Gut and Liver
https://doi.org/10.5009/gnl240494
pISSN 1976-2283 eISSN 2005-1212

Original Article

Effect of *Helicobacter pylori* Eradication on Metabolic Parameters and Body Composition including Skeletal Muscle Mass: A Matched Case-Control Study

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Article Info
Received October 24, 2024
Revised January 4, 2025
Accepted January 19, 2025
Published online April 25, 2025

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Background/Aims: Findings on the impact of *Helicobacter pylori* eradication on metabolic parameters are inconsistent. This study aimed to evaluate the effects of *H. pylori* eradication on metabolic parameters and body composition, including body fat mass and skeletal muscle mass.

Methods: We retrospectively reviewed the data of asymptomatic patients who underwent health screenings, including bioelectrical impedance analysis, before and after *H. pylori* eradication between 2005 and 2021. After matching individuals based on key factors, we compared lipid profiles, metabolic parameters, and body composition between 823 patients from the eradicated group and 823 patients from the non-eradicated groups.

Results: Blood pressure, erythrocyte sedimentation rate, and glycated hemoglobin values were significantly lower in the eradicated group than in the non-eradicated group. However, changes in body mass index (BMI), body fat mass, appendicular skeletal muscle mass (ASM), waist circumference, and lipid profiles were not significantly different between the two groups. In a subgroup analysis of individuals aged >45 years, blood pressure, erythrocyte sedimentation rate, and glycated hemoglobin changes were significantly lower in the eradicated group than in the non-eradicated group. BMI values were significantly higher in the eradicated group than in the non-eradicated group; however, no significant differences were observed between the two groups regarding changes in body weight, body fat mass, ASM, or waist circumference. Total cholesterol and low-density lipoprotein cholesterol levels were significantly lower in the eradicated group than in non-eradicated group.

Conclusions: *H. pylori* eradication significantly reduced blood pressure, glucose levels, and systemic inflammation and improved lipid profiles in patients aged >45 years. BMI, body fat mass, ASM, and waist circumference did not significantly differ between patients in the eradicated group and those in the non-eradicated group. **(Gut Liver, 2025;19:346-354)**

Key Words: *Helicobacter pylori*; Eradication; Metabolic syndrome; Body composition

INTRODUCTION

Helicobacter pylori infection contributes to the development of gastric cancer through the progression of chronic active gastritis, atrophy, intestinal metaplasia, and dysplasia due to intestinal flora disruption and chronic inflammation of the gastric mucosa.[1,2] *H. pylori* infection can cause extra-gastrointestinal diseases, including dyslipidemia and cardiovascular disease, due to the secretion of proinflammatory cytokines that activate macrophages and adipose tissue lipoprotein lipase, promote lipolysis, and stimulate hepatic fatty acid synthesis.[3-6] Many randomized controlled

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trials (RCT) and meta-analyses have demonstrated that *H. pylori* eradication can improve lipid profiles by inhibiting the release of inflammatory cytokines.[7-9] However, conflicting results have been presented regarding its effects on metabolic parameters, including body weight and body mass index (BMI) after eradication.[3,10-14] Additionally, there is a lack of clinical studies on changes in body composition, including body fat and skeletal muscle masses after *H. pylori* eradication.

Sarcopenia, an age-related disease characterized by decreased skeletal muscle mass and strength and impaired physical performance, is closely associated with systemic insulin resistance because skeletal muscle is the primary tissue responsible for insulin-dependent glucose uptake. This progressive insulin resistance can lead to metabolic syndrome.[15,16] In patients with sarcopenia, ghrelin, a decreasing hormone, has been proposed as a potential treatment due to its ability to increase muscle mass by stimulating food intake, growth hormone secretion, facilitating myocyte differentiation and fusion, and inhibiting anorectic proinflammatory cytokine production.[17,18] Recent studies have demonstrated an association between sarcopenia and *H. pylori* infection, atrophic gastritis, and gastric cancer, as *H. pylori* infection can disrupt hormonal regulation of energy homeostasis, particularly ghrelin and leptin.[19-21] Thus, *H. pylori* eradication can improve metabolic parameters and serve as a therapeutic option for sarcopenia by inhibiting the release of inflammatory cytokines and potentially enhancing ghrelin secretion.

