Summary and Conclusions

Dietary treatment of obesity

A Systematic Review

The full report contains tables in English that present included studies

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Summary and Conclusions of the SBU Report:

Dietary treatment of obesity

A Systematic Review

September 2013

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SBU's conclusions

The purpose of this report was to systematically collate scientific literature on dietary advice for obese individuals, or the actual food intake among such people. The following conclusions are limited to links between food and weight, morbidity and mortality among obese individuals (defined as people with a BMI of ≥30 kg/m^2 or a waist size of ≥102 cm (men) or ≥88 cm (women). Links with other outcomes are described in the introductions to each subsection of this report. SBU has previously discussed diet for individuals with diabetes. The results for obese individuals and individuals with diabetes generally point in the same direction. This report does not evaluate implemention methods for passing on dietary advice. Nor have we reviewed the scientific literature for links between diet and ill-health among the population in general.

- **Weight loss in adults.** A range of advice on alteration of eating and drinking habits can result in obese individuals losing weight or reducing their waist size. In the short term (six months), advice on strict or moderate low carbohydrate diets is a more effective means of achieving weight loss than advice on low fat diets. In the long term, there are no differences in the effect on weight loss between advice on strict and moderate low carbohydrate diets, low fat diets, high protein diets, Mediterranean diets, diets aimed at achieving a low glycaemic load or diets containing a high percentage of monounsaturated fats. Advice on increasing the intake of dairy products (primarily milk) or reducing the intake of sweet drinks may also lead to weight loss.

- **Weight loss in children and young people.** Advice on increasing the intake of dairy products (primarily milk) in the event of energy restriction may lead to weight loss among obese children and young people. There is insufficient scientific data to assess whether other dietary advice which is effective for obese adults is also effective for people under 18.

conclusions

- **Maintaining reduced weight.** When obese individuals have lost weight, they can maintain their weight more effectively with advice on low fat diets with a low glycaemic index and/or high protein content rather than low fat diets with a high glycaemic index and/or low protein content. There is no data available to assess whether advice on low carbohydrate diets and Mediterranean diets, for example, is effective to prevent weight increase after weight loss.

- **Onset of cardiovascular disease or death caused by cardiovascular disease.** For obese individuals, intensive advice on Mediterranean diets (with extra olive oil or nuts and almonds) leads to a reduced risk of onset of cardiovascular disease or death caused by cardiovascular disease, compared with advice on low fat diets. People who drink a lot of coffee also have a lower mortality rate, regardless of cause.

- **Onset of type 2 diabetes.** Obese individuals run a greatly increased risk of diabetes. The risk of falling ill with diabetes is lower among people who drink alcohol and people who drink a lot of coffee, while it is higher among people who drink sweet drinks. However, advice on low fat diets does not lead to a reduced risk of falling ill with diabetes compared with advice on diets with a standard fat content among obese post-menopausal women.

- **Knowledge gaps.** It is not possible to assess whether other types of diet or drink are of significance to morbidity or mortality among obese individuals. There is insufficient scientific data. There is likewise insufficient data to assess the effect of the foods studied – fruit, vegetables, wholemeal products, legumes, potatoes, soya products, meat and processed meats – on mortality, morbidity or weight loss among obese individuals.

SBU's Summary

Background and aims

In Sweden, the incidence of obesity in adults has more than doubled since the 1980s. Similar trends can be seen in children, although some studies seem to indicate that the incidence of childhood obesity has levelled off over the past few years. Obesity occurs when energy intake exceeds energy usage. This is why lifestyle treatment – which is the first stage of treatment progression among obese individuals – focuses on dietary advice and physical activity with a view to bringing energy intake below the energy usage level.

Health and medical care services have always provided obese individuals with dietary advice. However, there has often been disagreement on how significant diet is to the health of patients and the most appropriate diet composition. The report *Fetma – problem och åtgärder* [Obesity – problems and interventions] published by SBU in 2002 reviewed the data for all obesity treatment methods available at that time, including dietary treatment. The dietary treatments for obesity which were examined in randomised, controlled studies at that time were of three primary types: powder-based diet replacement products with low energy content (VLED), programmes which covered behavioural therapy, physical activity and other treatment methods in addition to diet, and studies which were balanced so that the isolated effect of diet could be gauged. Almost all studies of the latter type focused on what we now refer to as low fat diets, often in combination with energy restriction. One of the conclusions of the SBU report *Fetma – problem och åtgärder* was that a weight loss of

between 3 and 10 kg could be achieved with an energy-restrictive low fat diet over a period of one year. The low energy content per unit of weight is one reason as to why low fat diets have been recommended in the first instance for a number of decades in order to promote weight loss and/or prevent weight increase. Another reason is the fact that a high intake of fat – particularly saturated fat – is considered to have adverse effects on cardiovascular health.

Research into diet has developed considerably since the previous SBU report was published in 2002. Above all, diets of various compositions were examined in directly comparative studies to a greater extent, and in these studies the low fat diet is often the comparative alternative to the diet examined. The majority of modern studies examining the effect of diet among obese individuals focus on some form of low carbohydrate diet. At the same time a polarised and often emotionally charged debate has flared up in which advocates of diets with a low carbohydrate content and often a high fat content have criticised the low fat diet which has been recommended since the 1970s.

In 2010, SBU published its report *Mat vid diabetes* [Dietary treatment of diabetes]. Among other things, it was noted that a low fat diet and moderate low carbohydrate diet have similar beneficial effects on measurements for long-term glucose control (HbA_{1c}) and body weight in individuals with type 2 diabetes. On the other hand, there was insufficient data to assess the effect of a strict low carbohydrate diet. There was also a certain amount of scientific data to indicate that vegetables, legumes, fish and moderate alcohol consumption have beneficial effects among individuals with diabetes.

Give the large number of studies published with regard to diet and obesity since the SBU report *Fetma – problem och åtgärder* was published, it is important to create a new summary of the state of knowledge.

The purpose of this project has been to use a systematic overview of the literature to review the scientific data for dietary recommendations for obese individuals. This work has not included reviewing the literature relating to provision of dietary advice to individuals of normal weight or overweight individuals in order to prevent obesity (primary prevention).

We have opted to name this project "Dietary treatment of obesity" in order to indicate that the review of the literature relates to advice on everyday diet and not to specific regimens or diets in the first instance. The primary purpose of dietary advice is to prevent long-term complications and secondary illnesses resulting from obesity. This is why this overview does not include short-term effects of various diets (within days or a few weeks).

This report is results-driven, which means that the studies identified in the review of the literature have controlled the division and definition of the primary themes in the report (Facts Box 1).

Facts Box 1 Primary themes in the report.

- Foods
- Drinks
- Strict and moderate low carbohydrate diets
- Low fat diets
- High protein diets
- Mediterranean diets
- Diets focusing on a low glycaemic index or low glycaemic load (grams of carbohydrate in a normal portion multiplied by GI divided by 100)
- Diets focusing on a high intake of monounsaturated fats

Method

Systematic knowledge overview

This report is based on a systematic review of the scientific documentation in the field. Literature searches were carried out up to 15 November 2012 with a view to identifying all relevant scientific studies. An updated search was carried out on 31 May 2013. Studies identified during this update could be included if they altered the results or provided crucial new information.

