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Impact on weight and glycaemic control in adults with diabetes attending a group- based commercial weight management programme.

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Key points:

Role of ongoing support for people with diabetes can improve glycaemic control with results
seen comparable to treatment with expensive pharmacological agents

Weight management groups can offer this support, and help obese people with diabetes
manage their weight and glycaemic control

Healthcare encouragement increases physical activity levels which may further enhance
weight management and glycaemic control.

Accessible group support external to traditional healthcare models should be considered as
part of diabetes care and education.

Abstract

Healthcare professionals could work in partnership with commercial group weight management programmes (CGWMP) to help people with diabetes lose weight and improve their glycaemic control. The effect of ongoing CGWMP support on diabetes control has not previously been reported. This study evaluates weight loss and glycaemic control in people with diabetes attending a CGWMP.

Method: A cross-sectional online survey posted on a CGWMP's member's website. The survey asked for reported changes in HbA1c and physical activity and demographics including age, type of diabetes, medications taken and healthcare professional support. The dataset was linked to electronically reported weight and attendances. Data was statistically analyzed to assess percentage of individuals meeting targets for weight reduction and HbA1c and outcome changes with variation between genders, type of diabetes and support.

Results: 620 respondents with mean weight loss of $10.0 \pm 8.0\%$; 157 reported a mean reduction in HbA1c of $18 \pm 21 \text{ mmol/mol}$ ($1.6 \pm 1.9\%$). 58.2% lost $>10\%$ body weight after 24 weeks and 51.5% had achieved HbA1c of $<48 \text{ mmol/l}$ (6.5%). Those with type 2 ($n=547$) had greater reduction in HbA1c ($p=0.034$) but not weight ($p=0.317$) compared to type 1 diabetes ($n=73$). An increase in physical activity was associated with advice from a healthcare professional ($p<0.001$) with increases in PA not associated with lower HbA1c ($p=0.654$). A $>5\%$ weight reduction was associated with diabetes medication reduction ($p=0.028$) and improved glycaemic control ($p=0.001$).

Conclusion: Support provided by the CGWMP resulted in clinically significant weight losses and improvements in HbA1c with reductions in diabetes medication. Attendance at CGWMPs may be an effective long-term strategy and a scalable option to help improve diabetes control.

Introduction

Sustainable, scalable and cost effective approaches reducing chronic health risks associated with diabetes and obesity are required. Group education, emphasising self-management and maintenance of weight loss, is an accepted approach (NICE, 2015). Currently most UK diabetes and weight management education is short-term with local variation but diabetes is a lifelong condition and people are likely to benefit from access to on-going support. There are few ongoing group based programmes for people with diabetes, which are scalable, with evidence of long-term effectiveness (Brown et al, 2015).

Commercial group weight management programme (CGWMP) provider organisations are well placed to work in partnership with healthcare professionals to help people with diabetes lose weight and improve their glycaemic control. However, the effect of ongoing membership of a CGWMP on diabetes control has not previously been described.

This study evaluates the electronically reported weight changes in a subgroup of people with diabetes (both T1DM and T2DM) attending a CGWMP. The self-reported changes in glycaemic control (HbA1c) were compared against current clinical standards set by NICE (2015). Changes in levels of physical activity and diabetes medication were investigated.

Materials and Methods

A combination of a cross-sectional online survey, posted on the members' only section of Slimming World's website between 21st July and 9th August 2013, and data collected through the CGWMP provider's electronic weight record system were linked and analysed. The survey consisted of questions exploring type of diabetes, duration of diabetes, and glycaemic control with reported HbA1c at the time of joining and current values. In addition demographics including age and gender were requested alongside self-reported changes in physical activity levels, information about changes in medications taken to improve glycaemic control and support received from healthcare professionals.

The survey was designed specifically for this study, with the intention of being easy to complete and in language with which the participants attending the programme were familiar. The questionnaire was constructed and administered using Checkbox v4.4-Web Survey Software (Prezza Technologies, Inc, Watertown, MA, USA). Electronically recorded

attendance and weight data (Seca scales, Birmingham, UK; calibrated to the nearest 200g) were collected and used to report weight changes over time.

