Kjeldahl in place of two was developed and gives a better precision than the indirect method. For routine measurement, AB and IR give directly the true protein content.

Currently, the reference and routine methods of measurement of casein or paracasein and whey or serum proteins in milk requires two determinations, one on milk and one on the non-casein solution. With AB and IR methods, paracasein measurement is more easily performed with an accuracy standard deviation ranging between 0.025 and 0.050 g/ 100 g. To express the casein or paracasein concentration in milk (ww), specific factors have to
be applied to take into account the volumes of the precipitates. The difference between casein and paracasein varies significantly between milks and between seasons. For the measurement of individual proteins in milk, several attempts have been made to use HPLC, and PAGE or immunochemical methods. Most of the time these techniques have been used for identification of individual proteins and their genetic variants, but little information is available for quantitative measurement.

For the analysis of dairy products (retentate, casein, whey protein concentrate, coprecipitate, cheese, etc.), Kjeldahl nitrogen determination is the most straightforward method. The Dumas method is a good alternative to the Kjeldahl procedure, particularly because it has been fully automated, but it lacks versatility particularly when a large range of protein concentration has to be measured. Before concluding on the nutritive value of a dairy product on the basis of its N content, it has to be born in mind that the proportion of PNP may be extremely important.

With specific calibrations and sometimes sample preparation (dilution, homogenization) A.B and IR can be applied to casein, whey products and cheese. But for non-liquid dairy product, NIR spectroscopy is, for the time being, the most suitable method, moreover it measures simultaneously other compounds (moisture, fat, carbohydrate). Conversely to nitrogen determination, the major drawback of these techniques remains the difficulty of calibration.

5 Conclusion
Regardless of the definition which should be taken for protein (amount of nitrogen or number of peptides bonds), Kjeldahl nitrogen determination remains the easiest and most accurate quantitative method. This statement does not mean that AB or IR methods cannot be used.

With our better knowledge of the composition of the nitrogen fractions of milk and milk products, it appears now less and less acceptable to use 6.38 as a single conversion factor and to include the NPN fraction for all kinds of dairy products and for all purpose for the measurement of true protein.

A variable conversion factor, which would take into account, not only the AA composition of the proteins, but also the average NPN content of the product to avoid a separate determination of NPN, could be established by international agreement and be included in an analytical standard. It would greatly improve the accuracy of the measurement of the "true" value of milk proteins.

COW MILK PROTEINS AND TYPE 1 DIABETES

Professor Hans K. Akerman
The Children's Hospital, II Department of Pediatrics
University of Helsinki

The current concept of the etiopathogenesis of type 1 (insulin-dependent) diabetes in children is as follows: environmental factors, either alone or in combination trigger in a genetically susceptible individual an autoimmune process in the pancreas which leads to destruction of the insulin secreting beta cells. A clear increase in the incidence of type 1 diabetes in children has been observed in many countries over the last decades. This speaks in favor of an essential role of environmental factors. The main candidates among environmental factors are viral infections, some dietary factors, toxins and stressful life-events. Among dietary factors particularly cow milk (CM) proteins in the diet in early life is of interest.

Animal experiments (1,2) have convincingly shown the diabetogenic effect of CM proteins, particularly the whey protein component bovine serum albumin (BSA) on the pancreatic betacells. Our group and several others have over the last years published several reports indicating that early supplementation with CM based infant formula is a clear risk factor for type 1 diabetes in childhood, and the relative protection provided by exclusive breast feeding is another side of the same phenomenon (3,4,5). The observation of elevated levels of serum CM antibodies, b-lactoglobulin and BSA antibodies in newly diagnosed diabetic children vs. controls indicates a particular immunological behavior of diabetic children vs. these dietary proteins (6,7,4,8).

Our project aims at studying the hypothesis that the development of type 1 diabetes in children should be prevented through strict avoidance of exposure to CM proteins during at least the first 6 months of life. The subjects in the study will be newborn infants, whose mother, father or sibling has type 1 diabetes. These children have an estimated risk of 3% by the age of 10 years to contract type 1 diabetes. In the controlled blind study we will examine whether it is possible to reduce that incidence significantly by giving after breast feeding a special formula devoid of CM protein (casein hydrolysate), the controls receiving a conventional CM based formula. The project comprises a genetic prescreening, i.e. only high risk infants will be invited to remain in the study. The study requires a large number of infants, and therefore it will be implemented in several countries according to the same protocol (9).

The dietary advice given to the mothers is essential, and instructive advisory material prepared by us has been tested in a pilot study with 20 type 1 diabetic mothers in Helsinki. The study comprises also many assays of genetic and immunological markers of type 1 diabetes and requires naturally a good collaboration between the various study centres. Before the multinational study proper will be initiated we will also carry out a larger second pilot study, concentrating on the development of immunological markers during the first years of life. This part of the study will be started in the fall of 1994 in Finland and Sweden.

The consequences and costs of type 1 diabetes presenting in childhood are immense, not only economically and for the society, but also with regard to human life. Microvascular complications develop in a considerable
THE IMPACT OF THE RECENT FAO/WHO RECOMMENDATIONS FOR THE NUTRITIVE VALUE OF MILK PROTEIN AS COMPARED TO VEGETABLE PROTEINS

SUMMARY
by Prof. L. Hambraeus and Prof. Chr. Barth

Chairman: Prof. Chr. Barth
Round table panel participants: Dr. Vernon Young, Prof. H. Erbersdobler, Dr. R. van der Meer, Dr. Millward and Prof. L. Hambraeus.

It can be questioned whether the discussion really covered the title with respect to the comparison of vegetable and milk proteins, but it comprised a more detailed discussion of the methodological problems related to evaluation of protein turnover in man.

Dr. Young in his introduction to the round table once more commented on the background to outline of the 1991 FAO/WHO recommendation [1] and stressed the uncertainties regarding optimal amino acid requirement and if there really is a difference between the requirements of the adult and the preschool child. He was in favour of concerning the present amino acid scoring pattern of the preschool child to be most optimal also for adults and questioned the variance with age.

In comments titled "Scientific basis: critical assessment the present recommendations", Dr. Millward commented that the decrease in amino acid requirements with age might as well be an artifact of methodology. On the other hand the problem is that the preschool child values are based on studies performed at INCAP in rehabiliated malnourished children. Since these data have still not been published in a peer-reviewed scientific journal, however, it is difficult to evaluate their scientific relevance, commented Dr. Millward.

It was also discussed that amino acid scoring implies knowledge about physiological amino acid needs but this is still an unsolved problem. Dr. Millward found that
1) growth needs are probably negligible after the first year of life
2) maintenance needs comprise obligatory losses which are probably small and imply fixed physiological needs, and oxidative losses which may be variable and depending on habitual protein dietary level.

The comments lead to a debate about methodological problems involved in studying protein metabolism in man and how the results should be interpreted with respect to protein and amino acid requirement.

Dr. Millward stressed that protein quality cannot be predicted but must be assessed in balance studies using stable isotopes as well as analysis of any changes in body composition. Of special concern should be studies on the postabsorptive utilization of protein and the daily protein and energy balance.

Dr. Schaafsma commented on the problems of physiological functions of various proteins and how they should be...
taken into consideration when evaluating protein quality and also questioned the amino acid scoring. This was also treated by Dr van der Meer who commented on other nutritional attributes of milk proteins besides nitrogen equilibrium. Dr Erbersdobler commented on the impact of the recommendations with special reference to gastrointestinal function.

Finally Prof. Hambraeus commented on the discrepancy between the protein recommendation for the neonatal period and the protein intake in the breast-fed infant based on the real protein content in human milk. First the protein content of human milk is extremely low - much lower than the recommendations. Secondly, breast milk contains a substantial amount of non-protein nitrogen, the physiological role of which is still not fully understood. That means that estimates of protein content based on nitrogen determination are misleading if not corrected for the high NPN content. Finally there is a conflict between milk proteins as source of amino acid for protein synthesis and physiological roles of certain milk proteins as up to 30-40% of the milk proteins in human milk also exert a specific physiological function which need the proteins not to be digested in the gastrointestinal tract. The implication of these observations for the understanding of protein requirement during the neonatal period was thus discussed.

As a result of the discussions the evaluation of protein quality and requirement in man could be summarized as follows:

1. Growth requirement

This can be analysed by calculating the protein content in tissues which are formed during the anabolic phase of growth (most pronounced during the neonatal period and during adolescence but also during athletic training to build up body muscles) as well as during convalescence after disease (malnutrition, rehabilitation, healing of wounds or after surgical treatment, post infections).

Although it can be considered an essential component: calculations make it obvious that this is a minor component in quantitative amounts.

2. Maintenance requirement

It has been estimated that there is a continuous turnover of about 3000-400 g per day in the adult. This should be taken in relation to the dietary intake corresponding to 80-100 g per day via the diet. This maintenance requirement can be said to have two components:

a. a basic physiological need to replace losses which probably are relatively small and which represents obligatory oxidation losses

and

b. oxidative losses. This is considered as regulatory oxidation losses and is probably a very variable component and might be depending on various factors: energy turnover, protein intake, physical activity.