The review of the literature was restricted to studies examining the effect of dietary advice with varying macronutrient content (fat, carbohydrates, protein), different foods, fibres and drink, on mortality, morbidity, quality of life and weight loss or weight maintenance in obese adults and children over the age of two. At least three-quarters of study subjects were obese, unless the obese individuals were accounted for separately. Studies in which subjects had a certain degree of comorbidity have been included. This includes hypertension, type 2 diabetes, impaired glucose tolerance, blood lipid disorders, cardiovascular morbidity, arthritis, asthma and sleep apnoea. Studies in which subjects have been selected on the basis of factors such as cancer, hereditary diseases, psychosis, polycystic ovary syndrome, endocrine disorders, serious renal or liver disease, pregnancy with concomitant obesity or women up to one year after childbirth have not been included, however. To be included, studies had to have been balanced so that the effect of dietary advice can be separated from the effect of other treatments such as physical activity.

The overview includes both randomised, controlled studies and observation studies. Observation studies had to be prospective, i.e. monitoring a group of patients over a period of time following an initial survey. Studies with follow-up times of at least six months and including at least ten people in each group have been included.

The literature search took place in the medical literature databases PubMed, Embase, Cochrane Library, Cinahl and PsycInfo. Reference lists from overview articles identified were also reviewed in order to identify further studies. All studies which were deemed to be able to meet the criteria for inclusion were read fully in order to assess their relevance to the issue. Relevant studies were then reviewed using SBU's review templates.

Each study included has undergone quality review and tabulation. The international GRADE system – see Facts Box 2 – was applied during the final assessment of the scientific data amassed. The following factors were taken into account in the assessment of the overall strength of evidence: risk of bias, consistency, transfer capability to Swedish conditions, statistical power, risk of publication bias, effect size and dose-response relationship.

In many instances, the scientific data amassed was insufficient to demonstrate a difference in effect between the diets compared. When the project team assessed whether the statistical power – which was calculated on the basis of the number of subjects and the effect spread – was high enough to detect a predetermined difference, this was expressed as the diets having a "similar" effect. This should not be interpreted as meaning that proof has been acquired of the diets having the same effect.

Nine experts were involved in the project team, all of whom have extensive clinical experience of obesity and/or obesity research. The SBU secretariat also contributed health economics expertise. The project also engaged six external reviewers with equivalent skills.

Facts Box 2 Study quality, strength of evidence and conclusions.

Study quality. Assessment of to what extent the outcome of an individual study is sensitive to methodological weaknesses. SBU uses only studies with low or moderate risk of bias in the assessment of quality of evidence.

Strength of evidence. SBU uses GRADE, an international evidence grading system. Study design is the primary factor considered in the overall appraisal which is performed for each outcome of interest. The quality of evidence is rated down if one or several limitations are present: study limitations, inconsistency of results, imprecision of the estimated result, indirectness of evidence and risk of publication bias. Quality of evidence may also be rated up if there is a strong effect or a dose-response relationship.

The quality of evidence has four levels:

- **High quality of evidence** (⊕⊕⊕⊕)
  Based on studies of high quality with no factors that weaken the overall assessment.

- **Moderate quality of evidence** (⊕⊕⊕◯)
  Based on studies of high or moderate quality with a single factor that weakens the overall assessment.

- **Low quality of evidence** (⊕⊕◯◯)
  Based on studies of high or moderate quality with some factors that weaken the overall assessment.

- **Very low quality of evidence** (⊕◯◯◯)
  SBU considers that when the quality of evidence is very low, it is in practice insufficient. Very low quality of evidence could be due to weaknesses on several areas or that all studies have high risk of bias.

The stronger the quality of evidence, the lower is the likelihood that new research findings would affect the documented results within the foreseeable future.

Conclusions imply an overall assessment of benefits, risks, ethical considerations and cost effectiveness.

Evidence-graded results

Diets and dietary patterns

Evidence-graded results for the effect of diets on weight are summarised in Figure 1–2.

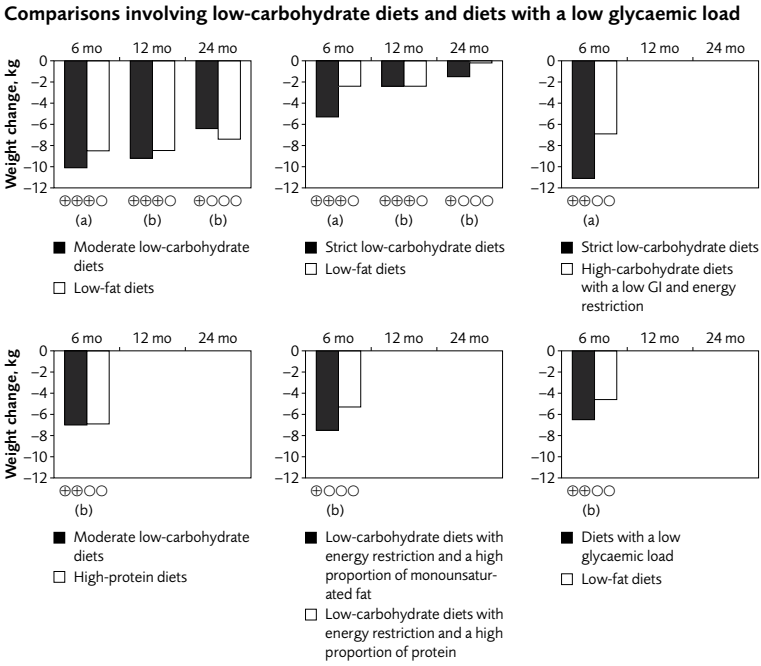

Figure 1 Effects of various diets on weight change among obese individuals at 6, 12 and 24 months. The comparisons in the figure involve different types of low carbohydrate diets or diets with low glycaemic load. ⊕⊕⊕○ moderately strong scientific data, ⊕⊕○○ low scientific data, ⊕○○○ very low scientific data, (a) strength of evidence for statistically significant difference between the groups compared, (b) strength of evidence for equivalent effect. mo = Months

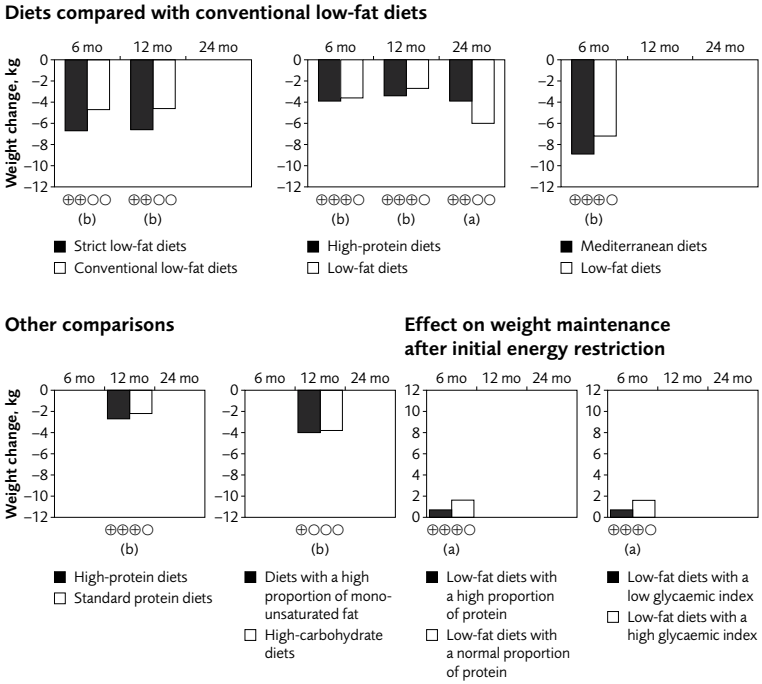

Figure 2 Effects of various diets on weight change among obese individuals at 6, 12 and 24 months. Top: comparisons comprising a conventional low fat diet. Bottom left: other comparisons. Bottom right: effect on weight maintenance following initial energy restriction. ⊕⊕⊕○ moderately strong scientific data, ⊕⊕○○ low scientific data, ⊕○○○ very low scientific data, (a) strength of evidence for statistically significant difference between the groups compared, (b) strength of evidence for equivalent effect. mo = Months