This study aimed to examine the effects of *H. pylori* eradication on metabolic parameters and body composition. Throughout the follow-up period, we evaluated the differences in lipid profiles, metabolic parameters, and body composition, including body fat mass and skeletal muscle mass, between the *H. pylori* eradicated and non-eradicated groups.

MATERIALS AND METHODS

1. Patients

This study was approved by the Institutional Review Board of the Asan Medical Center (IRB number: 2024-0716). The written informed consent was waived. We included 38,984 individuals who underwent health screenings, including *H. pylori* infection tests, gastroduodenoscopy, and bioelectrical impedance analysis (BIA) at least twice at the Health Screening and Promotion Center of Asan Medical Center, Seoul, Korea, between 2005 and 2021. Of these, 2,639 patients underwent health screenings again within 3 years after eradication, and 20,408 patients underwent health screenings again within 3 years without *H. pylori* eradication. We excluded 1,190 patients among 2,639 asymptomatic patients who underwent *H. pylori* eradication based on the following criteria: 315 patients who were not followed up within 3 years after eradication, 286 patients who were followed up for <1 year, 462 patients who did not undergo follow-up BIA tests on the same machine, 106 patients diagnosed with gastric dysplasia or cancer (categories 3, 4, or 5 of the Vienna classification) during initial upper endoscopy, and 21 patients who were <18 years old at initial health screening. We excluded 8,006 patients from 20,408 patients without *H. pylori* eradication based on the same exclusion criteria. Matching was

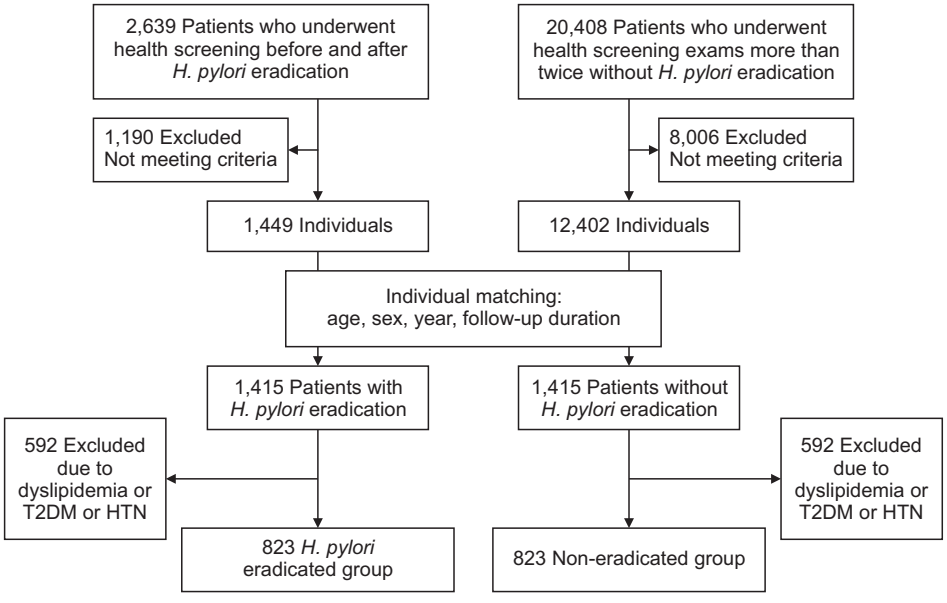

Fig. 1. Flow of study participants. *H. pylori*, *Helicobacter pylori*; T2DM, type 2 diabetes mellitus; HTN hypertension.

performed to balance key factors, including age (±5 years), sex, and year of initial screenings between the *H. pylori* eradicated and non-eradicated groups. A greedy algorithm was used to select matched controls in a 1:1 ratio, resulting in 1,415 individuals matched from each group. After excluding patients with dyslipidemia, type 2 diabetes mellitus, or hypertension, the *H. pylori* eradicated and non-eradicated groups were each enrolled with 823 patients (Fig. 1).