One of the real unsolved problems is then to what extent it could be said that the protein quality, and thereby amino acid requirement is different when we refer to growth requirement vs. maintenance requirement. What should be the real cause for such a difference since it is the same tissue that is synthesized or repaired?

Of special interest are the studies on oxidative losses. These are usually based on the use of stable isotopes for labeling various amino acids. So far most studies are performed using leucine as indicator of muscle protein turnover. However, also when using this model it is essential to differentiate between long-term and short-term effects. Thus it has been shown in many studies that there is an increased leucine oxidation secondary to physical exercise. However, in 24hr studies performed at our department we have been able to illustrate that this increased oxidation may be followed by a period when leucine oxidation is reduced thereby leading to an almost unchanged leucine oxidation during a 24hr period. Obviously much more research is needed before we understand the factors influencing oxidative losses and its possible impact on protein requirement under physiological and pathological conditions.

Outcome

Milk protein will continue to hold a singular position amongst other dietary proteins though Table 11 of the above dietary recommendations attributes a biological value to milk protein which is far less high than that of legume protein (for example soy protein isolate) when compared to former FAO/WHO evaluation schemes.

The key arguments for this conclusion are:

First, milk protein is virtually devoid of antinutrients.

Secondly, its rich content of lysine and sufficient content of sulfuric amino acids make it particularly suited to complement other proteins lacking sufficient amounts of these amino acids.

Thirdly, the biochemical knowledge on which the new reference pattern is based is everything else but firmly established. This holds to the fact that the data are too scarce up to now and have to be complemented by further research.

Fourthly, the other nutritional attributes which are more and more emerging like hormone-like activities and binding and transport of nutrients have also to be taken in consideration.

References


Differential Intestinal Effects of Casein and Soybean Protein

Roelof Van der Meer
Department of Nutrition
Netherlands Institute for Dairy Research (NIZO)
P.O. Box 20, 6710 BA Ede
The Netherlands

Introduction

In recent years, there has been an increasing use of soybean protein in the human diet. Processed and purified soybean proteins (isolates) are nowadays utilized in a broad spectrum of foods for adults as well as for infants. This is because of the relatively high nutritive value of the soy protein isolates, their low cost and high availability. This expanding use of soy proteins is supported by sponsored research concerning the possible favorable effects of these proteins. Because soy protein isolate is also used as a substitute for milk protein a solid understanding of the
possible different functional effects of these competing proteins is required. The essential amino acid composition of these proteins is not very different, which makes differences in primary systemic effects less likely. However, the polypeptide structure and composition of these proteins is very different and thus may result in a different processing of these proteins in the intestinal lumen. For that reason we decided to study the mechanisms of the possible differential effects of milk protein (casein) and soy protein isolate on intestinal physiology.

Effects on cholesterol and bile acid metabolism

Initially, our research was focussed on the differential effects of casein and soy protein on cholesterol and bile acid metabolism. The results can be briefly summarized as follows (see 1 for review). In rabbits, casein compared with soy protein inhibits the fecal excretion of cholesterol and bile acids and thus stimulates the intestinal absorption of these sterols. Therefore, casein has a hypercholesterolemic effect in this species. However, these casein-specific effects on fecal sterols and serum cholesterol are not observed in species like rat and man. We hypothesized that this rabbit-specific effect of casein is due to its high amount of phosphenolserine, as this phosphate ester is probably mainly hydrolysed in the rabbit intestine. This is supported by in vitro studies and in vivo studies with rabbits showing that dephosphorylated casein, in contrast to intact casein, does not affect cholesterol and bile acid metabolism. Thus, this mechanism offers a molecular explanation for this species-dependent effect of casein on cholesterol and bile acid metabolism.

Effects on magnesium absorption and on colonic epithelium

Subsequently, we focussed our research on the effects of casein and soy protein isolate on the absorption of magnesium, because it is known that the soy protein component phytate inhibits magnesium absorption in man. Our results (see e.g. 2,3) can be summarized as follows. Compared with casein, soy protein as well as phytate (equimolar to that in soy protein) inhibits the net absorption (which is measured as intake minus fecal excretion) of magnesium in rats for about 25%. The extent of this inhibitory effect is similar to that observed for phytate in humans. Net or apparent absorption is the net result of true absorption minus endogenous fecal excretion. Using the 28Mg isotope we found that, surprisingly, soy protein and phytate do not inhibit the true absorption of magnesium. Therefore, these results show that soy protein and phytate stimulate the endogenous fecal excretion of magnesium. Concerning the mechanism of this soy protein-specific effect we hypothesized that this protein may damage intestinal epithelial cells, which contain relatively high concentrations of magnesium. This hypothesis is based on our observation that soy protein drastically stimulates the fecal excretion of fat and fatty acids. Other work from my department (see e.g. 4-6) has shown that an increased fecal excretion of fat and fatty acids is accompanied by an increased cell-damaging activity of the colonic contents. This fat-enriched colonic contents damages the protective epithelial surface layer in the colon and thus stimulates a compensatory proliferation of the epithelial crypt cells. In line with this hypothesis we recently observed (see 7) that soy protein isolate compared with casein increases the cell-damaging activity of the colonic contents, damages colonic epithelium and consequently stimulates the epithelial cell proliferation. Preliminary results now indicate that phytate has analogous effects on colonic epithelium.

Conclusions

From the results of our studies summarized above the following conclusions can be drawn:

1. Casein compared with soybean protein is not hypercholesterolemic in humans.
2. Soybean protein compared with casein inhibits net absorption of magnesium by stimulating its endogenous fecal excretion.
3. This is due to a soybean protein-specific damage of colonic epithelial cells, which results in a compensatory epithelial cell proliferation.
4. Our results indicate that this detrimental intestinal effect of soybean protein is partly due to its phytate content, but its specific mechanism requires further investigation.

Further research into the mechanisms of these differential intestinal effects of casein and soybean protein offers an opportunity to strengthen the nutritive value of milk protein.

Literature

FERMENTED DAIRY PRODUCTS, 
INTESTINAL MICROFLORA AND HEALTH

INTRODUCTION

Seppo Salminen,
Department of Biochemistry and Food Chemistry, University of Turku, Finland

Finland has traditionally had a high consumption of fermented milks including buttermilk and the Nordic ryp fermented milk. This tradition has resulted in research interest in fermented diary products and probiotic bacteria. Already earlier, some of the traditional strains used in fermented milks were observed to have beneficial effects on health. More recently, this research has been focused on beneficial bacterial strains, their effects, suitable substrates and the metabolic products formed in milk during fermentation. Research has also been directed towards isolating new strains, developing new products and assessing the effects of traditional fermented milks. Already the earlier products were found beneficial and even some cheese products act as carriers for probiotic bacteria influencing the intestinal integrity. More recently, documented effects have been reported for Lactobacillus acidophilus products and especially for fermented milks containing Lactobacillus strain GG. At present, Lactobacillus strain GG appears to be one of strains with most significant clinical documentation backing the effects of the strain and products made with the strain. It has been shown that the strain has beneficial effects in the treatment of infant diarrhoea and related intestinal disorders. Finnish studies on fermented milk and lactic acid bacteria and cooperation reports from our Estonian partners give a perspective to the research interests, achievements and future directions in this area.

LACTIC ACID BACTERIA AND 
THE IMMUNE RESPONSE

Prof. Erika Isolauri,
University of Tampere, Finland

Gut mucosa provides selective exclusion and immune elimination of potentially harmful substances encountered by the enteral route. Gut microflora is an important constituent in the mucosal defence barrier, interacting closely with the elaborate immune system of the intestinal tract. Lactic acid bacteria are organisms of the subdominant flora throughout the gastrointestinal tract. Specific strains of the species of Lactobacillus reinforce the mucosal barrier and stimulate the local immune responses.

In the first study different lactic acid bacteria were compared for their effects on the immune response to rotavirus in children with acute rotavirus gastroenteritis. After oral rehydration, the patients randomly received either Lactobacillus casei subsp GG (LGG), Lactobacillus casei subsp rhamnosus or the combination of Streptococcus thermophilus and Lactobacillus delbrueckii subsp bulgaricus twice daily for five days. Serum antibodies to rotavirus, total number of immunoglobulin-secreting cells (ISC) and specific antibody-secreting cells (sASC) to rotavirus were measured at the acute stage and at convalescence. The ISC response was comparable in the three study groups while the rotavirus-specific immune responses were different. LGG therapy was associated with an enhancement of IgA sASC to rotavirus and serum IgA antibody level at convalescence. It is therefore suggested that certain strains of lactic acid bacteria, particularly LGG, promote systemic and local immune response to rotavirus, which may be of importance for protective immunity against reinfections.

The second study was designed to compare the immunological effects of viable and heat inactivated lactic acid bacteria. LGG administered as a viable preparation during acute rotavirus gastroenteritis resulted in a significant rotavirus specific IgA response at convalescence. The heat inactivated LGG was clinically as efficient, but the IgA response was not detected. It therefore appears that viability of the strain is critical in determining the capacity of lactic acid bacteria to induce immune stimulation.

