

Examining HbA_{1c} and quality of life in adults with type 1 diabetes: A quantitative study

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There has been little published research regarding the DAFNE (Dose Adjustment For Normal Eating) education programme. With the number of DAFNE centres increasing both nationally and internationally, the authors undertook this study to elucidate the effects of this education programme on quality of life and HbA_{1c} in adults with type 1 diabetes.

The importance of improving the care of people with diabetes is highlighted in the national service framework (NSF) for diabetes (Department of Health [DH], 2001). Standard 3 of this document requires that all children, young people and adults with diabetes will receive a service that encourages partnership and decision-making, supporting them in managing their diabetes and helping them to adopt and maintain a healthy lifestyle.

Structured education is one of the key interventions needed to achieve the standard. In support of this, the NSF delivery strategy (DH, 2003) clarifies that treatment in line with NSF standards should include referral to structured education.

This article discusses the background to the DAFNE (Dose Adjustment for Normal Eating) education programme for people with type 1 diabetes, and presents the results of a study examining the effects of DAFNE on glycaemia and quality of life (QOL).

Structured education

NICE (2004) defines structured education as:

“A planned and graded programme that is comprehensive in scope, flexible in content, responsive to an individual’s clinical and psychological needs, and adaptable to his or her educational and cultural background.”

The aim of patient education is for people with diabetes to improve their knowledge, skills and confidence, enabling them to take increasing control of their own condition and integrate effective self-management into their daily lives (Loveman et al, 2003).

High-quality structured education can have a profound effect on biomedical outcomes, and can significantly improve QOL and satisfaction, both with their diabetes control and life in general (DH, 2005). However, the length, content and style of educational options vary

Article points

1. There is a lack of published research into the DAFNE (Dose Adjustment For Normal Eating) education programme for adults with type 1 diabetes.
2. People on the DAFNE programme have a higher quality of life (QOL), and other improved biomedical parameters compared with people with type 1 diabetes not on the programme.
3. A significant negative correlation between HbA_{1c} and QOL was found in the DAFNE group, i.e. as HbA_{1c} decreased, QOL increased.
4. With DAFNE courses increasing nationally and, more recently, internationally, further research is required to see whether the successes of the original study continue.

Key words

- Type 1 diabetes
- Education
- Quality of life

Full author details can be found at the end of the article.

Page points

1. The DAFNE (Dose Adjustment For Normal Eating) programme embraces the patient empowerment approach, and involves multiple insulin injections and frequent blood glucose testing.
2. The aim of the study presented here was to compare QOL and HbA_{1c} values in adults with type 1 diabetes who had and had not completed the DAFNE education programme.
3. A convenience sample of people with type 1 diabetes ($n=28$) was recruited from two diabetes outpatient clinics in a large teaching hospital in the East Midlands.

greatly between services: some of the educational programmes offered are unstructured; few have been formally evaluated; and few individuals who deliver education have been formally trained for this purpose (Loveman et al, 2003). In response to this, the Patient Education Working Group has suggested that education programmes should have a structured, written curriculum, have trained educators be quality assured and audited (DH, 2005); for example, the DAFNE programme.

DAFNE

The DAFNE programme embraces the patient empowerment approach, and involves multiple insulin injections and frequent blood-glucose testing. Participants attend a 5-day training course, with a structured teaching programme delivered to small groups, covering topics including carbohydrate estimation, blood glucose monitoring, insulin regimens, hypoglycaemia, illness and exercise.

DAFNE was formally evaluated through a randomised control trial with 169 adults with type 1 diabetes recruited from three UK hospitals (DAFNE Study Group, 2002). Half were randomised to the intervention group where they attended a DAFNE course initially, and half were in the control group who waited to attend 6 months later. As well as HbA_{1c} levels, biomedical and QOL outcomes were measured at baseline, 6 and 12 months. The study found that at 6 months, those who had attended the DAFNE training course had experienced a significant reduction in mean HbA_{1c} of one percentage point compared with the control group.

At 1 year, although glycaemic control had deteriorated slightly, mean HbA_{1c} was still 0.5% (5.5 mmol/mol) lower than at baseline. QOL was again measured and, despite an increase in the number of injections and more frequent blood testing, those attending the training reported a significantly improved QOL from baseline. An important finding was that participants reported the freedom to eat as they liked. In the intervention group, the proportion of participants experiencing severe hypoglycaemia was unchanged, even though

overall control was considerably improved (DAFNE Study Group, 2002).

