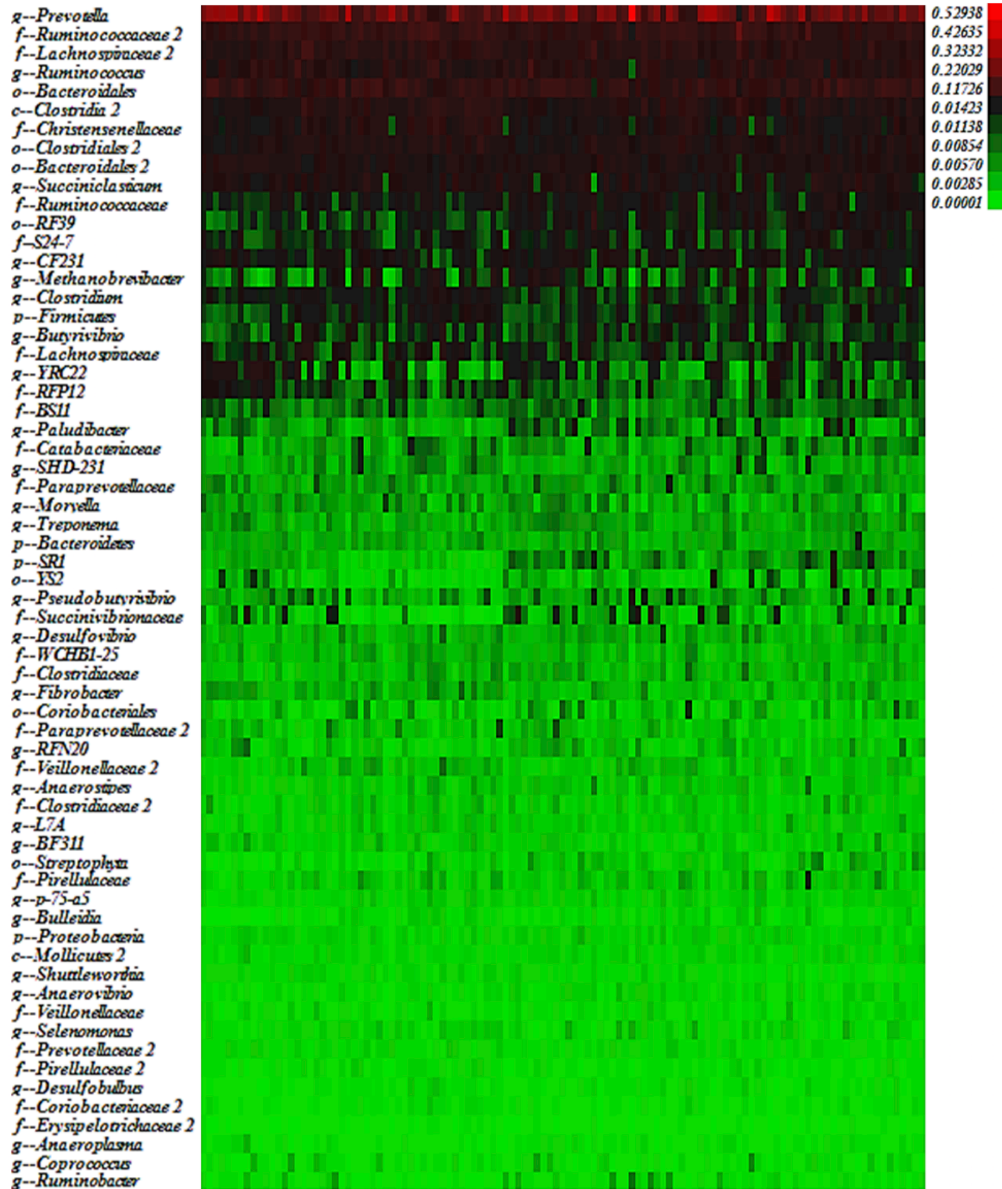
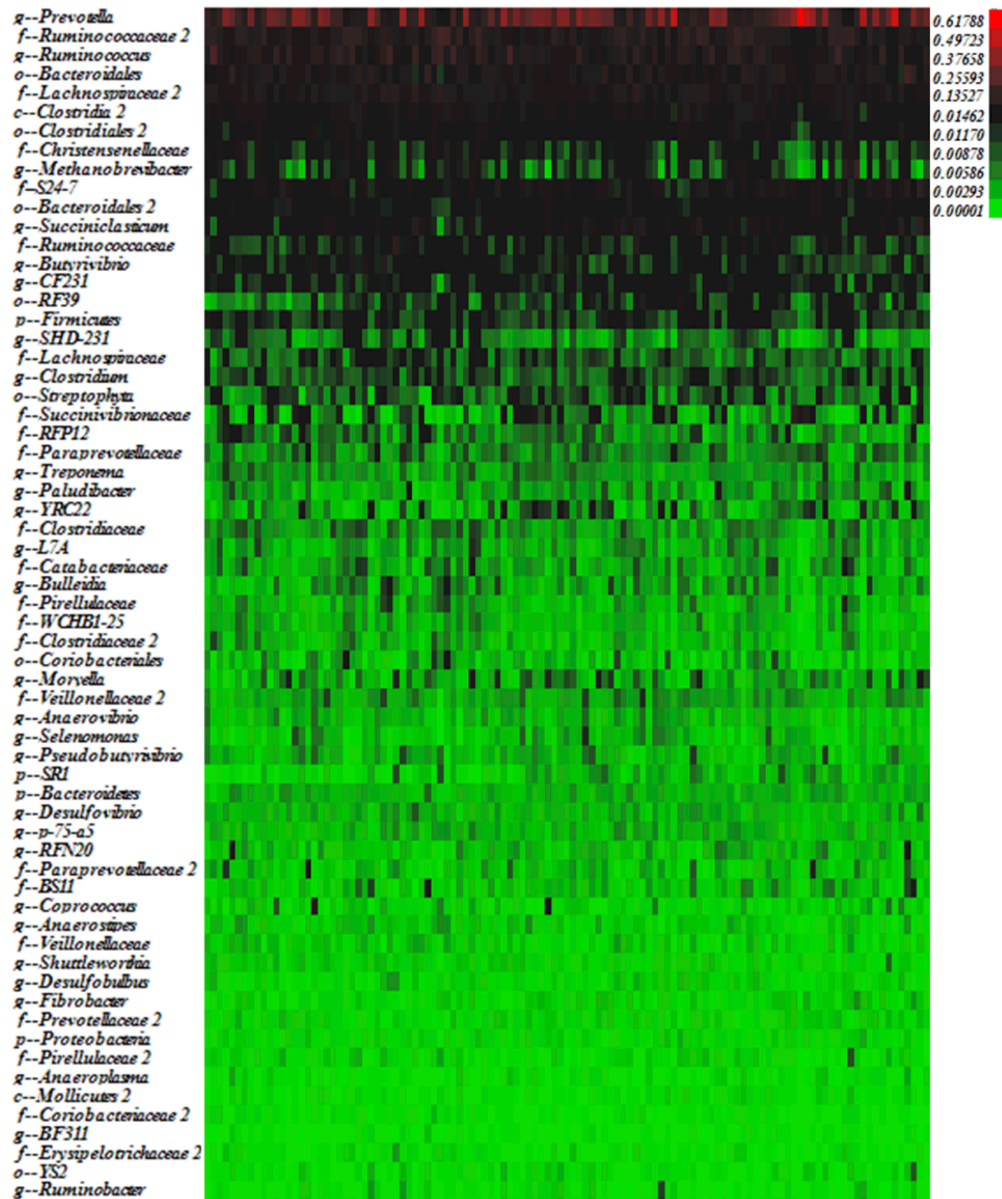