BIOACTIVE COMPOUNDS IN 
FERMENTED MILKS

Prof. Hannu Korhonen
Agricultural Research Centre of Finland, 
Food Research Institute 
31600 Jokioinen, Finland

Fermented milks are claimed to contain a number of biologically active compounds which may contribute to human health. These compounds include bacteria used for fermentation, their metabolic products and components derived from milk. Certain strains of lactic acid bacteria (LAB) have been found probiotic in vivo as such but in fermented milks the peptides derived from hydrolysed milk proteins could contribute to the probiotic properties. In fact, peptides of different activities have been detected in various milk proteins upon proteolysis with digestive enzymes or starter bacteria. These peptides include opioid, anti-microbial, anti-cancer, anti-hypertensive, immunomodulatory and mineral carriers. Both major casein fractions and whey proteins are known to act as precursors for the above bioactive peptides.

Several clinical studies have shown that the Lactobacillus GG strain has beneficial health effects, for example, in the treatment of gastrointestinal infections. The factors or mechanisms producing such effects are not fully understood but stimulation of the mucosal immune system has been implicated. It was, therefore, interesting to investigate whether immunoreactive peptides would be formed during fermentation of milk with Lactobacillus GG.

In the study, lactose-hydrolysed UHT milk was first fermented with Lactobacillus GG and then subjected to proteolysis with pepsin and trypsin, followed by fractionation with FPLC. Combined HPLC-MS analysis was used for identification of peptides in the collected fractions. Immunogenicity of the fractions was tested using a mitogen-induced human lymphocyte transformation test. Also,
hydrolysates of total casein and purified casein components were tested for immunomodulatory activity after degradation by pepsin-trypsin or an enzyme mixture prepared from Lactobacillus GG. The results showed that the hydrolysates of Lactobacillus GG fermented milk contained a large number of small peptides. Among them, several peptides were identified referred to as opioid or immunostimulating in the literature. Similar results were detected in the hydrolysed αs1- and β-caseins. Immunologic testing revealed that Lactobacillus GG fermented milk suppressed lymphocyte proliferation. Similar results were obtained with all casein components hydrolysed with the Lactobacillus GG enzyme mixture. After pepsin-trypsin treatment, αs1-casein was suppressive while β- and κ-caseins proved indusive. Further studies are under way in order to characterize more closely the immunoreactive properties of caseins and whey proteins hydrolysed by various strains of LAB.

These preliminary results would suggest that LAB used in fermented milks alter the immunogenic properties of milk proteins. This finding may be of importance for example in the selection of probiotic strains of LAB, development of hypoallergenic infant formulas and functional foods.

FERMENTED DAIRY PRODUCTS AND COLON-CANCER-RELATED ENZYMES

H. Mykkänen,
University of Kuopio, Finland

The causes of colorectal cancer, a disease with a high incidence in the Western countries, are largely unknown. Over 90% of the colon cancer cases are sporadic and believed to be due to dietary or environmental factors. The remainder of the cases are hereditary, with a specific genetic defect causing the malignancy. Diet can influence the development of colon carcinoma via several pathways. It can act as a source of carcinogens, precarcinogens and anticarcinogens, or it can influence the metabolic activity of the GI flora thereby modifying the production of mutagenic or carcinogenic compounds in the gut. Although there is some epidemiological evidence in humans and experimental studies in animals on the beneficial effects of fermented dairy products for health, the therapeutic value of these foods as anticarcinogens remains to be shown.

We have carried a series of studies in which we have determined the effects of Lactobacillus GG fermented dairy products on some fecal bacterial enzymes, known to be involved in the formation of toxic, mutagenic, or carcinogenic metabolites in the gut. L. GG fermented whey drink (2 x 100 ml/day for 2 weeks, cont. 108 cfu L. GG/ml) decreased significantly fecal bacterial glycocholic acid hydrolase activity in residents of a retirement home. The same tendency was observed in β-glucuronidase and urease activities (20% and 38% reductions, respectively).

Similarly, healthy adult females receiving of L. GG fermented yogurt (2 x 150 g/day for 4 weeks, cont. 108 cfu L. GG/g) with or without a rye-fiber product (30 g/day representing 9g of fiber/day) displayed significantly reduced fecal bacterial β-glucuronidase (-30%), nitroreductase (-30%) and glycocholic acid hydrolase (-40%) activities. The enzyme activities returned to the baseline levels during a 2-week follow-up period. In postmenopausal females with self-reported colonic disorders but no malignancies in colonoscopy examination, a 2-week supplementation with L. GG fermented yogurt following the colonic evacuation reduced the activities of fecal bacterial β-glucosidase, glycocholic acid hydrolase and urease.

Although cheese can be a considerable source of probiotic bacteria, a 10-fold increase in hard cheese intake did not significantly alter the fecal bacterial enzyme activities in the residents of a retirement home.

The present series of experiments shows clearly that L. GG fermented dairy products can alter the fecal bacterial enzyme activities in different populations. These modifications of the colonic metabolism may be of importance in understanding the beneficial effects on health by fermented foods.

LACTOBACILLAR PROBIOTICS AND INTESTINAL MICROECOLOGY

Marika Mikelsaar
Professor of Microbiology
Institute of Microbiology
Vanemuise 46
EE 2400 Tartu, Estonia

INTRODUCTION

Human gastrointestinal (GI) microflora (MF) is normally a well-balanced stable ecosystem where the number of microbes remain relatively constant. This ecosystem can schematically be divided into three levels:
I Groups of microorganisms performing microbiogenesis
II Microbiocenoses of different parts of GI
III GI Microbial Ecosystem

At the 1st level we can see different interactions of several groups of microorganisms influencing their number and occurrence by physiochemical activities.

At the 2nd level mucosal and luminal microbiocenoses of different parts of GI tract influence each other and the 1st level parameters.

At the 3rd level (macroorganism level) the influence of IMF results in several health parameters.

All these levels are under the influence of endogenous and environmental factors, like different nutrition, food microbes, infections, and antibiotics. All these factors can disturb the well balanced ecosystem and cause diseases like pseudomembranous colitis, antibiotic-associated diarrhea and simply dysbiosis (Haenel, Muller-Beuthow, 1965; Gorbach, 1992).

Lactobacilli as human probiotics have been used during many years for re-establishment of ecological balance but up to now mostly the investigation of the faeces has been applied.

It is impossible to predict what is really happening in the complicated GI ecosystem. Using different model situations (colonization of newborns) or examining the patients with different GI infections some knowledge has been obtained from human studies. Lactobacillus casei strain GG (Lactobacillus GG) has been shown to have several properties which make it good colonizer of adult GI tract (Goldin et al., 1992).
AIM OF OUR STUDIES:
1. To determine whether orally administered *Lactobacillus* GG could be detected in faecal samples of children with rotavirus diarrhea.
2. To evaluate patients with Shigellosis treated with trimethoprim-sulfamethoxazole (TMP-SMX) and *Lactobacillus* GG the clinical benefit and the intestinal microbial ecology.
3. To evaluate the ability of *Lactobacillus* GG to colonize healthy newborns and influence the normal microbiology.

Three different studies were conducted:

*Lactobacillus casei* strain GG survives the GI passage during rotavirus diarrhea.

M. Mikelsaar, E. Sepp, S. Salminen, M. Kaila, E. Isolauri: Estonia, Tartu; Finland, Helsinki, Tampere (submitted)

29 children (12mo, 5-27.5m) with positive Rotavirus test, after oral rehydration and refeeding were randomly divided into two groups: *Lactobacillus* GG formula group (VALIO) 3x10^8 CFU of 100 ml, and control group (usana formula). The stool samples were collected at admission and on 2-5 days of hospitalization and seeded on MRS media (different dilutions). Total lactobacilli and *Lactobacillus* GG counts were estimated in log CFU/g. For LB GG estimation the colony and the cells morphology were studied and 4 tests performed (gas from dextrose, growth atby 15°C, 0.4% teepol (SIGMA), fermentation of lactose).

During the study the total lactobacilli counts did not change and the wide variation was found in children with rotavirus diarrhea. *Lactobacillus* GG could be detected in all patients of GG-group. We concluded that *Lactobacillus* GG could be differentiated from indigenous lactobacilli of host and they survive during the passage through the GI tract in rotavirus diarrhea. Supposedly, the rotavirus affecting mostly the small intestinal mucosa did not influence the lactobacilli counts of faeces.

"Impact of lactobacilli probiotic on faecal microflora in children with Shigellosis"


31 children (5y, 2-3-7) with bacteriologically proved *Shigella sonnei* infection (Tartu Univ. Hospital) were randomly divided into 3 groups: & treated with LB GG- 10e10 - 10e11 x 3 during 10 days & treated with LB GG + TMP-SMX 36 mg/kg/d; during 5 days & TMP-SMX 5 days.

