Long-term efficacy of dietary treatment of obesity: a systematic review of studies published between 1931 and 1999

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Summary

Methods: MEDLINE surveys were carried out and reference lists were cross-checked to identify publications on long-term outcome for dietary treatment of obesity. 898 papers were identified, 17 fulfilled our planned criteria for inclusion (dietary treatment; adults; follow-up period ≥ 3 years; follow-up rate ≥ 50% of original study group; information on one of the success criteria: maintenance of all weight initially lost (or further weight reduction) or maintenance of at least nine to 11 kg of initial weight loss; obesity complications of the patient group not over-represented; English, German or Scandinavian languages). Results: The 17 included publications (hereof three publications on randomized clinical trials with control group relevant for this review) reported on 21 study groups, comprising 3030 patients. Of these 2131 (70%) were followed-up for 3–14 years (median 5 years). Mean initial weight loss ranged from four to 28 kg (median 11 kg). Overall, 15% (median, range 0–49%) of followed-up patients fulfilled one of the criteria for success. Overall, success rates seemed stable for up to 14 years of observation. Diet combined with group therapy lead to better long-term success rates (median 27%) than did diet alone (median 15%) or diet combined with behaviour modification (median 14%). Active follow-up was generally associated with better success rates than was passive follow-up (19% vs. 10%). Conventional diet seemed to be most efficacious in addition with group therapy, whereas VLCD apparently was most efficacious if combined with behaviour modification and active follow-up. Conclusion: The literature on long-term follow-up of dietary treatment of obesity, although limited and inhomogeneous, points to an overall median success rate of 15% and a possible adjuvant effect of group therapy, behaviour modification and active follow-up.

Keywords: behaviour modification, diet, group therapy, long-term follow-up, obesity, very-low-calorie diet.

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Introduction

Only very few obese patients are treated for obesity in order only to obtain a short-term effect, e.g. a risk reduction in relation to a surgical procedure. Most obese patients are treated with an intention to induce a lasting weight reduction in order to improve the risk profile characterizing obesity and, thus, reduce risk of premature death, morbidity and psychosocial suffering.

Despite the development of various pharmacological and surgical treatments, dietetic treatment is still the basic therapeutic tool against obesity. Numerous papers have been

published on the efficacy of various dietetic regimens. However, most studies have only been conducted short-term. The more sparse literature on long-term efficacy of dietary treatment has seen somewhat varying interpretations. An important explanation for the discrepancies can be sought in the selection of scientific papers underlying various reviews. Current knowledge on long-term efficacy of dietary treatments can only be adequately extracted from the literature through a thorough and systematic analysis of publications fulfilling well-defined criteria for inclusion. To our knowledge, no such systematic review on long-term outcome of dietary treatment for obesity has yet been published.

The aim of our study was to systematically review internationally published clinical data on long-term outcome of dietary treatment for obesity. We intended to evaluate whether general conclusions can be reached as to well-defined long-term success rates from papers fulfilling criteria which are stated above. Furthermore, we wanted to analyse long-term success rates in relation to time of observation and to different diets and adjuvant treatment modalities.

Methods

Papers were identified from 1966 to October 1993 using an extensive computerized MEDLINE survey. The following keywords were used for the search: obesity/diet *or* obesity/therapy *or* obesity/psychological *or* obesity/drug-therapy *or* diet/reducing *and* follow-up studies. A supplementary MEDLINE survey from 1993 to June 1999 was carried out using the following keywords: obesity and diet and follow-up. Based on the experience from the first survey this simplified search profile was found sufficient for the updating. In addition to the computerized surveys we performed a comprehensive cross-checking of reference lists. A total of 898 papers of possible relevance were identified.

The systematic selection of papers was carried out from protocolled criteria for inclusion. To be included the study had to refer to treatment of adults with diet alone or dietary treatment in combination with other nonsurgical treatment modalities. The long-term perspective was ensured by a demand for a follow-up period of at least 3 years. There had to be long-term data available on at least 50% of the original study group. Two alternative criteria for long-term success were used: maintenance of all weight (100%) initially lost (or further weight reduction), or maintenance of at least nine to 11 kg of the initial weight loss. The study had to report numerically on one of these criteria for success and report numerically on initial weight loss. The majority of the patient group had to be without obesity complications (e.g. diabetes). The publication had to be in English, German or Scandinavian languages.