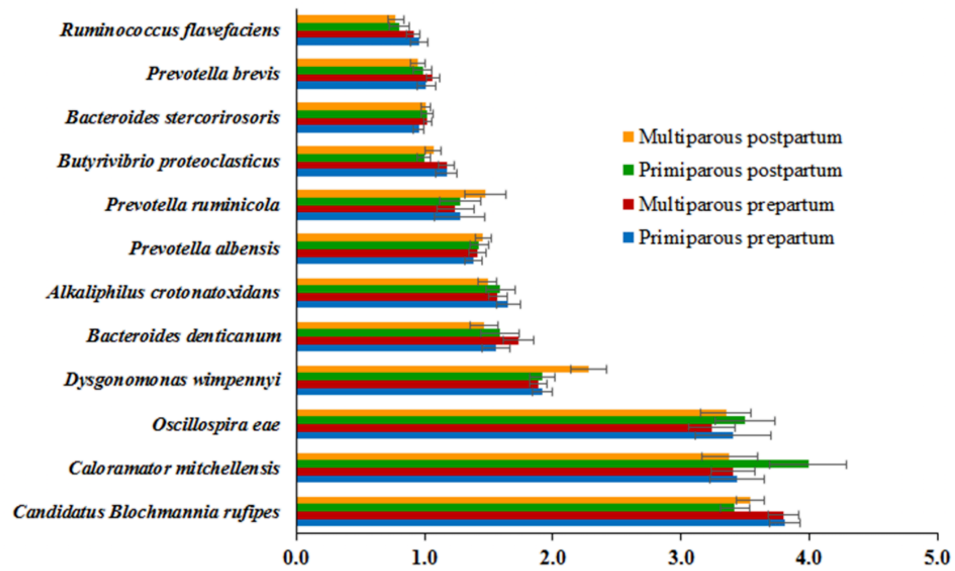
**Figure S1.** Heatmap illustrating the core rumen microbiome with bacterial taxa prevalence at the pre-partum period for 115 cows enrolled in the study. Bacteria were ordered from the highest (red color) to lowest (green color) average prevalence. The letters in front of the bacterial names identify the lowest level of classification (k=kingdom, p=phylum, c=class, o=order, f=family, and g=genus).