Faecal samples were collected at admission, on day 5 and 10.

12 groups of anaerobic and aerobic microorganisms were estimated on different media in CFU/g.

In children treated with *Lactobacillus* GG the median time to cure was lower (5.5 to 7.5 days, p<0.05) and on the 10-th day more patients were cured in LB GG groups than in pure TMP-SMX group. The number of lactobacilli in LB GG groups increased significantly during the treatment. The microbial ecology according to developed criterion of subordinate predominant microbes was improved in cases of probiotic treatment. We conclude that the *Lactobacillus* GG therapy improves the intestinal microbial ecology in patients with Shigellosis where the infectious process is localized in large intestine. *Lactobacillus* GG seems to be clinically useful as adjunct therapy for Shigellosis in children.

"Effect of administration of *Lactobacillus casei* strain GG on the gastrointestinal microbiota of newborns"


25 full-term newborns born at Tampere University Hospital and breastfed were divided into 2 groups: & 15 got LB GG supplement of 10e10-10e11 CFU/5 ml water during 2 weeks & 10 performed the control group. Faecal samples were collected on 3-4, 5-7, 28-31 days.

12 groups of anaerobic and aerobic microbes were estimated in CFU/g.

Orally administered LB GG increased the total lactobacilli counts and colonized nearly half of newborns (53%) during the 1. month of life. It does not impair the normal faecal microbial ecology as much as the predominance pattern of microorganisms was similar in both studied groups.

We conclude that in newborns age the *Lactobacillus* GG can colonize some newborns supposedly due to their individual differences of mucosal receptors and colonization resistance pattern.

Thus, lactobacilli probiotics might express different influence on microbial ecology of GI tract, depending on the age of patients and the localization of microecological changes in GI tract.

---

ROLE OF CULTURED AND CULTURE-CONTAINING DAIRY PRODUCTS IN HEALTH

Seppo Salminen & Ryuichiro Tanaka

1 Department of Biochemistry and Food Chemistry, University of Turku, 20500 Turku, Finland
2 Yakult Central Institute for Microbiological Research, 1979, Yaho, Kunitachi-shi, Tokyo 186, Japan

Address for correspondence: Professor Seppo Salminen, Department of Biochemistry and Food Chemistry, University of Turku, 20500 Turku, Finland

Telephone: +358-21-6336800

INTRODUCTION

IDF Group F20 has included in its ways of working an annual review of literature concerning new developments in cultured milks and health as well as related aspects. Thus, this review covers the literature since the 1993 one.

EFFECT ON GUT MICROFLORA

A review with several studies previously not reported in English was prepared by Mikelsaar and Mändar (1993) on the development of individual lactic acid microflora in the human microbial ecosystem. This review covers all stages of life from birth to old age. It also summarizes studies carried out during the last 20 years in Estonia.

The effects of the ingestion of yogurt on faecal microflora and faecal putrefactive metabolites were studied in healthy male adults (Terada et al., 1993) and healthy elderly volunteers (Morisaki et al., 1993). In the case of adults (n=8, mean age 49 years), the consumption of 500 g yogurt once a day for 2 weeks resulted in a significant increase of bifidobacteria counts along with a significant decrease of both faecal ammonia and indole contents. In
the case of elderly volunteers (n=9, mean age 80.2 years), consumption of 130 g of yogurt twice a day for 2 weeks also resulted in a significant increase of faecal bifidobacteria counts along with the decrease of putrefactive metabolites of ammonia, p-cresol, indole and skatole. Regarding the ammonia metabolism of bifidobacteria, Deguchi et al. (1993) measured the in vivo incorporation of [15N] ammonia as a sole nitrogen source in several strains of *Bifidobacterium*. To assess in vivo effects, *B. bifidum* YIT 4069 and galactosyl lactose were injected directly into the caecum of rats. The ammonia level in the portal vein was significantly lowered, suggesting that the administration of *B. bifidum* YIT 4069 may reduce the concentration of portal vein ammonia. The effects on various caecal bacteria and the metabolic activities resulting from feeding diets containing transgalactosylated oligosaccharides (TOS) with or without *Bifidobacterium breve* was investigated in rats colonized with a human faecal microflora (Rowland and Tanaka; 1993). TOS (5% w/w in diet) or TOS plus *B. breve*, fed for 4 weeks, induced increases in caecal concentration of total anaerobic bacteria, lactobacilli and bifidobacteria, and a decrease in numbers of enterobacteria. Caecal pH was significantly reduced by feeding TOS, as were the activities of β-glucuronidase and nitrate reductase. In contrast, β-glucosidase activity was increased in TOS-fed rats. Dietary TOS was also associated with decreased conversion by caecal contents, of the dietary carcinogen 2-amino-3-methyl-3H-imidazo [4, 5F] quinoline (IQ) to its genotoxic 7-hydroxy derivative (7-OH-IQ).

In a Swedish study (Gran et al. 1994) the interference of *Lactococcus lactis* strain on human gut flora was studied. The Lactococcus lactis L1A was isolated from traditional Nordic rye sour milk and was shown to inhibit a variety of bacteria. It survived the passage through the stomach and intestine and was recovered from faeces. In healthy volunteers the strain was detectable in faeces for two days after completing oral administration schedule.

Orriage and coworkers (1994) studied the effect of fermented milk supplements with *Bifidobacterium longum* BB 536 and *Lactobacillus acidophilus* NCFB 1748 on the intestinal microflora during administration of clindamycin. The numbers of anaerobic microorganisms decreased in all subjects. There was a smaller incidence of gastrointestinal discomfort in the subjects that received supplements containing both *Bifidobacterium longum* and *Lactobacillus acidophilus* when compared to groups receiving *Bifidobacterium longum* only or the placebo supplement.

Patel and coworkers (1992) reported that feeding milk fermented with mixed cultures of human strains of lactobacilli to human volunteers resulted in increased numbers of faecal lactobacilli and reduction in coliform counts. The balance was maintained up to 15 days after the feeding regimen was finished.

Several studies on the effects of *Lactobacillus* strain GG (ATCC 53103) in premature and newborn infants have been reported.

In a British study, *Lactobacillus* strain GG was given enterally to preterm infants (Millar et al. 1993). The strain was observed to colonize the bowel of premature infants, but did not appear to influence the faecal reservoir of potential pathogens. Stansbridge and coworkers (1993) studied the effects of *Lactobacillus* strain GG on gut fermentation in premature infants. No obvious adverse effects on nutritionally important short chain fatty acids were observed. Sepp et al. (1993) studied the influence of *Lactobacillus* strain GG on the gastrointestinal microflora of newborns. It was reported that a 2-week administration of the strain right after birth increases the intestinal concentration of lactobacilli when compared to controls.

Saxelin and coworkers (1993) observed better colonisation in healthy adult volunteers for *Lactobacillus* strain GG given in the form of fermented milk when compared to enterococcal tablets. In a study on healthy female adults supplementation with *Lactobacillus* strain GG fermented yogurt decreased faecal β-glucuronidase, glycolytic acid hydroxylase and nitroreductase activities. Also, urinary excretion of p-cresol was significantly decreased (Ling et al. 1994).

**IMMUNE RESPONSE**

The effects of cultured milks on the immune response have been of great interest during last years. The influence of long-term (12 months) yogurt consumption on young and elderly Californians was studied by Trapp and coworkers (1993). They reported that consumption of 200 g of yogurt daily was associated with a decrease in allergic symptoms in both the young and the elderly. The elderly volunteers not consuming yogurt experienced an increase in serum LDL cholesterol when compared to yogurt consumers. No significant differences were reported in immunological parameters (Gamma-interferon, total IgE and specific IgE) although the elderly volunteers consuming yogurt had lower levels of total IgE throughout the study. The study population consisted of 42 young adults and 56 elderly citizens each divided into three groups (yogurt with viable bacteria, heat-treated yogurt and no yogurt). This study shall need further verification with larger groups.

De Simone and coworkers (1993) reported a series of studies on the influence of yogurt and yogurt bacteria on immune response in man. They concluded that yogurt modulates gamma interferon production in vitro and in vivo. This group also proposed that the presence of receptors for lactic acid bacteria on human lymphocytes may represent a potent stimulus for lymphoid cell activation.

Marteau and Rambaud (1993) have also reviewed the potential of using lactic acid bacteria for immunomodulation in man, and have suggested that lactic acid bacteria could be promising for the therapy of mucosal diseases.

In a study with suckling rats, Isolauri and coworkers (1993) showed that *Lactobacillus* strain GG counteracts the permeability disorder caused by cow milk challenge, suggesting a link between the intensity of the antigen-specific immune response and stabilisation of the mucosal barrier.

A B-cell mitogenic substance was isolated and purified from the slime products of *Lactococcus lactis* ssp. cremoris KVS20 (Kitazawa et al., 1993). Chemical analysis showed that the substance was a phosphomycosaminoglycan and consisted of rhamnose, glucose, galactose, and phosphorus. B-cell mitogenic activity was also demonstrated in 9 *Lactobacillus acidophilus* strains using murine spleen cells (Yamada et al., 1993). Higher activity was generally observed in cell wall components than in whole cells. The carbohydrate moiety of active fractions was composed of glucose, N-acetylgalactosamine, N-acetyl muramic acid and glycerol.

