جامعـة الإسكندريـة
كلية الزراعة . سابا باشا

دراسات عن الخواص الوظيفيه والكيموحيويه لبروتينات لبن الابل

مقدمة من

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رسالة علمية مقدمة استيفاءً لمتطلبات منح درجة

الماجستير في العلوم الزراعية
(تخصص تكنولوجيا الألبان)
قسم علوم الأغذية

من

جامعة الإسكندرية

٢٠٠٨

Alexandria University
Faculty of Agric. (Saba-Basha)

STUDIES ON FUNCTIONAL AND BIOCHEMICAL PROPERTIES OF CAMEL MILK PROTEINS

BY

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A Thesis Submitted in Partial Fulfillment of the Requirements Governing the Award of the Degree of

MASTER IN AGRICULTURAL SCIENCES

(DAIRY TECHNOLOGY)

Department of Food Sciences

From

Alexandria University

2008

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LIST OF ABBREVIATIONS

KDa:	Kilo Dalton
SDS-PAGE:	Sodium dodecyl sulphate polyacrylamide gel electrophoresis
PSI:	The protein solubility index
PDI:	The protein dispersibility index,
(CMWP)	Camel milk whey proteins
(CMCCP)	Camel milk casein co-precipitate
(FVS)	Foam volume stability
FS:	Foam stability
FC:	Foam capacity
EC:	Emulsifying Capacity
CMP:	Caseinomacropeptide
CMR:	CM separated from powdered from commercial milk by microfiltration/ diafiltration
***pI*:**	Iso electric point
Cp:	Centipoise
WAC:	water absorption capacity
WPC:	whey proteins concentrate
MPC:	Milk protein concentrate
DH:	Degree of hydration
NA-CN:	Sodium Caseinate
(ESI)	Emulsion stability index
(EAI)	Emulsion activity index

Table (5a): Effect of pH and protein concentration on the foaming capacity (FC) of HCl-casein prepared from camel and cow milks.

milk	Casein concn (%)	pH 7.0			pH 7.5			pH 8.0		
		Total volume	FC%	FE%	Total volume	FC%	FE%	Total volume	Volume increase	FE%
Camel	0.25	251.00±1.53 [a]	25.50±0.76	125.50±0.76	245.33±1.45 [a]	22.67±0.73	122.67±0.73	254.67±1.45 [a]	27.33±0.73	127.33±0.73
	0.50	264.67±2.03 [b]	32.33±1.01	132.17±1.01	274.67±2.60 [b]	37.33±1.30	137.33±1.30	284.00±0.58 [b]	42.00±0.29	142.00±0.29
	0.75	279.33±1.20 [c]	39.67±0.60	139.67±0.60	285.33±0.88 [c]	42.67±0.44	142.67±0.44	304.67±2.03 [c]	52.33±1.01	152.33±1.01
	1.00	296.00±2.08 [d]	48.00±1.04	148.00±1.04	294.00±1.53 [d]	47.00±0.76	147.00±0.76	329.67±2.60 [d]	64.83±1.30	164.83±1.30
	F-test	122.433**			149.765**			303.075**		
	Sig. (p)	<0.001			<0.001			<0.001		
Cow	0.25	249.67±1.45 [a]	24.83±0.73	124.83±0.73	265.67±2.91 [a]	32.83±1.45	132.83±1.45	275.33±1.45 [a]	37.67±0.73	137.67±0.73
	0.50	276.33±2.19 [b]	38.17±1.09	138.17±1.09	285.33±2.03 [b]	42.67±1.01	142.67±1.01	310.67±2.91 [b]	55.33±1.45	155.33±1.45
	0.75	290.33±1.45 [c]	45.17±0.73	145.17±0.73	293.67±1.86 [c]	46.83±0.93	146.83±0.93	314.67±1.45 [b]	57.33±0.73	157.33±0.73
	1.00	301.67±2.19 [d]	50.83±1.09	150.83±1.09	306.00±2.08 [d]	53.00±1.04	153.00±1.04	334.67±2.60 [c]	67.33±1.30	167.33±1.30
	F-test	146.011**			56.495**			125.280**		
	Sig. (p)	<0.001			<0.001			<0.001		
t-test (p)		0.864 (0.397)			1.785 (0.088)			1.473 (0.155)		

F: F test (ANOVA) T-test: Student t-test

Different superscripts are significant: * Significant at p ≤0.05 ** Significant at p ≤0.01

a-b-c-d: Means the same columns with different subscriptions are significantly different (p ≤0.05

Table (5b): Effect of pH and protein concentration on the foaming capacity (FC) of HCl-casein prepared from camel and cow milks.