Data were analysed using SPSS 22.0 (IBM, New York, NY, USA). Normality of continuous variables was assessed using the Kolmogorov–Smirnov test and appropriate parametric and nonparametric statistics were then used to describe the sample. Chi-squared and Kruskal-Wallis tests were used to investigate the relationship between variables. Data was analysed on a per protocol basis. An ANOVA was undertaken to assess the effect of length of membership on weight loss, post-hoc analysis was undertaken using a Bonferroni correction. A p-value of <0.05 was taken as significance.

Ethical permission to undertake the analysis was obtained from the University of Nottingham's research ethics committee (School of Biosciences ref SB1516/15).

Results

A total of 620 members responded to the questionnaire. Table 1 shows the baseline characteristics. Responding members had a median length of membership of 6.0 months at point of survey (Range 0-24 months; IQR 11.0 months; mean value 12 ± 9.8 months).

Respondents to the survey were 88% (n=546) female and 88% (n=547) reported having T2DM. On joining the CGWMP, there were differences between genders and those with T1DM and T2DM (Table 1). Members with T1DM were significantly younger, lighter with a lower Body Mass Index (BMI) and had a longer duration of diabetes ($p < 0.001$). There were no significant differences in glycaemic control between genders ($p = 0.329$), type of diabetes ($p = 0.501$) or BMI ($p = 0.992$). For all members who attended for 12-24 weeks (n=236) a mean weight loss of 12.2 ± 7.0 kg was achieved. Members who attended for between 24-52 weeks (n=72) had a mean weight loss of 13.9 ± 7.0 kg and those attending for more than a year lost 15.4 ± 15.6 kg (n=99) (Tables 2 & 3).

72.5% of survey respondents lost more than 5% of body weight in 12 weeks, with 24.4 % losing more than 10% of their initial body weight. At 24 weeks 58.2% of respondents had lost greater than 10% of their initial body weight. Of the 93 respondents who had been a member for at least 52 weeks, a similar percentage, 40% of those with T1DM and 61% with T2DM, had lost at least 10% of their body weight (Figure 2b). Those who achieved $>5\%$ weight

reduction were more likely to have their diabetes medication reduced ($p=0.028$) and improved glycaemic control ($p=0.001$).

157 (28%) respondents reported changes in HbA1c levels. There were no significant differences in HbA1c between those with T1DM and those with T2DM at baseline (Table 1) ($p=0.501$). The numbers reporting an HbA1c of <48 mmol/mol (6.5%) increased from 16.4% ($n=177$) at joining to 51.5% ($n=161$) at the time of the survey (figures 1 and 2a and b). Members with T1DM reported a smaller reduction in HbA1c compared to members with T2DM ($p=0.034$). For respondents with T2DM, less weight was lost if treated with insulin (2.4kg, $p<0.05$). Despite a difference in weight loss, there were no differences between reductions in HbA1c (18 ± 21 mmol/mol ($1.6\pm 1.9\%$)) for those managed with insulin, compared to 19 ± 21 mmol/mol ($1.7\pm 1.9\%$) for those not managed with insulin, $p=0.758$). Members reporting the use of any diabetes medications lost significantly less weight, mean difference of weight loss 4.4kg ($p<0.001$, -13.9 ± 11.8 versus -9.5 ± 8.6 kg), however there were no differences with respect to improvement in HbA1c (-19 ± 22 ($-1.7\pm 2.0\%$)) compared to -16 ± 14 mmol/mol ($1.5\pm 1.9\%$)).