Yasui et al. (1994) showed that oral administration of heat-killed *Bifidobacterium breve* YIT4066 enhanced anti-influenza virus haemagglutinin (HA) antibody production by the murine Peyer's patch (PP) cell culture method. In brief, oral administration of *B. breve* YIT4066 with HA augments the differentiation of IgA precursor cells in PP and the appearance of anti-influenza virus IgA antibody in the respiratory mucosal tissue.
ANTITUMOUR PROPERTIES

A number of earlier studies have concentrated on the effects of cultured milks on tumour formation and growth. More data is reported on some aspects related to this area. Furukawa and coworkers (1993) have attempted to identify the component responsible for the reported antitumour properties of kefir grain. They examined the effects of kefir grain on glucose consumption and phagocytosis of peritoneal exudate cells (PEC) and resident peritoneal cells (RPC) using the the water soluble fraction (KGP). The addition of KGP stimulated in vitro glucose consumption of both PEC and RPC from normal BDF1 mice and C57BL/6 mice. Mice were given per os 6 to 17 times 20 mg/kg/day of KGP before and after transplantation of the Lewis lung carcinoma. The glucose consumption of PEC from BDF mice and RPC from C57BL/6 increased more than twice that for control mice. The phagocytosis of adherent cells in RPC from normal C57BL/6 was stimulated and the numbers of phagocytised polybeads increased with 7 times addition of KGP by oral route. In contrast, in tumour-bearing Lewis mice, there were no effects on the phagocytosis and the number of phagocytised polybeads by oral administration of KGP due to the prestimulated phagocytosis (30% higher than that for normal mice) by transplantation of tumour. The inhibitory effect of Lactobacillus casei on superficial bladder tumours was investigated in an experimental study using N-butyl-N-(4-hydroxybutyl) nitrosamine (BBN)-induced rat bladder cancer (Tomita et al., 1994). The oral administration of L. casei (1 x 10^9 cfu/g) was investigated for effectiveness against bladder tumours induced by 7-weeks exposure to BBN. The results indicate that both bladder weight and tumour volume per organ after 22 weeks were significantly lower in the L. casei-treated group. In addition, the degree of malignancy of induced tumours was significantly lower in the groups receiving L. casei. These results clearly indicate a suppressive effect of orally administered L. casei on bladder carcinogenesis. Recently, the effects of oral administration of BLP, a preparation of viable Lactobacillus casei (1.0 x 10^10 cfu/g), on tumour growth and mitogenic responses of splenocytes were studied using a murine tumour recurrence model (Kato et al., 1994). In brief, BALB/c mice were insufficiently immunized with Colon 26 tumour mass (primary tumour) grown for 5 days intra- dermally. Thereafter, mice were rechallenged by injecting Colon 26 tumour (secondary tumour) into the hind foot pad. The secondary tumour grew progressively in control mice, but was markedly suppressed by oral administration with BLP at a dose of 100 or 200 mg/kg/day for 7 consecutive days. The suppression was a primary tumour-specific response. In addition, oral administration of BLP potentiated systemic immune responses that modified T-cell functions in tumour-bearing mice.

ANTIMUTAGENIC PROPERTIES

In a Japanese study, milk cultured with Lactobacillus acidophilus LA106 showed antimutagenic properties on the mutagenicity of Aflatoxin B1 (AFB1) in vitro using Salmonella typhimurium TA 100 with S9 mixture (Hosoda et al., 1993).

OTHER PROPERTIES

Klaver and van der Meer (1993) studied cholestero-sis by cultivating various strains of Lactobacillus acidophilus and Biidobacterium spp. in the presence of cholesterol and oxgall. They concluded that the removal of cholesterol by these species was not due to bacterial uptake of cholesterol, but rather that it results from bacterial bile-salt deconjugating activity. Since deconjugation can potentially lead to the formation of cytotoxic secondary bile acids, the net effect on health is difficult to evaluate.

Aieljung et al. (1994) studied the collagen binding proteins of Lactobacillus reuteri and purified the type-1-binding proteins. Since most Lactobacillus isolates bind collagen type-1, identification and characterisation of them may be of importance in determining future applications.

Singh and Deodhar (1994) showed that the relative bioavailability of riboflavin was best in fermented milk, and better in milk than in pure riboflavin.

Ingestion of yogurt by lactose intolerant subjects resulted in alleviation of lactose absorption and abdominal symptoms such as diarrhea, abdominal pain and abdominal distension (Murao et al., 1992). Breath hydrogen excretion was measured in 30 lactose intolerant subjects after ingestion of 300 ml milk (14 g lactose) and 500 ml yogurt (lactose 14-16 g). The mean maximum increase in breath hydrogen concentration after yogurt ingestion was lower than that for milk ingestion (32 ppm vs 150 ppm). Lactic acid bacteria, including Bifidobacterium, were selected according to the antioxidative activity of intracellular cell-free extracts and were evaluated by in vivo methods in vitamin E deficiency. Kalzu et al. (1993). A total of 19 strains out of the 570 tested (16 lactic acid, 2 streptococci, and 1 lactococci) exhibited an antioxidative activity. The effect of selected strains Lactobacillus sp. SBT 2028 acted as a substitute for Vitamin E in rats. Thus, Lactobacillus sp. SBT 2028 could potentially decrease the risk of oxygen stress. The precise mechanism of antioxidative activity of this strain remains to be resolved.

REVIEWS

A number of books and reviews have been published since the last meeting. Fuller (1994) reviewed probiotics in general as well as for dairy product uses. Salminen and von Wright were authors for a book on Lactic Acid Bacteria covering the field from starter culture manufacture to health effects. Marteau and Rambaud (1993) reviewed the potential uses of lactic acid bacteria and cultured dairy products in dietary therapy. Conway and Henriksen (1993) reviewed the strategies for the isolation and characterisation of functional probiotics for dairy and other purposes. In California, a consensus panel of experts summarised the health attributes of lactic cultures and their significance to fluid milk products containing cultures (Sanders, 1993).

References


MILK LIPIDS IN THE DIET AND HEALTH

(IDF Subject F 37)

Prof. M I Gurr,
Maypole Scientific Services, St Mary’s, Isles of Scilly (UK)

IDF NEWS BRIEFING ON DIET AND HEALTH 1994

This year my report is in two sections. In the first I will review, as in previous years, recent research concerned with the influence of dietary fats on health, with emphasis on coronary heart disease. Most of the references are to work published since my last report was written but in some instances I have needed to refer back to earlier work in order to present a clearer picture of a topic. I have attempted to choose subjects of topical interest but, as always, demands of space and time mean that it has been necessary to be somewhat selective.

The second part takes a different approach. In putting together material for part 1, it occurred to me that almost all that was written about dairy fat appeared to be negative and I wondered whether it would not be possible to catalogue some positive aspects of milk fat. Part 2, therefore, is a brief summary of some positive aspects of milk fat in nutrition. This review is based on a presentation made earlier in 1994 to the Butter Council.

RECENT RESEARCH ON FATS AND HEALTH

Influence of fat on blood cholesterol reduction

Ramsay et al. (1) reviewed work showing that fat reduction of a practical nature had minimal impact on blood cholesterol. Hunninghake et al. (2) published the results of a cholesterol lowering study combining drug treatment with a low fat diet. The low fat diet had minimal effect compared with the drug and although lowering LDL cholesterol by a small but significant amount, the low fat diet also lowered HDL cholesterol, so that low fat diets may be counterproductive in this respect. A major problem is that the response of individuals to a change in dietary fat is entirely unpredictable. Kris-Etherton et al. (3) compared the cholesterolemic effects of butter, cocoa butter, soya bean oil, olive oil and milk chocolate. They focused on the greater average hypercholesterolaemic effect of butter but did not discuss the fact that this was exacerbated by the extreme responses of a few subjects. In more than a third of subjects, blood cholesterol actually fell in response to butter consumption.

Steinmetz et al (4) compared the influence of a diet containing whole milk with an otherwise identical, isocaloric diet containing skimmed milk. They claimed that after 6 weeks the LDL-cholesterol concentration was significantly lower in the group given skimmed milk than in that given whole milk and recommended that it would be advisable to consume skimmed rather than whole milk to reduce risk of CHD. However, the two dietary groups started the experiment with different initial LDL-cholesterol levels and after 6 weeks there were falls in LDL-cholesterol in both groups that were not significantly different from each other. Another interpretation of these results, therefore, is that when fat consumption is moderate, neither whole nor skimmed milk elevate plasma cholesterol and whole milk need not be avoided on this account.

