Circulation Reports
Circ Rep 2024; 6: 241–247
doi:10.1253/circrep.CR-24-0036

ORIGINAL ARTICLE
Exercise Physiology

Effects of Repeated Kurort Health Walking on Blood Pressure and Mental Health

Shinya Minatoguchi, MD, PhD; Taro Minagawa, MD, PhD; Kaori Osawa, BSc;
Shinsuke Ojio, MD, PhD; Shinji Yasuda, MD, PhD;
Tatehiro Marumo, BSc; Seiichiro Takahashi, BSc

Background: The German word "kurort" means cure (kur) and area (ort), whereby a patient's health improves through walking in areas full of nature. A single session of kurort health walking (kurort) decreased high blood pressure and improved mental health. However, its continuing effect with repeat sessions remains unclear.

Methods and Results: The subjects participated twice in kurort health walking in specially designated courses in Gifu City (n=242). Systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rate (PR) were measured before and after kurort health walking. Mental health was assessed using a 10-item checklist after kurort health walking. Both basal SBP and DBP before walking were significantly decreased more in the second session than in the first. In both the first and second sessions SBP and DBP decreased, but the decrease in SBP (ΔSBP) by kurort was significantly greater in the SBP ≥140- than in the SBP <140-mmHg group, SBP inversely correlated with ΔSBP, the decrease in DBP (ΔDBP) was significantly greater in the DBP ≥90- than in the DBP <90-mmHg group, and DBP inversely correlated with ΔDBP. Mental health was similarly improved after both the first and second kurort.

Conclusions: Basal SBP and DBP decreased more in the second than in the first kurort. The decrease in SBP and DBP, and improvement of mental health was noted after both sessions.

Key Words: Blood pressure; Kurort health walking; Mental health

Because hypertension and mental health status are associated with cardiovascular events,[1–3] it is recommended to decrease high blood pressure (BP) and improve the mental state for the prevention of cardiovascular events. Although antihypertensive drugs and antidepressants are effective, lifestyle modifications also may be useful. "Kurort" is a German word that means cure ("kur") and area ("ort"), and kurort health walking (kurort) improves a patient's health by taking place in areas full of nature, such as forests, scenic hills, rivers, and hot springs, with a good climate.[4] In Japan, based on German kurort, Japanese-style kurort was recently developed and has become popular with the support of local governments. In 2019, Gifu City opened 2 courses encouraging citizens to participate in kurort: the Mt. Kinka-Nagara river–Gifu park course, and Mt. Dodogamine–Nagara river–Fureai forest course, both of which are full of nature.[5] We recently reported that a single session of kurort decreased higher systolic and diastolic BPs, and improved mental health,[5] but the effect of 2 kurort sessions on these parameters is still unclear. Therefore, in the present study, we aimed to examine the effect of repeated kurort on the BP and mental health of participants.

Methods

The Ethics Committee of Gifu Municipal Hospital approved this clinical study (approval number: 634) and it conformed to the principles in the Declaration of Helsinki. The public trial registry number is UMIN000041617.

The subjects in this study were 242 persons who participated in kurort twice along either of the 2 courses in Gifu City between June 1, 2020 and May 31, 2023. Intervals between the first and second kurort sessions were determined by the participants. All participants agreed to registration in the study and none dropped out. Written informed consent was given by the participants before the study commenced. The participants were asked to record their age, sex, height, weight, and presence/absence of hypertension, dyslipidemia, and diabetes mellitus in a

Received April 5, 2024; revised manuscript received May 15, 2024; accepted May 26, 2024; J-STAGE Advance Publication released online June 12, 2024 Time for primary review: 24 days

Cardiology, Heart Failure Center, Gifu Municipal Hospital, Gifu (S.M., K.O., S.O., S.Y.); Minagawa Clinic, Gifu (T. Minagawa); and Health Promotion Section, Gifu Municipal Office, Gifu (T. Marumo, S.T.), Japan

S.M. is a member of *Circulation Reports*' Editorial Team.

Mailing address: Shinya Minatoguchi, MD, PhD, Cardiology, Heart Failure Center, Gifu Municipal Hospital, 7-1 Kashimacho, Gifu 500-8513, Japan. email: minatoguchi.shinya.g7@a.gifu-u.ac.jp

ISSN-2434-0790

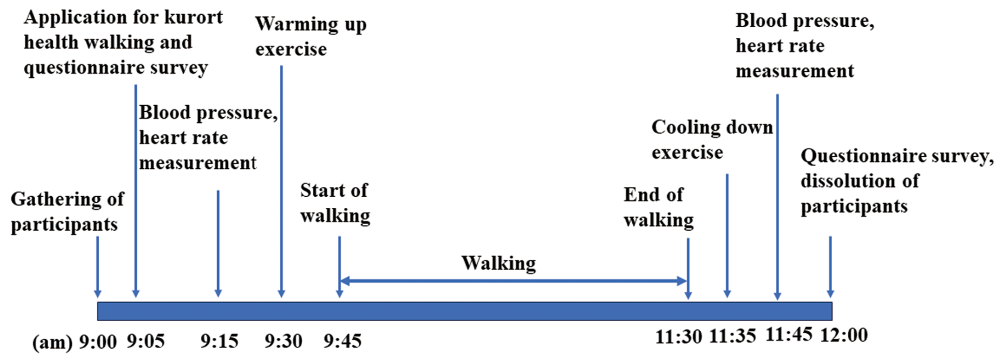

Figure 1. Time schedule for the kurort health walking.

