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Impact of Spare Time on Improving Anemia Data and the Maintenance of Physical Function in Elderly Caregivers with Chronic Fatigue

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Abstract

Background: Caregivers reportedly have lower hemoglobin levels compared to non-caregivers. Anemia is associated with decreased physical capacity and increased mortality. Caregivers feel burdened, and experience burnout and fatigue from caring for elderly people on a daily basis. Improving the general endurance of caregivers may lead to improvements in their psychiatric symptoms and quality of life. This study aimed to examine whether securing spare time among caregivers improves anemia symptoms.

Methods: The study targeted caregivers aged ≥65 years who cared for a family member at home. Participants were randomly assigned to either an intervention group or a control group. The intervention group was asked to create and secure spare time in their caregiving routine. The control group was asked to continue with their normal caregiving routine. Blood data, including red blood cell count (RBC), hemoglobin (Hb), hematocrit (HT), MCV, MCH, and MCHC, were collected at baseline and six months later and used to assess anemia. Variables for anemia in both groups were compared using t-tests. Results were considered significant when $P<0.05$. This study was approved by the Nagoya University Bioethics Review Committee. Written informed consent was obtained from participants.

Result: The intervention group showed no significant worsening of blood parameters after completion of the trial relative to baseline. In contrast, MCHC was significantly worse, and MCH tended to be worse, in the control group after completion of the trial relative to baseline ($P=0.001$ and $P=0.092$, respectively). With regard to the rate of change in blood parameters between the intervention and control groups, the control group showed larger negative rates of change for MCHC and MCH relative to the intervention group, but these differences were not significant.

Discussion: In this study, anemia data showed no significant deterioration as a result of selection of caregivers with good health status. The intervention group showed no significant change in anemia data, and thus likely experienced no negative impact on the caregiving routine. In the control group, MCHC and MCH worsened over time. This worsening likely had physical effects, such as reduced endurance, decreased activity, and impaired respiratory and circulatory systems.

Conclusion: Our results may contribute to efforts to screen for caregivers who are likely to benefit from intervention. Despite the need for endurance to maintain the caregiving routine, caregivers should be carefully monitored for anemia symptoms, given their potential negative systemic effect. Future intervention trials aimed at improving anemia will contribute to efforts to increase the overall endurance of caregivers in old age and their cardiopulmonary function.

Keywords: *Caregiver; Anemia; Spare time; Intervention study*

Introduction

Caregivers reportedly have lower hemoglobin levels compared to non-caregivers [1]. Anemia is more common in elderly people [2], and is associated with adverse effects such as decreased

physical ability [3], decreased quality of life [4], increased prevalence [5], left ventricular hypertrophy [6], cardiovascular disease [7], and increased mortality [8]. Caregivers often feel a sense of caregiving burden, burnout [9], and fatigue due to the strain of providing daily care to elderly people [10]. Improving general endurance in caregivers may help to improve their psychiatric symptoms and quality of life.

Most intervention studies targeting caregivers have involved comparative observations of changes in the caregiving burden. One psychological intervention study that examined whether the presence or absence of patient services changed the sense of caregiving burden reported an increase in the sense of caregiving burden in controls [11]. In that study, there was no significant difference between the intervention and control groups when the intervention group was provided with problem-solving skills, knowledge about dementia, social resources, and emotional support; however, on the coping and social subscales, mean scores for the intervention group increased while those of the control group decreased. This demonstrates that intervention research focused on caregiver problems can inform strategies for social support [12]. In a study of caregiver care management support services to caregivers, unmet needs were identified in the intervention group [13].

Many of the above-mentioned intervention studies focused on the psychological aspects of caregivers based on subjective data such as the sense of burden of caregiving. Few studies have collected biological samples and examined variations in objective clinical data (e.g., blood parameters) over time, and there have been no intervention studies aimed at improving anemia-related variables in caregivers. The purpose of this study was to verify whether anemia-related variables improve when caregivers create and secure spare time in order to improve their quality of life.

Methods

Participants

Caregivers aged ≥65 years who were caring for a family member at home were included in this study. Caregivers were defined as those caring for a patient diagnosed with Alzheimer's disease at home. Caregivers who regularly secured spare time in their caregiving routine prior to participating in this study were excluded.