2. Diagnosis of *H. pylori* and eradication and endoscopic gastric atrophy

IMMULITE 2000 *H. pylori* IgG system (Siemens Healthcare Diagnostics Products Ltd., Llanberis, Gwynedd, UK), a solid-phase chemiluminescent immunometric assay, was used to perform *H. pylori* serologic testing for all the participants. The cutoff values for negative, equivocal, and positive results were <0.9, 0.9–1.1, and >1.1 U/mL, respectively. This test has been validated in the Korean population with reported sensitivity and specificity values of 97% and 100%, respectively.[22]

We treated 823 patients with amoxicillin, clarithromycin, and proton pump inhibitor triple therapy for 7 to 14 days at our center. Bismuth-based quadruple therapy was administered as a second-line treatment for patients with unsuccessful eradication. Approximately 40% of participants underwent a urea breath test or rapid urease test, while the remaining 60% exhibited a reduction in antibody titers of >25% after eradication. Successful eradication was defined based on these criteria, supported by previous studies on the significance of serology in assessing *H. pylori* eradication.[22-26]

GIF-H260, HQ290, and H290 (Olympus, Tokyo, Japan) were used to perform upper endoscopies by 16 gastroenterologists. Based on the endoscopic findings, gastric mucosal atrophy was evaluated using the Kimura-Takemoto classification.[27] We classified C1, 2, and 3 as closed type, and O1, 2, and 3 as open type.

3. Anthropometric and body composition measurements

Trained examiners performed anthropometric measurements. BMI was calculated by dividing weight in kilograms by the square of height in meters. Waist circumference (WC; cm) was measured at the midpoint between the costal margin and the iliac crest at the end of a normal expiration. Direct segmental multifrequency BIA with the InBody 720 body composition analyzer (InBody Co., Ltd., Seoul, Korea) was used to measure body composition, including body fat and skeletal muscle masses. This system measured the impedance in the four limbs and trunk at six different frequencies (1, 5, 50, 250, 500, and 1,000 kHz).

Appendicular skeletal muscle mass (ASM; kg) was calculated as the sum of lean muscle mass in the bilateral arms and legs. ASM adjusted for height squared was used as an index for skeletal muscle mass.[28,29]

4. Outcome measures

Lipid profiles, metabolic parameters, and body composition of 823 *H. pylori* eradicated patients were compared to those of 823 non-eradicated patients. Additionally, we examined the differences between the 560 eradicated patients and the 560 non-eradicated patients by 1:1 matching of patients >45 years old.

5. Statistical analysis

Continuous variables, including age, weight, height, BMI, WC, body fat mass, ASM, and lipid levels, are expressed as means and standard deviations. Categorical variables are expressed as numbers and percentages. Paired student t-tests or Wilcoxon signed rank tests were used to compare the differences between pre- and post-eradication in the eradicated and non-eradicated groups, and pre- and post-eradication in the eradicated group. A linear mixed model was performed to identify significant factors associated with the changes of other metabolic parameters among several binary variables (sex, eradication, and atrophy-closed type) and continuous variables (initial age, duration, differences of BMI, diastolic blood pressure [DBP], glucose, and ASM). The linear mixed model included a covariance structure to account for the correlation within matched pairs, and multivariate analyses using backward elimination were performed. A two-tailed $p<0.05$ was considered statistically significant. SAS statistical software (version 9.4; SAS Institute Inc., Cary, NC, USA) was used for all statistical analyses.

RESULTS

1. Demographic data

Table 1 presents the baseline characteristics of the 823 *H. pylori* eradicated and 823 non-eradicated patients. The mean age of the patients was 48.44 years, and 1,124 (68.3%) were male. No significant differences were observed between the groups regarding mean age, BMI, WC, body composition (body fat mass and ASM), blood pressure, or lipid profiles. However, C-reactive protein (CRP) levels were significantly higher in the *H. pylori* eradicated group than in the non-eradicated group (0.70 mg/dL vs 0.05 mg/dL, $p<0.001$). Fasting blood glucose (FBG) levels were significantly lower in the eradicated group than in the non-

Table 1. Baseline Characteristics of *Helicobacter pylori* Eradicated and Non-Eradicated Groups