Milk	Casein concn (%)		pH 7.0			pH 7.5			pH 8.0			F-test (p)
			Total	FC%	FE%	Total	FC%	FE%	Total	FC%	FE%	
Camel	0.25	Mean	251.00 [a]	25.50	125.50	245.33 [b]	22.67	122.67	254.67 [a]	27.33	127.33	10.118* (0.012)
		±SE	1.53	0.76	0.76	1.45	0.73	0.73	1.45	0.73	0.73	
	0.50	Mean	264.67 [a]	32.33	132.17	274.67 [b]	37.33	137.33	284.00 [c]	42.00	142.00	24.990** (0.001)
		±SE	2.03	1.01	1.01	2.60	1.30	1.30	0.58	0.29	0.29	
	0.75	Mean	279.33 [a]	39.67	139.67	285.33 [b]	42.67	142.67	304.67 [c]	52.33	152.33	83.018** (<0.001)
		±SE	1.20	0.60	0.60	0.88	0.44	0.44	2.03	1.01	1.01	
	1.00	Mean	296.00 [a]	48.00	148.00	294.00 [a]	47.00	147.00	329.67 [b]	64.83	164.83	89.612** (<0.001)
		±SE	2.08	1.04	1.04	1.53	0.76	0.76	2.60	1.30	1.30	
Cow	0.25	Mean	249.67 [a]	24.83	124.83	265.67b	32.83	132.83	275.33c	37.67	137.67	39.798** (<0.001)
		±SE	1.45	0.73	0.73	2.91	1.45	1.45	1.45	0.73	0.73	
	0.50	Mean	276.33 [a]	38.17	138.17	285.33b	42.67	142.67	310.67c	55.33	155.33	54.853** (<0.001)
		±SE	2.19	1.09	1.09	2.03	1.01	1.01	2.91	1.45	1.45	
	0.75	Mean	290.33 [a]	45.17	145.17	293.67a	46.83	146.83	314.67b	57.33	157.33	68.101** (<0.001)
		±SE	1.45	0.73	0.73	1.86	0.93	0.93	1.45	0.73	0.73	
	1.00	Mean	301.67 [a]	50.83	150.83	306.00a	53.00	153.00	334.67b	67.33	167.33	60.720** (<0.001)
		±SE	2.19	1.09	1.09	2.08	1.04	1.04	2.60	1.30	1.30	

F: F test (ANOVA)

Different superscripts are significant: * Significant at p ≤0.05 ** Significant at p ≤0.01

a-b-c-d: Means the same columns with different subscriptions are significantly different (p ≤0.05

Table (6a): Effect of pH and protein concentration on the foaming stability (FS) of HCl-casein prepared from camel and cow milks.

