Table S1. General and oral conditions of participants with different total bacterial density on the tongue microbiota.

	Total bacterial density[a]		
	Low (n= 242)	High (n= 242)	*P*-value
Age (Mean ± SD)	74.9±2.9	75.1±3.0	0.426[b]
No. (%) of female	139 (57.4)	127 (52.5)	0.273[c]
Body mass index (Mean ± SD)	23±3.4	23.4±3.2	0.202[b]
Smoking intensity (n (%))			0.582[c]
Nonsmokers	149 (61.6)	141 (58.3)	
Moderate smokers	36 (14.9)	34 (14)	
Heavy smokers	57 (23.6)	67 (27.7)	
Current smokers (n (%))	16 (6.6)	16 (6.6)	1[c]
Never drinkers (n (%))	97 (40.1)	82 (33.9)	0.158[c]
Physically active (n (%))	135 (55.8)	149 (61.6)	0.196[c]
Dental conditions			
No. of teeth	20.8±7.6	21.4±6.9	0.347[a]
No. (%) of subjects with decayed teeth	45 (18.6)	50 (20.7)	0.567[c]
Mean % of caries-experienced teeth	66.2±26.9	66.4±24.7	0.905[c]
Mean max plaque index	1.1±0.8	1.2±0.7	0.063[b]
Periodontal conditions[d] (n (%))			0.358[c]
No/Mild	165 (68.2)	160 (66.1)	
Moderate/Severe	66 (27.3)	77 (31.8)	
No. (%) of edentulous individuals	11 (4.5)	5 (2.1)	0.203[e]
Presence of airflow limitation	41 (16.9)	59 (24.4)	0.043[c]

[a]Stratified by median value. [b]Student's t-test. [c]Chi-square test. [d]Only 468 dentulous individuals were included. [e]Fisher's exact test.

Table S2 Adjusted odds ratio for airflow limitation in multiple logistic regression analysis.

	Adjusted odds ratio (95%CI)
Age	1.12 (1.04–1.21)**
Gender (Male)	0.98 (0.45–2.10)
Body mass index	0.87 (0.80–0.94)***
Smoking intensity	
Nonsmokers	1
Moderate smokers	2.02 (0.87–4.71)
Heavy smokers	3.68 (1.65–8.20)**
Never drinkers	1.11 (0.63–1.97)
Presence of decayed teeth	1.35 (0.77–2.37)
Periodontal condition	
No/Mild	1
Moderate/Severe	1.07 (0.64–1.78)
Edentulous	1.44 (0.41–5.04)
Total bacterial density on the tongue (Log copies)	1.80 (1.01–3.18)*

Each odds ratio was adjusted by age, gender, body mass index, smoking intensity, alcohol intake, presence of decayed teeth and periodontal condition with *P* values < 0.2 in a bivariate analysis. ****P*< 0.001, ***P*< 0.01, **P*< 0.05.

Table S3 Odds ratio for airflow limitation of total bacterial density on the tongue in multiple logistic regression analysis for 452 individuals without any current habit of smoking.

	Odds ratio	
	Crude (95%CI)	Adjusted (95%CI)
Total bacterial density on the tongue		
Low	1	1
High	1.81 (1.12–2.97)*	1.81 (1.09–3.04)*

Odds ratios were calculated after excluding 32 current smokers. The odds ratio was adjusted by age, sex, body mass index, smoking intensity, alcohol intake, presence of decayed teeth and periodontal condition. *P< 0.05.

Table S4 Community types of the tongue microbiota and the presence of airflow limitation.

	Normal airflow (n= 384)	Airflow limitation (n= 100)	*P*-value[a]
Community types[b]			0.112
Type 1 (n= 87)	71 (18.5)	16 (16.0)	
Type 2 (n= 110)	84 (21.9)	26 (26.0)	
Type 3 (n= 152)	129 (33.6)	23 (23.0)	
Type 4 (n= 135)	100 (26.0)	35 (35.0)	

[a]Chi-square test. [b]Community types of the tongue microbiota were classified by partitioning around medoids (PAM) cluster analysis using the Jensen-Shannon divergence (JSD) and Calinski-Harabasz (CH) index which were used for enterotypes clustering.