Characteristic	Eradicated group (n=823)	Non-eradicated group (n=823)	p-value
Age, mean±SD, yr	48.76±7.73	48.12±7.90	0.097
Sex, No. (%)			1.000
Male	562 (68.3)	562 (68.3)	
Female	261 (31.7)	261 (31.7)	
Body composition, mean±SD			
Height, cm	167.57±7.64	167.28±7.69	0.439
Weight, kg	66.79±10.72	67.18±10.86	0.464
BMI, kg/m^2	23.69±2.74	24.91±2.76	0.108
Body fat mass, kg	14.34±4.48	14.45±4.44	0.621
Body fat percentage, %	21.46±5.70	21.55±5.73	0.762
ASM, kg	16.92±3.80	16.97±3.81	0.791
ASM/H^2, kg/m^2	5.97±1.04	6.01±10.03	0.483
Waist circumference, cm	81.30±8.00	82.02±7.97	0.068
Gastric mucosal atrophy, No. (%)			0.156
Absence of atrophy	577 (70.1)	606 (73.6)	
Atrophy-closed type	81 (9.8)	82 (10.0)	
Atrophy open type	165 (20.0)	135 (16.4)	
Blood pressure, mean±SD			
SBP, mm Hg	116.57±13.26	115.99±13.76	0.382
DBP, mm Hg	74.00±10.09	73.41±10.49	0.246
Blood test, mean±SD			
TC, mg/dL	194.18±33.20	195.61±34.99	0.396
LDL, mg/dL	123.57±29.05	124.36±30.72	0.593
HDL, mg/dL	55.67±13.99	54.74±13.67	0.174
TG, mg/dL	123.55±74.49	129.98±81.73	0.095
ESR, mm/hr	13.84±10.74	12.75±9.61	0.064
CRP, mg/dL	0.70±1.90	0.05±0.12	<0.001
HbA1c, %	5.40±0.45	5.42±0.64	0.400
FBG, mg/dL	95.47±12.12	98.81±16.43	<0.001

BMI, body mass index; ASM, appendicular skeletal muscle mass; ASM/H^2, appendicular skeletal muscle mass/height^2; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; TG, triglyceride; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; HbA1c, glycated hemoglobin; FBG, fasting blood glucose.

eradicated group (95.47 mg/dL vs 98.81 mg/dL, p<0.001).

2. Effect of eradication in the *H. pylori* eradicated group

Table 2 presents the differences in body weight, BMI, WC, body composition (body fat mass and ASM), blood pressure, and lipid profiles before and after *H. pylori* eradication. The mean follow-up duration after *H. pylori* eradication was 488.63 days. Significant increases were observed in body weight (0.181±2.378 kg, p=0.029), body fat mass (0.136±1.953 kg, p=0.046), and WC (0.402±2.999 cm, p<0.001) after eradication. However, body fat percentage (0.143%±2.433%, p=0.143) and ASM (0.003±0.591 kg, p=0.869) did not differ significantly. Regarding lipid profile, low-density lipoprotein (LDL) levels (–1.646±23.026 mg/dL, p=0.041) and erythrocyte sedimentation rate (ESR; –2.131±8.964 mm/hr, p<0.001) decreased significantly, while total cholesterol (TC), high-density lipoprotein (HDL), and triglyceride did not differ significantly.

Table 2. Effect of Eradication on the *Helicobacter pylori* Eradicated Group (n=823)

Variable	Baseline	After eradication	p-value
Age, mean±SD, yr	48.76±7.73	50.11±7.68	<0.001
Body composition, mean±SD			
Height, cm	167.57±7.64	167.60±7.64	0.256
Weight, kg	66.79±10.72	66.98±10.81	0.029
BMI, kg/m^2	23.69±2.74	23.74±2.75	0.091
Body fat mass, kg	14.34±4.48	14.48±4.52	0.046
Body fat percentage, %	21.46±5.70	21.61±5.64	0.143
ASM, kg	16.92±3.80	16.92±3.78	0.869
ASM/H^2, kg/m^2	5.97±1.04	5.97±1.02	0.811
Waist circumference, cm	81.30±8.00	81.68±8.08	<0.001
Blood pressure, mean±SD			
SBP, mm Hg	116.57±13.26	116.69±12.67	0.760
DBP, mm Hg	74.00±10.09	74.38±9.91	0.152
Blood test, mean±SD			
TC, mg/dL	194.18±33.20	194.16±31.05	0.987
LDL, mg/dL	123.57±29.05	121.92±28.42	0.041
HDL, mg/dL	55.67±13.99	55.94±14.01	0.368
TG, mg/dL	123.55±74.49	126.33±74.48	0.218
ESR, mm/hr	13.84±10.74	11.90±8.91	<0.001
CRP, mg/dL	0.70±1.90	0.59±1.71	0.780
HbA1c, %	5.40±0.45	5.40±0.48	0.743
FBG, mg/dL	95.47±12.12	95.90±11.91	0.538

BMI, body mass index; ASM, appendicular skeletal muscle mass; ASM/H^2, appendicular skeletal muscle mass/height^2; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; TG, triglyceride; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; HbA1c, glycated hemoglobin; FBG, fasting blood glucose.