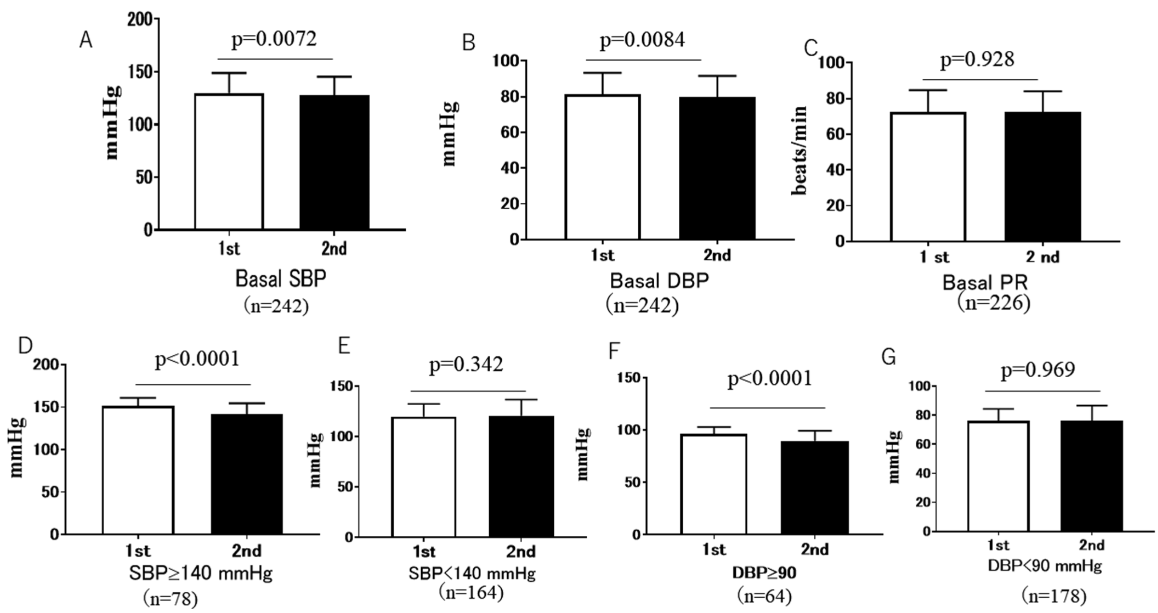

Figure 2. (**A**) Basal systolic blood pressure (SBP), (**B**) basal diastolic blood pressure (DBP), and (**C**) basal pulse rate (PR) in the first and second kurort. (**D**) SBP ≥140mmHg and (**E**) SBP <140mmHg in the first and second kurort (**F**) DBP ≥90mmHg and (**G**) DBP <90mmHg in the first and second kurort.

checklist before walking. To ensure safety, participants with SBP >180mmHg and/or DBP >110mmHg were prohibited from participating. The warm-up and cool-down exercises before and after walking were performed under the direction of health exercise instructors.

Participants accompanied by 2 health exercise instructors were asked to measure their pulse rate (PR) at 5 or 6 points along either course to maintain the target PR. To safely perform kurort, walking pace was maintained under the anaerobic threshold based on the target PR during walking, which was set as (160−age) beats/min.[6,7] This target PR is lower and safer than that set by Karvonen's formula [target heart rate = rest heart rate + (peak heart rate − rest heart rate)×k, where k ranges 0.6 to 0.8],[8] which is often used during cardiac rehabilitation. The time schedule of the kurort health walking is shown in **Figure 1**.

Measurement of SBP, DBP, and PR

For each kurort session, SBP, DBP, and PR were measured 30min before the start of walking and 15min after the completion of walking using a wrist-type sphygmomanometer (Terumo, Tokyo, Japan). Based on the definition of hypertension in the Guidelines for the management of hypertension 2019,[9] SBP was used to divide participants into 2 groups: SBP ≥140mmHg and SBP <140mmHg; DBP was similarly used: DBP ≥90mmHg and DBP <90mmHg groups.