Influence of cholesterol reduction on CHD

Three papers published in the British Medical Journal early in 1994 and the editorial that accompanied them have created great interest (5). They represent a response to a growing expression of doubt about the scientific validity and safety of general measures to lower mean plasma cholesterol levels in individuals and populations. Put simply, these papers aim to show that previous analyses of prospective and intervention studies have grossly underestimated the association between plasma cholesterol and CHD by two mechanisms. The authors apply sophisticated techniques to correct for these two sources of bias and conclude that a difference in 0.6mm cholesterol (about 10% of the average UK plasma cholesterol concentration) is equivalent to a 27% difference in CHD mortality.

The authors also discuss the excess of non-cardiovascular mortality at low cholesterol levels observed by many investigators and dismiss it as not being supported by the evidence.

Many people reading these papers will probably be convinced by the arguments. However, the many letters written to the British Medical Journal subsequently indicate that there may be many flaws in the arguments and that this remains an area of great controversy. Of particular importance is the impression given by the papers that these authors have themselves demonstrated that a 0.6mm lowering of plasma cholesterol by dietary means does indeed result in a 27% drop in CHD mortality. In fact, these authors did not conduct a dietary intervention study. They merely used sophisticated statistical techniques to derive theoretical associations between different levels of plasma cholesterol and different levels of CHD risk. This in no way proves that a 0.6mm lowering could easily be achieved by diet or that the outcome would be a 27% reduction in CHD mortality.

Sex differences in CHD-risk factor association

The review of Jacobs et al. (6) from the USA and accompanying editorial by Hulley et al. (7) point out the important observation that high total or LDL-cholesterol does not appear to be a significant risk factor in women. The Paisley and Renfrew Study (rarely quoted by American authors) showed that the lowest cholesterol in men carried greater risk than the highest cholesterol in women (8).

Results of modifying risk factors in primary prevention trials: problems associated with cholesterol lowering or of having an intrinsically low cholesterol

Strandberg and colleagues (9) reported on the results of an intervention trial in which drugs were used to lower
blood lipids and blood pressure, CHD risk factors were significantly reduced in the intervention group during the 5 years of intervention. After 10 years follow-up, however, risk factors in the intervention group had returned to control levels and there were 67 deaths in the intervention group and 46 among the controls. Thirteen intervention group deaths were due to violence.

Morgan and colleagues (10) reported the results of a prospective study which found that a low plasma cholesterol was associated with increased prevalence of clinical depression. In another prospective study, Lindberg et al. (11) found a strong negative relationship between initial cholesterol concentration and mortality from injuries and suicides in men.

Problems associated with recommendations to increase PUFA intakes

Reaven et al. (12) and Abbey et al. (13) found that diets containing predominantly either oleic or linoleic acid resulted in LDL enriched in either oleic or linoleic acid respectively. The PUFA-enriched LDL were much more susceptible to oxidation and the authors tended to the view that substitution of saturated or monounsaturated rather than polyunsaturated fatty acids is preferable. Hodgson et al. (14) found that the higher the linoleic acid content of adipose tissue (reflecting high long term intake of this fatty acid) the higher the degree of atherosclerosis. Nestel, a long term adherent to the concept that lipid modification will benefit heart disease risk, cautions against the use of too much linoleic acid (15).

Seven countries Study follow-up

Farchi et al. (16) reported on a 20-year follow-up of the Italian rural cohorts of the Seven Countries Study, which was influential in supporting the view that high intakes of saturated fatty acids were associated with high risk of CHD. They found that survival rates over the 20 year period were not related at all to saturated fatty acid intakes. The authors claimed that the lack of association with SFA was due to insufficient range of SFA intakes in this population. However, one can calculate from the author's results that the range of energy intakes (for which a significant positive correlation with survival rate was found) was even narrower than for SFA.

Trans fatty acids and CHD

Several comprehensive reports in the mid to late 1980s concluded that average intakes of trans fatty acids in most Western industrialized countries were not likely to be harmful but that excessive consumption might lead to the type of metabolism characteristic of essential fatty acid deficiency or be related to CHD (for example see reference 17). Several experimental studies within the last 4 years have demonstrated that trans fatty acids may raise LDL-cholesterol almost as much as the 12-16-carbon chain length saturated fatty acids and may also lower HDL-cholesterol (e.g. see reference 18), thereby resulting in an adverse change in the LDL/HDL ratio. A general conclusion would be that this would indicate increased risk of CHD.

A large epidemiological study involving about 80,000 women in the USA (19) concluded that women with higher intakes of trans fatty acids coming from margarines and other industrially hydrogenated fats had a significantly higher risk of CHD than those with lower intakes. Higher intakes of trans fatty acids from ruminant products was not associated with higher risk. While this study is of great interest and could be potentially important for the dairy industry, the results need to be interpreted with caution until more information becomes available.

First, the women at highest risk were consuming only a few grammes more trans fatty acids than those at lowest risk. Secondly, similar trans isomers are present in both types of products; only the proportions are different. Thus, in ruminant products, trans-vaccenic acid predominates (trans-9-18:1) while in industrially hydrogenated fats, no single isomer predominates but isomers with trans double bonds in positions 9,10 and 11 all make a significant contribution.

Other possible explanations for the association with CHD may have to be considered. The industrial hydrogenation process may give rise to an as yet unidentified toxic component that is not a trans fatty acid. Alternatively the lifestyle of people who happen to choose diets containing hard margarines and other hydrogenated fats may be more conducive to CHD than lifestyle of those consuming dairy fats. Socio-economic factors may play a part.

Pitfalls of 'healthy eating'

The dangers of translating incomplete knowledge hastily into dietary advice that can easily be misconstrued was graphically illustrated recently (20). The author, a doctor specializing in diabetes, described the case of a 72 year old lady who had had insulin-dependent diabetes for over 30 years and had remained healthy, with perfectly controlled diabetes and appropriate weight over most of that time. Her marked deterioration between recent 6-monthly consultations therefore surprised and alarmed her doctor. The answer, after much questioning, was that, because of various things she had read or heard about eating 'healthily' she had started taking skimmed milk, was now using polyunsaturated margarine instead of butter and, because she disliked the margarine, was eating less bread. She had stopped eating red meat, eggs and cheese and was afraid to eat chicken because of worries about salmonella. Her total energy intake had halved as a result of the change to a 'healthy' diet.

New theories

If the 'lipid hypothesis' is crumbling, what should go in its place? Several alternative theories have been considered in the last few years. Barker and colleagues (21) propose that nutritional deprivation in early life coupled with a rich diet later challenges the adaptive capacity of the cardiovascular system.

Atherosclerosis has been associated with the presence in the blood of antibodies to "heat shock proteins" (proteins released into the blood as a result of some form of stress, not necessarily heat). These results (22) may provide a link between stress conditions and CHD that have hitherto proved elusive.

Some genetic material is present in mitochondria of cells rather than the nucleus. Damage to mitochondrial DNA was reported to be up to 200-fold greater in hearts afflicted with CHD and such genetic damage, it was suggested, may play a role in the development of CHD (23).

A genetic trait, associated with high levels of angiotensin converting enzyme, which controls hormones involved in the regulation of the vascular system, was found significantly more frequently in people who had a family history of heart disease than in those with no family history (24).

Many scientists believe that the rise and fall of heart disease this century is best explained by an infectious organism. In particular, Chlamydia pneumoniae, a human
respiratory pathogen, was detected in a large number of coronary artery plaques examined post mortem (25).

Finally, it has often been suggested that LDL concentrations should be as low as possible because of their proposed role in the causation of atherosclerosis. Even the normally held belief that the role of LDL is to transport cholesterol to tissues for membrane formation and repair is dismissed by some on the grounds that all tissues can synthesize their own cholesterol. It seems illogical that a normal constituent of the blood of all mammals from birth should be entirely harmful and have no positive role. Recently, other roles for LDL have been proposed including the theory that their prime role is to carry arachidonic acid to cells for the purpose of prostaglandin formation. Persuasive experimental evidence for this view has been presented (26) which should certainly challenge the view that LDL is a redundant particle which merely causes disease.

NUTRITIONAL BENEFITS OF MILK FAT

The down-side
Milk fat has received an almost universally 'bad press' because of the concentration of interest on its supposed role in raising blood cholesterol. Coupled with the contribution milk fat makes to overall fat intakes and the potential contribution of dietary fat to the worrying prevalence of overweight, attention has been diverted from a number of possible beneficial influences of milk fat on nutrition and health. Some of these are outlined here.

Digestion and absorption
Milk fat is unique among animal fats in containing a high proportion of short and medium chain fatty acids. These are digested and absorbed by the body more efficiently than the longer chain fatty acids. Moreover, they are absorbed by a route that avoids the formation of 'chylomicrons' - the large lipoprotein particles that transport newly absorbed long chain fatty acids. The short and medium chain fatty acids do not, therefore, contribute to raised blood lipid levels; moreover, they are rapidly metabolized in the liver and do not contribute to adipose tissue stores. They constitute about 12% of milk fatty acids and therefore the 'caloric' and 'cholesterol-raising' properties of milk fat are smaller than theoretically predicted.