Moderate low carbohydrate diets compared with low fat diets among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on moderate low carbohydrate diets and advice on low fat diets for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on moderate low carbohydrate diets compared with advice on low fat diets for obese individuals has a more beneficial effect on weight at 6 months. At 12 months, the effect on weight is the same (⊕⊕⊕○). There is inadequate data available to assess whether there is any difference between advice on the two diets with regard to weight at 24 months (⊕○○○).

- There is moderately strong scientific data to indicate that advice on moderate low carbohydrate diets compared with advice on low fat diets for obese individuals has a similar beneficial effect on waist size at 6 months (⊕⊕⊕○). At 12 months, data indicating a similar effect is limited (⊕⊕○○). There are no studies for 24 months.

- There is inadequate data available to assess whether there is any difference between advice on moderate low carbohydrate diets and advice on low fat diets for obese individuals with regard to body fat and lean body mass at 6 months (⊕○○○). There are no studies for 12 and 24 months.

Strict low carbohydrate diets compared with low fat diets among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on strict low carbohydrate diets and advice on low fat diets for obese individuals with regard to mortal-

ity, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on strict low carbohydrate diets compared with advice on low fat diets for obese individuals has a more beneficial effect on weight at 6 months (⊕⊕⊕○). At 12 months, advice on both diets has a similar beneficial effect on weight (⊕⊕⊕○). There is inadequate data available to determine whether there is any difference between advice on the two diets with regard to weight at 24 months (⊕○○○).

- There is inadequate data available to assess whether there is any difference between advice on strict low carbohydrate diets and advice on low fat diets for obese children and young people with regard to BMI-Z at 6 months (⊕○○○). There are no studies for 12 and 24 months.

- There is inadequate data available to determine whether there is any difference between advice on strict low carbohydrate diets and advice on low fat diets for obese individuals with regard to body fat and lean body mass at 6 months (⊕○○○). There are no studies for 12 and 24 months.

- There is inadequate data available to assess whether there is any difference between advice on strict low carbohydrate diets and advice on low fat diets for obese individuals with regard to energy intake (⊕○○○).

Effect of strict low carbohydrate diets compared with high carbohydrate diets with a low glycaemic index and energy restriction among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on strict low carbohydrate diets and ad-

vice on high carbohydrate diets with a low glycaemic index and energy restriction for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on strict low carbohydrate diets compared with advice on high carbohydrate diets with a low glycaemic index and energy restriction for obese individuals has a more beneficial effect on weight, but a similar effect on waist size at 6 months (⊕⊕○○). There are no studies relating to long-term follow-ups.

Low carbohydrate diets compared with high protein diets among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on low carbohydrate diets and advice on high protein diets for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on low carbohydrate diets compared with advice on high protein diets for obese individuals has a similar effect on weight, waist size and body fat at 6 months (⊕⊕○○). There are no studies relating to long-term follow-ups.

Low carbohydrate diets with energy restriction and a high proportion of monounsaturated fat compared with low carbohydrate diets with energy restriction and a high proportion of protein among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on low carbohydrate diets with energy restriction and a *high proportion of monounsaturated fat* and advice

on low carbohydrate diets with energy restriction and a *high proportion of protein* for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is inadequate data available to assess whether there is any difference between advice on low carbohydrate diets with energy restriction and a *high proportion of monounsaturated fat* and advice on low carbohydrate diets with energy restriction and a *high proportion of protein* for obese individuals without diabetes with regard to weight, total cholesterol, HDL cholesterol, triglycerides, glucose and insulin levels (⊕○○○).

Diets focusing on low glycaemic load compared with low fat diets among obese individuals

- There is no data available to assess whether there is any difference between advice on diets focusing on low glycaemic load and advice on low fat diets for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on diets focusing on low glycaemic load compared with advice on low fat diets has a similar effect on weight and waist size over 40 weeks (⊕⊕○○).

Low fat diets with a low glycaemic index compared with a high glycaemic index for maintenance of weight after initial energy restriction among obese individuals

- There is no data available to assess whether there is any difference between advice on low fat diets with a low glycaemic index and advice on low fat diets with a high glycaemic index for obese individuals after initial energy restriction with regard to mortality,

morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on low fat diets with a low glycaemic index compared with advice on low fat diets with a high glycaemic index for obese individuals after initial energy restriction has a beneficial effect on maintenance of weight over 6 months (⊕⊕⊕○).

Low fat diets with a high proportion of protein compared with normal protein content for maintenance of weight after initial energy restriction among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on low fat diets with a high proportion of protein and advice on low fat diets with a normal protein content with regard to mortality, morbidity or quality of life for obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on low fat diets with a high proportion of protein compared with advice on low fat diets with a normal protein content for obese individuals after initial energy restriction has a beneficial effect on maintenance of weight over 6 months (⊕⊕⊕○).

High protein diets compared with low fat diets among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on high protein diets and advice on low fat diets for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on high protein diets compared with advice on low fat diets for obese individuals has a similar beneficial effect on weight and waist size at 6 and 12 months (⊕⊕⊕○).

- There is limited scientific data to indicate that advice on low fat diets compared with advice on high protein diets for obese individuals has a more beneficial effect on weight and waist size at 24 months (⊕⊕○○).

- There is moderately strong scientific data to indicate that advice on high protein diets compared with advice on low fat diets for obese individuals has a similar beneficial effect on body fat at 6 months (⊕⊕⊕○). There is inadequate data available to assess whether there is any difference between advice on both diets with regard to body fat at 12 and 24 months (⊕○○○).

- There is inadequate data available to assess whether there is any difference between advice on high protein diets and advice on low fat diets for obese individuals with regard to lean body mass at 6 months (⊕○○○). There are no studies for 12 and 24 months.

High protein diets compared with standard protein diets among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on high protein diets and advice on standard protein diets for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on high protein diets and advice on standard protein diets for obese individuals has a similar beneficial effect on weight at

12 months (⊕⊕○○). There are no studies relating to long-term follow-ups.

- There is inadequate data available to assess whether there is any difference between advice on high protein diets and advice on standard protein diets for obese individuals with regard to waist size and body fat at 12 months (⊕○○○). There are no studies relating to long-term follow-ups.

Low fat diets compared with diets with a standard fat content among obese individuals

- There is moderately strong scientific data to indicate that advice on low fat diets and advice on diets with a standard fat content for obese post-menopausal women has a similar effect on the incidence of diabetes over 6 years (⊕⊕⊕○).

- There is no data available to assess whether there is any difference in effect between advice on low fat diets and advice on diets with a standard fat content among obese individuals with regard to the incidence of diabetes among younger men or women (there are no studies which meet the criteria for inclusion in the report).