Table S5 Bacterial taxa corresponding to differentially abundant OTUs in tongue microbiota of the individuals with airflow limitation and those with normal airflow.

OTU No.	Bacterial taxa corresponding to OTU[a]	Normal airflow (n= 384)	Airflow limitation (n= 100)	LDA score
Differentially abundant in the individuals with airflow limitation				
#6	*Neisseria flavescens* (610)	5.5±7.8	7.3±10.5	4.00
#4	*Prevotella melaninogenica* (469)	8.9±6.5	10.1±6.1	3.71
#421	Genus *Neisseria*[b]	2.1±4.8	3.0±5.7	3.70
Differentially abundant in the individuals with normal airflow				
#19	*Streptococcus parasanguinis* (411)	4.5±3.9	3.7±3.8	3.53

Linear discriminant analysis effect size (LEfSe) analysis was conducted and OTUs with a high LDA score (>3.5) were shown.

[a]Oral taxon IDs in HOMD are given in parentheses following bacterial names. [b]No BLAST hit with ≥98.5% identity was found in the HOMD.

Table S6 Bacterial amounts of 21 predominant (with mean relative abundance >1%) operational taxonomic units (OTUs) in the tongue coating samples of participants with normal airflow and those with airflow limitation

	Median bacterial density per sample		
OTU No.	Normal airflow (n= 384)	Airflow limitation (n= 100)	Bacterial taxa corresponding to each OTU[a]
#4	16730119	25656687**	*Prevotella melaninogenica* (469)
#2	14446642	15183719	*Streptococcus salivarius* (755)
#1	12662001	14488616*	*Rothia mucilaginosa* (681)
#9	12629204	15106277	*Veillonella atypica* (524)
#19	6851811	6427302	*Streptococcus parasanguinis*_II (411)
#10	5923537	9753585**	*Actinomyces odontolyticus* (701)
#7	5627024	6546995*	*Granulicatella adiacens* (534)
#6	4699346	9303785**	*Neisseria flavescens* (610)
#3	4589601	5660723	*Prevotella histicola* (298)
#5	3766301	4181986	*Haemophilus parainfluenzae* (718)
#25	2738309	3023472	*Actinomyces* sp. (172)
#15	2299137	3407161	*Prevotella pallens* (714)
#11	1840369	1707299	*Gemella sanguinis* (757)
#8	1644017	2326732	*Fusobacterium periodonticum* (201)
#28	1490319	2405718*	Genus *Streptococcus*[b]
#22	1441301	2117044*	*Streptococcus* sp. (074)
#23	1183495	1860080*	*Actinomyces graevenitzii* (866)
#17	1142547	1164849	*Alloprevotella* sp. (308)
#12	380751	698806*	*Leptotrichia* sp. (417)
#14	337964	635212	*Porphyromonas pasteri* (279)
#421	27296	147826*	Genus *Neisseria*[b]

We calculated the bacterial amounts of 21 OTUs by multiplying total bacterial density and the relative abundance of each OTU. Bacterial amount of each OTU was compared between participants with normal airflow and those with airflow limitation using Wilcoxon Rank Sum test. $^{**}P < 0.01$, $^{*}P<0.05$; [a]Oral taxon IDs in HOMD are given in parentheses following bacterial names. [b]No BLAST hit with ≥98.5% identity was found in the HOMD.

Supplemental figure legends

Figure S1 Total bacterial density (Log 10 transformed) of the tongue microbiota of the elderly adults with various oral conditions. Dots indicate the mean; the error bars indicate 95% confidence intervals. No significant difference was observed between the groups by Kruskal-Wallis analysis.