Questionnaire Survey on Mental Health

On the completion of both kurort sessions, we performed

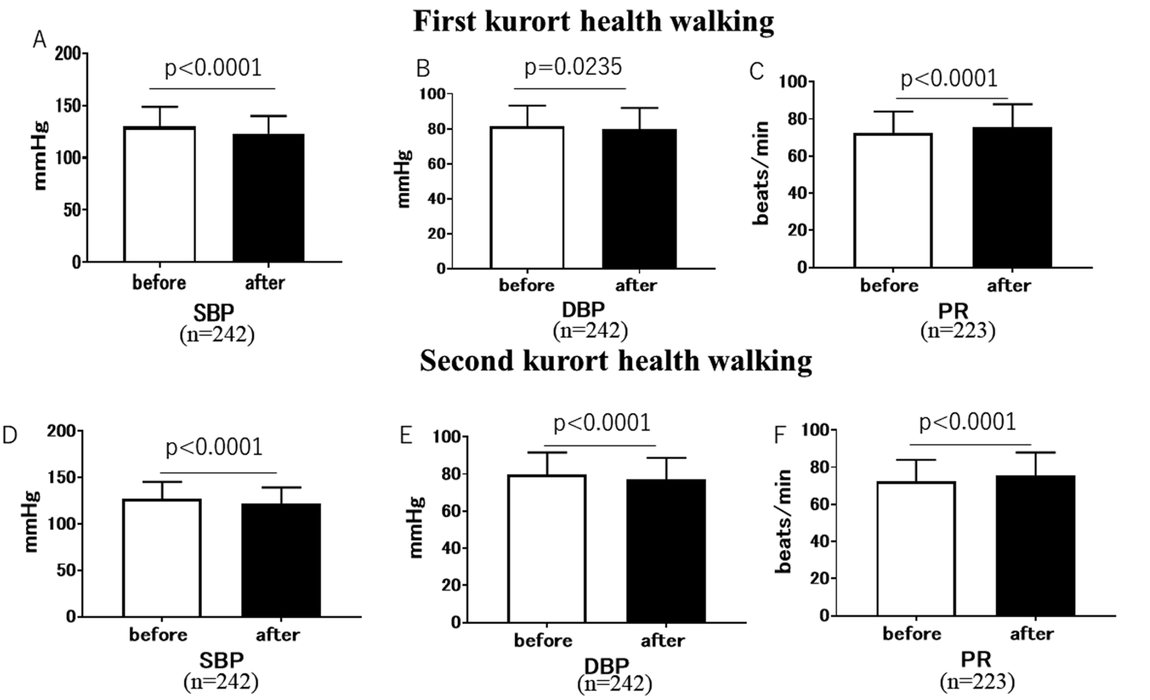

Figure 3. (**A**) Systolic blood pressure (SBP), (**B**) diastolic blood pressure (DBP), and (**C**) pulse rate (PR) before and after the first kurort. (**D**) SBP, (**E**) DBP and (**F**) PR before and after the second kurort.

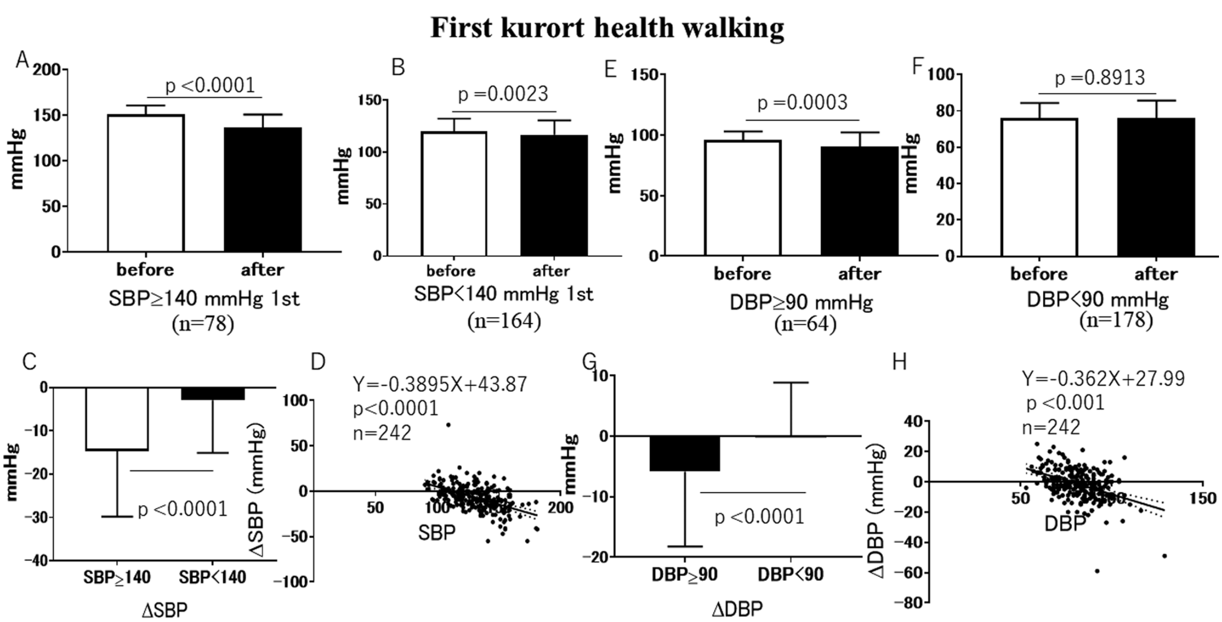

Figure 4. SBP before and after the first kurort in participants with (**A**) SBP ≥140 mmHg and (**B**) SBP <140 mmHg. (**C**) Decrease in SBP (ΔSBP) due to the first kurort in the SBP ≥140- and SBP <140-mmHg groups. ΔSBP was significantly greater in the SBP ≥140-mmHg group. (**D**) Relationship between SBP and ΔSBP. SBP before the first kurort inversely correlated with ΔSBP. (**E**) DBP before and after the first kurort in participants with DBP ≥90 mmHg. (**F**) DBP before and after the first kurort in participants with SBP <90 mmHg. (**G**) Decrease in DBP (ΔDBP) due to the first kurort in the DBP ≥90- and DBP <90-mmHg groups. ΔDBP was significantly greater in the DBP ≥90-mmHg group. (**H**) Relationship between DBP and ΔDBP. DBP before the first kurort inversely correlated with ΔDBP.

