

Table S1-1. Descriptive statistics of the phenotypic values for milk production traits in the first lactation.

Traits	Mean	S.D.	Min.	Max.	C.V.
Milk yield (kg)	10379.81	1476.18	6057.96	14505.68	14.22
Fat yield (kg)	350.55	60.7	184.8	537.97	17.31
Fat percentage (%)	3.387	0.423	2.059	4.742	12.49
Protein yield (kg)	313.78	48.2	157.73	457.53	15.36
Protein percentage (%)	3.024	0.198	2.257	3.508	6.548

Table S1-2. Descriptive statistics of the phenotypic values for milk production traits in the second lactation.

Traits	Mean	S.D.	Min.	Max.	C.V.
Milk yield (kg)	10859.85	1876.61	4756.94	16512.08	17.28
Fat yield (kg)	390.12	83.85	145.05	658.25	21.49
Fat percentage (%)	3.599	0.504	2.212	5.431	14.004
Protein yield (kg)	322.2	57.63	137.86	467.03	17.89
Protein percentage (%)	2.97	0.192	2.199	3.538	6.465

Table S2-1. Primers and procedures for PCR used in SNP identification.

Primer ID	Location	Primer sequence (5'-3')	Product length (bp)	Annealing temp. (°C)
LPIN1-1F LPIN1-1R	5' flanking region	ggagttatttctccactgatctcc agcaatgcctaccagcaaat	643	60
LPIN1-2F LPIN1-2R		aatgagaaggcccatgggtt agtccacagggtcccaag	800	60
LPIN1-3F LPIN1-3R	5' flanking region	tcctgtaattactcatctttgtct cgctcagtaatccaactgattg	638	60
LPIN1-4F LPIN1-4R		tggataaagtcattctccctta cgggtcgatcttctctttc	521	60
LPIN1-5F LPIN1-5R	Exon1	agaggggtgcaggtgaaagg caaacacgcaccatgggtta	609	60
LPIN1-6F LPIN1-6R	Exon2	taaaccaggactctcatctg aagctggctttgtgggaag	580	60
LPIN1-7F LPIN1-7R	Exon3	gtgacccatggacagtagc tgctttacgcactataaatctg	582	60
LPIN1-8F LPIN1-8R	Exon4	gcattggaagcatggagtct acctgcacttctctgcac	583	60
LPIN1-9F LPIN1-9R	Exon5	aatggcatttagtgacatgtga agcacagggaaccctactca	703	60
LPIN1-10F LPIN1-10R	Exon6	tctgagtaattgttttcgtttcca tcactgtttctccccctga	585	60
LPIN1-11F LPIN1-11R	Exon7	cgtgttctgtccgctct agcagcagcagcttgaaata	463	60
LPIN1-12F LPIN1-12R	Exon8	catttgctttggaacacga tccctctgaagaatcctga	611	60
LPIN1-13F LPIN1-13R	Exon9	ggaagtgtagggttaaaaatgg ctcaaacacgcctgacgac	659	60
LPIN1-14F LPIN1-14R	Exon10	tgattaagggtgacctgtcc atagaggccagggtgtga	587	60
LPIN1-15F LPIN1-15R	Exon11	ggagtttgctggaggaag acccatagactgtggccta	505	60
LPIN1-16F LPIN1-16R	Exon12	tggatgccattaggtttgc ctgaccacactctcaagca	503	60
LPIN1-17F	Exon13	agctcgatttagacgacgc	501	60

<i>LPIN1-17R</i>		tttgaaagtcagtatctatggagtg		
<i>LPIN1-18F</i>	Exon14	agagtgatgatgccagcaag	517	60
<i>LPIN1-18R</i>		acaggaggcaccgaaatg		
<i>LPIN1-19F</i>	Exon15	ccaagtcctggaaagaacca	500	60
<i>LPIN1-19R</i>		atgtcaggagccactgc		
<i>LPIN1-20F</i>	Exon16	ttgaagtgtagtgttattacagtgttg	501	60
<i>LPIN1-20R</i>		accatcttccctcccatc		
<i>LPIN1-21F</i>	Exon17	ccatgaggattaaccaagtga	560	60
<i>LPIN1-21R</i>		tttccaagggccatgat		
<i>LPIN1-22F</i>	Exon18	cagactgaaagtgcggattc	520	60
<i>LPIN1-22R</i>		tttcaagctgaaaccacaa		
<i>LPIN1-23F</i>	Exon19	ttatgcgattggcttactgg	471	60
<i>LPIN1-23R</i>		ccttctatgtgccctgaagtg		
<i>LPIN1-24F</i>	Exon20	tttctataagttagcggaggact	880	60
<i>LPIN1-24R</i>		ttagctttaactggaagaatgagaga		
<i>LPIN1-25F</i>	3' flanking region	cttgggatgacgagatccag	822	60
<i>LPIN1-25R</i>		gcccttaatctgagtgggaaa		
<i>LPIN1-26F</i>	3' flanking region	actctggggttactgttaataagcat	720	60
<i>LPIN1-26R</i>		taaaattcaccccaaaataccc		
<i>LPIN1-27F</i>	3' flanking region	ccctcctgattgtccatgt	700	60
<i>LPIN1-27R</i>		cacgtgtgatgaacattttagtg		
<i>LPIN1-28F</i>	3' flanking region	cccggagaggctgaacttt	545	60
<i>LPIN1-28R</i>		agtatgcttgataccataacagga		

Table S2-2. Reaction system.