Respondents who reported reducing their diabetes related medication reported a significantly greater reduction in HbA1c 24 ± 22 mmol/mol ($2.2\pm 2.0\%$, $n=83$) compared to those who had not 13 ± 18 mmol/mol ($1.2\pm 1.6\%$, $n=73$, $p=0.001$). When this was considered in terms of type of medication reduced there was no significant association with any type of medication ($p=0.073$). Respondents who reported reducing their diabetes medication lost a significantly greater percentage of their starting bodyweight, $-10.9\pm 7.2\%$ ($n=74$) compared to $-8.2\pm 7.9\%$ ($n=74$) for those who did not decrease their medication ($p=0.028$). The type of medication reduced did not affect the amount of weight loss ($p=0.0249$).

Reported change in physical activity was examined as a potential confounding variable, with 72.3% ($n=448$) of respondents reporting an increase in physical activity. Members who reported an increase in physical activity did not lose significantly more weight (11.9 ± 10.5 kg for those reporting increased physical activity compared with 8.5 ± 8.2 kg; $p=0.094$). Reporting an increase in physical activity was associated with being advised to lose weight by a healthcare professional ($p<0.001$), with those with T2DM being more likely to report an increase in physical activity than those with T1DM ($p=0.001$). Change in medication dose and decreases

in insulin were not associated with an increase in physical activity ($p=0.272$). Reported increases in physical activity was not associated with an improved HbA1c ($p=0.654$).

Duration of membership, significantly increased weight loss ($p<0.001$) if greater than 12 weeks, and the loss was maintained for at least one year, but the effect of duration of membership on HbA1c was not significant ($p=0.126$).

Discussion

Slimming World (SW) is the largest CGWMP in the UK, currently running 16,000 group sessions each week, reaching 800,000 members weekly. It is estimated that approximately 10% of this number may have diabetes. Groups are located in a variety of local community venues throughout the UK across a range of days and times, making the groups easily accessible. The group facilitators are supported by regularly updated resources and dietitians based at Head office.

The majority of respondents had T2DM and with a starting BMI of over 39kg/m^2 . This pragmatic evaluation, using an on-line survey, reports significant weight loss and improvements in glycaemic control, as measured by self-reported changes in HbA1c levels, in people with both T1 and T2DM attending the CGWMP. Reductions in weight and improved glycaemic control were associated with reduced need for diabetes medication. Although a self-selecting sample, with a current median membership of 6 months, this study provides evidence that long term management can improve the key markers of weight and HbA1c whilst reducing medication requirements. Although length of membership does not increase reductions in HbA1c, it supports the suggestion that improvements in glycaemic control are maintained. This is concordant with the findings of Trento and colleagues (2010) that diabetes is not necessarily, with good self-management, a progressive condition.

Currently in the UK only Orlistat is licensed for weight management and although caution needs to be taken in comparing this evaluation with a randomized controlled trial, 72.5% of respondents lost at least 5% of body weight at 12 weeks which increased to 81.3% at 24 weeks. This compares to 51.3% at 1 year for Orlistat (compared to 31.6% for placebo) in a population with T2DM (Hanefield & Sachse, 2002).

The respondents reported a mean decrease in HbA1c of 18mmol/mol (1.6%), which is comparable to the 22mmol/mol (2.0%) reported in the DCCT study (1993) for T1DM and almost double that reported in the UKPDS study (1998), associated with a 50% reduction in microvascular complications in T1DM⁵ and 10% reduction in diabetes related deaths in T2DM⁶. In addition, this level of reduction exceeds that reported for emerging therapies for diabetes management including the sodium-glucose cotransport 2 inhibitors, (Kadowaki et al, 2014), DPP-4 inhibitors, (Moses et al, 2014), and incretin mimetics and analogues, (Moretto et al, 2008).

There are few ongoing group NHS based programmes for obese people with diabetes, which are scalable, with evidence of long-term effectiveness. The data reported in this study can be compared with data from the subset of 142 patients with diabetes who completed the SLiM 6-month programme facilitated by trained dietetic assistants. The mean weight loss reported for the SLiM programme was 5.7 ± 6.9 kg ($p=0.001$) with 30% of patients with diabetes achieving $\geq 5\%$ and 11% achieving $\geq 10\%$ weight loss over the 6 months, with those who lost weight achieving a mean weight loss of $4.0 \pm 4.6\%$. A mean reduction in HbA1c of 4.0 ± 14.8 mmol/l was reported, representing a change from 64.0 ± 18.2 mmol/l at base-line to 60.1 ± 15.5 mmol/l at the end of the programme (Brown et al, 2015).

