

## Effects of Activities that Calm the Mental State on Caregiver HbA1c Levels

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### Abstract

**Background:** Caregivers have a significantly higher incidence of cardiovascular disease compared to non-caregivers. While stress is an important risk factor for impaired glycemic control, no study has examined variations in HbA1c levels in caregivers. This study aimed to examine whether performing acts that calm the mental state of caregivers improve their HbA1c levels.

**Method:** Subjects of this study were elderly caregivers. Subjects were assigned to either an intervention group or control group. The intervention group was asked to perform calming activities at home in addition to their normal caregiving routine. The control group continued with their normal caregiving routine. HbA1c levels were compared between the two groups at the beginning of the intervention (baseline) and 24 weeks later.

**Result:** HbA1c did not significantly improve in the intervention group at 24 weeks. However, the control group had significantly higher HbA1c levels than the intervention group at 24 weeks. Caregiver weight and BMI did not significantly differ between the two groups. Although the intervention group had fewer subjects with increased HbA1c levels than the control group, the difference was not significant.

**Discussion:** Several reasons may explain the lack of improvement in HbA1c levels in the intervention group, such as HbA1c staying within the reference range without fluctuating significantly, subjects being older adults and thus not very active, and subjects not undergoing any restrictions in diet or activities during the intervention. The fewer number of subjects with increased HbA1c in the intervention group suggests that the impact of the intervention on the mental state of caregivers may have prevented the worsening of HbA1c levels.

**Conclusion:** Stress relief may prevent the worsening of caregiver HbA1c levels. Future intervention studies that examine other methods to alleviate caregiver stress and improve health are warranted.

**Keywords:** Caregiver, stress, HbA1c, calming activities

### Introduction

Caregivers have a significantly higher incidence of cardiovascular disease compared to non-caregivers [1]. Caregivers are also at higher risk for hypertension and have reduced renal function [2]. The risk of

stroke is 23% higher when caregiver burden is high [3]. Underlying these effects is the higher likelihood that, compared to non-caregivers, caregivers experience multiple daily stressors, which are associated with higher IL-6 and CRP levels [4]. Furthermore, the challenging behavior of

dementia patients has been shown to mildly increase the blood coagulation capacity of their caregivers[5].

Risk factors for caregiver burden include being female and living with a person requiring care. Psychosocial interventions for caregivers include support groups and psycho-education. Many studies have reported improvements in mood symptoms of caregivers, even when improvements in caregiver burden were minimal [6]. Professionals support family caregivers with skill workshops to provide complex care that reduces a caregiver's sense of caregiving burden [7]. Reducing caregiver burden can improve the quality of life of both caregivers and their care recipients, and possibly delay institutionalization of the elderly [8].

Fluctuations in HbA1c levels have been reported to increase the risk of cardiovascular disease in patients with type 2 diabetes [9]. Stress has been shown to be a potentially important risk factor for impaired glycemic control [10]. However, no study has focused on variations in HbA1c levels in caregivers. We hypothesized that reducing caregiver stress will prevent the worsening of HbA1c levels in caregivers.

The purpose of this study was to examine whether HbA1c levels in caregivers improve when they perform activities that calm their mental state.

## Methods

### Subjects

Subjects were elderly caregivers providing care at home.

### Research Design

Subjects were assigned to an intervention group or control group. The intervention group engaged in calming activities at home while continuing their normal caregiving routine. The subjects themselves chose the activity that was calming to their mental state. The control group conducted their normal caregiving routine. The intervention and control groups were compared at baseline and 24 weeks later.

### Caregiver Assessments

HbA1c was used as an indicator of caregiver health status. HbA1c fluctuates and reflects average blood glucose levels

over the past 1-2 months, with high values being indicative of diabetes [11]. Higher HbA1c levels are strongly associated with chronic kidney disease and cardiovascular disease [12]. The reference value for HbA1c is 4.6-6.2%.

### Statistical Analysis

The Mann Whitney U test was used for group comparisons at baseline. The Wilcoxon signed rank test was used for group comparisons after the intervention.