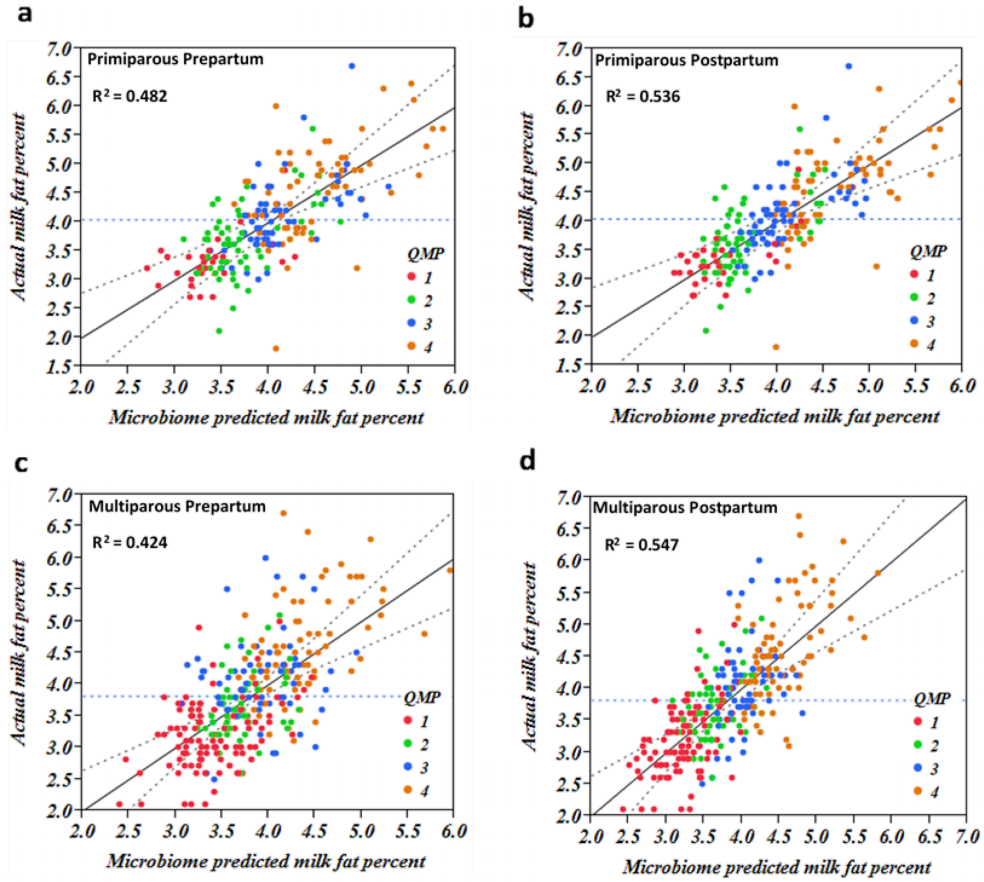
**Figure S2.** Heatmap illustrating the core rumen microbiome with bacterial taxa prevalence at the postpartum period for 115 cows enrolled in the study. Bacteria were ordered from the highest (red color) to lowest (green color) average prevalence. The letters in front of the bacterial names identify the lowest level of classification (k=kingdom, p=phylum, c=class, o=order, f=family, and g=genus).



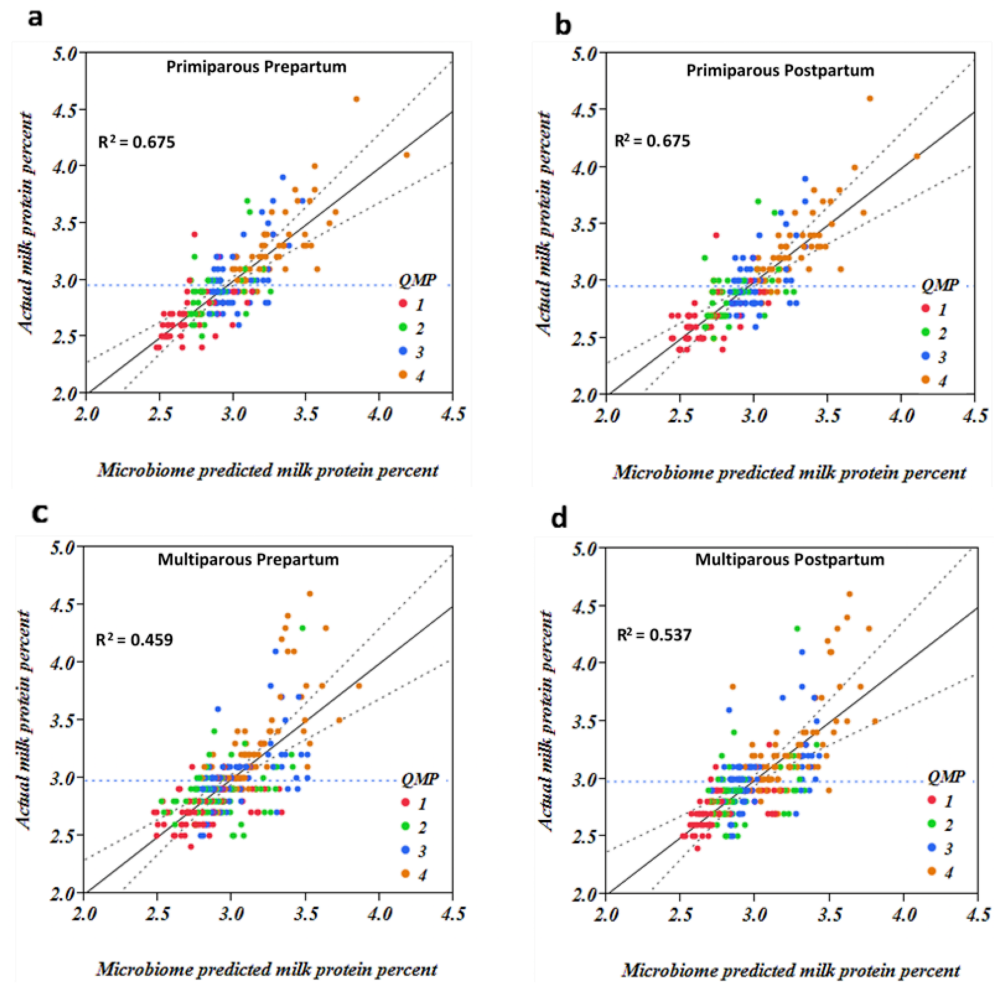
**Figure S3.** Graph bars illustrating the means relative abundance for the twelve most prevalent bacterial species. Mean bacterial species prevalence according to period relative to calving (prepartum and postpartum) and parity (multiparous and primiparous) is represented by the x axis values. Error bars represent the standard errors.