The DAFNE programme appears to be successful, although the only substantial published research paper on DAFNE concerns the original pilot project. With DAFNE increasing in national and, more recently, international, importance, this is an area future research needs to focus on.

Aim of the present study

The study presented here aimed to compare QOL and HbA_{1c} values in adults with type 1 diabetes who had and had not completed the DAFNE education programme.

Methods

Participants

A convenience sample of people with type 1 diabetes ($n=28$) was recruited from two diabetes outpatient clinics in a large teaching hospital in the East Midlands; one clinic for people who had completed the DAFNE course and another clinic for those who had not. DAFNE-specific clinics are held to ensure DAFNE-trained professionals meet with people on the programme, which cannot necessarily be ensured in a single clinic. All individuals attending the clinics on the days when the researcher was present were invited to participate in the study. The study comprised men and women with type 1 diabetes aged over 18 years, but excluded those who were pregnant, prisoners attending the clinic, those with severe learning difficulties and those with severe mental health problems.

Data collection

Data were collected between November and December 2007 using an adapted diabetes-specific QOL scale (DSQOLS [Bott et al, 1998]). Participants were asked to respond to 44 statements on a 6-point Likert scale examining QOL (*Box 1*), with different areas of the DSQOLS focusing on daily function of work and leisure time (how well a person copes with what they are doing for work and in their free time), dietary restrictions, physical complaints, social relationships and worries about the

Box 1. Results of the questionnaire examining quality of life in people attending diabetes outpatient clinics.

Question	This statement meets my point of view					
	0 (perfectly)	1	2	3	4	5 (not at all)
1. I can't get used to the pricking for blood glucose self-monitoring.	5	3	2	1	4	13
2. It burdens me that I always have to think about my diet	3	5	6	0	6	8
3. I suffer from pain because of diabetes	2	1	5	2	3	15
4. Because of diabetes, the relationship with my partner has become worse	1	0	3	0	4	19
5. I am worried that my life could be shorter because of diabetes	3	7	5	0	5	8
6. I believe I am less attractive to others because of my diabetes	3	2	0	3	4	16
7. Because of diabetes, I feel sad or depressed	5	1	5	1	3	13
8. I am worried about my future health	7	4	10	0	3	4
9. It burdens me how other people react to my diabetes	1	1	8	3	3	12
10. I feel tired and exhausted	4	2	7	3	6	6
11. It bothers me that I have to spend so much time on my therapy	3	1	6	4	4	10
12. Because of diabetes, travelling is complicated and troublesome	6	0	6	3	2	11
13. Diabetes prevents me from spontaneous physical activities	2	2	7	3	3	11
14. I suffer from the frequent need to pass urine	0	2	5	1	7	13
15. My diet plan forces me to eat even if I am not hungry	7	3	3	0	2	13
16. Because of my diabetes I feel anxious and threatened	3	0	2	3	4	16
17. I suffer from thirst or dry mouth	0	1	5	0	11	11
18. Other people find it difficult to understand my problems with the diabetes treatment	1	3	7	0	8	9
19. I feel physically ill	0	0	6	2	5	15
20. I have to give up tasty food	3	2	2	0	1	20
21. In spite of diabetes, I can fulfil the demands of work, school or the household very well	13	2	4	2	2	5
22. Because of diabetes I often have physical troubles	1	3	3	1	7	11
23. Diabetes restrains my future plans	2	1	8	0	5	12
24. Because of diabetes I have less contact with friends or acquaintances	1	0	2	1	2	22
25. My professional prospects are restricted because of my diabetes	2	0	3	2	6	14
26. I suffer from frequent infections, itching or alterations of my skin	1	2	2	1	7	15
27. I feel dull or sluggish	0	3	6	2	5	12
28. I am not satisfied with the amount of time I spend in consultations	1	2	4	1	3	17
29. Because of my diabetes I can't spend my leisure time as I want to	3	3	1	2	4	15
30. I feel like a disabled person	2	3	1	3	1	18
31. Because of hypoglycaemia I feel physically handicapped	2	1	3	1	2	19
32. It bothers me that I can't eat like other people	6	0	3	0	0	19
33. I am often worried about diabetic late complications	9	1	7	3	3	5
34. Because of diabetes people treat me like a "sick person"	1	2	4	4	3	13
35. Because of my diabetes I can't pursue my hobbies as I would like to	2	0	4	2	4	15
36. I often ponder over diabetes and its consequences	4	4	5	0	5	10
37. My diet is the same as it would be without diabetes	10	3	2	2	1	10
38. Diabetes again and again leads me to problems with other people	0	0	2	0	1	25
39. It bothers me that I have to take my diabetes equipment (e.g. insulin) with me wherever I go	3	6	4	3	2	10
40. I am often worried that I could be helpless and need care later in life	5	0	8	1	4	10
41. I often cannot eat my food	0	2	1	0	4	20
42. Because of diabetes my family life is affected	2	1	1	0	6	18
43. Because of diabetes my physical fitness is restricted	4	0	4	2	6	12
44. Because of diabetes it is much easier to make friends	18	1	3	3	1	2