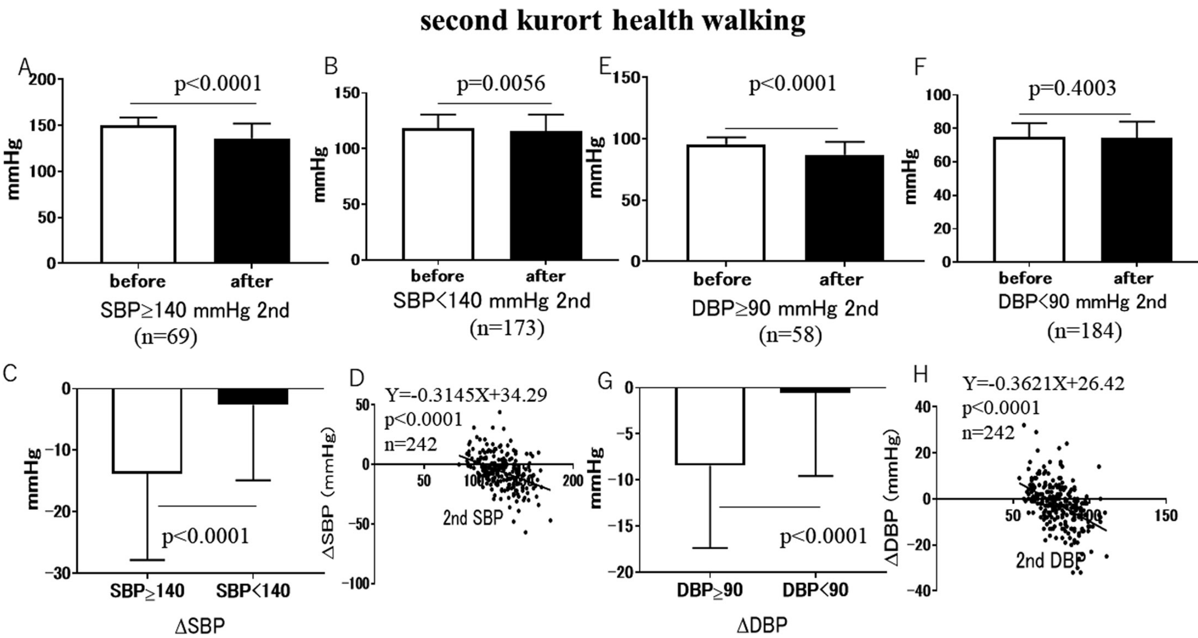

Figure 5. (**A**) SBP before and after the second kurort in participants with SBP ≥140mmHg. (**B**) SBP before and after the second kurort in participants with SBP <140mmHg. (**C**) Decrease in SBP (ΔSBP) due to the second kurort in the SBP ≥140- and SBP <140-mmHg groups. ΔSBP was significantly greater in the SBP ≥140-mmHg group. (**D**) Relationship between SBP and ΔSBP. SBP before the second kurort inversely correlated with ΔSBP. (**E**) DBP before and after the second kurort in participants with DBP ≥90mmHg. (**F**) DBP before and after the second kurort in participants with SBP <90mmHg. (**G**) Decrease in DBP (ΔDBP) due to the second kurort in the DBP ≥90- and DBP <90-mmHg groups. ΔDBP was significantly greater in the DBP ≥90-mmHg group. (**H**) Relationship between DBP and ΔDBP. DBP before the second kurort inversely correlated with ΔDBP.

a questionnaire survey on changes in the following 10 items of mental health: (1) feeling lively, (2) feeling refreshed, (3) feeling vivid, (4) feeling exhilarated, (5) feeling relaxed, (6) feeling calm, (7) feeling fun, (8) feeling anxious, (9) feeling irritated, and (10) feeling tired, as previously reported.[5,10] The participants checked "improved", "no change", or "worsened", for the 10 checklist items. 'Improved' was scored as 1, 'no change' was 0, and 'worsened' was −1. The effects of kurort on each of the 10 feelings and their total sum were assessed by the average scores.

Statistical Analysis

Data are shown as the mean±standard deviation. The normality of the data distribution was tested using the Kolmogorov-Smirnov test. The significance of differences in variables between groups was determined by paired or unpaired Student's t-tests. Correlation coefficients between 2 variables were obtained by linear regression analysis. A P value <0.05 was considered statistically significant. All statistical analyses were performed using GraphPad Prism 7 (GraphPad Software Inc.).

Results

Participants' Backgrounds

There were 242 subjects who participated twice, comprising 78 males and 164 females, with a mean age of 60.3±12.8 years (range, 21–83 years). Some of the participants (29.8%) had histories of hypertension (n=45), diabetes mellitus (n=11), and dyslipidemia (n=16).