Comparing data suggests that membership of weight management groups can provide valuable long term support for people with diabetes wishing to lose weight and improve their health. It should be recognized that improvements in health might not be entirely dependent on weight loss but might also be related to associated changes in dietary behaviours, not reported here, or increased physical activity levels. The group and peer support may also contribute to the weight loss maintenance reported and is an area requiring further exploration (MacLean et al, 2015). The findings may be of relevance to the quest to find scalable solutions to reduce HbA1c levels in people presenting with prediabetes. A CGBWMP offers a non-clinical support option, and as diabetes is a long-term condition requiring self-management, this in itself might explain some of its benefits and value. Diabetes UK (2015) have suggested that people with diabetes only spend a maximum of three hours a year with their healthcare team meaning that other sources of ongoing support, such as weight management group membership could support improved self-management.

Future work should look to enhance partnership working between CGWMPs and diabetes teams (either in primary or secondary care) to better support people with diabetes. Adjusting medication is important not only to reduce risks associated with hypoglycaemia, but also to facilitate weight loss. Hypoglycaemia and over treatment with insulin and sulphonylureas have been associated with weight gain, linked to the need to consume additional food energy as carbohydrate to treat hypoglycaemia (DCCT, 2001). It is clear that both people with T1DM and T2DM can benefit from membership of a weight management programme, and more research needs to be undertaken on the best way of monitoring and reducing the potential risks including hypoglycaemia. Effective teamwork between the person with diabetes, their diabetes care team and the weight management organisation is vital to optimize safe and desired outcomes.

Limitations

This cross sectional survey represents a fluid sample of around 1% of the total number of people with diabetes attending SW groups. All were still attending the groups having been members for variable lengths of time. Thus, the results may not reflect the overall impact of the intervention.

The use of self-reported retrospective information, apart from weight and attendance, is a potential limiting factor. The overall nature of self-reported studies of this type; means that the data may represent a self-selection bias, in that those who chose to participate may be those who achieve better outcomes in terms of weight and improvement in glycaemic control and therefore may be more likely to respond positively to survey requests. Although this is possible it is considered that online surveys are no more prone to this than paper based surveys (Weigold et al, 2013). Therefore, a main limitation is the self-reported HbA1c which unlike the weight data could not be verified in this study, and should be an area of focus for future work.

Adverse event reporting, especially the incidence of hypoglycaemia related to changes in dietary patterns and doses of insulin and sulphonylureas was not reported within the scope of this study.

Although there are a number of methodological limitations to consider, the results suggest that attending a CGWMP is beneficial to people with diabetes. Although weight loss is known to improve HbA1c and reduce medication usage, it is also significant that these are not necessarily interdependent, and improved lifestyle behaviours associated with group attendance may

explain the observations seen. This observation has been supported by other lifestyle interventions in groups with diabetes³ and warrants further investigation.

Conclusion

People with both T1DM and T2DM, who attend a CGWMP can achieve clinically significant weight loss and glycaemic control as measured by changes in HbA1c levels. Improvements in physical activity levels and decreases in diabetes medication can also be achieved. The data supports the role of healthcare professionals encouraging the person with diabetes to lose weight, with these individuals apparently experiencing better glycaemic control, and this partnership approach warrants further emphasis and exploration. Whilst it is important for prospective research to fully assess the role of CGWMPs in supporting the self-management of people with diabetes. The mean length of attendance suggests that CGWMPs may offer long-term support to both long-term conditions (diabetes and obesity) and given the infrastructure of these organisations, this may offer a scalable solution to the associated public health burden.

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Figure legends;

Figure 1: Percentage of survey respondents achieving the NICE target for HbA1c

Figure 2a) and b): Percentage of survey respondents achieving the NICE target for pharmacological weight loss interventions of 5% and 10% of initial body weight.