Antibacterial properties
Fatty acids, but especially those of short and medium chain length, have antimicrobial properties. They inhibit, to a degree that is poorly understood, the activity of microbes in the alimentary tract. This is probably one of the reasons why the milks of all mammals contain a large proportion of short and medium chain acids, in order to limit the growth of potentially infective organisms in the baby's gut.

Protective effects on teeth
There is an extensive literature on the anti-cariogenic effects of cheese and other dairy products. This is almost always attributed to the combined effects of proteins and minerals in the cheese, preventing the lowering of mouth pH by cariogenic organisms and aiding the remineralization of the enamel. Far less attention has been given to milk fat. One paper (27) described a protective effect of milk fat on human tooth decay which the authors ascribed to adsorption of lipid onto the enamel surface. The effect may also be due, in part, to antimicrobial effects of milk fatty acids and this whole area deserves more research.

Protective effects on gastric mucosa
Milk drinking is sometimes recommended as protection against, or alleviation of, the effects of ulceration, although this view is not without its critics. One paper (28) has described the protective effects of milk phospholipids on the gastric mucosa of rats. A recent paper has extended this concept to demonstrate a protective effect of milk phospholipids in the human gut (29).

Anticancer effects
A recent review describes protective effects of milk against some types of cancer and exacerbating effects on other types (30). Fat in general is widely regarded as increasing cancer risk, although not necessarily for all cancers. However, recent research has identified a specific fatty acid (a cis-trans isomer of linoleic acid), present in milk, which appears to be an inhibitor of cancerous growth (31). A recent epidemiological study found a protective effect of cheese consumption against lung cancer and speculated that this fatty acid plays a role. Again, much more research is required.

Carotenoids and retinol
It is frequently forgotten that milk and milk products, including butter, supply a substantial proportion of vitamin A and vitamin A precursors (beta-carotene) in many Western countries (about one-quarter in the UK). The trend towards greater consumption of low fat milks and lower consumption of butter results in a potential reduction of our supply of these vitamins unless they are obtained from alternative sources. With increasing emphasis on the importance of beta-carotene as an important nutrient in its own right (quite distinct from its properties as a vitamin A precursor), there is some merit in emphasizing the role of milk fat as a source of this nutrient.

Flavour, texture and palatability
No food is nutritious if it is not eaten and an important role of fat, and milk fat in particular, is to enhance the enjoyment of food.

Re-examination of the cholesterolaemic role of butter
One of the earliest studies which showed that butter had cholesterolaemic properties was the famous work of Ancel Keys and his colleagues in Minnesota. Careful examination of these results shows that the 'butter diet' was not always significantly more cholesterolaemic than the control diet (32). A recent paper underlines this point. The large average cholesterolar reaction to butter was influenced by a few subjects with very large responses, whereas in more than a third of subjects, cholesterol actually fell in response to butter consumption (3)

References
PROBLEMS WITH THE RECOMMENDATION TO CONSUME DIETS WITH LESS THAN 30% OF CALORIES FROM FAT

Helen Bishop MacDonald
Dairy Bureau of Canada, 20 Holly Street, Suite 400, Toronto On M4S 3D1, Canada

Abstract
Just as twenty years or so ago people were convinced that starch was "flattening" and had a fear of eating foods like bread, rice, potatoes or pasta, so today their fear is focussed on another component of food: fat.
The fear is translated into consumers’ choices of non-fat foods with the expectation that they then will avoid or lose excess deposits of body fat. The focus on non-fat foods is for the most part an exercise in self-delusion. It is covering up the real cause of over-fairness — genetics, lack of exercise, unbalanced diets and general over-consumption of everything.
Adding to the confusion is the message to consume no more than 30% of the total daily calories from fat. Aside from the fact that not many people have the ability or inclination to perform these calculations, the major problem is that many people translate this to mean that no single food should contribute more than 30 percent of it’s calories from fat — which generally leaves nothing but plant products and non-fat milk.

If people must focus on fat then, they might do well to add up absolute grams of fat — 65 per day for a woman, 80 grams per day for a man. In altering their diet, the best course of action would be to first avoid foods that are high in fat but low in nutrients (de-pried snacks) and not be so fearful of those foods like meat and milk products that naturally contain some fat, but are rich in vitamins and minerals.

Recently, prior to attending a heart—health conference, I was sent a Heart Check Profile to fill out so that the conference organizers could inform me of my risk of developing coronary heart disease. The questions in the Profile were so designed as to indicate to the respondent a sense of best or worst behavior vis-à-vis heart disease. For example, the question on smoking had "never smoked" as answer #1; 10 or more cigarettes a day as answer #5. Similarly, the question on desserts had "nearly always eat the high fat products" as answer #1, and "eat only low-fat products or none at all" as answer #5.

So, despite the preamble statement that "there are no right or wrong answers", one needn’t be a rocket scientist to determine which behavior the sponsoring health agency considers to be commendable behavior conducive to good health. As a nutritionist, then, I was deeply dismayed to see that the "best" response regarding meat—protein consumption was "seldom or never eat meat; eat vegetable protein", and the "best" response for dairy products was "eat only low-fat products or none at all".

Nonetheless I filled out my profile and eagerly awaited the Heart Check Report containing my Coronary Risk Profile. I was delighted to see that my overall rating was considered IDEAL RISK, as it was for each of the categories considered. Blood pressure: ideal risk; total cholesterol: ideal risk; Body Mass Index: ideal risk.

Despite the ideal nature of my risk, however, I was cautioned in two sections of my report to use low-fat dairy products and non-fat milk whenever possible. I wondered if the conference organizers were aware of some research that had escaped me that shows an individual with a low serum cholesterol, no family history of heart disease and an ideal Body Mass Index (therefore by implication on a diet that is low in total fat and below the recommended 10% intake of saturated fats) must avoid regular-fat milk products or risk heart disease.

Had the organizers determined that Canada’s Food Guide to Healthy Eating is in fact in error when it recommends four food groups? Had it also determined that everyone would benefit from seldom or never eating meat and eating only low-fat milk products or none at all?

While pondering these questions I encountered one of the dietitians who had worked with the organizing committee, who volunteered the answer: low—or no-fat dairy products were recommended in my diet — despite my ideal risk — because most milk and milk products contribute more than 30 percent of their calories as fat.

This, of course, was simply further evidence that, in Canada at least, the recommendation to consume diets with less than 30 percent of their calories from fat had been widely misinterpreted to apply to individual foods rather than total diets. And even at that, the application tends to be selective since, for example, one rarely hears a recommendation for the restriction of cooked soybeans in the diet, despite a percentage of fat calories at 46.7.

The upshot of this distorted perspective of food and its fat content has been a further undermining of the fundamental principles on which nutritional recommendations are based: moderation, variety and balance.

Adding to the problem is a poor understanding of basic English and arithmetic. The dairy industry is frequently accused of trying to mislead the public with statements claiming that whole milk is 3.25% milk fat when "nutrition gurus" are telling them it is 49% milk fat. The confusion of course stems from the fact that few understand that percent actually means per hundred and the statement milk is 49 percent fat really means that forty-nine percent of the calories in milk are derived from fat.

A popular American health fitness "personality" (Susan Powter, whose claim to nutrition expertise is that she lost in the area of 150 pounds) has appeared on television telling people that a slice of low-fat cheese with one gram of fat may look like a good food choice, but her calculations show that 35 percent of its calories come from fat, so it’s a forbidden food.

Little, if any, distinction is made by health professionals
between nutrient-dense and nutrient-poor foods with similar percentages of fat calories. They tend to be all lumped together as "bad" foods. In fact, despite official admonitions to the contrary by government health agencies, the following statement appears in the Instruction Manual of the Canadian Forces Nutrition Campaign "To Your Health" (March 1991): "A nutritious food choice or meal is defined as containing 30% or less of total calories from fat and preferably a source of dietary fibre".

An extreme example of perspective distortion can be seen in the recommendation found in various Health Newsletters that one good way of achieving the 30% or less fat contribution is by adding more carbohydrate to the meal. So, for example, a meal of spaghetti with meat sauce that registers a whopping 50 percent calories from fat can be rendered more virtuous by the addition of another cup and a half of spaghetti to the plate.

This approach is a natural tie-in to the increasingly popular notion that dietary fat slides into the body more readily than does dietary carbohydrate. In an interesting reversal of the thinking in the seventies, when the low-carbohydrate diet was king (and people actually did lose weight albeit on an inappropriate diet) popular wisdom today holds that the road to true salvation — weight loss — is the way of the high carbohydrate diet.

Diet that restricts foods to only those with less than 30 percent of their calories from fat are typically synonymous with high carbohydrate diets which reduce HDL cholesterol proportionally more than they do total cholesterol. These diets also have the tendency to increase serum triglycerides and either blood sugar or insulin, not to mention an association with increased rates of gallstone formation.

All of this amounts to strong evidence that not everyone can benefit from a reduction in dietary fat, and certainly not from a diet that prohibits any food with more than 30% of its calories from fat. Those with an excess of anything in their diet would do well to moderate their intake. If that excess is in the form of fat, then they may want to count grams of fat — 65 per day for a woman, 85 for a man.