- There is no data available to assess whether there is any difference in effect between advice on low fat diets and advice on diets with a standard fat content among obese individuals with regard to mortality, morbidity other than diabetes or quality of life (there are no studies which meet the criteria for inclusion in the report).

Strict low fat diets compared with conventional low fat diets among obese individuals

- There is no data available to assess whether there is any difference in effect between advice on strict low fat diets and advice on conventional low fat diets among obese individuals with regard to

mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on strict low fat diets and advice on conventional low fat diets for obese individuals has a similar effect on weight and waist size (⊕⊕○○).

Diets with a high monounsaturated fat content compared with high carbohydrate diets among obese individuals

- There is no data available to assess whether there is any difference between advice on diets with a high monounsaturated fat content and advice on high carbohydrate diets for obese individuals with regard to mortality, morbidity or quality of life (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on diets with a high monounsaturated fat content and advice on high carbohydrate diets for obese individuals has a similar effect on weight and body fat (⊕⊕○○).

Mediterranean diets compared with low fat diets among obese individuals

- There is limited scientific data to indicate that advice on Mediterranean diets (reinforced with either extra olive oil intake or increased daily intake of nuts and almonds) compared with advice on low fat diets for obese individuals has a beneficial effect on a composite outcome comprising stroke, heart attack and cardiovascular death after a 4.8-year follow-up (⊕⊕○○).

- There is moderately strong scientific data to indicate that advice on Mediterranean diets compared with advice on low fat diets for obese individuals and sleep apnoea has a beneficial effect on symptoms of sleep apnoea within a 6 month period (⊕⊕⊕○).

- There is moderately strong scientific data to indicate that advice on Mediterranean diets compared with advice on low fat diets for obese individuals has a beneficial effect on waist size and body fat, but a similar effect on weight within a 6 month period (⊕⊕⊕○).

Link between Mediterranean diet and mortality among obese individuals

- There is inadequate data available to assess whether there is any link between consumption of a Mediterranean diet and total mortality for obese individuals with a followup of 10 years (⊕○○○).

- There is inadequate data available to assess whether there is any link between consumption of a Mediterranean diet and total mortality for individuals with abdominal obesity with a follow-up of 10 years (⊕○○○).

- There is no data available to assess whether there is any link between a Mediterranean diet and morbidity or quality of life for obese individuals (there are no studies which meet the criteria for inclusion in the report).

Link between intake of polyunsaturated fat, trans unsaturated fat and cholesterol and incidence of type 2 diabetes

- There is inadequate data available to assess whether there is any link between the intake of polyunsaturated fat, trans unsaturated fat and cholesterol and the risk of falling ill with type 2 diabetes for obese individuals with a followup of 14 years (⊕○○○).

Foods

Fruit and vegetables

- There is no data available to assess any effect of fruit or vegetables with regard to mortality, morbidity or quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on increased intake of fruit and vegetables, compared with advice on reduced fat intake, leads to slightly less pronounced weight loss at 6 months among obese individuals (⊕⊕○○). There is inadequate data available to determine whether there is any difference in effect on waist size (⊕○○○). For a longer period (12 months or more), there is inadequate data available to determine whether advice on increased intake of fruit and vegetables has a beneficial effect on body weight or waist size (⊕○○○).

- There is inadequate scientific data available to determine whether intake of fruit and vegetables demonstrates a link with future weight change among obese individuals (⊕○○○).

Nuts and almonds

- There is inadequate data available to determine whether there is a link between a higher intake of nuts (including peanuts) and a lower risk of diabetes among obese individuals (⊕○○○).

- There is no data available to assess any effect of nuts on morbidity other than diabetes, mortality or quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data to indicate that advice on supplements of almonds compared with advice on supplements of starchy foods (corn, potatoes, pasta, rice, peas, etc.) in the case

of a low energy powder diet has a beneficial effect on body weight, waist size and body fat at 24 weeks among obese individuals (⊕⊕○○).

- There is limited scientific data to indicate that the advice to avoid nuts with a low energy diet compared with advice on supplements of almonds has a slightly more beneficial effect on body weight at 6 months among obese individuals (⊕⊕○○).

- There is inadequate data to assess the effect of nuts and almonds on body weight in the longer term (12 months or more) among obese individuals (⊕○○○).

Wholemeal products and legumes

- There is inadequate data available to determine whether there is a link between a higher intake of wholemeal and a lower risk of diabetes among obese individuals (⊕○○○).

- There is no data available to assess any effect on morbidity other than diabetes, mortality or quality of life of wholemeal products or legumes among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is inadequate scientific data available to assess the effect of wholemeal products in combination with legumes compared with more refined carbohydrate-rich foods on body weight and waist size among obese individuals (⊕○○○).

Potatoes and chips

- There is inadequate data available to determine whether there is a link between a higher intake of potatoes or chips and an increased risk of diabetes among obese individuals (⊕○○○).

- There is no data available to assess any effect of potatoes or chips on morbidity other than diabetes, mortality, quality of life, weight reduction or risk factors for cardiovascular disease among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is no data available to assess any effect of potatoes or chips on body weight (no studies are available).

Soya products

- There is inadequate data available to determine whether there is a link between a higher intake of soya products and an increased risk of diabetes among obese individuals (⊕○○○).

- There is no data available to assess any effect of soya products on morbidity other than diabetes, mortality, quality of life, weight reduction or risk factors for cardiovascular disease among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is no data available to assess any effect of soya products on body weight (no studies are available).

Meat and processed meats

- There is inadequate data available to determine whether there is a link between a higher intake of processed meats and an increased risk of diabetes among obese individuals (⊕○○○).

- There is no data available to assess any effect on morbidity other than diabetes, mortality, quality of life or risk factors for cardiovascular disease of meat and processed meats among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is inadequate data available to determine whether there is a link between a higher intake of poultry and weight loss among obese individuals (⊕○○○).

- There is inadequate data available to determine whether there is a link between a higher intake of meat in general, red meat or processed meat products and change in body weight among obese individuals (⊕○○○).

Energy-dense foods with low nutritional content

- There is no data available to assess any effect of energy-dense foods with low nutritional content on morbidity, mortality, quality of life or risk factors for cardiovascular disease among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is inadequate scientific data to indicate that advice on reduced selection of energy-dense foods with a low nutritional content leads to unchanged weight over 6–18 months among obese individuals (⊕○○○).

Drinks

Sweet drinks

- There is limited scientific data available to indicate that the intake of sweet fruit drinks is linked to an increased risk of diabetes (⊕⊕○○).

- There is no data available to assess any effect of intake/reduced intake of sweet fruit drinks on morbidity other than diabetes, mortality or quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data available to indicate that drinks sweetened with aspartame, compared with drinks not sweetened with aspartame, lead to weight loss among obese individuals (⊕⊕⊕○).

- There is limited scientific data available to indicate that reduction of sweet drinks is linked to weight loss and lower blood pressure among obese individuals (⊕⊕○○).

Dairy products

- There is no data available to assess whether intake of dairy products is linked with mortality, morbidity or quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is moderately strong scientific data to indicate that advice on an increased proportion of dairy products in an energy-restrictive diet results in reduced weight in the form of age-adjusted BMI (BMI SDS) among obese children after 36 months (⊕⊕⊕○).

- There is moderately strong scientific data to indicate that advice on an increased proportion of dairy products in an energy-restrictive diet leads to weight loss among obese adults after 6–12 months (⊕⊕⊕○).