Content	Dosage	Total
Forward primer (10 pmol/μL)	1.25 μL	
Reverse primer (10 pmol/μL)	1.25 μL	
2 × Taq Master Mix	12.5 μL	25 μL
DNA (50-100 ng/μL)	2 μL	
ddH ₂ O	8 μL	

Table S2-3. The procedures of PCR amplification.

Temperature (°C)	Time	Cycle No.
95	5 min	1
95	30 s	
Annealing Temp.	30 s	35
72	40 s	
72	10 min	1
4	Forever	1

Table S3. Additive, dominant and allele substitution effects of seven SNPs on milk production traits of *LPIN1* gene in Chinese Holstein.

SNP	Lactation	Genetic effects	Milk yield (kg)	Fat yield (kg)	Fat percentage (%)	Protein yield (kg)	Protein percentage (%)
g.86129263C>G	1	Additive effect (a)	-74.85	-4.2*	-0.0132	-2.94*	-0.0064
		Dominant effect (d)	20.73	-0.01	-0.0156	0.63	-0.0026
		Substitution effect (α)	-65.58	-4.21	-0.0201	-2.66	-0.0075
	2	Additive effect (a)	-98.44	-1.06	0.0333	-2.58	0.0017
		Dominant effect (d)	-20.01	-5.26	-0.0417	-1.66	-0.0116
		Substitution effect (α)	-107.39	-3.41	0.0146	-3.32	-0.0035
c.637T>C	1	Additive effect (a)	22.78	0.14	-0.0052	1.42	0.0076
		Dominant effect (d)	15.55	1.2	0.0078	0.53	0.0016
		Substitution effect (α)	20.25	-0.05	-0.0065	1.33	0.0073
	2	Additive effect (a)	63.35	-1.69	-0.0442*	0.99	-0.0074
		Dominant effect (d)	155.91*	3.78	-0.0224	5.22**	0.0051
		Substitution effect (α)	37.98	-2.31	-0.0406*	0.14	-0.0082
c.708A>G	1	Additive effect (a)	8.98	0.62	0.0025	-0.33	-0.0066
		Dominant effect (d)	-14.04	1.23	0.0149	-0.04	0.0036

c.1521C>T	2	Substitution effect (α)	11.43	0.41	-0.0001	-0.32	-0.0073
		Additive effect (a)	-57.63	1.57	0.0431	-0.33	0.0111
		Dominant effect (d)	177.45**	4.89*	-0.0191	5.8**	0.0031
	1	Substitution effect (α)	-88.56	0.71	0.0464	-1.34	0.0106
		Additive effect (a)	-87.78	-4.19*	-0.0082	-2.93*	-0.0021
		Dominant effect (d)	-25.1	-0.17	-0.0028	0.09	0.0059
	2	Substitution effect (α)	-98.97	-4.27	-0.0095	-2.89	0.0006
		Additive effect (a)	-263.84**	0.79	0.0503*	-1.88	0.0104
		Dominant effect (d)	-305.32**	-5.1	-0.0199	-3.12	0.0075
	1	Substitution effect (α)	-400.01**	-1.48	0.0414	-3.28	0.0138
		Additive effect (a)	14.57	0.77	0.0015	-0.29	-0.0078
		Dominant effect (d)	-27.76	-0.49	0.0058	-0.74	0.0016
c.1555A>C	2	Substitution effect (α)	19.46	0.85	0.0004	-0.16	-0.0081
		Additive effect (a)	-81.8	1.51	0.0499**	-0.88	0.013*
		Dominant effect (d)	184.66**	5.05*	-0.0183	5.51**	0.0009
	1	Substitution effect (α)	-114.34*	0.62	0.0531**	-1.85	0.0128
		Additive effect (a)	-108.19	3.58	0.0559	-0.65	0.0209
		Dominant effect (d)	211.57	17.73**	0.0823	8.99*	0.0181
g.86049523C>T	2	Substitution effect (α)	57.6	17.48*	0.1203	6.4	0.035
		Additive effect (a)	434.67*	18.53**	0.0394	13.58**	-0.0046
		Dominant effect (d)	278.98	15.55*	0.0747	12.02*	0.0293
	1	Substitution effect (α)	653.28*	30.71*	0.0979	23*	0.0183
		Additive effect (a)	-98.9	0.87	0.0332	-0.27	0.0218**
		Dominant effect (d)	143.22*	7.6**	0.0178	7.18**	0.0208*
g.86049389C>T	2	Substitution effect (α)	-26.83	4.7	0.0422	3.35	0.0323**
		Additive effect (a)	-66.75	-3.84	-0.0175	-3.66	-0.0172
	1	Dominant effect (d)	-124.29	-10.63**	-0.0525	-4.47	-0.0056
		Substitution effect (α)	-129.28	-9.18*	-0.044	-5.91	-0.02

Note: * indicates $p < 0.05$; ** indicates $p < 0.01$.