Table 1: Baseline demographics of the respondents to the survey. Data presented as means \pm standard deviations, all data was found to be normally distributed (Kolmogorov-Smirnov $p>0.05$) and p values are for unpaired t-tests, significance taken at $p<0.05$ level.

	All Members	Members with T2DM	Members with T1DM	P value T2DM vs T1DM
Total respondents	620	547	73	-
Age	51.1 \pm 12.5	52.7 \pm 11.7	38.0 \pm 11.9	<0.001
Gender (n) Total/Female/Male	620/546/74	547/477/70	73/69/4	-
Gender (%) Female/Male	88/12	87/13	95/5	-
Duration diabetes (months)	(n=619) 101.4 \pm 100.0	(n=546) 81.9 \pm 69.6	(n=73) 246.1 \pm 156.9	<0.001
Recorded Body Mass Index (kg/m ²) at joining	(n=419) 38.7 \pm 7.5	(n=373) 39.3 \pm 7.3	(n=46) 33.6 \pm 7.1	<0.001
Self-reported HbA1c at joining (mmol/mol) (%)	(n=177) 68 \pm 21 8.4 \pm 1.9	(n=138) 67 \pm 22 8.3 \pm 2.0	(n=39) 8.5 \pm 1.6	0.50

Table 2: Recorded data at point of survey along with changes in weight and glycaemic control. Data presented as means +/- standard deviations, all data was found to be normally distributed (Kolmogorov-Smirnov $p > 0.05$) and p values are for unpaired t-tests, significance taken at $p < 0.05$ level. As survey was open over a two week period, the average weight for members over this period was used.

	All Members	Members with T2DM	Members with T1DM	P value T2DM vs T1DM	Females Members	Male Members	P value Female vs Male
Percentage weight loss (%)	-10.0±8.0	-9.9±8.0	-11.2±8.0	0.32	-9.7±7.8	-12.0±8.9	0.06
Self-reported HbA1c at time of survey (mmol/mol)	(n=161) 50±16	(n=128) 47±15	(n=33) 60±16	<0.001	(n=143) 50.2±15.3	(n=18) 47.9±21.1	0.58
Self-reported change in HbA1c joining to survey (mmol/mol) (%)	(n=157) -18±21 -1.6±1.9	(n=123) -20±22 1.8±2.0	(n=34) -12±16 1.1±1.5	0.034	(n=141) -18±20 -1.6±1.8	(n=16) -24±25 -2.2±2.3	0.21

Table 3: Recorded weight loss and reported change in HbA1c according to length of membership at the time of survey. Data presented as means +/- standard deviations, all data was found to be normally distributed (Kolmogorov-Smirnov $p>0.05$) and p values are for ANOVA post-hoc test with Bonferroni correction, following $p<0.05$ ANOVA result as indicated. Significance taken at $p<0.05$ level. As survey was open over a two week period, the average weight for members over this period was used.

	Total	< 12 weeks membership	12-24 weeks membership	24-52 weeks membership	> 52 weeks membership	p-value ANOVA	Post-Hoc
Recorded weight change (kg)	(n=393) -11.0±10.0	(n=156) -6.5±4.4	(n=65) -12.2±7.0	(n=72) -13.9±7.0	(n=99) -15.4±15.6	<0.001	Less than 12 weeks vs other groups ($p<0.001$) No significant differences for duration of membership greater than 12 weeks
Self-reported change in HbA1c (mmol/mol) (%)	(n=156) -18 ±21 -1.6±1.9	(n=51) -18±20 -1.6±1.8	(n=24) -26±26 -2.4±2.4	(n=38) -13±23 -1.2±2.1	(n=43) -20±16 -1.8±1.5	0.126	Not Applicable