3. Comparison between *H. pylori* eradicated and non-eradicated groups

Table 3 illustrates the differences between the 823 *H. pylori* eradicated and 823 non-eradicated patients. The follow-up duration was significantly shorter in the eradicated group than in the non-eradicated group (488.63 days vs 516.99 days, p=0.002). The changes in systolic blood pressure (SBP) and DBP were significantly smaller in the eradicated group than in the non-eradicated group (SBP: 0.115 mm Hg vs 1.837 mm Hg, p=0.001; DBP: 0.386 mm Hg vs 2.022 mm Hg, p<0.001). Additionally, follow-up ESR and glycated hemoglobin (HbA1c) levels were significantly lower in the eradicated group than in the non-eradicated group (ESR: –2.131 mm/hr vs –0.466 mm/hr, p=0.016; HbA1c: –0.003% vs 0.070%, p<0.001). However, changes in body weight, BMI, WC, body composition, and lipid profiles were not significantly different between the two groups.

Table 3. Comparison of the *Helicobacter pylori* Eradicated and Non-Eradicated Groups

Variable	Eradicated group (n=823)	Non-eradicated group (n=823)	p-value
Age, mean±SD, yr	48.76±7.73	48.12±7.90	0.097
Duration of follow-up, mean±SD, day	488.63±188.33	516.99±177.64	0.002
Body composition, mean±SD			
Height, cm	0.034±0.867	0.102±0.820	0.106
Weight, kg	0.181±2.378	0.070±2.352	0.335
BMI, kg/m^2	0.050±0.847	−0.004±0.857	0.191
Body fat mass, kg	0.136±1.953	0.121±1.953	0.876
Body fat percentage, %	0.143±2.433	0.146±2.387	0.983
ASM, kg	0.003±0.591	−0.001±0.647	0.883
ASM/H^2, kg/m^2	0.001±0.209	−0.001±0.229	0.901
Waist circumference, cm	0.402±2.999	0.166±3.116	0.115
Blood pressure, mean±SD			
SBP, mm Hg	0.115±10.834	1.837±10.897	0.001
DBP, mm Hg	0.386±7.737	2.022±8.058	<0.001
Blood test, mean±SD			
TC, mg/dL	−0.016±26.936	1.226±29.400	0.367
LDL, mg/dL	−1.646±23.026	−0.433±25.518	0.304
HDL, mg/dL	0.271±8.627	0.433±8.032	0.694
TG, mg/dL	2.776±64.016	−3.899±66.118	0.055
ESR, mm/hr	−2.131±8.964	−0.466±8.634	0.016
CRP, mg/dL	−0.108±2.452	0.024±0.173	0.153
HbA1c, %	−0.003±0.359	0.070±0.388	<0.001
FBG, mg/dL	0.435±10.463	0.379±11.221	0.840

BMI, body mass index; ASM, appendicular skeletal muscle mass; ASM/H^2, appendicular skeletal muscle mass/height^2; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; TG, triglyceride; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; HbA1c, glycated hemoglobin; FBG, fasting blood glucose.

4. Comparison between *H. pylori* eradicated and non-eradicated groups according to the endoscopic atrophy

We used the Kimura classification to classify atrophy and compared the eradicated and non-eradicated groups according to endoscopic atrophy. In the group without endoscopic atrophy, metabolic changes tended to be improved due to eradication treatment (Table 4). The changes in SBP, DBP, and HbA1c were significantly lower in the eradicated group than in the non-eradicated group (SBP: –0.552 mm Hg vs 1.928 mm Hg, p<0.001; DBP: –0.014 mm Hg vs 2.167 mm Hg, p<0.001; HbA1c: 0.004% vs 0.099%, p<0.001). However, no significant metabolic change was observed in the group with atrophy because of eradication treatment.