- There is moderately strong scientific data to indicate that advice on an increased proportion of dairy products in an energy-restrictive diet leads to reduced waist size among obese adults after 6–12 months, and among obese children after 36 months (⊕⊕⊕○).

- There is moderately strong scientific data to indicate that advice on an increased proportion of dairy products in an energy-

restrictive diet leads to reduced body fat among obese adults at 6–12 months. For children, adding dairy products does not lead to reduced body fat after 36 months (⊕⊕⊕○).

Water

- There is no data available to assess whether water intake has any effect on mortality, morbidity or quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is inadequate scientific data available to assess whether an intake of more than 1 litre of drinking water per day, compared with a lower water intake, can reduce body weight, waist size and body fat among obese individuals (⊕○○○).

- There is limited scientific evidence that there are no clinically significant effects on obese children in a school population when providing drinking water in the school environment (⊕⊕○○).

Coffee

- There is limited scientific data available to indicate that a high intake of coffee, compared with low or no intake, is linked with a reduced risk of death among obese individuals (⊕⊕○○).

- There is strong scientific data to indicate a link with increasing coffee intake and a reduced risk of diabetes among obese individuals (⊕⊕⊕⊕).

- There is inadequate scientific data available to assess whether there is any link between coffee intake and the risk of stroke and cancer among obese individuals (⊕○○○).

- There is no data available to assess whether coffee intake influences the risk of morbidity other than diabetes, stroke and cancer, and influences quality of life, among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data available to indicate that a high intake of coffee, compared with low or no intake, is linked with a slightly lower long-term weight increase among women but not men (⊕⊕○○).

Tea

- There is no scientific data available to assess whether tea intake has any effect on mortality, morbidity or quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is inadequate scientific data available to assess whether tea has any effect on body weight among obese individuals (⊕○○○).

Alcohol

- There is moderately strong scientific data available to indicate that a moderate intake of alcohol, compared with very low or no intake, is linked with a reduced risk of diabetes among obese individuals (⊕⊕⊕○).

- There is inadequate data available to assess whether alcohol intake has any effect on the risk of cancer or death (⊕○○○).

- There is no scientific data available to assess whether alcohol intake has any effect on morbidity other than diabetes and cancer, or influences quality of life among obese individuals (there are no studies which meet the criteria for inclusion in the report).

- There is limited scientific data available to indicate that a moderate intake of alcohol, compared with very low or no intake, does not affect weight among obese individuals (⊕⊕○○).

Other

Meal replacements and energy restriction

- There is moderately strong scientific data available to indicate that the addition of meal replacements using powder-based VLED (very low energy diet) products to a low fat diet with energy restriction has a beneficial effect on weight loss for obese individuals in the short term, but after 12 months the differences between the groups have evened out (⊕⊕⊕○).

- There is strong scientific data available to indicate that initiating dietary intervention with a VLED (very low energy diet) regimen of 8–12 weeks can achieve greatly increased weight loss over up to 12 months for obese individuals, but after two years the effect of the regimen is marginal (⊕⊕⊕⊕).

Physical activity as a supplement to dietary advice

- There is strong scientific data available to indicate that physical activity as a supplement to dietary intervention with energy restriction has no significant supplementary value for weight reduction after 6 months for obese individuals (⊕⊕⊕⊕).

- There is moderately strong scientific data available to indicate that dietary intervention with energy restriction leads to greater weight loss than physical activity of an intensity equivalent to 1 500 kcal/week for obese individuals (⊕⊕⊕○).

Practical survey

A questionnaire-based survey was carried out in order to gain an overview of the dietary recommendations provided to obese individuals by healthcare professionals at present. Invitations to participate in the survey were sent to members of the Swedish Association of Clinical Dieticians (Dietisternas riksförbund, DRF), the District Nurse Association (Distriktssköterskeföreningen), doctors and coordinators at child health service units (BHVs) and members of the Swedish Association of General Practice (Svensk Förening för Allmänmedicin, SFAM). The total response frequency was 53 per cent. The response frequencies for DRF and BHVs were high, but lower for the District Nurse Association and SFAM: this is why there is uncertainty as to whether the responses from district nurses and general practitioners are representative for the groups.

The results of the practical survey indicate that most of the respondents at least sometimes provide advice on diets with a low glycaemic index (52–75%), moderate low carbohydrate diets (51–74%) and Mediterranean diets (60–72%). Child healthcare professionals, who rarely or never give advice on these types of diet, were an exception. Advice on low-calorie powder is relatively uncommon in comparison (3–21%). Advice on strict low carbohydrate diets is very uncommon in all professional categories. There was no specific question asked about high protein diets as part of the practical survey. Nor is it apparent whether respondents directly advise against low carbohydrate diets or high protein diets.

Between 41 and 59 per cent of respondents to the practical survey state that their advice is queried at least sometimes, and questions on the proportion of fat and carbohydrates in the diet, carbohdrate-rich foods, butter, cheese and cream and low-calorie drinks are particularly common. Between 33 per cent (dietitians) and 73 per cent (general practitioners) of respondents state that they at least sometimes feel uncertain about what dietary advice is evidence-based for weight loss treatment.

Discussion and analysis of consequences

Limitations of the report

Obese individuals (BMI >30 kg/m^2) do in theory have greater opportunities to lose a lot of weight compared with overweight individuals (BMI 25–30 kg/m^2), as they have more excess weight to lose. However, it is not possible to rule out the fact that many obese individuals find it more difficult to really lose weight due to genetic, epigenetic, psychological and social factors. It is also reasonable to assume that obese individuals have more failed weight loss attempts behind them than overweight individuals. Therefore, in studies where the population is made up of a mixture of obese individuals and overweight individuals, it is possible that the effect of treatment will differ between various subgroups. The assignment involved looking at diets among obese individuals, and so only studies in which at least three-quarters of the population involved obese individuals have been included unless obese individuals have been reported separately. As a result, many studies in which the average BMI of the study population was just over 30 kg/m^2 have been excluded as the project team calculated that the proportion of obese individuals was too low. Some of these excluded studies are otherwise very well executed and so they have been discussed in detail in the report.

When scientifically comparing the effect of different measures, major emphasis is normally placed on randomised, controlled studies, i.e. studies in which subjects have been randomly assigned measures. There are a number of clear limitations with studies of this kind. To begin with, it is not guaranteed that obese individuals who choose to participate in long-term dietary experiments are representative of all obese individuals, or else it is difficult to stick to the randomised diet for a long period of time. As these diets are not selected by subjects themselves, there is a major risk of a low degree of compliance with the diet. If compliance is not measured with sufficient precision, randomised studies therefore often merely make it possible to examine the effect of the dietary advice, not the actual food intake or com-

pliance with the advice, other than in the long term. The difficulties with recording compliance over a long period of time have rendered it impossible to study and interpret long-term effects on morbidity and death.

The way in which the dietary advice is given can influence the degree of compliance. Some studies have offered subjects regular contact with dietary advisors, patient training, behavioural therapy, encouragement to keep a food diary and monitor weight loss (or increase). Subjects have also been given food at times. These methods can be expected to increase motivation within the study population. In other studies, dietary advice has been given on a single occasion. Lower compliance can also be expected in the studies in which the intensity of dietary advice was lower. The lack of scientific evidence for differences between the effects of two diets could therefore be explained by saying that intensive dietary advice was inadequate.