Basal SBP, DBP and PR in the First and Second Kurort Sessions

The mean interval between the first and second sessions was 97.9±152.2 days (n=242). Basal SBP, DBP, and PR before the first and second kurort sessions are shown in **Figure 2**. Between the first and second sessions, basal SBP significantly decreased from 129.9 to 127.4mmHg (n=242, P=0.0072) (**Figure 2A**), and basal DBP significantly decreased from 81.4±11.9 to 79.7±11.9mmHg (n=242, P=0.0084) (**Figure 2B**). There was no difference in the basal PR between the first (72.7±12.1 beats/min) and second (72.6±11.5beats/min, n=226, P=0.928) sessions (**Figure 2C**). In participants with SBP ≥140mmHg, SBP significantly decreased from 151.2±9.9mmHg in the first kurort to 141.5±13.2mmHg in the second kurort (n=78, P<0.0001) (**Figure 2D**). However, in participants with SBP <140mmHg, SBP did not differ between the first (119.8±12.5mmHg) and second (120.8±15.9mmHg, n=164, P=0.342) sessions (**Figure 2E**). In participants with DBP ≥90mmHg, DBP significantly decreased from 96.2±6.8mmHg in the first kurort to 89.7±9.6mmHg in the second kurort (n=64, P<0.0001) (**Figure 2F**). However, in participants with DBP <90mmHg, DBP did not differ between the first (76.1±8.3mmHg) and second (76.2±10.5mmHg, n=178, P=0.969) sessions (**Figure 2G**).

Effect of Kurort Health Walking on SBP, DBP and PR

First Kurort SBP significantly decreased from 129.9±18.8

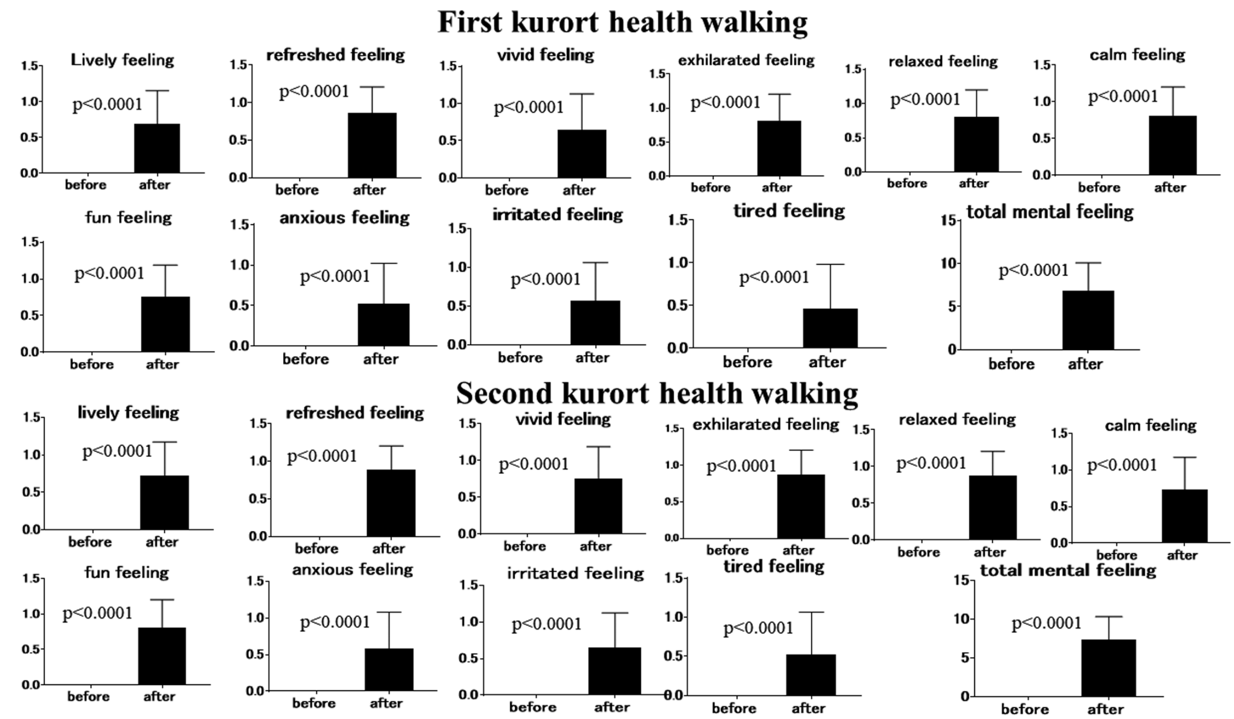

Figure 6. Effect of kurort on changes in mental health after the first and second sessions. Improvement in all items of the 10-item questionnaire after as compared with before kurort. Changes before and after kurort were assessed by paired Student's t-tests and scored as improved=1, no change=0, worsened=−1, for each of the 10 items.

