Physical activity – how much is needed to optimise glycaemic control?

This systematic review and meta-analysis of 126 randomised controlled trials, published in *Diabetes Care*, identified that the weekly dose of physical activity required to optimise glucose-lowering in people with type 2 diabetes is 1100 Metabolic Equivalents of Task (MET)-minutes per week, and this remained consistent across a wide range of baseline HbA_{1c} values. This is the equivalent of 36 minutes per day of moderate-paced walking, 244 minutes of moderate-intensity aerobic activity per week or 318 minutes of moderate strength training per week. Multicomponent activity (a mix of strength and aerobic activity), strength training and brisk walking were the most effective activities. Achieving the optimal weekly MET dose had greater effects in those with higher HbA_{1c} at baseline, including up to a 1.02% reduction in those with an initial HbA_{1c} >64 mmol/mol, and there was even a statistically significant 0.24–0.38% HbA_{1c} reduction in those with prediabetes (HbA_{1c} <48 mmol/mol) at baseline. These findings suggest that people with diabetes may need more physical activity than in the current generic recommendations of 150–300 minutes per week of moderate-intensity activity or 75–150 minutes per week of vigorous activity. Since we know that many do not achieve current recommendations consistently, helping people undertake these doses of physical activity is likely to need support from a multidisciplinary team, including exercise professionals and coaches, as well as from family and friends.

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Optimising glycaemic control is important to reduce risks of diabetes complications and mortality, and to improve wellbeing. In the UKPDS (UK Prospective Diabetes Study), a 1.0% HbA_{1c} reduction was associated with a 37% reduction in microvascular complications and a 21% reduction in diabetes-related death (Stratton et al, 2000). The ADA and EASD *Consensus Report on the Management of hyperglycaemia in Type 2 diabetes 2022* highlights the importance of physical activity, providing guidance on Stepping, breaking up prolonged Sitting, Sweating and Strengthening, as well as optimising Sleep (Davies et al, 2022). The report recommends at least 150 minutes of moderate to vigorous activity or 75 minutes of vigorous activity per week spread over 3 days, with no more than two consecutive days of inactivity. In addition, strength, flexibility and balance training are recommended two to three times a week (see Brown, 2022). The report also summarises the expected impact of the different types of physical activity on glucose, HbA_{1c}, lipids, physical function, depression and quality of life. However, the optimal dose and type of physical activity to maximise impact on glycaemia remains unknown.

In this systematic review and meta-analysis published in *Diabetes Care*, Gallardo-Gómez and colleagues examined the dose–response relationship between physical activity and HbA_{1c} using data from 126 studies, mainly in the US and UK, involving a pooled 6718 participants with type 2 diabetes. Baseline HbA_{1c} was used to allocate participants into four groups, as defined by the American Diabetes Association (2014):

- Prediabetes (<48 mmol/mol).
- "Controlled" type 2 diabetes (48 to <53 mmol/mol).
- "Uncontrolled" type 2 diabetes (53–64 mmol/mol).
- "Severely uncontrolled" type 2 diabetes (>65 mmol/mol).

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Table 1. Physical activity types and amounts required for optimal glycaemic benefits (Zhang and Yang, 2024).

Activity	Weekly amount
Moderate-intensity aerobic physical activity	244 min/week
Vigorous-intensity aerobic physical activity	157 min/week
Moderate-intensity multicomponent activity (aerobic and strength combined)	314 min/week
Vigorous-intensity multicomponent activity	138 min/week
Moderate-intensity strength training	314 min/week
Vigorous-intensity strength training	183 min/week
Moderate-paced brisk walking	256 min/week
Vigorous-paced brisk walking	157 min/week

Table 2. Examples of physical activities and their associated metabolic equivalents of task (METs).

Activity	METs/minute	Category
Resting	1.0	Reference
Sitting at desk, writing	1.5	Light
Slow walking	2.0	Light
Walking 3 mph	3.0	Moderate
Sweeping floors and hoovering carpets	3.0–3.5	Moderate
Cycling on flat	6.0	Vigorous
Swimming moderate to hard	8.0–11.0	Vigorous
Jogging (9 km/h, 11 km/h)	8.8, 11.2	Vigorous

Data taken from the Compendium of Physical Activities website.

Since 2017, there has been a move away from using stigmatising language in diabetes care (Dickinson et al, 2017), and terms such as "controlled" and "uncontrolled" glycaemia are no longer appropriate, so we can instead use the participants' baseline HbA_{1c} value alone to identify their group for the analyses.

Results

The optimal dose of physical activity identified to optimise HbA_{1c} was 1100 Metabolic Equivalents of Task (MET)-minutes per week, and interestingly, this was the same irrespective of baseline HbA_{1c}. The authors used the Compendium of Physical Activities to translate this activity dose into minutes per week of specific activities, such as just over 36 minutes of moderate-paced brisk walking daily (see *Table 1* for other equivalents).

This is more than both the ADA/EASD recommendations and the 150 minutes of moderate activity and 75 minutes of vigorous activity recommended for adults without diabetes in the UK (Davies et al, 2019). In this study, multicomponent (strength and aerobic activity combined), strength training and brisk walking were the most effective activities.