The best course of action, in terms of fat, would be to first limit foods that are high in fat but low in nutrients (deep-fried snacks and pastries) and not be so fearful of those foods like meat and milk products that naturally contain some fat, but are rich in vitamins and minerals.

---

**FOOD AND HEALTH - WHAT DO FINNS THINK?**

The Dairy Nutrition Council, Finland

**INTRODUCTION**

Education, advice and information are methods employed in the promotion of good health and general wellbeing throughout the whole population. The aim of nutrition communication is to improve knowledge and attitudes which will eventually lead to healthy and health-promoting eating habits. Thus the planning of nutrition programmes requires knowledge about food preferences of the target group, how important they think food is and how willing they are to change their perhaps nutritionally incorrect diets.

**METHODS**

The Interview Department of the Centre of Statistics (Tilastokeskus) collects research material concerning e.g. smoking and eating habits of the Finns every spring. The study is called "Health habits of the adult Finns". The interviewees are 15-74 years of age. Last spring some more questions about food and health were included sponsored by the Ministry of Health and Social Affairs. The total number of valid answers was 1685. The results of the food and health questions were summarized by the Dairy Nutrition Council in Finland.

The idea of the questions was:
- to value the importance of the way of living and food choice advise to health,
- to give one's opinion about acute nutrition discussion topics,
- to describe one's attitude to a healthy diet, attempts to change the diet, reasons for change and any difficulties in the changing and
- to describe the kind of diet followed.

**WE BELIEVE IN VARIETY**

The message concerning the importance of diet on health has been well received in Finland. Two-thirds (63%) of Finns think it very important. Women (69%) believe in a varied diet more than men (56%). The role of a varied diet seems to be almost as significant as that of non-smoking in Finland. About 65% of Finns regard non-smoking as extremely important. Attitudes in respect of alcohol, however, are more permissive. Half of the people interviewed were of the opinion that a modest alcohol consumption is fairly important to good health. Only 30% of Finns regard it as very important. (Table 1.)

**WE UNDERESTIMATE THE RISKS OF OVERWEIGHT**

Finns do not perceive overweight as a particularly threatening health risk. The maintenance of normal body weight for health reasons was important to only 37% of the interviewees. Women pay more attention to weight than men, though men would have more reason for that at all adult ages.

The need for exercise is generally accepted. The majority of Finns believe that the role of exercise is very or at least fairly important to health. (Table 1.)
Table 1. Manners of life valued very important by the Finns (%)

<table>
<thead>
<tr>
<th>Manner of life</th>
<th>Male (N= 783)</th>
<th>Female (N=902)</th>
<th>All together (N= 1685)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-smoking</td>
<td>56</td>
<td>72</td>
<td>65</td>
</tr>
<tr>
<td>Moderate alcohol consumption</td>
<td>27</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>A varied diet</td>
<td>56</td>
<td>69</td>
<td>63</td>
</tr>
<tr>
<td>Maintenance of ideal body weight</td>
<td>31</td>
<td>43</td>
<td>37</td>
</tr>
<tr>
<td>Regular exercise</td>
<td>54</td>
<td>65</td>
<td>60</td>
</tr>
</tbody>
</table>

Table 2. The importance of diet messages to the Finns

<table>
<thead>
<tr>
<th>Diet message</th>
<th>Very important to Finns (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eat a lot of fiber-containing foods</td>
<td>63</td>
</tr>
<tr>
<td>2. Lower your salt intake</td>
<td>33</td>
</tr>
<tr>
<td>3. Avoid excess fat in dairy and meat products</td>
<td>33</td>
</tr>
<tr>
<td>4. Prefer low-fat products</td>
<td>28</td>
</tr>
<tr>
<td>5. Avoid sugar-containing foods</td>
<td>28</td>
</tr>
<tr>
<td>6. Avoid fat in cooking</td>
<td>27</td>
</tr>
<tr>
<td>7. Use oil in cooking</td>
<td>24</td>
</tr>
<tr>
<td>8. Eat a lot of bread, potatoes and pasta</td>
<td>20</td>
</tr>
</tbody>
</table>

WARNINGS ABOUT SALT AND FAT DO NOT IMPRESS EVERYONE

Salt as a health risk was less discussed at the time of the interview than it is today. Only a third of Finns believe that it is very important to reduce salt intake. However, about half of them consider it fairly important. The average salt intake in Finland is 9 g for women and 12 g for men.

Finns have received a great deal of information about excess fat-containing dairy and meat products. In spite of this only one-third of them believe that avoidance of such products is extremely important to health. It was fairly important to 45% of the interviewees. On the other hand the advice to prefer low-fat products does not reach Finns any better: 28% think it very important. The average fat content of the Finnish diet is 34% of energy when alcohol is included.

The recommendation to use rape seed oil and other vegetable oils has not been received even moderately. Only for one quarter of Finns is this extremely important as regards a healthy diet. Women, no wonder, take this point more seriously than men, as they usually cook the meal at home.

Nutrition recommendations encourage to boil and simmer the food instead of frying it. Finns remain unconvinced of the importance of this instruction as only 27% thought it very important. (Table 2.)

WE KNOW THE USE OF FIBER BUT NOT THAT OF STARCHY FOODS

We know that fiber-containing foods such as whole meal bread, fruit and vegetables belong to a varied diet. That is why the message to eat a lot of them has been best received by the Finns interviewed: 63% signed it as very important.

But we are ill-informed regarding the benefits of starch-containing foods. Only one fifth of Finns believe that it is very important to eat a lot of bread, potatoes, pasta etc. This would help us to get more energy from starch instead of fats.

Finns have not been utterly convinced about the need to reduce sugar intake. The avoidance of sweets, biscuits, pastry and other foods containing sugar is crucial in the formulation of a healthy diet to 28% of Finns. (Table 2.)

WE PAY ATTENTION TO NUTRITION DISCUSSION

Some of the arguments of the research analyze how well current nutrition discussion reaches the population.

A tremendous amount of talk and writing has revolved around cholesterol over the last few years. No wonder, 64% of the population is of the opinion that high cholesterol levels in serum increase the risk of coronary and heart diseases. The connection between nutrition and cancer is far less clear in the minds of most people, as it is within the research field itself. However, 18% of the interviewees believed that there was a clear connection between diet and cancer.

The energy requirement of infants is huge in comparison to their size. Recent discussion has concerned the inadequacy of a low-fat diet for the growth needs of infants. Almost 40% of the interviewees believe whole heartedly that an under 2-year old infant should be given standard (3,9%) or low-fat (1,9%) milk rather than non-fat milk. Milk is the favourite topic of Finnish nutrition discussion. Its reputation has fluctuated from "white poison" to "elixir of life". Milk is an essential part of a varied diet as the recommendations of the National Nutrition Council define. In this study 47% of the interviewed agreed with the recommendation.

Nutrition information has been criticized because individual nutrition ingredients have been emphasized and that has lead to an obscure total picture of a healthy diet. However, 61% of the Finns interviewed felt they had understood the total picture and agreed that there are no good or bad foods but that variety is the most important thing in diet. Further, 19% completely agreed with the notion that the role of fat has been overemphasized at the expense of other important nutrition issues.
A FIFTH BELIEVE THEY EAT CORRECTLY

And how do knowledge and attitudes reflect on practical activities? One fifth of the Finns consider a healthy diet personally important and believe they also follow a healthy diet. A great number of the interviewees (46%) try to adhere to a healthy diet but are not too anxious about it. One quarter believe that they are not capable of eating correctly whether or not they believe a healthy diet is important. About one in ten say they eat what they please without consideration of the nutritional value of the food.

People are interested in eating in a healthy way. 70% of the interviewees have changed or at least have tried to change to a healthier, more varied diet.

HABITS ARE DIFFICULT TO GIVE UP

Changing diet is not easy. Old habits live long. They become more entrenched at the very moment a change to a healthier diet is suggested. Satisfaction with current eating habits has been an obstacle to over a quarter of the interviewees as they have tried healthier eating habits. Ten per cent finds it difficult to give up sugar and sweets; reduction of fat intake is a problem to eight per cent. Only four per cent of Finns finds a change of diet hampered by the fact that they do not like healthy foods tasty.

Finns eat all kinds of food. Less than one per cent are vegetarians. Over 20% of Finns prefer fish to meat. Nine per cent follows a diet low in lactose and seven per cent some other special diet.

SUMMARY

Finns know well the effects of personal behaviour on health and wellbeing. Most Finns admit that non-smoking, regular exercise and a varied diet are important to good health. However, when it comes to modest intake of alcohol or the maintenance of ideal body weight, acceptance is somewhat less clear.

The message of the need for a varied diet has reached the audience. Prohibitions and recommendations relating to individual foodstuffs are not respected quite so willingly. Women are better informed in health issues than men and in general take them more seriously.

The questions of this study follow the research study "What does Britain think?" from the year 1992. The British results have been published as a campaign report in the series "Making sense of food" by the National Dairy Council.

* * *