to 123.2±16.8 mmHg (P<0.0001, n=242) (**Figure 3A**) and significantly decreased DBP from 81.4±11.9 to 79.9±11.9 mmHg (P=0.0235, n=242) (**Figure 3B**). The PR significantly increased from 72.2±11.8 to 74.9±12.4 beats/min (P<0.0001, n=223) (**Figure 3C**). In the SBP ≥140-mmHg group, SBP significantly decreased from 151.2±9.9 to 136.5±14.7 mmHg (P<0.0001, n=78) (**Figure 4A**), and in the SBP <140-mmHg group, SBP significantly decreased from 119.8±12.5 to 116.8±13.7 mmHg (P=0.0023, n=164) (**Figure 4B**). The decrease in SBP (ΔSBP) was significantly greater in the SBP ≥140-mmHg group (−14.7±15.1 mmHg, n=78) than in the SBP <140-mmHg group (−2.9±12.2 mmHg, n=164) (P<0.0001) (**Figure 4C**). SBP before kurort inversely correlated with the decrease in SBP (ΔSBP) due to kurort (Y=−0.3895X+43.87, P<0.0001, n=242) (**Figure 4D**). In the DBP ≥90-mmHg group, DBP significantly decreased from 96.2±6.8 to 90.3±12.0 mmHg (P=0.0003, n=64) (**Figure 4E**), and in the DBP <90-mmHg group, DBP changed from 76.1±8.3 to 76.2±9.5 mmHg (n=178), but was not significant (P=0.891, n=178) (**Figure 4F**). The decrease in DBP (ΔDBP) was significantly greater in the DBP ≥90-mmHg group (−5.9±12.3 mmHg, n=64) than in the SBP <90-mmHg group (0.08±8.7 mmHg, n=178) (P<0.0001) (**Figure 4G**). DBP before kurort inversely correlated with the decrease in DBP (ΔDBP) due to kurort (Y=−0.362+27.99, P<0.0001, n=242) (**Figure 4H**).

Second Kurort SBP significantly decreased from 127.4±17.9 to 121.6±17.6 mmHg (P<0.0001, n=242) (**Figure 3D**) and significantly decreased DBP from 79.7±11.9 to 77.3±11.4 mmHg (P<0.0001, n=242) (**Figure 3E**). The PR significantly increased from 72.5±11.5 to 75.4±12.6 beats/min (P<0.0001, n=223) (**Figure 3F**). In the SBP ≥140-mmHg group, SBP significantly decreased from 149.7±8.7 to 135.9±15.9 mmHg (P<0.0001, n=69) (**Figure 5A**), and in the SBP <140-mmHg group, SBP significantly decreased from 118.6±11.9 to 116.0±14.8 mmHg (P=0.0056, n=173) (**Figure 5B**). The decrease in SBP (ΔSBP) was significantly greater in the SBP ≥140-mmHg group (−13.8±14.2 mmHg, n=69) than in the SBP <140-mmHg group (−2.6±12.2 mmHg, n=173) (P<0.0001) (**Figure 5C**). SBP before kurort inversely correlated with the decrease in SBP (ΔSBP) due to kurort (Y=−0.3145X+34.29, P<0.0001, n=242) (**Figure 5D**).

In the DBP ≥90-mmHg group, DBP significantly decreased from 95.5±5.6 to 87.1±10.4 mmHg (P<0.0001, n=58) (**Figure 5E**), and in the DBP <90-mmHg group, DBP changed from 74.8±8.5 to 74.2±9.9 mmHg, but was not significant (P=0.4003, n=184) (**Figure 5F**). The decrease in DBP (ΔDBP) was significantly greater in the DBP ≥90-mmHg group (−8.4±8.9 mmHg, n=58) than in the SBP <90-mmHg group (−0.6±9.0 mmHg, n=184) (P<0.0001) (**Figure 5G**). DBP before kurort inversely correlated with the decrease in DBP (ΔDBP) due to kurort (Y=−0.3621X+26.42, P<0.0001, n=242) (**Figure 5H**).

Mental Health

Both the first and second kurort sessions, respectively, significantly improved each of the 10 items of mental health: (1) 0.69±0.43 and 0.73±0.45, (2) 0.86±0.34 and 0.89±0.32, (3) 0.65±0.48 and 0.75±0.43, (4) 0.81±0.39 and

0.87±0.34, (5) 0.81±0.40 and 0.87±0.33, (6) 0.81±0.40 and 0.73±0.45, (7) 0.76±0.43 and 0.81±0.39, (8) 0.52±0.50 and 0.59±0.49, (9) 0.57±0.50 and 0.64±0.48, and (10) 0.46±0.52 and 0.52±0.54. The sum total was 6.8±3.3 and 7.4±2.9, respectively, out of a maximum score of 10 (**Figure 6**).

Discussion

The major findings of the present study were: (1) both the basal SBP and DBP in the second kurort were significantly lower than in the first session, (2) the first and second kurort sessions decreased both SBP and DBP, (3) both in the first and second kurort sessions, the decrease in SBP (ΔSBP) was significantly greater in the SBP ≥140 than in the SBP <140-mmHg group, and SBP inversely correlated with ΔSBP, (4) both in the first and second kurort sessions, the decrease in DBP (ΔDBP) was significantly greater in the DBP ≥90 than in the DBP <90-mmHg group, and DBP inversely correlated with ΔDBP, and (5) both the first and second kurort sessions improved mental health.