### Ethical Consideration

This study was approved by the Bioethics Review Committee of Nagoya University Hospital. Written informed consent was obtained from all subjects.

## Results

Median HbA1c levels in the intervention and control groups were 5.2 and 5.1, respectively, and median BMI values were 23.4 and 22.4, respectively, at baseline with no significant differences in assessed parameters between the two groups (Table 1).

Post-intervention changes in the intervention group are shown in Table 2. HbA1c levels did not significantly improve after the intervention. Caregiver weight and BMI after the intervention also did not significantly differ from those at baseline. A comparison of rank sum of ranks after the intervention showed that the sums of positive, negative, and equal ranks were almost identical for HbA1c, weight, and BMI (Table 3).

Post-intervention changes in the control group are shown in Table 4. HbA1c levels were significantly higher in caregivers after the intervention, with more positive ranks than negative ranks for HbA1c. Caregiver weight and BMI after the intervention did not significantly differ from those at baseline. A comparison of rank sum of ranks after the intervention (Table 5) showed 13 positive ranks and 8 negative ranks + tied ranks for HbA1c, and an almost identical sum of positive and negative + tied ranks for weight and BMI.

These results suggest that the intervention group had fewer subjects with increased HbA1c levels compared to the control group, although the difference was not significant.

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**Table1.** Subject characteristics at baseline

Factor	Intervention group			Control group			P
	Median	IQR		Median	IQR		
HbA1c	5.2	5.0	5.5	5.1	5.0	5.5	.062
BMI	23.4	21.2	24.6	22.4	19.0	25.9	.950
History of diabetes (n)	4			3			.682

**Table2.** Post-intervention changes in the intervention group

Change after intervention ( $\Delta$ )		N	Mean Rank	Sum of Ranks	Z	P
	Positive Ranks <sup>b</sup>	11	8.0	87.5		
	Ties (same) <sup>c</sup>	7				
Body weight (kg)	Negative Ranks	10	14.2	142.0	-.921	.357
	Positive Ranks	11	8.1	89.0		
	Ties (same)	0				
BMI	Negative Ranks	10	13.8	138.0	-.782	.434
	Positive Ranks	11	8.5	93.0		
	Ties (same)	0				

a.  $Post-HbA1c < BaselineHbA1c$ ; b.  $Post-HbA1c > BaselineHbA1c$ ; c.  $post-HbA1c = BaselineHbA1c$

**Table3.** Comparison of ranks in the intervention group after intervention

Change after intervention ( $\Delta$ )	Factor	Positive Ranks (N)	Negative Ranks and Ties (same ranks) (N)
Positive ranks more common	HbA1c	11	10
	Body weight (kg)	11	10
	BMI	11	10
Negative and tied ranks more common	None		

**Table4.** Changes after intervention in the control group

Change after intervention ( $\Delta$ )		N	Mean Rank	Sum of Ranks	Z	P
	Positive <sup>b</sup> Ranks	13	8.00	104.00		
	Ties <sup>c</sup>	6				
Body weight (kg)	Negative Ranks	9	10.22	92.00	-.121	.904
	Positive Ranks	10	9.80	98.00		
	Ties	2				
BMI	Negative Ranks	9	10.11	91.00	-.161	.872
	Positive Ranks	10	9.90	99.00		
	Ties	2				

a.  $Post-HbA1c < BaselineHbA1c$ ; b.  $Post-HbA1c > BaselineHbA1c$ ; c.  $post-HbA1c = BaselineHbA1c$

**Table5.** Comparison of ranks in the control group after intervention

Change after intervention ( $\Delta$ )	Factor	Positive Ranks (N)	Negative Ranks and Ties (same ranks) (N)
Positive ranks more common	HbA1c	13	8
Negative and tied ranks more common	Body weight (kg)	10	11
	BMI	10	11

## Discussion

Post-intervention HbA1c levels in the intervention group did not significantly improve, and caregiver weight and BMI did not significantly differ after the intervention. However, in the control group, caregiver HbA1c was significantly higher after the intervention relative to baseline. While there was no significant difference between the control and intervention groups, it was clear that fewer subjects had increased HbA1c levels in the intervention group.