For studies dealing with more than one study group (e.g. dietary and surgical treatments), only study groups fulfilling our inclusion criteria were included.

For each of the included papers we registered the following variables (1) Study design (control groups formed with or without randomization); (2) Number of patients starting treatment; (3) Degree of initial overweight (BMI or percent overweight); (4) Duration of initial treatment (months); (5) Mean initial weight loss (kg) of the fraction of patients completing initial treatment; (6) Follow-up time (years) and (7) Fraction of patients followed-up (%).

From each study group included we further registered the following variables (1) Treatment program (diet alone or diet plus group therapy, behaviour modification or exercise or combinations hereof); (2) Type of initial diet (very-low-calorie diet (VLCD) with a stated energy content between 300 and 600 kcal/24 h or conventional diet (CD); (3) Intensity of follow-up (active or passive follow up); (4) Use of measured or self-reported weight at follow-up; (5) Criterion for success (maintenance of all weight (100%) initially lost (or further weight reduction), or maintenance of at least nine to 11 kg of the initial weight loss)) and (6) Success rate (number of patients fulfilling the criterion for success relative to the number of patients followed-up in the study group).

Not all variables were reported in all references. In a few papers numerical data could only be read from figures. The group therapy/group treatment programmes and the behaviour modification programmes were rarely described in any detail.

Active follow-up was defined as offering the patients the opportunity to have some kind of contact with the clinic at least for some time after cessation of the initial dietary treatment. *Passive follow-up* was defined as absence of such possibility.

Results

The inclusion criteria were fulfilled by 17 (1–17) of the 898 publications, and 881 publications were, thus, excluded. From Table 1 it can be seen that the major reasons for exclusion were due to lack of long-term follow-up, use of surgery, or irrelevance. Two or more reasons for exclusion of a publication were commonplace.

Of the 17 publications included, three publications dealt with more than one study group fulfilling the criteria for inclusion, giving a total of 21 study groups to be included. The total number of patients starting dietary treatment was 3030. Median study group size was 31 patients (range, 11–1000 patients). The initial degree of overweight was 3–89% (12 publications), 34.3–39.4 $kg\,m^{-2}$ (three publications), 0.85–1.70 $kg\,cm^{-1}$-100 (one publication). The initial degree of overweight was not stated in one paper. Duration of treatment ranged from 1 to 24 months (median 3 months), two publications did not state duration of initial treatment. Mean initial weight loss ranged from four to 28 kg (median 11 kg), follow-up time ranged from 3 to

14 years (median 5 years). Total number of patients followed-up was 2131, equal to 70% of patients starting treatment. Eight study groups had initially been treated with VLCD (preceded by fasting in one study). Thirteen study groups had initially been treated with CD (with an energy content of 800–1800 kcal/24 h when stated (eight publications)).

Follow-up weights were based on measurements in four publications, on measured weights supplemented with self-reported weights in eight publications, while two publications stated self-reported weights only and three publications gave no information about the method used for registration of follow-up weights.

Eight publications (representing 9 study groups) reported on the success criterion 'maintaining all weight initially lost (or further weight reduction)' and nine publications (representing 12 study groups) reported on the criterion 'maintaining at least nine to 11 kg of initial weight loss'. Exercise was briefly described as a part of the programme in about half of the publications, but the influence of exercise on long-term results was generally not described in any detail and could, therefore, not be analysed as a separate factor.

Table 2 gives the median success rates for the 21 study groups, subdivided according to initial treatment, energy level of initial diet and the intensity of follow-up.

The overall median success rate for the 21 study groups included was 15% (range, 0–49%). A median of 14% had long-term success if treated with VLCD and 18% had success if treated with CD. It appears that diet combined with group therapy leads to better long-term success rates (median 27%) than diet alone (median 15%) or diet combined with behaviour modification (median 14%). Active follow-up was generally associated with better success rates than was passive follow-up (19% vs. 10%).