Page points

1. Of the 20 individuals who completed the DAFNE (Dose Adjustment For Normal Eating) course and attended the outpatient's clinic during the time of data collection, 18 completed the questionnaire.
2. The results show that the DAFNE group had a significantly lower mean HbA_{1c} than the non-DAFNE group ($P<0.05$).
3. The DAFNE group were found to have a higher quality of life than the non-DAFNE group, which may be related to the better glycaemic control of this group.

future. Demographical data were also recorded, including age, gender, ethnic origin, diabetes duration, time since completing DAFNE (if applicable) and self-reported HbA_{1c}.

Ethical approval was gained from the local research ethics committee and the Hospital Trust's research and development department.

Results

Of the 20 individuals who completed the DAFNE course and attended the outpatient's clinic during the time of data collection, 18 completed the questionnaire. The response rate for the non-DAFNE group was considerably lower, with 10 out of a possible 19 people completing the questionnaire.

Table 1 shows the demographic characteristics of the participants, and indicates that although participants were randomly selected, they were not matched due to time constraints. The results show that the DAFNE group had a significantly lower mean HbA_{1c} than the non-DAFNE group ($P<0.05$).

Table 2 shows the mean percentage QOL scores and their significance for the DAFNE and non-DAFNE groups. Results from the study found the DAFNE group to have:

- Significantly higher QOL than the non-DAFNE group ($P<0.01$).
- Significantly higher daily function of work and leisure time than the non-DAFNE group ($P<0.01$).

- Lower dietary restrictions than the non-DAFNE group ($P<0.01$).
- Lower physical complaints than the non-DAFNE group ($P<0.01$).
- Reduced worries about the future than the non-DAFNE group ($P<0.01$).

A significant negative correlation was found in the DAFNE group between HbA_{1c} and overall QOL ($P<0.05$); no such correlation was found in the non-DAFNE group (Figure 1).

Discussion

In this study the DAFNE group were found to have a higher QOL than the non-DAFNE group, which may be related to the better glycaemic control of this group; however, it could be due to other factors, such as illness or personal circumstances unrelated to diabetes. This finding mirrors the findings of a number of other studies examining diabetes education (DeSouza and Nairy, 2003; Tankova et al, 2004; Mannucci et al, 2005).

Daily function of work and leisure time requirements

The DAFNE group reported a statistically significant improved daily function compared with the non-DAFNE group. Some may argue that this is surprising due to DAFNE having more of an impact on a person with type 1 diabetes' daily function, as it involves up to six injections per day as well as more frequent blood tests. However, the authors did not believe it to be surprising as one of them has had personal experience of the DAFNE programme.

Less than 20% of people with type 1 diabetes test their blood glucose daily, mainly due to pain and inconvenience (Burge, 2001). An integral part of the DAFNE programme is regular blood glucose testing, with studies showing this to be a good indicator for improved control (Evans et al, 1999; Burge, 2001). Therefore, with the lower HbA_{1c} levels in the DAFNE group, it could be argued that there appears to be an improved compliance with blood glucose testing.

Regular blood glucose testing has been found to reduce rates of hypoglycaemia (Evans et al, 1999), and Dubé et al (2006) found that

Table 1. Demographic characteristics and HbA _{1c} in groups of people having or not having undertaken the DAFNE course.		
	DAFNE (n=18)	non-DAFNE (n=10)
Male (n [%])	8 (44)	6 (60)
Age (years)	38±10	48±23
Ethnicity: White British	89% (n=16)	100% (n=10)
Other	11% (n=2)	
Diabetes duration (years)	18±10	31±26
Time since DAFNE (years)	2.25±1	NA
HbA _{1c} (%)	8.0±1.1	9.4±1.8

Table 2. Mean percentage quality-of-life (QOL) scores and their significance.