Subjects with well-controlled diabetes were included in the present study, and several subjects with a history of diabetes were included in both the intervention and control groups. The reason why HbA1c levels did not improve markedly after the intervention in the intervention group may be because the subjects were observed within a period of relatively low level of activity and were not asked to undergo dietary restrictions or other restrictions due to their advanced age.

Higher work-related stress is reportedly associated with higher HbA1c levels, and the higher the perceived risk of stress affecting physical health, the higher the HbA1c levels [13]. In a study of stress and HbA1c in patients with diabetes, HbA1c was strongly correlated among subgroups facing disproportionate stress [14]. In the present study, fewer subjects in the intervention group had increased HbA1c levels compared to the control group, although this difference was not significant. The intervention group may have avoided the worsening of HbA1c levels due to the effects of psychological intervention. The psychological intervention in the present study, as in other studies, may have had a small beneficial effect on self-efficacy and HbA1c levels.

The mechanism underlying how emotions affect HbA1c levels remains unknown [15]. However, higher levels of positive effects are associated with lower HbA1c levels [16] and a lower risk of all-cause mortality [17]. In the future, trends in the results of the present study could be further explored to investigate strategies to reduce the deterioration of caregiver health status.

## Conclusion

No significant differences were observed between the intervention and control groups in the present study, but there were fewer subjects in the intervention group with increased HbA1c levels. Our findings suggest that the intervention group may have avoided the worsening of HbA1c levels by calming their mental state. Such stress relief may lessen the deterioration of caregivers' biochemical markers, such as HbA1c. Future intervention studies aimed at alleviating caregiver stress and improving their health are warranted.

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## References

- [1] Miyawaki A, Tomio J, Kobayashi Y, Takahashi H, Noguchi H, Tamiya N. Impact of long-hours family caregiving on non-fatal coronary heart disease risk in middle-aged people: Results from a longitudinal nationwide survey in Japan. *Geriatr Gerontol Int*. 2017 Nov;17(11):2109-2115. doi: 10.1111/ggi.13061. Epub 2017 May 2. PMID: 28464424.
- [2] Torimoto-Sasai Y, Igarashi A, Wada T, Ogata Y, Yamamoto-Mitani N. Female family caregivers face a higher risk of hypertension and lowered estimated glomerular filtration rates: a cross-sectional, comparative study. *BMC Public Health*. 2015 Feb 22;15:177. doi: 10.1186/s12889-015-1519-6. PMID: 25927998; PMCID: PMC4340290.
- [3] Haley WE, Roth DL, Howard G, Safford MM. Caregiving strain and estimated risk for stroke and coronary heart disease among spouse caregivers: differential effects by race and sex. *Stroke*. 2010 Feb;41(2):331-6. doi: 10.1161/STROKEAHA.109.568279. Epub 2010 Jan 14. PMID: 20075357; PMCID: PMC2818824.
- [4] Gouin JP, Glaser R, Malarkey WB, Beversdorf D, Kiecolt-Glaser J. Chronic stress, daily stressors, and circulating inflammatory markers. *Health Psychol*. 2012 Mar;31(2):264-8. doi: 10.1037/a0025536. Epub 2011 Sep 19. PMID: 21928900; PMCID: PMC3253267.
- [5] von Känel R, Mausbach BT, Dimsdale JE, Mills PJ, Patterson TL, Ancoli-Israel S, Ziegler MG, Roepke SK, Allison M, Grant I. Problem behavior of dementia patients predicts low-grade hypercoagulability in