The dietary study dropout rate is often very high compared with many pharmaceutical studies, for example. Potential reasons for people dropping out include dissatisfaction with the diet they have been assigned, no effect being seen, or side effects. The published studies include two main ways in which the results are reported. The most common reporting method among the dietary studies included in this summary involves reporting on the effects among the individuals continuing with the study. It is likely that the individuals continuing with the study maintain a higher level of compliance with the diet assigned to them and see better effects and fewer side effects than the individuals who drop out. Because of this, the results of such analyses tend to show greater effects and sometimes also greater differences between the treatments compared than can be expected in the study population as a whole. The other way of reporting the results is to use what is known as an intention-to-treat analysis (ITT). This includes everyone included in the study, and prespecified assumptions on the effects – using the latest values measured, for example – are applied at the end of the study to indi-

viduals who drop out. This type of analysis is considered to be more conservative and is very common when reporting on pharmaceutical studies, for example. As the ITT analysis is more likely to include subjects offering low compliance with dietary advice, among other things, this often leads to considerably lower reported effect than can be expected from subjects offering high compliance. As studies of both types have been included in the meta-analyses executed in this report, it is possible that the results have been affected in different directions depending on how many studies of each type are included in a meta-analysis.

Observation studies, particularly what are known as cohort studies, provide another source of information. Here, researchers have charted food intake among obese individuals, for example, and then monitored them for a certain amount of time. They have recorded – among other things – the onset of cardiovascular disease, diabetes or death among subjects. The advantages of observation studies include the fact that it is possible to include many subjects, often several thousand, and to monitor them over a period of time so long that effects on morbidity and death can be measured. However, even this type of study has its difficulties. Most importantly, the groups of individuals compared may differ in considerably more ways than just in terms of the eating habits they have selected. Researchers are able to adjust the results of the statistical analyses in order to take into account differences in smoking habits and physical activity, for example. However, it is worth noting that researchers have remarkably rarely adjusted the results to take into account socioeconomic differences, despite the fact that these factors are strongly linked with the risk of being affected by problems such as obesity, diabetes and cardiovascular disease. Therefore, when evaluating the quality of studies we have considered whether the analyses have taken into account differences in socioeconomic considerations between groups with differing consumption in terms of diet, food or drink. Attention should also be paid to the fact that the diets described in most

cohort studies are not weight loss diets that follow a well thought out protocol or manual. Instead, the measurements specified in the studies are designed in retrospect and are calculated on the basic of intake of different foods and macronutrients (fat, carbohydrate and protein).

Many studies included in the systematic summary of the literature have measured self-reported food intake using what are known as food frequency questionnaires, FFQs, or food diaries and 24-hour diet interviews. In some instances, these measurements have been supplemented with objective findings, such as analysis of the excretion of ketone bodies or nitrogen in urine. Self-reported food intake results in a certain degree of incorrect reporting, which may be general or specific. General incorrect reporting underestimates energy and nutrient intake, which may be due to incorrect assessment of the quantities consumed. Specific incorrect reporting normally involves underestimating the intake of foods which are considered unhealthy, primarily foods with a high energy content and high content of refined carbohydrates and fat, such as sweets, fizzy drinks and fast food. More incorrect reporting is seen among individuals with higher BMI. Uncertainty in the measurement of self-reported food intake is a problem which makes it more difficult to interpret many dietary studies.

When two different pieces of dietary advice lead to the same effect on weight loss, for example, it is not possible to state with certainty that the two diets are equivalent if compliance with the dietary advice is inadequate or unknown. Therefore, many randomised dietary treatment studies can only answer the question of whether there is any difference in effect between pieces of dietary advice, not the question of whether there are any effects caused by differences in actual food intake. This is particularly true as regards longer-term follow-up, as it is common for compliance to be so low in both groups compared that any differences in effect between the diets per se are eliminated.

Diet

The review of the literature identified 23 randomised, controlled studies and two observation studies which compare the effects of various diets on weight and different laboratory values among obese individuals over up to two years. The majority of studies included were published after 2002, when the SBU report *Fetma – problem och åtgärder* was published. The various diets examined in such directly comparative studies are moderate and strict low carbohydrate diets, low fat diets, diets with a low glycaemic index, high protein diets and Mediterranean diets. Overall, these studies show that all diet interventions examined lead to weight loss and improved blood lipid and glucose values among obese individuals. The effects are generally greatest at six months and then decline over time. It is likely that this is a consequence of reduced compliance, and the same reason is likely to be the cause of the differences declining after six months.

It is not possible to demonstrate any difference in effect between two diets for most direct comparisons. However, the analysis showed that low carbohydrate diets compared with low fat diets lead to slightly more weight loss and a marginally greater increase in HDL cholesterol ("good cholesterol") in the short term (six months) without having any adverse effects on LDL cholesterol ("bad cholesterol"). This is applicable to both moderate low carbohydrate diets, with a carbohydrate intake of less than 40 per cent of the total energy intake, and strict low carbohydrate diets, where the carbohydrate intake amounts to no more than 20 per cent of the total intake. Strict low carbohydrate diets also lead to improved glucose values for obese individuals and individuals with diabetes in the short term, and to marginally reduced triglycerides.

Only one of the studies identified examined the effect of various diets on maintenance of weight after initial weight loss with a low energy regimen. This study compared four different diets with a control diet. These diets had a high or low protein content combined with a high or low glycaemic index. All the diets compared had a low fat content.

The study shows that diets with a higher protein content and/or a lower glycaemic index resulted in less weight increase. None of the studies which examined the effect of e.g. low carbohydrate diets or Mediterranean diets on maintenance of weight after weight loss met the criteria for inclusion in the report.

Given the intensive discussion taking place in the field, there is a remarkably small number of randomised studies which examine the long-term effects of various diets on outcomes of significance to individuals, such as morbidity, quality of life and death. A comparative study between low fat diets and diets with a standard fat content showed no difference in the incidence of diabetes among obese post-menopausal women with six years followup. In the biggest randomised study of diet patterns to date, the risk of suffering (or dying) from cardiovascular disease was slightly lower among obese individuals who were given advice on Mediterranean diets (and support to stick to this diet) compared with individuals who were given advice on low fat diets. This study had certain shortcomings, and the effects on weight change or total mortality in the group of obese individuals have not been reported as yet. Nevertheless, the long-term effects among obese individuals, including safety, can be said to be documented more effectively for Mediterranean diets than for other diets, including low fat and low carbohydrate diets.

Foods

A number of the studies discussed in the section on diets include advice on which foods should be included in such diets or avoided. The foods constitute part of a whole in these, however, and the studies have not been carried out in a way which would make it possible to evaluate the specific effects of a single food. The report reviewed more than 1 000 studies on the effects of various items of food advice and links between ill-health and the intake of specific foods. Most of this research is made up of observation studies. Only five randomised, controlled studies and eight observation studies met the criteria for

inclusion in the report. The food groups examined in these studies are fruit, vegetables, wholemeal products, legumes, potatoes, soya products, meat and processed meats. However, all in all these studies provide no clear evidence for advice on individual foods for obese individuals in order to prevent morbidity or achieve weight loss.