Research design

Participants were randomly assigned to either the intervention group or the control group. The intervention group was asked to create and secure spare time as a meaningful part of their caregiving routine. For the intervention group, older adults could be mildly anemic, which could affect their physical and quality of life [14]. Participants were asked to avoid high-intensity activities that could contribute to anemia. The control group was asked to carry out their normal caregiving routines. Bloodwork data were collected at baseline and six months later (i.e., after completion of the trial) through participants' home-based efforts.

Assessment of caregivers

Anemia-related data from bloodwork were used as indicators. The following data were collected: red blood cell count (RBC), hemoglobin (Hb), hematocrit (HT), MCV, MCH, and MCHC. RBC, Hb, and HT were measured to determine the presence or absence of anemia and erythrocytosis. Erythrocyte indices were calculated using these values and included the size of red blood cells (MCV), the amount of hemoglobin per red blood cell (MCH), and the concentration of hemoglobin (MCHC).

Table 1: *Participant characteristics at baseline.*

	Intervention group		Control group		
	Mean	**SD**	**Mean**	**SD**	**P**
RBC	440.48	42.85	424.62	48.87	.270
Hb	13.59	1.18	13.25	1.54	.422
Ht	41.92	3.29	40.62	4.24	.275
MCV	95.45	5.12	95.85	4.39	.787
MCH	30.93	1.97	31.23	1.63	.593
MCHC	32.42	0.91	32.58	0.75	.533

Standard values: Red blood cell count (RBC), M: 427-570, F: 376-500 (×104/μL); hemoglobin level (Hb), M: 13.5-17.6, F: 11.3-15.2 (g/dL); Hematocrit (HT), M: 39.8-51.8, F: 33.4-44.9 (%); MCV, M: 82.7-101.6, F: 79.0-100.0 (fL); MCH, M: 28.0-34.6, F: 26.3-34.3 (pg); MCHC, M: 31.6-36.6, F: 30.7-36.6 (%)

Statistical Analysis

Demographic variables for the intervention and control groups were compared using t-tests with no correspondence. Anemia variables for both groups were compared using T-tests with correspondence. $P<0.05$ was considered statistically significant.

Ethical Considerations

This study was approved by the Nagoya University Bioethics Review Committee. Written informed consent was obtained from participants.

Results

Participants were caregivers aged ≥65 years. There were more female participants than male participants.

Table 1 shows that blood data indicating anemia were within the reference range. The control group had slightly lower RBCs than the intervention group, but the difference was not significant. Overall, there was no significant difference in data between the intervention and control groups.

Table 2 shows changes in blood data after completion of the trial relative to baseline in the intervention group. There was no significant difference in blood data after completion of the trial relative to baseline. Moreover, the intervention group showed no significant worsening of blood parameters after completion of the trial relative to baseline.

Table 2: *Blood parameters in the intervention group.*

	Baseline		After completion of trial		
	Mean	**SD**	**Mean**	**SD**	**P**
RBC	440.48	42.85	438.19	46.96	.445
Hb	13.59	1.18	13.48	1.29	.271
Ht	41.92	3.29	41.90	3.36	.942
MCV	95.45	5.12	95.93	4.67	.262
MCH	30.93	1.97	30.99	2.03	.601
MCHC	32.42	0.91	32.16	1.01	.202

Table 3: *Blood parameters in the control group.*

	Baseline		After completion of trial		
	Mean	**SD**	**Mean**	**SD**	**P**
RBC	424.62	48.87	423.71	50.77	.844
Hb	13.25	1.54	13.06	1.59	.182
Ht	40.62	4.24	40.75	4.35	.755
MCV	95.85	4.39	96.40	4.45	.266
MCH	31.23	1.63	31.03	1.80	.092
MCHC	32.58	0.75	32.00	0.90	.001

Table 4: *Paired samples correlations at baseline and after completion of trial in the intervention and control groups.*

		Intervention group		Control group	
	Parameter	**Correlation**	**P**	**Correlation**	**P**
Pair 1	RBC	.959	.000	.913	.000
Pair 2	Hb	.939	.000	.919	.000
Pair 3	Ht	.901	.000	.906	.000
Pair 4	MCV	.929	.000	.877	.000
Pair 5	MCH	.970	.000	.957	.000
Pair 6	MCHC	.572	.007	.666	.001

Table 5: *Percent change in intervention and control groups.*

	Intervention group		Control group		
	Mean	**SD**	**Mean**	**SD**	**P**
RBC	-0.56	2.84	-0.16	5.37	.761
Hb	-0.83	3.20	-1.43	5.24	.656
Ht	-0.01	3.40	0.37	5.06	.774
MCV	0.54	1.94	0.60	2.32	.933
MCH	-0.30	1.73	-1.29	2.16	.110
MCHC	-0.77	2.71	-1.77	2.10	.187

Rates of change after completion of the trial (%) = (Post-intervention value – baseline value)/baseline value x 100.