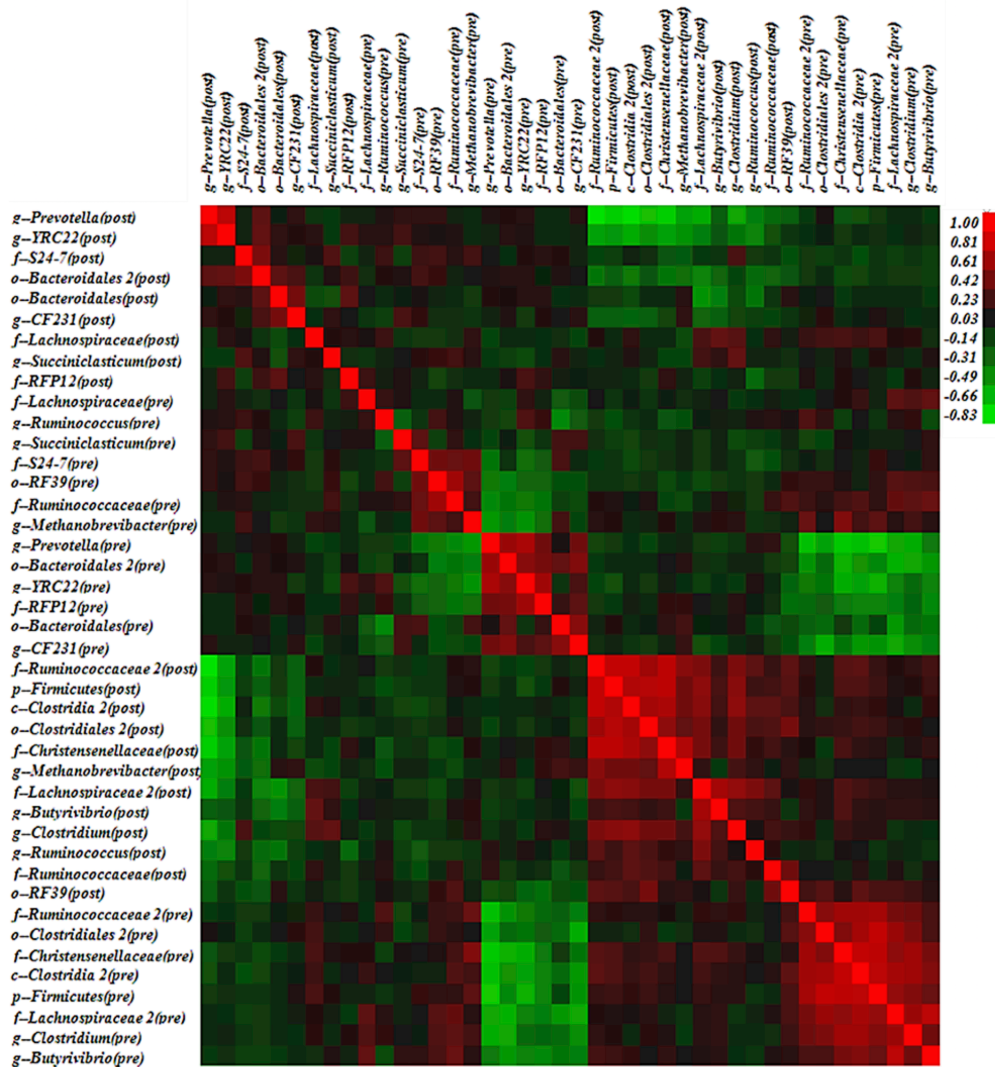
**Figure S4.** Linear regression illustration of microbiome-predicted milk fat percent and actual milk fat percent. The x axis represents the microbiome-predicted milk fat percent according to microbial genera that significantly affected milk fat percent for monthly values and the y axis represents the actual average of monthly milk fat percent. Legend shows different milk fat percent quartiles.



**Figure S5.** Linear regression illustration of microbiome-predicted milk protein percent and actual milk protein percent. The x axis represents the microbiome-predicted milk protein percent according to microbial genera that significantly affected milk protein percent for monthly values and the y axis represents the actual average of monthly milk protein percent. Legend shows different milk protein percent quartiles.



**Figure S6.** Heatmap illustrating correlations between the most prevalent core microbiome components prepartum and postpartum. The color and intensity of each square represent the value of the correlation between bacteria observed at the prepartum and postpartum periods. The color legend represents the values of the correlations. The letters in front of the bacterial names identify the lowest level of classification (k=kingdom, p=phylum, c=class, o=order, f=family, and g=genus).