These results suggest that even a single session of kurort will decrease the basal SBP and DBP, and the decreases in basal SBP and DBP were noted mainly in participants with SBP ≥140 mmHg and DBP ≥90 mmHg. Although the precise reason why a single session of kurort decreased basal SBP and DBP prior to the second session is unclear; a possible explanation may be that participation helped form a habit of walking in daily life before the second kurort, because longterm exercise training will decrease BP.[11,12] Another possible explanation is the seasonal variation in BP, which increases in winter and decreases in summer.[13] However, the number of subjects who participated in winter (December–February) for the first kurort and then participated in summer (June–August) for the second kurort was 2 (SBP at the first kurort 133.5±30.4 mmHg vs. at the second kurort 135±31.1 mmHg: P=0.2048; DBP at the first kurort 80±12.7 mmHg vs. at the second kurort 83.5±19.1 mmHg: P=0.5792), and 11 participated in spring (March, April, May) for the second kurort (SBP at the first kurort 135.9±27.2 mmHg vs. at the second kurort 127.5±18.9 mmHg: P=0.128;, DBP at the first kurort 86±14.6 mmHg vs. at the second kurort 79.9±10.9 mmHg: P=0.2252). These data suggest that seasonal variation did not affect the basal BP, at least in the present study. Other possibilities may be temperature, barometric pressure, and climate at the 10:00 am start on the day of the kurort health walking. We examined the temperature, barometric pressure, and climate data from the Japan Meteorological Agency at 10:00 am on the days of the kurort health walking. We scored sunny, cloudy and rainy weather as 1, 2 and 3, respectively. There was no significant difference between the first and second kurort health walking session for temperature (first kurort 18.1±7.2°C vs. second kurort 16.9±7.4°C: P=0.056), barometric pressure (first kurort 1,014±6.9 hPa vs. second kurort 1,016±7.3 hPa: P=0.072) or weather (first kurort 1.517±0.707 vs. second kurort 1.442±0.617: P=0.238). Therefore, the results suggest that the decrease in basal BPs before walking at the second kurort was not due to the temperature, barometric pressure or weather.

Kurort health walking decreased SBP and DBP in both the first and second session and significantly increased the PR. An increase in the PR after exercise such as walking is a normal physiological response. Because the heart rate of participants was maintained under the target (160 − age beats/min) throughout each kurort session, we considered it would be safe even for those with heart disease.

In both the first and second kurort, SBP was significantly decreased by walking in the SBP ≥140-mmHg group and the SBP <140-mmHg group. The decrease in SBP (ΔSBP) by kurort was significantly greater in the SBP ≥140 than in the SBP <140-mmHg group, and SBP before kurort inversely correlated with ΔSBP by walking, suggesting that higher SBP was decreased more than lower SBP by kurort. In the DBP ≥90-mmHg group, but not in the DBP <90-mmHg group, DBP was significantly decreased by kurort. The decrease in DBP (ΔDBP) by kurort was significantly greater in the DBP ≥90 than DBP <90 mmHg group and DBP before kurort inversely correlated with ΔDBP by kurort, suggesting that higher DBP was decreased more than lower DBP by walking. These findings suggest that kurort preferentially decreased higher BP in both the first and second sessions. Based on these findings, kurort may be a useful strategy to reduce SBP and DBP in hypertensive patients.

Exercise training decreases both SBP and DBP in hypertensive and normotensive subjects.[11,12,14,15] Although the precise mechanisms by which exercise training decreases BP remain unclear, a candidate mechanism may be attenuation of plasma norepinephrine and epinephrine levels and enhancement of the plasma prostaglandin E level.[11] In addition, kurort among nature such as scenic hills, forests, and rivers, with clean air and a good climate may improve participants' physiological and mental health through the attenuation of augmented sympathetic nerve activity.

Kurort improved all 10 items on the survey of mental health similarly in both the first and second sessions. Furthermore, the sum of the items out of a maximum score of 10 was 6.8±3.3 in the first kurort and 7.4±2.9 in the second kurort. Therefore, 68% of participants in the first kurort and 74% in the second kurort showed an improvement in mental health, which suggests kurort can improve mental health status and is a safe therapeutic strategy. It has been reported that aerobic exercise improved the mental health status of patients with diabetes mellitus and depressive disorders,[16,17] and that people who did not leave their homes to walk showed more depressive symptoms or a greater likelihood of clinical depression.[18] Because hypertension and mental health are associated with cardiovascular events,[1–3] kurort may reduce the risk of cardiovascular events because it decreases SBP and DBP, and improves mental health.

Forest bathing (Shinrin-yoku) also decreases sympathetic nerve activity, decreases BP and improves mental status.[19] Kurort health walking is performed in nature, such as forests, scenic hills, rivers, and hot springs, in areas with a good climate,[4] which may have better and bigger effects than walking in urban areas or indoors.

Study Limitations

This study only showed the effect of 2 kurort sessions on BP and mental health, and the intervals between the first and second sessions varied among the participants and were not identical. The longer term effects of repeated kurort on BP and mental health status remain to be investigated. Furthermore, we could not obtain the information on whether any medical intervention was performed between the first and second sessions, because the participants were general citizens not patients under hospital care.