In Table 3 the study groups are categorized according to type of initial diet (VLCD or CD) and subdivided according to adjuvant treatment modalities (none, group therapy or behaviour modification) and intensity of follow-up (active or passive). Again it appears that VLCD is in general not superior to CD. However, VLCD plus behaviour modification seems to lead to better success rates than CD plus behaviour modification (median 27% vs. 12%). Combining VLCD and behaviour modification with active follow-up appears to be the most efficacious treatment (median success rate 38%) but the total number of subjects was only 71 (two study groups). VLCD plus behaviour modification plus passive follow-up gave a 9% success rate (one study group).

Irrespective of the type of diet, passive follow-up was associated with lower median success rates than active follow-up, except from the CD plus group therapy study groups in which passive follow-up lead to a 31% success rate (compared to 25% in the actively followed-up groups). No group had been treated with CD plus behaviour modification plus active follow-up. No group had been treated with VLCD and group therapy. Thus, the 27% successes

Table 1 Main reason for exclusion of publications

Criteria for exclusion	% of all excluded papers ($n = 881$)
No follow-up or follow-up < 3 years	35
Surgical treatment	26
Reference of no relevance	10
Children or adolescents	9
Obesity complications over represented	6
Follow-up of < 50% of study group	4
Survey	4
Reference not available or duplicate publication	2
Lacking information on use of diet, initial weight loss, criteria for success or success rate	2
Language other than Scandinavian, English or German	2

Table 2 Success rate for reported study groups, subdivided according to initial treatment, energy level of initial diet and intensity of follow-up

	No. of patients	No. of study groups	Median success rate (range)
Overall success rate	2131	21	15% (0–49%)
Influence of initial treatment:			
Diet* alone**	1337	10	15% (6–28%)
Diet* plus group therapy	487	4	27% (14–31%)
Diet* plus behaviour modification	307	7	14% (0–49%)
Influence of energy level of initial diet:			
Very-low-calorie diet (300–600 kcal/24 h)**	304	8	14% (6–49%)
Conventional diet (800–1800 kcal/24 h)	1827	13	18% (0–31%)
Influence of intensity of follow-up:			
Passive follow-up**	597	10	10% (0–31%)
Active follow-up	1534	11	19% (13–49%)

*Conventional diet or very-low-calorie diet. **Fasting was initially used in one study group.

Energy level of initial diet	Followed-up number of		Median success rate (range)
	Study groups	Patients	
VLCD (300–600 kcal/24 h)*	8	304	14 (6–49)
VLCD alone	5	211	13 (6–17)
Passive follow-up*	2	139	9 (6–11)
Active follow-up	3	72	15 (13–17)
VLCD plus			
Behaviour modification	3	93	27 (9–49)
Passive follow-up	1	22	9
Active follow-up	2	71	38 (27–49)
VLCD plus group therapy	0	0	
CD (800–1800 kcal/24 h)	13	1827	18 (0–31)
CD alone	5	1126	19 (6–28)
Passive follow-up	2	209	14 (6–21)
Active follow-up	3	917	19 (15–28)
CD plus			
Behaviour modification	4	214	12 (0–18)
Passive follow-up	4	214	12 (0–18)
Active follow-up	0	0	
CD plus group therapy	4	487	27 (14–31)
Passive follow-up	1	13	31
Active follow-up	3	474	25 (14–28)

Table 3 Percentage successes in relation to regimen used: influence of energy level of initial diet and the intensity of follow-up. VLCD = very-low-calorie diet. CD = conventional diet

* Fasting was initially used in one study group.

from diet plus group therapy in Table 2 are based on data from treatment with CD plus group therapy exclusively.

Special emphasis should be put on the results of controlled studies, in particular randomized clinical trials. Ten of the included publications were controlled studies. Five of these were nonrandomized studies. For various reasons none of these were helpful with regard to supporting best choice of treatment or of follow-up regimen (in two studies the control groups were not followed-up long-term, in one study the control group was treated with jaw-fixation, in one study the control group was not treated with diet, and in one study the control group was not treated at all). Of the five randomized clinical trials, the control group was not followed-up long-term in one study, and in another study the control was treated surgically. Thus, three controlled studies – all randomized – can be particularly valuable for choice between treatments and follow-up modalities. Because two of these randomized clinical trials included two relevant study groups each and one trial included three relevant study groups, four clinical comparisons can be illustrated by these three randomized clinical trials.