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- spousal caregivers. *J Gerontol A Biol Sci Med Sci*. 2010 Sep; 65(9):1004-11. doi: 10.1093/gerona/glq073. Epub 2010 May 19. PMID: 20484338; PMCID: PMC2920581.
- [6] Adelman RD, Tmanova LL, Delgado D, Dion S, Lachs MS. Caregiver burden: a clinical review. *JAMA*. 2014 Mar 12;311(10):1052-60. doi: 10.1001/jama.2014.304. PMID: 24618967.
- [7] Prado P, Norman RS, Vasquez L, Glassner A, Osuoha P, Meyer K, Brackett JR, White CL. An Interprofessional Skills Workshop to Teach Family Caregivers of People Living with Dementia to Provide Complex Care. *J Interprof Educ Pract*. 2022 Mar;26:100481. doi: 10.1016/j.xjep.2021.100481. Epub 2021 Nov 18. PMID: 34977361; PMCID: PMC8716014.
- [8] Sorrell JM. Moving beyond caregiver burden: identifying helpful interventions for family caregivers. *J Psychosoc Nurs Ment Health Serv*. 2014 Mar;52(3):15-8. doi: 10.3928/02793695-20140128-05. Epub 2014 Feb 5. PMID: 24496059.
- [9] Shen Y, Zhou J, Shi L, Nauman E, Katzmarzyk PT, Price-Haywood EG, Horswell R, Bazzano AN, Nigam S, Hu G. Association between visit-to-visit HbA1c variability and the risk of cardiovascular disease in patients with type 2 diabetes. *Diabetes Obes Metab*. 2021 Jan;23(1):125-135. doi: 10.1111/dom.14201. Epub 2020 Oct 7. PMID: 32965068; PMCID: PMC9092602.
- [10] Sarika KS, Kumar H, Balakrishnan V, Sundaram KR. Impact of Integrated Amrita Meditation® technique on stress in type 2 diabetic patients. *Indian J Med Res*. 2020 Nov; 152(5):508-514. doi: 10.4103/ijmr.IJMR\_2109\_18. PMID: 33707393; PMCID: PMC8157888.
- [11] Weykamp C. HbA1c: a review of analytical and clinical aspects. *Ann Lab Med*. 2013 Nov;33(6):393-400. doi: 10.3343/alm.2013.33.6.393. Epub 2013 Oct 17. PMID: 24205486; PMCID: PMC3819436.
- [12] Hernandez D, Espejo-Gil A, Bernal-Lopez MR, Mancera-Romero J, Baca-Osorio AJ, Tinahones FJ, Armas-Padron AM, Ruiz-Esteban P, Torres A, Gomez-Huelgas R. Association of HbA1c and cardiovascular and renal disease in an adult Mediterranean population. *BMC Nephrol*. 2013 Jul 17;14:151. doi: 10.1186/1471-2369-14-151. PMID: 23865389; PMCID: PMC3720537.
- [13] Walker RJ, Garacci E, Campbell JA, Egede LE. The influence of daily stress on glycemic control and mortality in adults with diabetes. *J Behav Med*. 2020 Oct;43(5):723-731. doi: 10.1007/s10865-019-00109-1. Epub 2019 Oct 15. PMID: 31617047; PMCID: PMC7156304.
- [14] Hilliard ME, Yi-Frazier JP, Hessler D, Butler AM, Anderson BJ, Jaser S. Stress and A1c Among People with Diabetes Across the Lifespan. *Curr Diab Rep*. 2016 Aug;16(8):67. doi: 10.1007/s11892-016-0761-3. PMID: 27287017; PMCID: PMC4936828.
- [15] Chew BH, Shariff-Ghazali S, Fernandez A. Psychological aspects of diabetes care: Effecting behavioral change in patients. *World J Diabetes*. 2014 Dec 15;5(6):796-808. doi: 10.4239/wjdv5.i6.796. PMID: 25512782; PMCID: PMC4265866.
- [16] Bradley C, Lewis CS. Measures of psychological well-being and treatment satisfaction developed from the responses of people with tablet-treated diabetes. *Diabetic Med*. 1990 7: 445-451.
- [17] Moskowitz JT, Epel ES, Acree M. Positive affect uniquely predicts lower risk of mortality in people with diabetes. *Health Psychol* 2008 27: S73-S82.

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