**Table S1.** Ingredient and nutrient composition of prepartum and postpartum diet (DM basis).

ITEM	DIET	
	Prepartum	Postpartum
<b>INGREDIENTS, %</b>		
WHEAT STRAW	36.00	6.90
ALFALFA SILAGE	--	14.74
CORN SILAGE	32.76	38.48
GRASS SILAGE	7.27	--
CORN MEAL	--	15.85
WHEY	3.09	2.86
BLOOD MEAL	1.64	1.23
SOY PLUS	--	7.35
LIMESTONE GROUND	1.89	0.94
CANOLA MEAL	7.45	3.60
DISTILLERS GRAIN	--	1.44
CORN GLUTEN	7.56	2.95
BERGA FAT F-100 <sup>1</sup>	--	1.59
MINTREX <sup>2</sup>	0.07	0.04
MEPRON <sup>3</sup>	--	0.03
SMARTAMINE <sup>4</sup>	0.04	0.02
NACL	0.22	0.40
PREPARTUM MINERAL SUPPLEMENT <sup>5</sup>	2.00	--
POSTPARTUM MINERAL SUPPLEMENT <sup>6</sup>	--	0.46
<b>NUTRIENT PROFILE</b>		
NEL, MCAL/KG <sup>6</sup>	1.39	1.69
CP, %	13.65	16.50
SOLUBLE PROTEIN, %	5.20	6.14
NDF, %	38.23	24.15
ADF, %	43.28	30.09
NFC, %	30.51	40.83
STARCH, %	14.04	25.32
SUGAR, %	6.88	4.92
ETHER EXTRACT,	3.13	5.32
CA, %	1.43	0.90
P, %	0.42	0.39
MG, %	0.45	0.32
K, %	1.52	1.56
NA, %	0.15	0.47
CL, %	0.44	0.77
S, %	0.49	0.26
CU, PPM	16.81	22.52
MN, PPM	96.21	65.03
SE, PPM	0.45	0.70
ZN, PPM	66.61	84.93

<b>VITAMIN A, IU/KG</b>	6,364.00	6,577.49
<b>VITAMIN D3, IU/KG</b>	1,148.00	1,452.09
<b>VITAMIN E, IU/KG</b>	56.86	32.46

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**Table S2.** Relative abundance of taxa in the core rumen microbiome according to period relative to calving

TAXA LEVEL	Classification	PERIOD RELATIVE TO CALVING	
		Prepartum	Postpartum
GENUS	<i>Anaeroplasma</i>	0.05 ± 0.005	0.06 ± 0.005
GENUS	<i>Anaerostipes</i>	0.20 ± 0.012	0.15 ± 0.010
GENUS	<i>Anaerovibrio</i>	0.08 ± 0.008	0.24 ± 0.015
ORDER	Bacteroidales	7.20 ± 0.213	5.75 ± 0.240
ORDER	Bacteroidales 2	3.19 ± 0.081	2.67 ± 0.107
PHYLUM	Bacteroidetes	0.39 ± 0.017	0.27 ± 0.011
GENUS	<i>BF311</i>	0.16 ± 0.009	0.03 ± 0.003
FAMILY	BS11	0.79 ± 0.029	0.24 ± 0.029
GENUS	<i>Bulleidia</i>	0.08 ± 0.006	0.39 ± 0.029
GENUS	<i>Butyrivibrio</i>	1.41 ± 0.071	1.82 ± 0.095
FAMILY	Catabacteriaceae	0.55 ± 0.032	0.41 ± 0.030
GENUS	<i>CF231</i>	2.00 ± 0.064	1.76 ± 0.065
FAMILY	Christensenellaceae	3.32 ± 0.156	2.24 ± 0.137
CLASS	<i>Clostridia</i> 2	4.12 ± 0.167	3.82 ± 0.018
FAMILY	Clostridiaceae	0.30 ± 0.010	0.48 ± 0.025
FAMILY	Clostridiaceae 2	0.17 ± 0.010	0.26 ± 0.018
ORDER	<i>Clostridiales</i> 2	3.49 ± 0.118	2.90 ± 0.111
GENUS	<i>Clostridium</i>	1.64 ± 0.062	1.00 ± 0.041
GENUS	<i>Coprococcus</i>	0.08 ± 0.009	0.19 ± 0.047
FAMILY	Coriobacteriaceae 2	0.05 ± 0.003	0.05 ± 0.003
ORDER	Coriobacteriales	0.24 ± 0.023	0.26 ± 0.023
GENUS	<i>Desulfobulbus</i>	0.06 ± 0.004	0.10 ± 0.007
GENUS	<i>Desulfovibrio</i>	0.35 ± 0.004	0.36 ± 0.012
FAMILY	Erysipelotrichaceae 2	0.02 ± 0.002	0.05 ± 0.005
GENUS	<i>Fibrobacter</i>	0.33 ± 0.016	0.10 ± 0.007
PHYLUM	Firmicutes	1.51 ± 0.057	1.41 ± 0.060
GENUS	<i>L7A</i>	0.17 ± 0.008	0.36 ± 0.023
FAMILY	Lachnospiraceae	1.57 ± 0.080	1.06 ± 0.064
FAMILY	Lachnospiraceae 2	5.44 ± 0.162	5.74 ± 0.164
GENUS	<i>Methanobrevibacter</i>	1.61 ± 0.115	2.11 ± 0.203
CLASS	<i>Mollicutes</i> 2	0.11 ± 0.004	0.06 ± 0.004
GENUS	<i>Moryella</i>	0.43 ± 0.023	0.45 ± 0.037
GENUS	<i>p-75-a5</i>	0.13 ± 0.006	0.25 ± 0.011
GENUS	<i>Paludibacter</i>	0.61 ± 0.042	0.41 ± 0.032
FAMILY	Paraprevotellaceae	0.48 ± 0.020	0.60 ± 0.020
FAMILY	Paraprevotellaceae 2	0.23 ± 0.017	0.23 ± 0.025
FAMILY	Pirellulaceae	0.21 ± 0.017	0.30 ± 0.023
FAMILY	Pirellulaceae 2	0.06 ± 0.004	0.09 ± 0.004
GENUS	<i>Prevotella</i>	19.51 ± 0.822	21.26 ± 1.205
FAMILY	<i>Prevotellaceae</i> 2	0.08 ± 0.004	0.10 ± 0.005
PHYLUM	Proteobacteria	0.13 ± 0.005	0.09 ± 0.005
GENUS	<i>Pseudobutyrvibrio</i>	0.53 ± 0.040	0.28 ± 0.020
ORDER	<i>RF39</i>	1.77 ± 0.091	1.35 ± 0.093
GENUS	<i>RFN20</i>	0.22 ± 0.016	0.23 ± 0.021
FAMILY	<i>RFP12</i>	1.12 ± 0.052	0.63 ± 0.040
GENUS	<i>Ruminobacter</i>	0.09 ± 0.013	0.06 ± 0.011
FAMILY	Ruminococcaceae	2.03 ± 0.078	1.92 ± 0.127
FAMILY	Ruminococcaceae 2	7.26 ± 0.213	8.00 ± 0.336
GENUS	<i>Ruminococcus</i>	4.85 ± 0.183	7.33 ± 0.377
FAMILY	<i>S24-7</i>	1.62 ± 0.065	3.80 ± 0.177
GENUS	<i>Selenomonas</i>	0.11 ± 0.008	0.23 ± 0.020