Drinks

A total over 26 studies relating to drink intake and weight/risk of illness among obese individuals have met the criteria for inclusion in this overview of the literature. Most of these studies are major cohort studies. The fact that conclusions are based on observation studies means – according to evidence grading system GRADE – that the scientific data is limited even from the outset. However, a number of factors offset this: there are a number of major, high quality studies for coffee and alcohol, there is often a dose-response relationship, and some of the links are very strong. This means that the strength of evidence (according to GRADE) for certain links may nevertheless be moderately strong or even strong.

Most major American cohort studies of drinks have involved various groups of healthcare and dental care professionals. These people probably differ from "ordinary" obese individuals in respect of their knowledge of illness, and possibly also in their ability to handle it. As with the dietary studies based on the same American cohorts, we have nevertheless come to the conclusion that the differences with obese Swedish individuals are not so major that they would bear little relevance to Swedish conditions. The American observations for coffee and alcohol have generally been confirmed in other populations, some of them Scandinavian.

Several of the links between *drinks* and illness among obese individuals have stronger evidence than the links between *foods* and illness. This is because there are more studies involving drinks in which illness or death has been examined, because the results are reason-

ably consistent, and because the reliability of measurements of drink intake is often considerably better than when individuals measure their food intake.

There are particular problems with interpretation of the four studies of dairy products, all of them randomised. The dietary advice here involved increased intake of all types of dairy products and was measured on the basis of calcium content; i.e. not just milk. The results also related to relatively short-term effects on weight – no long-term follow-ups (>1.5 years) have been carried out among adults. Therefore, these results must be interpreted subject to these limitations.

In the drink studies included in this overview, the results have generally been corrected statistically for both socioeconomic factors and a range of other interacting factors. However, one weakness in most of the studies involving drinks is that there has been no correction in the analyses for differences in food intake (including total energy intake): it is likely that people with different drink intakes also demonstrate differences in their diet patterns in other regards as well.

Low-energy powder

Regimens involving low energy powder ("Very Low Energy Diets") may be one way of starting off weight loss. The principle for these regimens within the scope of treatment or studies is that subjects achieve major weight reduction by means of extensive energy restriction over a period of two to three months which they can then hopefully maintain by making a cautious transition to a health, energy-reduced diet. Systematic overviews confirm that VLED regimens can lead to major weight reduction in the short term, but that the long-term effects (>6 months) are not as clear. This is probably due to a lack of compliance with the dietary advice given after the initial weight loss, and the fact that individuals among the study population return to their old habits in the long term.

Physical activity

One message which is often repeated as a solution to the issue of excess weight is that people should eat less and move about more. Exercise has positive effects on physiological functions such as oxygen uptake and quality of life even for obese individuals, and it is well known that regular physical activity is linked with reduced morbidity and longer life. However, systematic overviews of the literature indicate that adding physical activity to dietary intervention for obese individuals has a marginal – if any – effect on weight loss at group level. The lack of effect can be explained by compensatory mechanisms, such as a lower degree of physical activity throughout the rest of the day or increased hunger and less of a sense of satiety in connection with meals.

Compliance

The studies included in the systematic review of the literature were unable to demonstrate any differences between different diets in the longer term, despite the fact that differences could be seen at six months in some instances. One likely explanation for this is the fact that compliance with dietary treatment declines over time, so a large proportion of subjects return to their old habits. This is also the case in clinical reality. A lack of compliance with dietary advice may be due to many factors such as the motivation of the patient, frustration with regard to a lack of effect and the acceptability of the diet. The latter is an appraisal of the patient's perception of the advantages and disadvantages of the diet in relating to how palatable it is, what it costs, how accessible the diet is with regard to being able to find the foods included in the diet and the selection at restaurants which serve lunch, how the patient feels as a result of the diet, and how different the diet is to the patient's previous eating habits.

Individualised dietary advice

No study examining the effect of individualised dietary advice could be identified in the systematic review of the literature. It is likely that compliance with various diets is individual as the acceptability of the diet is largely controlled by individual perceptions and environmental factors (see above). When obese patients seek help with their weight problems, these are frequently people who have attempted to lose weight numerous times over a large proportion of their adult lives. It may be valuable for ongoing discussion to chart the patient's experiences with regard to weight loss, what he or she has tried previously, what effect these weight loss attempts have had on his or her weight and whether any weight was lost and, if so, how long the patient was able to maintain this lower weight. It makes little sense to try a method which has previously failed. It is more reasonable to try an alternative approach. This report indicates that there may be a range of alternative diets available which can all lead to weight loss, at least in the short term.

Health economic aspects

Obesity causes major costs for society and often affects individuals' quality of life. This is why it is important to identify interventions to counter or reduce obesity. To justify spending society's resources on altering the eating habits of individuals, it is important for such initiatives to have sufficient impact in relation to cost: in other words, such interventions must be cost-effective. The overview of health economic studies within the scope of this report indicated that there is a lack of well-executed studies relating to the cost-effectiveness of various types of dietary advice.

Whether the actual diet recommended has an effect on the health of individuals is crucial to whether one item of dietary advice is cost-effective compared with another. As regards the level of compliance with diets among individuals, it is conceivable that price has a certain part to play as food is purchased by individuals themselves in

the majority of cases. We have been unable in this report to indicate a link between the price of various foods and weight/BMI. However, studies have shown that there is a link between the price and the food we buy. This report has calculated what it costs to eat in accordance with the various elements of dietary advice, and this calculation shows that low fat diets are cheaper than low carbohydrate diets which are slightly more effective, at least in the short term. As obesity affects individuals with poorer financial conditions to a greater extent, there is a clear risk of the choice of diet being influenced by cost rather than the effects on health. Therefore, if the diets which may be relevant for weight loss attempts are more expensive that consumers' regular diets, this is problematic.

When measures are in place which are cost-effective and lead to weight reduction without serious side effects, society should ensure that these are implemented. Behaviours can be influenced in a number of different ways, financial incentives being regarded as one of the most powerful methods. These are sometimes cited as ways of controlling the development of obesity in society. This concept involves taxing particularly unhealthy foods and/or subsidising healthy foods as a means of controlling demand and hence household consumption. The question is whether such methods would affect the right elements of society so that weight reduction can be achieved, as neither taxation nor subsidies can be targeted at individuals. Sensitivity to price increases is greatest in the populations which find themselves in an intermediate financial position. People with poorer financial conditions have fewer choices, and affluent people do not need to make choices based on price.

Consequence analysis

The practical survey carried out in connection with this report saw a low response rate among some professional categories. However, if the results of the practical survey can be generalised, it can be stated that it is relatively common in Swedish health and medical services

to provide advice on diets with a low glycaemic index, moderate low carbohydrate diets and Mediterranean diets when treating obesity. The results of the systematic review of the literature indicate that all the dietary advice examined leads to reduced weight, which justifies a broad range of dietary advice variants in order to meet the preferences of individuals.

However, advice on strict low carbohydrate diets is extremely uncommon, if the practical survey is to be believed. It is not apparent how common it is for staff to actively advise individuals not to follow a strict low carbohydrate diet. Low carbohydrate diets, including strict ones, lead to greater weight loss than low fat diets in the short term, without the studies having indicated any adverse effects on blood lipids provided that the weight remains lower. Therefore, increased use of strict low carbohydrate diets for short-term weight reduction is one possible consequence of this report.