Concentration (%)		PH 7.0							PH 7.5							PH 8.0						
		Volume of foam (ml) at 20ºC after time, min.																				
		0	5	10	15	20	25	30	0	5	10	15	20	25	30	0	5	10	15	20	25	30
Camel	0.25	64.33 ±1.20	35.33 ±0.88	19.67 ±2.60	14.67 ±2.03	6.33 ±1.86	0.00 ±0.00	0.00 ±0.00 [a]	85.67 ±1.20	66.00 ±2.08	39.67 ±1.45	24.00 ±1.53	14.67 ±2.60	5.33 ±1.45	0.00 ±0.00 [a]	94.67 ±1.45	70.33 ±1.45	46.33 ±1.86	24.67 ±2.60	15.33 ±2.03	9.33 ±1.20	9.33 ±1.76 [a]
	0.50	95.67 ±1.76	60.33 ±3.18	45.67 ±1.20	26.00 ±2.08	14.00 ±1.53	5.67 ±2.33	0.00 ±0.00 [a]	104.67 ±1.45	84.67 ±2.03	58.33 ±2.19	41.00 ±2.08	26.67 ±2.19	14.00 ±2.08	6.00 ±1.53 [b]	119.33 ±2.91	89.33 ±1.76	63.67 ±1.86	40.33 ±0.88	25.33 ±1.45	25.33 ±2.60	15.67 ±1.20 [b]
	0.75	105.67 ±1.20	79.67 ±0.88	44.67 ±1.45	29.33 ±2.91	10.33 ±3.18	5.67 ±1.76	0.00 ±0.00 [a]	124.00 ±1.53	95.33 ±2.03	80.33 ±1.45	54.00 ±2.08	34.67 ±2.03	21.00 ±1.53	9.67 ±3.18 [b]	156.00 ±2.08	113.67 ±1.86	96.00 ±2.65	119.33 ±1.20	44.33 ±1.76	35.33 ±2.03	29.33 ±1.20 [c]
	1.00	120.33 ±2.60	89.00 ±2.65	71.33 ±2.40	25.33 ±0.88	15.33 ±2.03	5.33 ±0.88	4.33 ±1.20 [b]	140.67 ±1.76	105.33 ±0.88	84.00 ±1.53	65.67 ±2.33	49.33 ±2.33	34.67 ±2.03	19.67 ±0.88 [c]	184.00 ±1.53	150.33 ±2.03	108.67 ±2.40	91.00 ±2.08	73.67 ±1.86	49.67 ±1.45	44.67 ±2.60 [d]
	F (p)							13.000** (0.002)							20.583** (<0.001)							76.994** (<0.001)
Cow	0.25	94.33 ±1.20	75.33 ±0.88	65.67 ±1.76	55.67 ±2.33	54.67 ±2.60	50.00 ±1.15	45.00 ±2.31 [a]	114.67 ±2.03	95.33 ±2.03	91.00 ±2.08	89.67 ±2.03	84.67 ±3.18	80.67 ±1.20	74.67 ±0.88 [a]	125.67 ±1.20	95.33 ±2.33	95.67 ±1.76	90.67 ±2.91	84.67 ±2.65	79.00 ±2.08	75.33 ±0.88 [a]
	0.50	128.33 ±0.88	104.67 ±0.88	95.67 ±1.20	86.00 ±1.53	81.33 ±2.96	79.33 ±2.91	75.33 ±3.18 [b]	130.33 ±2.03	109.00 ±2.08	101.00 ±3.21	95.67 ±1.76	90.33 ±2.03	84.67 ±0.88	81.00 ±1.53 [b]	154.67 ±10.33	109.00 ±0.88	130.67 ±2.33	123.33 ±2.19	90.33 ±2.33	114.67 ±2.03	110.33 ±1.45 [b]
	0.75	134.67 ±2.03	110.33 ±2.03	105.67 ±2.33	93.00 ±2.52	91.00 ±2.08	84.33 ±2.33	80.67 ±1.76 [b]	146.00 ±2.08	130.00 ±2.31	126.00 ±2.65	118.67 ±1.86	110.33 ±1.45	105.67 ±2.91	99.67 ±1.45 [c]	169.00 ±3.21	130.00 ±2.33	145.67 ±2.91	134.33 ±2.33	110.33 ±2.08	124.67 ±2.60	119.33 ±1.20 [c]
	1.00	146.00 ±2.08	124.33 ±2.33	114.33 ±1.76	110.67 ±2.91	105.67 ±1.20	103.33 ±2.73	100.67 ±2.33 [c]	161.67 ±2.19	145.67 ±1.76	139.33 ±3.48	134.67 ±2.03	130.67 ±1.76	125.67 ±2.33	124.67 ±2.03 [d]	205.67 ±2.91	145.67 ±2.19	176.00 ±1.53	171.33 ±2.96	130.67 ±1.53	164.67 ±0.88	160.67 ±1.76 [d]
	F (p)							88.350** (<0.001)							215.905** (<0.001)							661.149** (<0.001)
t (p)								12.119** (<0.001)							13.622** (<0.001)							9.095** (<0.001)

F: F test (ANOVA) T-test: Student t-test

Different superscripts are significant: * Significant at p ≤0.05 ** Significant at p ≤0.01

a-b-c-d: Means the same columns with different subscriptions are significantly different (p ≤0.05

Table (6b): Effect of pH and protein concentration on the foaming stability (FS) of HCl-casein prepared from camel and cow milks.