<b>GENUS</b>	<i>SHD-231</i>	0.46 ± 0.029	0.73 ± 0.056
<b>GENUS</b>	<i>Shuttleworthia</i>	0.09 ± 0.004	0.12 ± 0.008
<b>PHYLUM</b>	<i>SR1</i>	0.46 ± 0.033	0.21 ± 0.020
<b>ORDER</b>	<i>Streptophyta</i>	0.16 ± 0.014	1.02 ± 0.070
<b>GENUS</b>	<i>Succiniclasticum</i>	3.06 ± 0.121	3.37 ± 0.168
<b>FAMILY</b>	<i>Succinivibrionaceae</i>	0.50 ± 0.070	1.04 ± 0.148
<b>GENUS</b>	<i>Treponema</i>	0.42 ± 0.016	0.44 ± 0.021
<b>FAMILY</b>	<i>Veillonellaceae</i>	0.08 ± 0.006	0.13 ± 0.009
<b>FAMILY</b>	<i>Veillonellaceae 2</i>	0.23 ± 0.013	0.37 ± 0.020
<b>FAMILY</b>	<i>WCHB1-25</i>	0.31 ± 0.013	0.27 ± 0.016
<b>GENUS</b>	<i>YRC22</i>	1.40 ± 0.108	0.55 ± 0.052
<b>ORDER</b>	<i>YS2</i>	0.32 ± 0.037	0.07 ± 0.009

**Table S3.** Estimates (coefficients), P-values, and P-values adjusted for false discovery rate (FDR) for variables included in multivariable regression models used to predict milk production.

Multivariable Regression Model	Variables	Estimates	P-value	P-value adjusted for FDR
Primiparous prepartum	c--Deltaproteobacteria	-5192.106941	2.20752E-05	0.000281835
Primiparous prepartum	c--Gammaproteobacteria	-11600.91503	1.52365E-24	1.94525E-23
Primiparous prepartum	f--Bacteroidaceae 2	-60803.96647	3.257E-23	4.15822E-22
Primiparous prepartum	f--Bifidobacteriaceae	-211332.9459	1.13409E-06	1.4479E-05
Primiparous prepartum	f--Caulobacteraceae 2	123251.821	2.57684E-15	3.28986E-14
Primiparous prepartum	f--Fusobacteriaceae	123704.5655	8.43472E-16	1.07686E-14
Primiparous prepartum	f--Lachnospiraceae 2	76.32144246	1.72217E-10	2.1987E-09
Primiparous prepartum	f--Micrococcaceae	63552.74406	2.19908E-11	2.80757E-10
Primiparous prepartum	g--BF311	-1280.945826	4.86886E-07	6.21609E-06
Primiparous prepartum	g--Holdemania	-661241.7664	4.22005E-35	5.38776E-34
Primiparous prepartum	g--Mitsuokella	67694.45099	7.74959E-11	9.89393E-10
Primiparous prepartum	g--Paenibacillus	106159.3405	6.60392E-05	0.000843125
Primiparous prepartum	g--RFN20	1459.614836	6.76507E-16	8.63699E-15
Primiparous prepartum	g--SJA-88	851637.7489	5.65788E-53	7.22343E-52
Primiparous prepartum	g--Turcibacter	869361.4161	4.9645E-35	6.3382E-34
Primiparous prepartum	g--Ureibacillus	-2018085.388	3.35534E-65	4.28377E-64
Primiparous prepartum	Intercept	33.58916285	5.6732E-135	7.243E-134
Primiparous prepartum	Milk average week 1	-11.80309312	6.95912E-79	8.88473E-78
Primiparous prepartum	Milk average week 10	3.390326075	7.31526E-10	9.33941E-09
Primiparous prepartum	Milk average week 11	4.183981406	8.83089E-14	1.12744E-12
Primiparous prepartum	Milk average week 12	4.731502067	5.57396E-17	7.11629E-16
Primiparous prepartum	Milk average week 2	-7.011426455	3.21839E-35	4.10892E-34
Primiparous prepartum	Milk average week 3	-3.514729051	8.01086E-11	1.02275E-09
Primiparous prepartum	Milk average week 4	-1.10660526	0.03713941	0.47416007
Primiparous prepartum	Milk average week 5	0.55683768	0.293536737	1