Statement group	DAFNE (n=18)	non-DAFNE (n=10)	Significance
Overall QOL	81±13	45±21	<i>P</i> <0.001
Daily function	84±12	40±29	<i>P</i> <0.001
Dietary restrictions	86±15	34±16	<i>P</i> <0.001
Physical complaints	85±17	54±22	<i>P</i> <0.001
Worries about the future	74±21	36±24	<i>P</i> <0.001

the risk of hypoglycaemia was one of the main reasons preventing people with type 1 diabetes from carrying out daily activities. Individuals undertaking the DAFNE programme are taught to manage their diet and insulin to prevent hypoglycaemia, which should, therefore, improve daily function.

Dietary restrictions

Management of type 1 diabetes hinges primarily on three equally important issues: diet, insulin administration, and exercise. The DAFNE programme advocates dietary freedom, with the motto “Like what you eat – eat what you like”. The authors believe that education alone will not enable dietary freedom, but when education is accompanied with a flexible insulin regimen, dietary freedom can be promoted, thus improving HbA_{1c} and QOL. The present study found that there were significantly fewer dietary restrictions in the DAFNE group, mirroring the findings of the original DAFNE study where participants reported a freedom to eat what and when they liked (DAFNE Study Group, 2002).

Mean age of participants in the DAFNE group in the present study was 38±10 years (oldest person, 59 years). Mean age in the non-DAFNE group was greater at 48±23 years (oldest individual, 81 years). The impact of older age was not taken into account in the DAFNE group, and as older people tend to have less dietary freedom than younger people (Takahashi et al, 2004). This is an area that requires future research – specifically to determine whether a DAFNE programme for older people may be required.

Physical complaints

The results indicate that fewer physical complaints were made by people in the DAFNE group compared with those who had not received DAFNE education. Physical complaints can affect people with type 1 diabetes in all areas of their lives, and often result from short-term complications, such as hypoglycaemia – which limit what a person with the condition can do – or hyperglycaemia, which can increase thirst, tiredness and susceptibility to infection.

As with most of the other issues surrounding QOL, physical complaints are intrinsically

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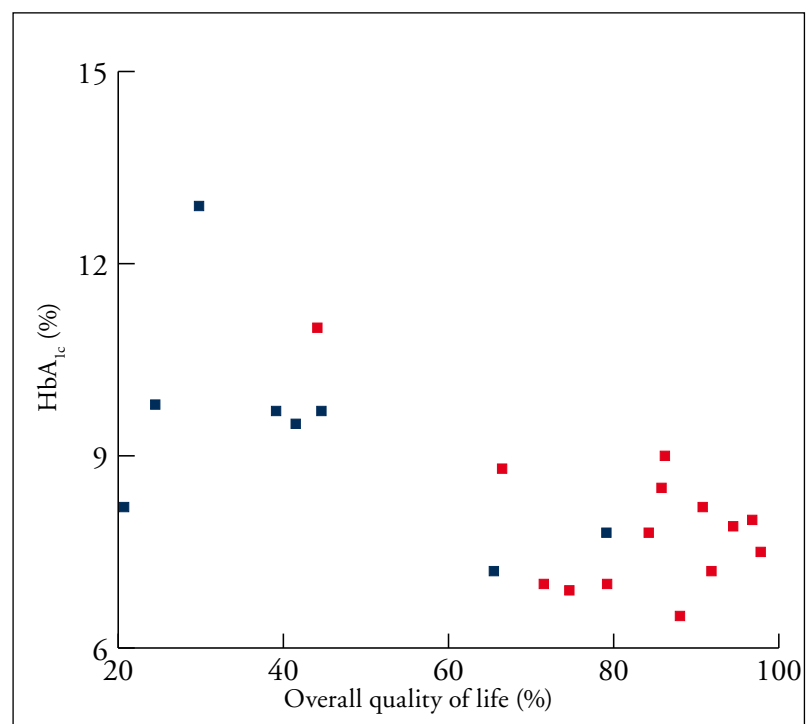


Figure 1. Correlation between quality of life and HbA_{1c} in the DAFNE (red) and non-DAFNE (blue) groups.

Page points

1. With the risk of limb- and life-threatening complications, it is to be expected that people with type 1 diabetes will have worries about the future, particularly regarding micro- and macrovascular complications.
2. An interesting finding was the statistically significant negative correlation between HbA_{1c} and quality of life that was only present in the DAFNE (Dose Adjustment For Normal Eating) group.
3. As more people with type 1 diabetes undertake DAFNE and treat their condition according to the DAFNE principles, healthcare professionals need to become aware of this approach towards the management of type 1 diabetes.

linked to HbA_{1c}. It is, therefore, unsurprising that with a lower HbA_{1c} than the non-DAFNE group, the DAFNE group reported less physical complaints. This change could also be attributed to the non-DAFNE group being older.