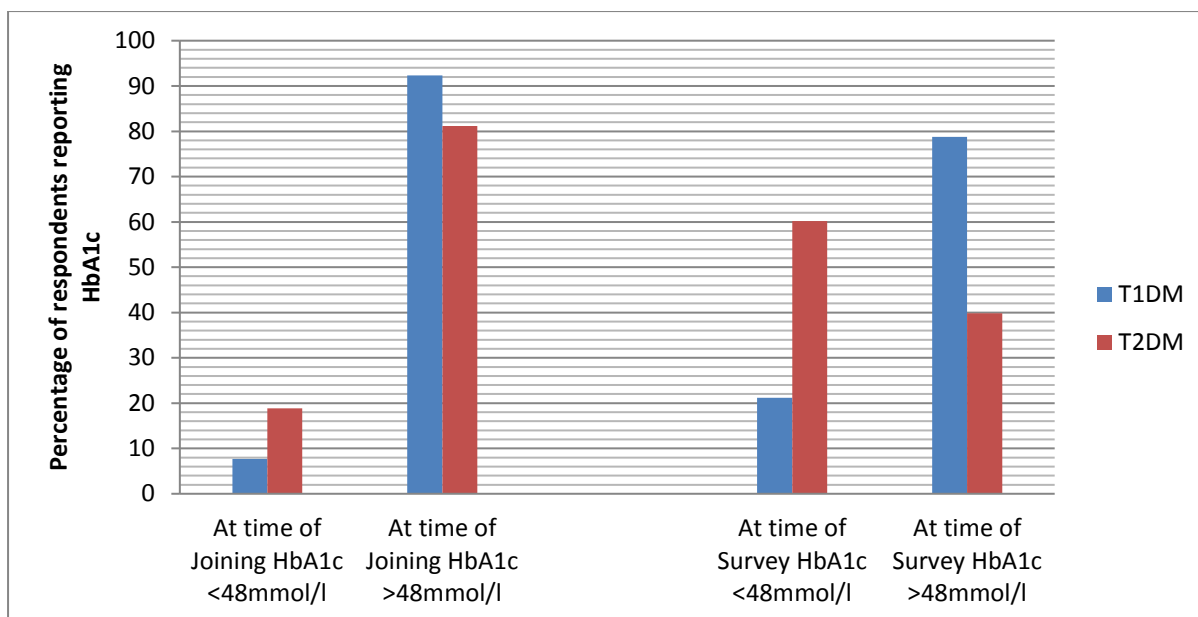
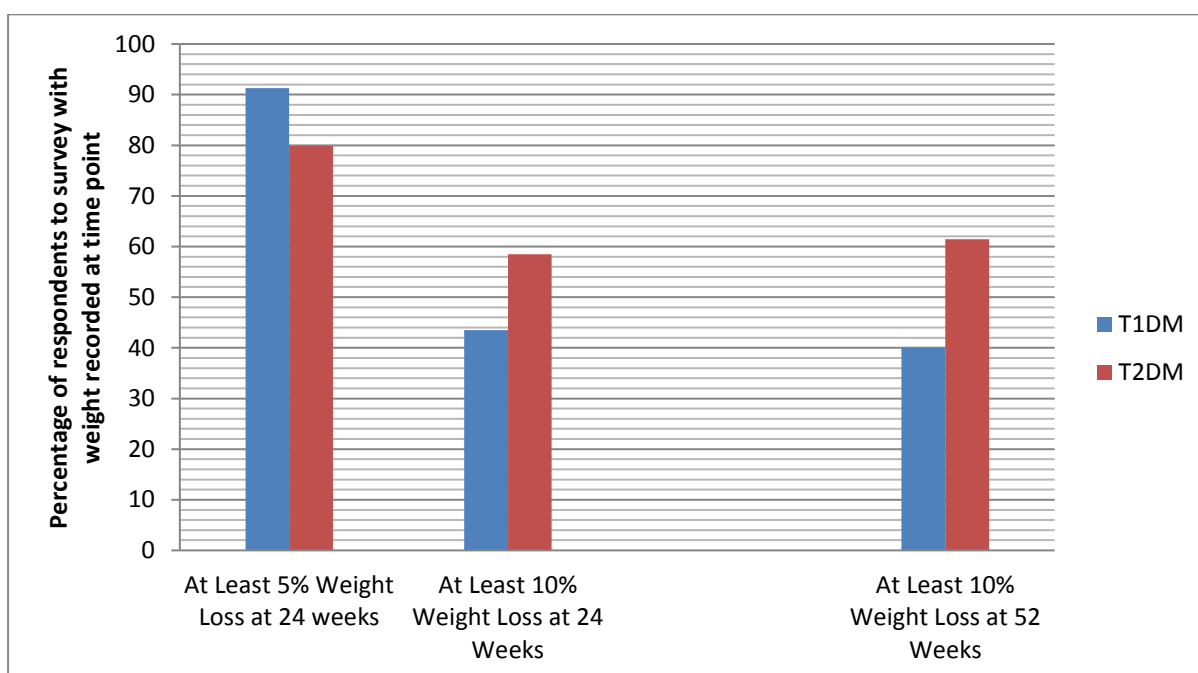
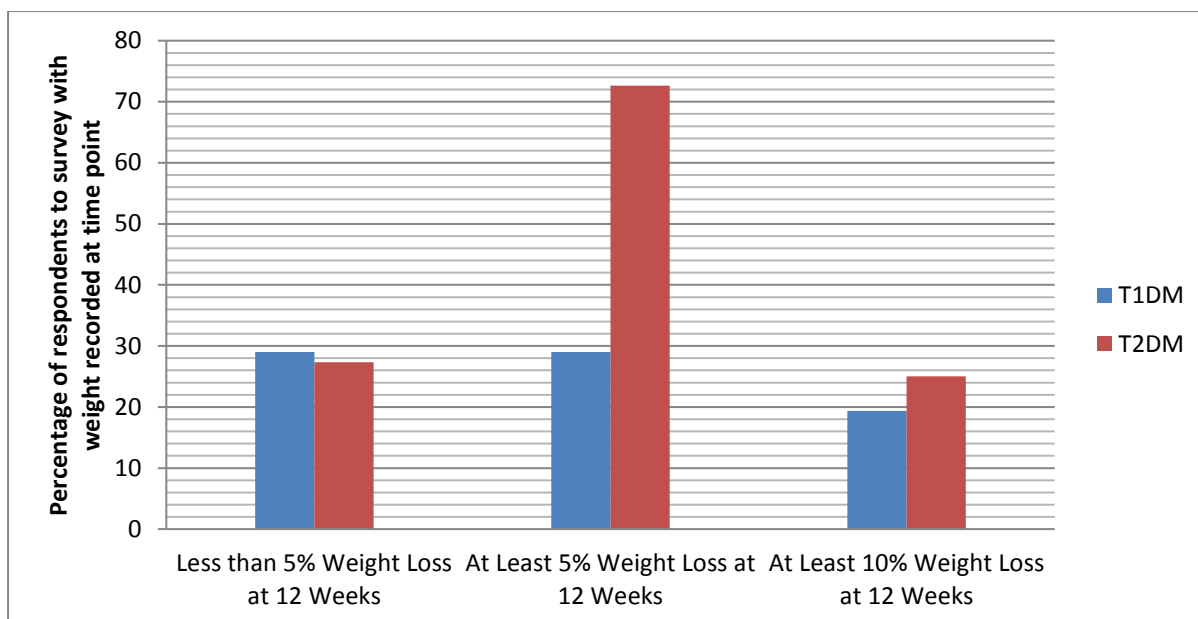


Figure 1: Percentage of survey respondents achieving the NICE target for HbA1c(<48mmol/l or <6.5%) . As data is cross-sectional, it is not possible to adjust for attendance; median attendance was 6 months. n=138 for respondents with T2DM and 39 for respondents with T1DM reporting a HbA1c at time of joining, and n=128 for respondents with T2DM and 33 for respondents with T1DM at the time of survey reported a HbA1c.



Figures 2a and 2b