Primiparous prepartum	Milk average week 6	1.978501123	0.000207538	0.002649644
Primiparous prepartum	Milk average week 7	2.713386694	5.41269E-07	6.91039E-06
Primiparous prepartum	Milk average week 8	3.187694994	4.60317E-09	5.87688E-08
Primiparous prepartum	o--Anaeroplasmatales 2	7785.143652	0.003916337	0.05
Primiparous prepartum	o--Pirellulales	-18497.20395	9.50051E-14	1.21293E-12
Primiparous postpartum	c--Deltaproteobacteria	-42247.47153	5.12259E-41	1.99406E-40
Primiparous postpartum	f--Bacillaceae	30132.0896	4.01806E-11	1.5641E-10
Primiparous postpartum	f--Desulfobulbaceae	-20576.79686	1.00364E-41	3.90683E-41
Primiparous postpartum	f--Enterobacteriaceae	32035.94414	8.28933E-13	3.22677E-12
Primiparous postpartum	f--Erysipelotrichaceae	76585.88177	2.15881E-46	8.40357E-46
Primiparous postpartum	f--Pirellulaceae	-180.5804543	0.019594665	0.076275718
Primiparous postpartum	f--Spirochaetaceae	12730.21197	6.16879E-27	2.40131E-26
Primiparous postpartum	g--Butyrivibrio	270.1871426	8.65138E-52	3.3677E-51
Primiparous postpartum	g--Campylobacter	12528.58125	1.60977E-14	6.26631E-14
Primiparous postpartum	g--CF231	-34.73072856	0.190482489	0.741486961
Primiparous postpartum	g--Oligella	-17169.88613	0.516348831	1
Primiparous postpartum	g--Paludibacter	-144.3832582	0.012844628	0.05
Primiparous postpartum	g--Xanthomonas	1540938.233	3.58466E-45	1.39539E-44
Primiparous postpartum	Intercept	22.51697922	4.15578E-84	1.61771E-83
Primiparous postpartum	k--Archaea	444777.5905	1.45108E-25	5.6486E-25
Primiparous postpartum	Milk average week 1	-11.87175356	1.20256E-79	4.68116E-79
Primiparous postpartum	Milk average week 10	3.393223116	6.80634E-10	2.64949E-09
Primiparous postpartum	Milk average week 11	4.125677348	1.74522E-13	6.79357E-13
Primiparous postpartum	Milk average week 12	4.673198009	1.16308E-16	4.52749E-16
Primiparous postpartum	Milk average week 2	-7.080086893	8.2521E-36	3.21228E-35
Primiparous postpartum	Milk average week 3	-3.494776149	9.77318E-11	3.80438E-10
Primiparous postpartum	Milk average week 4	-1.086652358	0.040521935	0.157738839
Primiparous postpartum	Milk average week 5	0.576790582	0.276229027	1
Primiparous postpartum	Milk average week 6	1.998454025	0.000177146	0.000689571
Primiparous postpartum	Milk average week 7	2.770460142	3.08788E-07	1.20201E-06
Primiparous postpartum	Milk average week 8	3.244768443	2.4125E-09	9.39107E-09