5. Comparison in individuals over 45 years of age

We further analyzed the differences between the 560 patients in the eradicated group and the 560 in the non-eradicated group by 1:1 matching of patients older than 45 years (Table 5). The mean age in both subgroups was 52.44 years, with no significant age difference between the groups. The follow-up duration was significantly shorter in the eradicated group than in the non-eradicated group (480.94 days vs 504.59 days, p=0.025). The changes in SBP and DBP were significantly smaller in the eradicated group than in the non-eradicated group (SBP: 0.28 mm Hg vs 1.85 mm Hg, p=0.019; DBP: 0.59 mm Hg vs 1.81 mm Hg, p=0.010). BMI was significantly increased in the eradicated group; however, no significant differences were observed between the two groups based on changes in body weight, body fat mass, ASM, or WC (BMI: 0.053 kg/m^2 vs –0.044 kg/m^2, p=0.040). Regarding lipid profile, TC and LDL levels were significantly decreased in the *H. pylori* eradicated group (TC: –2.11 mg/dL vs 1.52 mg/dL, p=0.035; LDL: –2.81 mg/dL vs 0.35 mg/dL, p=0.034). ESR and HbA1c levels were significantly decreased in the eradicated group than in the non-eradicated group (ESR: –2.52 mm/hr vs –0.22 mm/hr, p<0.001; HbA1c: –0.001% vs 0.072%, p=0.002).

Table 4. Comparison of the *Helicobacter pylori* Eradicated and Non-Eradicated Groups in Patients without Endoscopic Atrophy

Variable	Eradicated group (n=444)	Non-eradicated group (n=44)	p-value
Body composition, mean±SD			
BMI, kg/m^2	0.048±0.885	0.008±0.912	0.488
Body fat mass, kg	0.085±1.996	0.095±2.057	0.941
ASM, kg	0.025±0.604	−0.005±0.528	0.417
Waist circumference, cm	0.319±3.022	0.179±3.235	0.499
Blood pressure, mean±SD			
SBP, mm Hg	−0.552±11.470	1.928±10.192	<0.001
DBP, mm Hg	−0.014±8.376	2.167±8.032	<0.001
Blood test, mean±SD			
ESR, mm/hr	−1.390±8.212	−0.588±9.071	0.509
CRP, mg/dL	−0.181±2.490	0.045±0.197	0.120
HbA1c, %	0.004±0.398	0.099±0.332	<0.001
FBG, mg/dL	1.059±11.271	0.203±10.225	0.177

BMI, body mass index; ASM, appendicular skeletal muscle mass; SBP, systolic blood pressure; DBP, diastolic blood pressure; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; HbA1c, glycated hemoglobin; FBG, fasting blood glucose.

6. Linear mixed model for changes in metabolic parameters

A linear mixed model for metabolic parameters was performed to identify significant risk factors associated with changes in HbA1c, DBP, and LDL (in patients ≥45 years) and TC (in patients ≥45 years) among several binary variables (sex, eradication, and atrophy-closed type) and continuous variables (initial age, duration, changes in BMI, DBP, FBG, and ASM). BMI, DBP, and glucose were positively correlated, while *H. pylori* eradication was

Table 5. Comparison of *Helicobacter pylori* Eradicated and Non-Eradicated Groups in Patients Aged >45 Years

Variable	Eradicated group (n=560)	Non-eradicated group (n=560)	p-value
Age, mean±SD, yr	52.67±5.53	52.21±5.52	0.162
Duration of follow-up, mean±SD, day	480.94±179.10	504.59±174.60	0.025
Sex, No. (%)			1.000
Male	362 (64.6)	362 (64.6)	
Female	198 (35.4)	198 (35.4)	
Body composition, mean±SD			
Height, cm	0.02±0.84	0.11±0.82	0.093
Weight, kg	0.18±2.23	−0.04±2.14	0.103
BMI, kg/m^2	0.053±0.799	−0.044±0.789	0.040
Body fat mass, kg	0.176±1.873	0.140±1.758	0.734
Body fat percentage, %	0.220±2.404	0.214±2.263	0.966
ASM, kg	−0.002±0.599	−0.034±0.693	0.409
ASM/H^2, kg/m^2	−0.003±0.198	−0.020±0.234	0.198
Waist circumference, cm	0.420±2.912	0.080±2.910	0.051
Gastric mucosal atrophy, No. (%)			0.646
Absence of atrophy	366 (65.4)	376 (67.1)	
Atrophy-closed type	61 (10.9)	64 (11.4)	
Atrophy open type	133 (23.8)	120 (21.4)	
Blood pressure, mean±SD			
SBP, mm Hg	0.28±11.33	1.85±10.99	0.019
DBP, mm Hg	0.59±7.79	1.81±7.95	0.010
Blood test, mean±SD			
TC, mg/dL	−2.11±27.87	1.52±29.72	0.035
LDL, mg/dL	−2.81±24.19	0.35±25.78	0.034
HDL, mg/dL	−0.06±8.78	0.39±8.26	0.377
TG, mg/dL	0.49±62.51	−4.49±69.58	0.208
ESR, mm/hr	−2.52±9.17	−0.22±8.60	<0.001
CRP, mg/dL	−0.153±2.351	0.036±0.201	0.061
HbA1c, %	−0.001±0.369	0.072±0.426	0.002
FBG, mg/dL	0.10±10.82	0.39±11.70	0.198