As expected, achieving the optimal weekly MET dose had the greatest impact in the group with baseline HbA_{1c} >64 mmol/mol, achieving HbA_{1c} reductions of 0.66–1.02%. Significant reductions were also achieved in the other groups:

- 0.49–0.64% in those with baseline HbA_{1c} 53–64 mmol/mol.
- 0.40–0.47% in those with baseline HbA_{1c} 48–53 mmol/mol – roughly similar to adding a DPP-4 inhibitor to treatment.
- 0.24–0.38% in those with prediabetes (baseline HbA_{1c} <48 mmol/mol) – enough to reduce risk of progression to type 2 diabetes.

The study also identified the minimal doses of physical activity required to move between different HbA_{1c} groups according to baseline HbA_{1c}. The minimal physical activity dose range required to improve by one glycaemic category was calculated to be as low as the following:

- 150–810 MET-minutes per week for people to move from a baseline HbA_{1c} of 65 or 70 mmol/mol, respectively, to 53–64 mmol/mol.
- 330–990 MET-minutes per week to move from HbA_{1c} 54 or 58 mmol/mol, respectively, to 48–53 mmol/mol.
- 570–900 MET-minutes per week to move from HbA_{1c} 49 or 51 mmol/mol, respectively, to prediabetes.

Discussion

A MET, or "metabolic equivalent of task", is a measure of the oxygen uptake for a given activity compared to resting oxygen consumption, with resting consumption designated as 1 MET. Some examples of activities and their MET values are shown in *Table 2*. Most of us are unfamiliar with discussing activity by MET values, so the translation of these findings to hours of weekly activity provided in the associated comment piece (Zhang and Yang, 2024) and taken from the supplementary material to the full paper is useful.

To help people understand the intensity of an activity, we can explain that during light activities they should be able to both talk and sing; when pursuing moderately vigorous activities, they would be able to talk but not sing; and during vigorous activity – which may need clinician assessment beforehand (see *Box 1*) – it is hard to talk in sentences.

In their associated comment, Zhang and Yang recognise the individualised and more specific and user-friendly types of physical activity examined in this review compared to previous studies, and how this may improve real-world implementation.

Some limitations to this study were identified. Although the optimal dose of physical activity is now clearer, the duration over which these activity levels need to be maintained to achieve HbA_{1c} changes remains unclear, since the included studies varied in length and design. Furthermore, although a J-shaped curve of HbA_{1c} versus activity was identified, this was not a symmetrical J shape and may have been limited by lack of data on individuals with very high activity levels; further randomised controlled trials with varying levels of activity intensity are recommended. Trials involving people with severe health conditions, such as mental health problems, were excluded from the analysis and, therefore, these findings cannot be extrapolated to all people with type 2 diabetes.

Implications for practice

Helping people with diabetes make lifestyle changes to improve glycaemia, cardiovascular risk and general health is an important role for healthcare professionals. This study provides us with the data to help people with type 2 diabetes quantify the activity needed to achieve the greatest impact on their HbA_{1c}. Rather than offer generic recommendations, we can now encourage people to tailor their weekly activity plan to optimise personal glycaemic impact.

However, the types of activity encouraged must take into account any individual diabetes complications or comorbidities. Professor Tom Yates offers a how-to guide on this, as well as providing a ready-made, self-administered walking programme we can share with people with diabetes.

These analyses suggest that people with diabetes may need more physical activity than previously recommended to optimise its glycaemic impact. Since we know that many do not achieve current recommendations consistently, helping people undertake these doses of physical activity is likely to need support from a multidisciplinary team, including exercise professionals and coaches, as well as from family and friends. ■

Box 1. Contraindications to vigorous physical activity.

A recent update to the American Heart Association's Scientific Statement on resistance exercise training in individuals with and without cardiovascular disease has just been published (Paluch et al, 2024). Although this confirms the benefits and safety of resistance exercise in those with and without cardiovascular disease, it lists diabetes, controlled hypertension, history of stroke, and implanted defibrillators or pacemakers as relative contraindications, and recommends that such individuals consult a physician before undertaking resistance training.

The guidance reminds us that absolute contraindications need to be shared with people, and these include:

- Uncontrolled hypertension.
- Unstable coronary heart disease.
- Any form of carditis.
- Atrial or ventricular arrhythmias.
- Severe or symptomatic aortic stenosis.
- Decompensated heart failure.
- Severe pulmonary stenosis.
- Aortic dissection.
- Marfan syndrome.

High-intensity resistance training and some aerobic activities are contraindicated in people with active proliferative retinopathy or moderate or worse non-proliferative diabetic retinopathy.

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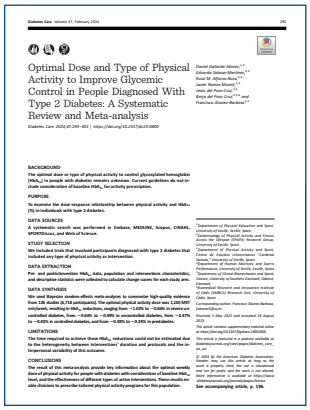
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