<b>Primiparous postpartum</b>	o--Actinomycetales	-66496.4827	1.66901E-07	6.4969E-07
<b>Multiparous prepartum</b>	f--Peptostreptococcaceae	-227496.2383	1.86993E-06	5.52239E-07
<b>Multiparous prepartum</b>	f--Porphyromonadaceae 2	-33461.79635	9.84913E-31	2.9087E-31
<b>Multiparous prepartum</b>	g--Acinetobacter	-7786.925464	5.6097E-08	1.65669E-08
<b>Multiparous prepartum</b>	g--Corynebacterium	-33917.03191	3.94946E-08	1.16638E-08
<b>Multiparous prepartum</b>	g--Faecalibacterium	-912.1235844	9.83682E-16	2.90507E-16
<b>Multiparous prepartum</b>	g--Lautropia	-347230.9552	9.2468E-20	2.73082E-20
<b>Multiparous prepartum</b>	g--Solibacillus	-159805.0107	3.28379E-07	9.69788E-08
<b>Multiparous prepartum</b>	g--Virgibacillus	157292.6499	1.48908E-29	4.39762E-30
<b>Multiparous prepartum</b>	Intercept	53.59249432	0	0
<b>Multiparous prepartum</b>	Milk average week 1	-12.94438403	3.27331E-61	9.66694E-62
<b>Multiparous prepartum</b>	Milk average week 10	2.713038811	0.000215837	6.37423E-05
<b>Multiparous prepartum</b>	Milk average week 11	3.259913811	9.13396E-06	2.69749E-06
<b>Multiparous prepartum</b>	Milk average week 12	2.632530116	0.000363678	0.000107403
<b>Multiparous prepartum</b>	Milk average week 2	-6.974234779	2.91969E-21	8.62259E-22
<b>Multiparous prepartum</b>	Milk average week 3	-2.401643191	0.00082172	0.000242675
<b>Multiparous prepartum</b>	Milk average week 4	0.983702806	0.1693046	0.05
<b>Multiparous prepartum</b>	Milk average week 5	2.50436774	0.000528232	0.000156001
<b>Multiparous prepartum</b>	Milk average week 6	2.559464159	0.00039763	0.00011743
<b>Multiparous prepartum</b>	Milk average week 7	2.432205063	0.000825583	0.000243816
<b>Multiparous prepartum</b>	Milk average week 8	2.94968758	5.15192E-05	1.52149E-05
<b>Multiparous prepartum</b>	o--Anaeroplasmatales 2	36406.54201	2.37292E-33	7.00785E-34
<b>Multiparous prepartum</b>	o--HA64	-10250.18176	6.29816E-08	1.86001E-08
<b>Multiparous prepartum</b>	o--PL-11B10	-6380.806457	3.55687E-07	1.05043E-07
<b>Multiparous postpartum</b>	c--Actinobacteria	-65016.09403	1.87279E-11	1.12859E-11
<b>Multiparous postpartum</b>	c--Betaproteobacteria	-12476.49968	3.89198E-16	2.3454E-16
<b>Multiparous postpartum</b>	c--Thermoplasmata	392201.7903	1.42175E-10	8.56781E-11
<b>Multiparous postpartum</b>	f--Alcaligenaceae	707496.8738	2.43413E-12	1.46686E-12
<b>Multiparous postpartum</b>	f--Erysipelotrichaceae	52889.55299	3.57418E-20	2.15388E-20
<b>Multiparous postpartum</b>	f--Peptostreptococcaceae 2	119805.258	2.89779E-14	1.74628E-14
<b>Multiparous postpartum</b>	f--Phyllobacteriaceae	-489007.4	1.13322E-10	6.82902E-11

<b>Multiparous postpartum</b>	f--Pirellulaceae 2	-2587.126662	5.58073E-30	3.36308E-30
<b>Multiparous postpartum</b>	f--Prevotellaceae 2	5852.18734	3.18865E-38	1.92156E-38
<b>Multiparous postpartum</b>	f--R4-41B	-165895.1894	7.62532E-31	4.5952E-31
<b>Multiparous postpartum</b>	f--Rhodobacteraceae	125875.2658	4.57818E-17	2.75892E-17
<b>Multiparous postpartum</b>	g--BF311	-3844.757279	9.28114E-05	5.59303E-05
<b>Multiparous postpartum</b>	g--Bulleidia	-562.8182958	1.11549E-11	6.72223E-12
<b>Multiparous postpartum</b>	g--Escherichia	51780.62929	3.99579E-14	2.40796E-14
<b>Multiparous postpartum</b>	g--Faecalibacterium	30258.76826	0.000431879	0.000260261
<b>Multiparous postpartum</b>	g--Kocuria	-442753.8944	2.8504E-50	1.71772E-50
<b>Multiparous postpartum</b>	g--Methanosphaera	14942.96665	3.49161E-11	2.10413E-11
<b>Multiparous postpartum</b>	g--Sejonia	-338908.0479	3.96648E-29	2.39029E-29
<b>Multiparous postpartum</b>	Intercept	46.41113925	9.977E-274	6.0124E-274
<b>Multiparous postpartum</b>	Milk average week 1	-12.9575192	3.60609E-90	2.17312E-90
<b>Multiparous postpartum</b>	Milk average week 10	2.70795884	2.5031E-06	1.50843E-06
<b>Multiparous postpartum</b>	Milk average week 11	3.25483384	1.6959E-08	1.02199E-08
<b>Multiparous postpartum</b>	Milk average week 12	2.640077846	5.15513E-06	3.1066E-06
<b>Multiparous postpartum</b>	Milk average week 2	-6.987369948	1.03275E-32	6.22359E-33
<b>Multiparous postpartum</b>	Milk average week 3	-2.41477836	1.77511E-05	1.06972E-05
<b>Multiparous postpartum</b>	Milk average week 4	0.970567637	0.082970514	0.05
<b>Multiparous postpartum</b>	Milk average week 5	2.529311308	7.96749E-06	4.8014E-06
<b>Multiparous postpartum</b>	Milk average week 6	2.584407727	5.06626E-06	3.05305E-06
<b>Multiparous postpartum</b>	Milk average week 7	2.433960314	1.96548E-05	1.18444E-05
<b>Multiparous postpartum</b>	Milk average week 8	2.951442831	2.44504E-07	1.47344E-07
<b>Multiparous postpartum</b>	o--GMD14H09	-26509.31665	4.71474E-05	2.84122E-05