Table 3 shows changes in blood data after completion of the trial relative to baseline in the control group. MCHC was significantly worse, and MCH tended to be worse, after completion of the trial relative to baseline (P=0.001 and P=0.092, respectively).

Table 4 shows significant correlations and differences in all variables for the intervention and control groups, respectively. Table 5 shows percent changes in blood data between the intervention and control groups. The control group showed larger negative mean rates of change for MCH and MCHC relative to the intervention group, but these differences were not significant.

Discussion

Comparison of the intervention and control groups revealed larger negative rates of change for MCH and MCHC in the control group relative to the intervention group, but these differences were not significant. Anemia is under-recognized in elderly people, and its management is a top priority due to its high morbidity and mortality and associated reduction in quality of life [15].

A study by Sahin et al. reported the risk of anemia as 2.12 times higher in participants at risk for malnutrition and 5.05 times higher in those who were malnourished [16]. In that study, the most common cause of anemia was chronic disease among participants with malnutrition or malnutrition risk. In the present study, anemia data were within reference values, so we assumed that our participants had a healthy nutritional status in general. Notably, even mild anemia has been reported to be associated with increased morbidity and mortality [17]. Participants of the present study were healthy and free of bleeding disorders and were able to fulfill their roles as caregivers.

No significant improvement in blood data was observed in the intervention group after completion of the trial. However, this also means that there was no significant deterioration in blood data. Other studies have found a consistent trend toward improvement in performance-based scores, represented by activity, with increases in hemoglobin [18]. In the present study, since the intervention group was healthy and showed no significant changes in blood data, their caregiving routine was unlikely to have been negatively impacted.

Mildly lower hemoglobin levels have been reported to be associated with a significantly lower quality of life in elderly people [19]. In the control group of the present study, the rate of change in MCH and MCHC showed a large negative value, with a significant worsening of MCHC and a trend toward worsening of MCH. With regard to lifestyle, participants continued their normal lifestyle without any change during the study period and did not develop any chronic diseases that would affect anemia. Anemia has been reported to be associated with greater disability and reduced performance, as reflected in significantly lower knee extensor strength and lower grip strength, as well as reduced physical fitness and muscle strength [20]. Despite the absence of data indicating anemia, participants of the control group in the present study did not have a significant impact on their bodies, as their anemia data declined in the natural course of their condition. Therefore, participants of the control group likely did not experience detrimental conditions which could impact their functional status. However, it has been reported that low hemoglobin concentration and anemia were associated with a risk of frailty in elderly people [21]. As anemia progresses, preventive interventions become important as the amount of activity of caregivers is expected to decrease, resulting in reduced endurance and progression to a state of muscular hypotonia or frailty.

Significant correlations and significant differences were observed in all variables for the intervention and control groups, respectively. This may be because anemia data are a component of red blood cells. Thus, data before and after the intervention are likely to correlate with each other.

Elderly people, who are prone to reduced hematopoietic function, are less likely to exhibit anemia symptoms, making it difficult to recognize anemia before it progresses. Caregivers require endurance to maintain the caregiving routine. However, a worsening of anemia data necessitates preventive interventions, as progressive anemia is predicted to decrease further their activity and endurance, negatively affect their respiratory and circulatory systems, and lead to muscle weakness and progression to frailty.

Conclusion

This study, which targeted healthy elderly caregivers, did not detect a significant deterioration in anemia data in the intervention group, allowing caregivers to maintain their caregiving routine. However, MCH and MCHC worsened without the intervention in the control group. Our findings may contribute to efforts to screen for caregivers who require intervention. Interventions aimed to improve anemia are expected to help elderly caregivers maintain general endurance and reduce their cardiopulmonary burden.

Conflict of Interest

None to report.

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