Worries about the future

With the risk of limb- and life-threatening complications, it is to be expected that people with type 1 diabetes will have worries about the future, particularly regarding micro- and macrovascular complications.

This study found the DAFNE group worried less about the future than the non-DAFNE group. It is reasonable to suggest that this is due to better glycaemic control in the DAFNE group, as good glycaemic control is linked to fewer complications later in life. Education regarding glycaemia is a cornerstone of the DAFNE programme, specifically regarding the risks of poor control.

DAFNE and HbA_{1c}

The authors found a statistically significant difference in HbA_{1c} between individuals who had completed DAFNE and those who had not. The difference in HbA_{1c} between the control and intervention group appeared to be more prominent in this study than other studies, although this may have been due to other studies having a larger number of participants, taking HbA_{1c} results from medical notes and adopting a longitudinal approach. This study took a cross-sectional approach with the two groups unmatched. Therefore, differences in the motivation of the participants, as well as differences in insulin regimens between the two groups, may have impacted on the results.

HbA_{1c} and QOL

An interesting finding was the statistically significant negative correlation between HbA_{1c} and QOL that was only present in the DAFNE group. Few studies have examined the relationship between HbA_{1c} and QOL. A study conducted by Graue et al (2003) examined the relationship between HbA_{1c} and QOL and found no significant correlation, while Vanelli et al (2003) reported that lower HbA_{1c} was associated with improved QOL.

Only a small number of studies have explored and reported this correlation. The authors hypothesised that a good QOL may well be linked to HbA_{1c}. However, if HbA_{1c} is too low then this could be indicative of increased hypoglycaemia, which could decrease QOL.

Implications

As more people with type 1 diabetes undertake DAFNE and treat their condition according to the DAFNE principles, healthcare professionals need to become aware of this approach towards the management of type 1 diabetes. Frequently, when people with type 1 diabetes are admitted to hospital they receive sub-optimal diabetes care (Bhattacharya et al, 2004). It is an all too common experience that people with type 1 diabetes have their insulin removed from them while they are in hospital, and this, coupled with poor hospital food and stress, results in a loss of glycaemic control. This loss of control can impede recovery, which could prolong the hospital stay (Bhattacharya et al, 2002).

At the authors' institution, however, there is a team of DSNs available to troubleshoot any problems on the wards. The majority are DAFNE trained, and, therefore, are aware of the needs of the person with diabetes. The Trust also employs diabetes link nurses on wards. These are designated nurses who have undertaken further training in diabetes to gain a greater understanding of the condition.

There are also implications for practitioners who prescribe. As DAFNE involves flexible insulin regimens, these need to be taken into account when insulin is prescribed. If an incorrect dose of insulin is prescribed, then this could lead to the patient developing hypoglycaemia or hyperglycaemia, potentially prolonging the hospital stay (Metchick et al, 2002).

Conclusion

This study has found that people who have undergone the DAFNE training have a higher QOL and an improved HbA_{1c} level compared with those who have not. This supports the findings from the original DAFNE study. Other significant findings were that the DAFNE programme had a significant positive impact on

daily function of work and leisure time, dietary restrictions, physical complaints, worries about the future, and an inverse correlation between QOL and HbA_{1c} in the DAFNE group.

The treatment of a chronic condition, such as diabetes, is recognised as being different from the treatment of acute illnesses, and requires a multifaceted process in which the person receiving education is actively participating (Mannucci et al, 2005). In the past, some healthcare professionals have seen it as their responsibility to dictate treatment to people with type 1 diabetes; however, by advocating the concept of empowerment, which DAFNE does, type 1 diabetes can be seen in a bio-psychosocial, rather than in a compliance-orientated, way, in which a partnership exists between the healthcare professional and the individual with type 1 diabetes (Fox and Kilvert, 2003). This partnership promotes the best possible outcomes, while enabling the person with type 1 diabetes to control his or her condition.

In spite of the successes reported here, DAFNE may not be suitable for everyone, as participants need to be motivated for the changes to be effective. With DAFNE courses increasing nationally and internationally, it is important to assess whether the successes of the original study continue in the short-term as well as the long-term. Published research into DAFNE is still lacking into DAFNE, and this study has served to increase and improve the DAFNE-related literature. ■

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