BMI, body mass index; ASM, appendicular skeletal muscle mass; ASM/H^2, appendicular skeletal muscle mass/height^2; SBP, systolic blood pressure; DBP, diastolic blood pressure; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; TG, triglyceride; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; HbA1c, glycated hemoglobin; FBG, fasting blood glucose.

negatively correlated with changes in HbA1c. Sex (female), duration, BMI, FBG, and atrophy-closed type were positively correlated, while *H. pylori* eradication was negatively correlated with changes in DBP. Duration, BMI, and FBG were positively correlated, while sex (male), ASM, and *H. pylori* eradication were negatively correlated with changes in LDL (in patients ≥45 years). Duration, BMI, DBP, and FBG were positively correlated, while ASM and *H. pylori* eradication were negatively correlated with changes in TC (in patients ≥45 years).

A multivariate linear mixed model revealed that BMI and FBG were positively correlated with changes in all the other metabolic parameters, and DBP was positively correlated with HbA1c and TC. However, *H. pylori* eradication was negatively correlated with changes in all the metabolic parameters except TC (p=0.078, marginally significant), and ASM was negatively correlated with changes in DBP, LDL, and TC (Table 6).

DISCUSSION

To our knowledge, this is the first retrospective longitudinal study to investigate the effects of *H. pylori* eradication on body composition, including body fat mass and ASM. Our study demonstrated that metabolic parameters, including blood pressure and HbA1c, and inflammatory markers, including ESR and CRP, and LDL cholesterol in patients aged >45 years old, significantly improved approximately 1.3 years after *H. pylori* eradication compared with the non-eradicated group. Although body weight, BMI, body fat mass, ASM, and WC were increased after eradication, the changes were statistically non-significant between the two groups. Additionally, unlike patients with atrophy, those without atrophy exhibited significant positive changes in metabolic parameters due to eradication

Table 6. Multivariate Analysis of Metabolic Parameters

Variable	HbA1c		DBP		LDL (in patients ≥45 yr)		TC (in patients ≥45 yr)	
	β	p-value	β	p-value	β	p-value	β	p-value
Male sex					−3.216	0.039		
Duration					0.009	0.038	0.015	0.002
BMI	0.026	0.019	1.144	<0.001	3.147	0.001	3.277	0.003
DBP	0.003	0.004					0.343	0.002
FBG	0.009	<0.001	0.091	<0.001	0.205	0.002	0.304	<0.001
Atrophy-closed			1.689	0.010				
ASM			−0.930	0.004	−4.184	<0.001	−3.695	0.006
H. pylori eradication	−0.069	<0.001	−1.641	<0.001	−3.073	0.036	−2.977	0.078

HbA1c, glycated hemoglobin; DBP, diastolic blood pressure; LDL, low-density lipoprotein; TC, total cholesterol; BMI, body mass index; FBG, fasting blood glucose, ASM, appendicular skeletal muscle mass; *H. pylori, Helicobacter pylori.*

treatment.