The studies relating to strict low carbohydrate diets which were included in the report give no indication of whether low carbohydrate diets should provide small portions or not include saturated fat. A few of the studies of strict low carbohydrate diets included provide specific advice on increasing the intake of foods which are rich in saturated fat. The fat in other studies has been vegetable in origin, while the type of fat has not been specified in a number of studies. As a high intake of saturated fat is considered to involve a risk of cardiovascular disease, this has raised the question of whether a low carbohydrate diet could increase the risk of coronary artery disease, stroke, etc. Meta-analyses of randomised studies have been carried out and indicated that the risk of cardiovascular events is reduced when saturated fat is swapped for unsaturated. However, a number of the studies included had shortcomings which make them more difficult to interpret, and none of them have specifically examined low carbohydrate diets. This means that it is not possible to draw any conclusions on the link between low carbohydrate diets – irrespective of fat content type – and cardiovascular morbidity. The precaution-

ary principle could be applied here. This may result in restraint on the intake of saturated fat when advice is given on low carbohydrate diets, as long as the documentation on the long-term effects is so inadequate.

Another issue which has been raised is the fact that low carbohydrate diets are said to be linked with inadequate intake of micronutrients (vitamins, minerals and dietary fibre). Moreover, concerns have been expressed on raised energy intake among recipients of advice on strict low carbohydrate diets, due to the fact that such diets are based on a number of fatty foods with high energy density. For this reason, any advice on low carbohydrate diets may therefore – in accordance with a number of the studies carried out – include information on which foods should be selected in addition to the fatty foods in order to guarantee sufficient micronutrient intake and lower energy density. Examples of such foods include vegetables, legumes and root vegetables.

This systematic list of literature also provides a certain degree of guidance on the advice which health and medical services can provide to obese individuals with regard to what they should drink, and in what quantities. The most obvious measure is to reduce the intake of sweet drinks – scientific evidence indicates that this leads to weight loss. One common notion is that large quantities of water, particularly when consumed before meals, can increase the feeling of satiety and so have a positive effect on weight. However, there is insufficient scientific evidence to provide obese individuals with advice on a large water intake.

Bearing in mind the energy content of dairy products, it is worth noting that the scientific data available indicates that a high intake of dairy products (in studies, milk and cheese together) leads to weight loss, at least over one to two years. Therefore, there appears to be no reason to provide advice to generally restrict the intake of dairy prod-

ucts. It may be reasonable for some obese individuals to consume only cheese with a low energy content.

Obese individuals run a greatly increased risk of diabetes, and both coffee and alcohol, depending on dose, are linked with a reduced risk of diabetes among obese individuals. Therefore, there is no reason to routinely advise obese individuals not to consume coffee or alcohol. As far as alcohol is concerned, the advice often needs to be more nuanced. Firstly, the advice should consider the energy content of alcoholic drinks. Secondly, it is of course necessary to take into account situations in which moderate or high alcohol intake is directly inappropriate, such as in pregnancy, when alcohol would be hazardous or when individuals are genetically predisposed to alcoholism. A third aspect is the fact that it is not possible to withhold information on the U-shaped link which is often demonstrated between alcohol intake and cardiovascular disease/mortality, although this has not been studied among obese individuals. It is also important to take into account other adverse effects of alcohol, such as violence and other psychosocial consequences, as well as the increased risk of certain forms of cancer in individuals with a high alcohol intake.

Growth of the research field and remaining knowledge gaps

The number of randomised studies published in the research field of dietary treatment among obese individuals has grown exponentially since the mid-1990s. At least about a thousand randomised studies have been carried out by now. However, most of these have short follow-up times, small study populations, have not gauged compliance with the dietary advice given, or have been carried out in a manner which makes them difficult to interpret. Only a small number of studies compare the effects of two or more kinds of dietary advice with one another, and the majority of these have been published over the past decade. About half of these study some form of low carbohydrate diet.

Most striking as regards diet comparisons is the lack of outcomes important to patients, such as morbidity, death and quality of life. The only inclusive randomised study which actually indicates a difference in falling ill with or death from cardiovascular disease between two types of diet (Mediterranean diets and low fat diets) was published after the last search of the literature was carried out. Besides this study, there is actually no scientific evidence to indicate that it is beneficial – in terms of morbidity and/or death – to implement dietary intervention for obese individuals. Certainly observational studies have been carried out in which links have been demonstrated between factors such as low carbohydrate intake and morbidity or mortality in the long term, albeit not among obese individuals. However, most of these studies are marred by major shortcomings which make them difficult to interpret. The main shortcoming among these studies is the fact that it is often impossible to determine whether the individuals with the lowest intake are deliberately eating a moderate low carbohydrate diet for health reasons, or whether they are prolific consumers of fast food.

In other words, it is important to carry out major studies with a long follow-up period which compare the effects of various items of dietary advice on outcomes relevant to patients, particularly in the light of the intensive debate currently under way with regard to the benefits and risks of carbohydrates and various types of fat. Such studies should be randomised in the first instance, but even well-executed observation studies which actually study the effects of various items of dietary advice can help to provide valuable knowledge in the field.

Almost all dietary studies involving children and young people have been carried out in a manner which makes it impossible to evaluate the effect of a single dietary intervention. Moreover, most of them have worked on the basis of the same kind of diet (low fat diets). Therefore, pure dietary comparisons are warranted for this group.

In clinical reality, compliance with dietary advice is crucial to the results that individuals wish to achieve, and ways of increasing compliance have not been researched adequately.

Scientific data and clinical guidelines

This systematic overview of the literature presents a list of the scientific data for advice on food and drink aimed at obese individuals. Clinical guidelines, care programmes and other types of steering document in the field of health and medical care may sometimes need to be based on factors other than scientific data, but scientific data should provide a basis in the fields in which it exists, particularly when the evidence is moderately strong or strong.

Tried and tested experience is an alternative when there is inadequate or no scientific data available. There is disagreement within the caring professions and among patients concerning the implications of "tried and tested experience" with regard to dietary advice for various diseases. One alternative then would be to extrapolate from evidence-based knowledge of other patient groups, primarily overweight individuals (BMI >25 kg/m^2), if any such knowledge exists.

Reports *published by SBU*

SBU Reports in English (2005–2013)

Treatment of Hemophilia A and B and von Willebrand Disease (2011), no 208E

Medical and Psychological Methods for Preventing Sexual Offences Against Children (2011), no 207E

Methods of Diagnosis and Treatment in Endodontics (2010), no 203E

Dementia, three volumes (2008), no 172E

Obstructive Sleep Apnoea Syndrome (2007), no 184E

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SBU Evaluates Health Care Technology

Below is a brief summary of the mission assigned to SBU by the Swedish Government:

- SBU shall assess healthcare methods by systematically and critically reviewing the underlying scientific evidence.
- SBU shall assess new methods as well as those that are already part of established clinical practice.
- SBU's assessments shall include medical, ethical, social and economic aspects, as well as a description of the potential impact of disseminating the assessed health technologies in clinical practice.
- SBU shall compile, present and disseminate its assessment results such that all parties concerned have the opportunity to take part of them.
- SBU shall conduct informational and educational efforts to promote the application of its assessments to the rational use of available resources in clinical practice, including dental care.
- SBU shall contribute to the development of international cooperation in the field of health technology assessment and serve as a national knowledge centre for the assessment of health technologies.

Dietary treatment of obesity

The report on dietary treatment of obesity from the Swedish Council on Health Technology Assessment (SBU) is a systematic review of the scientific literature in the field.

This document presents the summary and conclusions of the full report approved by SBU's Board and Scientific Advisory Committee.

The full report is available at www.sbu.se/218

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