The study by Hakala and co-workers (7) on patients treated with CD and followed-up actively showed that an individualized programme was superior to group therapy for achieving long-term results. In patients receiving behaviour therapy as adjuvant treatment and followed-up passively, Wadden and co-workers (17) found that CD and VLCD did not differ significantly as to long-term results. Further, Wadden and co-workers (17) found that in patients treated with VLCD and followed-up passively, addition of behaviour modification made no significant difference as to long-term results. On the other hand, Ohno and co-workers (12) found that in VLCD patients followed-up actively, addition of behaviour modification lead to significantly better long-term outcome.

In Fig. 1 success rates of the 21 included study groups have been plotted against time of observation. It appears that there is no obvious association between these variables. Thus, no decline of success rates with time could be observed.

In Fig. 2 success rates have been plotted against follow-up rates. No association appears, meaning that no tendency towards declining success rates with increasing follow-up rates could be observed.

Discussion

We have systematically sought and reviewed publications on long-term success of dietary treatment for obesity from 1931 to 1999. It is interesting that only 17 publications fulfilled our criteria for inclusion which was chosen to give an adequate and clinically relevant overview of long-term results of dietary treatment. Of course the criteria could have been chosen differently. However, if our criteria for inclusion had been more rigorous very little information

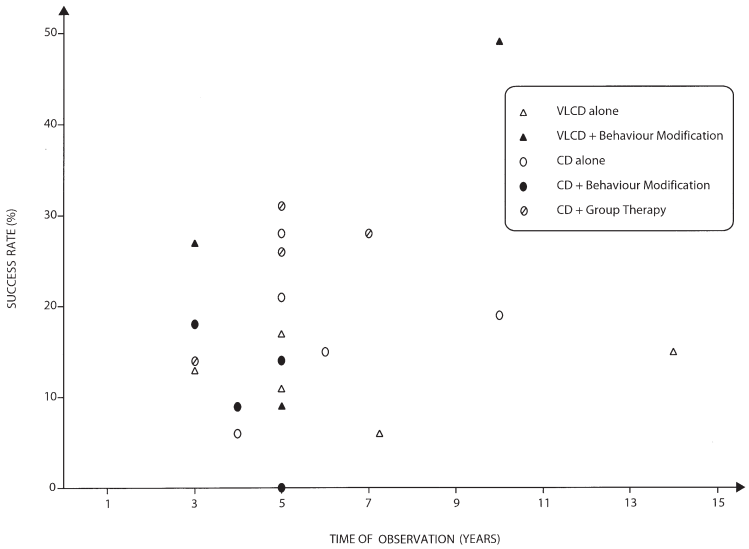

Figure 1 Relationship between success rate and time of observation in 21 study groups. VLCD = very-low-calorie diet; CD = Conventional diet.

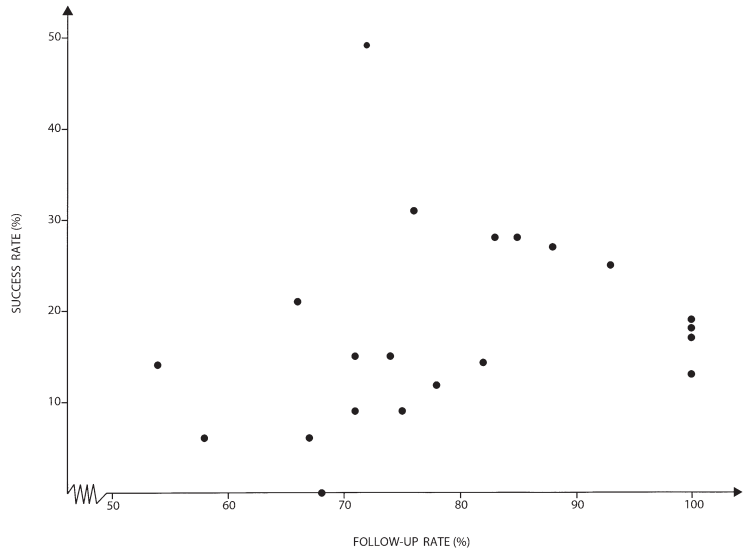

Figure 2 Relationship between success rate and follow-up rate in 21 study groups.

might well have been gathered, and if our criteria had been weakened too much dubious information would have disturbed the conclusions. Only a few studies that could otherwise have been included, have been excluded as they did not give information on the success criteria chosen for this literature study.