Acknowledgments

We are grateful for the support of the Health Promotion Section of Gifu Municipal Office, Gifu City, Japan. This study was funded by Terumo Life Science Foundation 2022, 2024, Gifu Prefecture Medical Association 2022, and Taiyo Life Insurance Company 2023.

Conflicts of Interest

None declared.

Disclosures

S.M. is a member of *Circulation Reports*' Editorial Team. The other authors declare that no conflicts of interest exist.

IRB Information

The ethics committee of Gifu Municipal Hospital approved this clinical study (approval number: 634).

Data Availability

The de-identified participant data will not be shared.

Author Contributions

S.M.: organization and design of the study, data interpretation and analysis, manuscript writing, financial support, and final approval of manuscript. T. Minagawa, S.O., S.Y.: data interpretation, K.O.: data registration and analysis, T. Marumo: organization of kurort and data collection, S.T.: organization of kurort and data collection.

References

1. Stamler J, Stamler R, Neaton JD. Blood pressure, systolic and diastolic, and cardiovascular risks: US population data. *Arch Intern Med* 1993; **153:** 598–615.
2. Nielsen TJ, Vestergaard M, Christensen B, Christensen KS, Larsen KK. Mental health status and risk of new cardiovascular events or death in patients with myocardial infarction: A population-based cohort study. *BMJ Open* 2013; **3:** e003045.
3. Hata J, Kiyohara Y. Epidemiology of stroke and coronary artery disease in Asia. *Circ J* 2013; **77:** 1923–1932.
4. Guenther K. Exercises in therapy: Neurological gymnastics between Kurort and hospital medicine. *Bull Hist Med* 2014; **88:** 102–131.
5. Minatoguchi S, Minagawa T, Nishigaki K, Ojio S, Yasuda S, Osawa K, et al. Kurort health walking preferentially decreases higher blood pressure and improves mood. *Circ Rep* 2021; **3:** 639–646.
6. Schuh A. Klima-und thalassotherapie: Grundlagen und Praxis. *Hippokrates Verlag* 2004; 34–40 (in German).
7. Wasserman K, Whipp BJ, Koyl SN, Beaver WL. Anaerobic threshold and respiratory gas exchange during exercise. *J Appl Physiol* 1973; **35:** 236–243.
8. Omiya K, Itoh H, Osada N, Kato M, Koike A, Sagara K, et al. Impaired heart rate response during incremental exercise in patients with acute myocardial infarction and after coronary artery bypass grafting: Evaluation of coefficients with karvonen's formula. *Jpn Circ J* 2000; **64:** 851–855.
9. Umemura S, Arima H, Arima S, Asayama K, Dohi Y, Hirooka Y, et al. The Japanese Society of Hypertension Guidelines for the management of hypertension (JSH 2019). *Hypertens Res* 2019; **42:** 1235–1481.
10. Ueda H, Machida K, Kawamura N, Koseki N. A study on the process of mood alteration through forest walking. *J Jpn Inst Landscape Architecture* 2013; **76:** 533–538.
11. Kiyonaga A, Arakawa K, Tanaka H, Shindo M. Blood pressure and hormonal responses to aerobic exercise. *Hypertension* 1985; **7:** 125–131.
12. Ghadieh AS, Saab B. Evidence for exercise training in the management of hypertension in adults. *Can Fam Physician* 2015; **61:** 233–239.
13. Stergiou GS, Palatini P, Modesti PA, Asayama K, Asmar R, Bilo G, et al. Seasonal variation in blood pressure: Evidence, consensus and recommendations for clinical practice. Consensus statement by the European Society of Hypertension Working Group on Blood Pressure Monitoring and Cardiovascular Variability. *J Hypertens* 2020; **38:** 1235–1243.
14. Carpio-Rivera E, Moncada-Jiménez J, Salazar-Rojas W, Solera-Herrera A. Acute effects of exercise on blood pressure: A meta-analytic investigation. *Arq Bras Cardiol* 2016; **106:** 422–433.
15. Whelton SP, Chin A, Xin X, He J. Effect of aerobic exercise on blood pressure: A meta-analysis of randomized, controlled trials. *Ann Intern Med* 2002; **136:** 493–503.
16. Gilani SRM, Feizabad AK. The effects of aerobic exercise training on mental health and self-esteem of type 2 diabetes mellitus patients. *Health Psychol Res* 2018; **6:** 6576.
17. Morres ID, Hatzigeorgiadis A, Stathi A, Comoutos N, Arpin-Cribbie C, Krommidas C, et al. Aerobic exercise for adult patients with major depressive disorder in mental health services: A systematic review and meta-analysis. *Depress Anxiety* 2019; **36:** 39–53.
18. Julien D, Gauvin L, Richard L, Kestens Y, Payette H. The role of social participation and walking in depression among older adults: Results from the VoisiNuAge study. *Can J Aging* 2013; **32:** 1–12.
19. Li Q. Effects of forest environment (shinrin-yoku/forest bathing) on health promotion and disease prevention: The establishment of "forest medicine". *Environ Health Prev Med* 2022; **27:** 43.