Previous studies have reported the beneficial effects of *H. pylori* eradication on lipid profiles and the varying effects on metabolic parameters. A meta-analysis of 24 studies (including four RCTs and 20 non-RCTs) demonstrated that HDL and triglyceride levels increased after *H. pylori* eradication.[30] Another meta-analysis demonstrated a slight increase in BMI and body weight after eradication.[14] Park *et al.*[31] reported that HDL and BMI were significantly increased in the eradicated group than in the non-eradicated group after 12 months of follow-up. However, the 5-year BMI change was not significantly different. Mokhtare *et al.*[6] reported significant improvement in TC, LDL, HDL, FBG, HbA1c, and WC after *H. pylori* eradication. Our findings are consistent with those of these studies, as we observed significant improvements in lipid profiles (TC and LDL) and metabolic parameters (blood pressure and HbA1c). Although body weight, body fat mass, and WC increased after eradication, these changes were not significantly different between the two groups. *H. pylori* eradication may enhance amino acids and carbohydrate metabolism by modifying intestinal flora, changing the intestinal microbiome, increasing ghrelin levels, and reducing leptin, potentially resulting in weight gain and increased BMI.[20,32-34]

Sarcopenia, characterized by age-related loss of skeletal muscle and strength, is associated with metabolic syndrome due to the role of skeletal muscle in insulin-dependent glucose uptake. It is associated with adverse events, including cardiovascular disease and mortality.[15,16] Although recent studies have reported an association between *H. pylori* infection, atrophic gastritis, and gastric cancer,[19-21] few have examined the changes in skeletal muscle mass after *H. pylori* eradication. A previous study has demonstrated that individuals with a history of *H. pylori* eradication exhibited a lower prevalence of low skeletal muscle mass.[20] Another previous study has shown that *H. pylori* infection is associated with sarcopenia and decreased muscle mass;[21] however, these studies could not establish a causal relationship because of their non-longitudinal design.

Our analysis of body composition, including body fat mass, ASM, and ASM adjusted for height squared, revealed no significant differences between the eradicated and non-eradicated groups. However, there was a tendency for body weight, BMI, body fat mass, and ASM to increase after *H. pylori* eradication. Furthermore, patients without atrophy exhibited significant positive changes in metabolic parameters because of eradication treatment. This might be attributed to the increase in circulating ghrelin and the decrease in proinflammatory cytokines, including interleukin 1 and 6, tumor necrosis factor-α, oxidative stress, and immunological cross-reactivity.[20,35] Previous studies have demonstrated reductions in inflammatory markers, including CRP and white blood cell, after *H. pylori* eradication.[7,33] Following these findings, our study demonstrated significant decreases in ESR and CRP levels after *H. pylori* eradication compared with those in the non-eradicated group. These results provide further evidence that *H. pylori* eradication may reduce systemic inflammation and potentially mitigate muscle wasting.

This study has some limitations. First, as a retrospective single-center study, the non-eradicated group exhibited a significantly longer follow-up duration than the eradicated group, which could introduce bias. Additionally, our asymptomatic patients were not followed up annually at a health examination center, precluding periodical analysis. Second, we used BIA to measure muscle mass, while dual-energy X-ray absorptiometry is considered the gold standard for evaluating skeletal muscle mass. However, BIA is noninvasive, cost-effective, and a recognized method for diagnosing sarcopenia, according to the Asian Working Group consensus. Third, assessing intestinal metaplasia was difficult because a mapping biopsy was not performed. Therefore, we used the Kimura classification to classify atrophy and analyzed it based on the presence or absence of endoscopic atrophy.

In conclusion, this study demonstrated the beneficial effects of *H. pylori* eradication on lipid profiles, metabolic parameters, and inflammatory parameters. However, *H. pylori* eradication did not significantly increase body weight, BMI, body fat mass, and ASM. *H. pylori* eradication may improve metabolic parameters by inhibiting the release of inflammatory cytokines and potentially increasing ghrelin secretion; however, its viability as a therapeutic option for sarcopenia is unclear. Further prospective longitudinal studies are required to investigate whether *H. pylori* eradication ameliorates sarcopenia.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

AUTHOR CONTRIBUTIONS

Study concept and design: K.D.C., S.E.B. Data acquisition: S.E.B. Data analysis and interpretation: K.D.C., S.E.B., M.J.L. Drafting of the manuscript: S.E.B. Critical revision of the manuscript for important intellectual content: K.D.C., J.C. Statistical analysis: S.K. Study supervision: K.D.C., J.C. Approval of final manuscript: all authors.

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