The study demonstrates that the literature on long-term weight maintenance is very limited. This is evident when considering that the 17 publications cover a number of different diets and treatment programmes. Furthermore, in this field there is a striking paucity of long-term randomized controlled trials comparing different treatment programmes. Regrettably, the scientific level and data quality do not seem to have improved during recent years. From the last 6 years only one paper could be included in this review. A straightforward meta-analysis would have been an obvious approach for this review, but the quality of the literature did not allow for this methodology.

With these reservations in mind, the present literature study has indicated a long-term success of 15% among patients followed-up after dietary treatment for obesity, and this outcome seems fairly stable over time for up to 14 years of observation. There were no clear cut trends in success rates in the studies with repeated observations after 3 years. Two studies found declining success rates between 3 and 6 years of observation (1, 13). One study found

declining and increasing success rates for men and women, respectively, from the third to the fourth year of observation (11). One study found better success rates after 10 years compared to the outcome after 4 years of observation (2).

Even though many of the successful patients were probably still overweight, a lasting improvement in 15% of patients suffering from a chronic condition cannot be viewed as being of no value. Most of the study groups included maintained a weight loss of at least nine to 11 kg, which is known to be associated with significant improvements in complications due to obesity (18).

We have attempted to evaluate which type of diet and which treatment programmes lead to the best long-term outcomes. Also these results should be interpreted with great precaution, even more so as the number of study groups in each category was small.

It has been a matter of long-standing debate whether VLCD with its rapid initial weight loss is associated with poorer long-term outcomes than CD (19). Overall, long-term outcome after VLCD seems equal to or only marginally poorer than the outcome of CD. The only randomized, clinical trial comparing VLCD with CD (behaviour modification and passive follow-up applied in both groups) supports this statement (17).

Also the importance of supportive efforts adjuvant to dietary treatment has been extensively discussed. The results of the present literature study do not point to any maintained efficacy of behaviour modification when type of diet is not taken into account. The two randomized clinical trials (12,17) focusing on this question present conflicting results as only the study of Ohno (12) points to a superiority of additional behaviour modification as to long-term outcome.

As to the effect of group therapy during dieting overall data from our review indicate that this approach improves long-term outcome. However, this finding is not supported by the only randomized clinical trial (7). It should be noted that group therapy as well as behaviour modification were typically ill-defined components of treatment programmes for obesity.

An active follow-up compared to no support after initial treatment seems, from overall data, advantageous, but this question has not been addressed in a randomized trial design. However, two studies (12,20) have found that the number of attended booster sessions during follow-up correlates positively to maintained weight loss.

The present review has revealed results on a number of different combinations of diet types, adjuvant treatment modalities and follow-up programmes. Among these combinations particularly good long-term success rates have been reported from the combination of VLCD, behaviour modification and active follow-up (two study groups representing 71 patients). Accordingly, a recent review (19) concluded that an increased initial weight loss in obese patients produces a better long-term retention of the weight loss, providing auxiliary therapy is supplied at least in the weight maintenance phase. Our data show that long-term outcome of CD, on the other hand, seems to benefit from the addition of group therapy.

It is an extremely demanding task to follow obesity patients for extended periods of time and to ensure they remain as participants of fixed programmes. The fraction of patients followed-up was 70% among the included studies, with a cut-off point at 50% defined in the criteria for inclusion. It is a commonplace judgement that patients with poor outcome are more likely to drop out. Thus, a negative association between follow-up rate and success rate could be expected. This relationship could not be demonstrated in the present literature study. If we consider all patients lost to follow-up to be failures, the overall median success rate was 13% (range 0–35%), calculated from the initial patient population (3030 patients) of the 21 study groups.

The present literature study has revealed the weak base for our knowledge on long-term effect of dietary treatment of obesity. Current information points to an overall success rate of 15% and a possible adjuvant effect of group therapy, behaviour modification and active follow-up.

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