Concentration (%)		PH 7.0							PH 7.5							PH 8.0							F (p)
		Volume of foam (ml) at 20ºC after time, min.																					
		0	5	10	15	20	25	30	0	5	10	15	20	25	30	0	5	10	15	20	25	30	
Camel	0.25	64.33 ±1.20	35.33 ±0.88	19.67 ±2.60	14.67 ±2.03	6.33 ±1.86	0.00 ±0.00	0.00 [a] ±0.00	85.67 ±1.20	66.00 ±2.08	39.67 ±1.45	24.00 ±1.53	14.67 ±2.60	5.33 ±1.45	0.00 [a] ±0.00	94.67 ±1.45	70.33 ±1.45	46.33 ±1.86	24.67 ±2.60	15.33 ±2.03	9.33 ±1.20	9.33 [b] ±1.76	28.000** (0.001)
	0.50	95.67 ±1.76	60.33 ±3.18	45.67 ±1.20	26.00 ±2.08	14.00 ±1.53	5.67 ±2.33	0.00 [a] ±0.00	104.67 ±1.45	84.67 ±2.03	58.33 ±2.19	41.00 ±2.08	26.67 ±2.19	14.00 ±2.08	6.00 [b] ±1.53	119.33 ±2.91	89.33 ±1.76	63.67 ±1.86	40.33 ±0.88	25.33 ±1.45	25.33 ±2.60	15.67 [c] ±1.20	49.618** (<0.001)
	0.75	105.67 ±1.20	79.67 ±0.88	44.67 ±1.45	29.33 ±2.91	10.33 ±3.18	5.67 ±1.76	0.00 [a] ±0.00	124.00 ±1.53	95.33 ±2.03	80.33 ±1.45	54.00 ±2.08	34.67 ±2.03	21.00 ±1.53	9.67 [b] ±3.18	156.00 ±2.08	113.67 ±1.86	96.00 ±2.65	119.33 ±1.20	44.33 ±1.76	35.33 ±2.03	29.33 [c] ±1.20	58.010** (<0.001)
	1.00	120.33 ±2.60	89.00 ±2.65	71.33 ±2.40	25.33 ±0.88	15.33 ±2.03	5.33 ±0.88	4.33 [a] ±1.20	140.67 ±1.76	105.33 ±0.88	84.00 ±1.53	65.67 ±2.33	49.33 ±2.33	34.67 ±2.03	19.67 [b] ±0.88	184.00 ±1.53	150.33 ±2.03	108.67 ±2.40	91.00 ±2.08	73.67 ±1.86	49.67 ±1.45	44.67 [c] ±2.60	138.160** (<0.001)
Cow	0.25	94.33 ±1.20	75.33 ±0.88	65.67 ±1.76	55.67 ±2.33	54.67 ±2.60	50.00 ±1.15	45.00 [a] ±2.31	114.67 ±2.03	95.33 ±2.03	91.00 ±2.08	89.67 ±2.03	84.67 ±3.18	80.67 ±1.20	74.67 [b] ±0.88	125.67 ±1.20	95.33 ±2.33	95.67 ±1.76	90.67 ±2.91	84.67 ±2.65	79.00 ±2.08	75.33 [b] ±0.88	130.694** (<0.001)
	0.50	128.33 ±0.88	104.67 ±0.88	95.67 ±1.20	86.00 ±1.53	81.33 ±2.96	79.33 ±2.91	75.33 [a] ±3.18	130.33 ±2.03	109.00 ±2.08	101.00 ±3.21	95.67 ±1.76	90.33 ±2.03	84.67 ±0.88	81.00 [a] ±1.53	154.67 ±10.33	109.00 ±0.88	130.67 ±2.33	123.33 ±2.19	90.33 ±2.33	114.67 ±2.03	110.33 [b] ±1.45	72.740** (<0.001)
	0.75	134.67 ±2.03	110.33 ±2.03	105.67 ±2.33	93.00 ±2.52	91.00 ±2.08	84.33 ±2.33	80.67 [a] ±1.76	146.00 ±2.08	130.00 ±2.31	126.00 ±2.65	118.67 ±1.86	110.33 ±1.45	105.67 ±2.91	99.67 [b] ±1.45	169.00 ±3.21	130.00 ±2.33	145.67 ±2.91	134.33 ±2.33	110.33 ±2.08	124.67 ±2.60	119.33 [c] ±1.20	168.217** (<0.001)
	1.00	146.00 ±2.08	124.33 ±2.33	114.33 ±1.76	110.67 ±2.91	105.67 ±1.20	103.33 ±2.73	100.67 [a] ±2.33	161.67 ±2.19	145.67 ±1.76	139.33 ±3.48	134.67 ±2.03	130.67 ±1.76	125.67 ±2.33	124.67 [b] ±2.03	205.67 ±2.91	145.67 ±2.19	176.00 ±1.53	171.33 ±2.96	130.67 ±1.53	164.67 ±0.88	160.67 [c] ±1.76	216.000** (<0.001)

F: F test (ANOVA) t-test: Student t-test

Different superscripts are significant: * Significant at p ≤0.05 ** Significant at p ≤0.01

a-b-c-d: Means the same columns with different subscriptions are significantly different (p ≤0.05

Table (7a): Effect of pH and protein concentration on the foaming capacity (FC) of casein co-precipitates prepared from camel and cow milks.

milk	Concentration (%)	pH 7.0			pH 7.5			pH 8.0		
		Total volume (ml)	FC%	FE%	Total volume (ml)	FC%	FE%	Total volume (ml)	FC%	FE%
Camel	0.25	220.33±1.45[a]	10.17±0.73	110.17±0.73	223.67±2.40[a]	11.83±1.20	111.83±1.20	239.33±1.20[a]	19.67±0.60	119.67±0.60
	0.50	236.00±1.53[b]	18.00±0.76	118.00±0.76	240.33±2.60[b]	20.17±1.30	120.17±1.30	260.00±3.46[b]	30.00±1.73	130.00±1.73
	0.75	240.67±2.33[b]	20.33±1.17	120.17±1.30	251.67±2.19[c]	26.00±1.26	125.83±1.09	270.67±1.76[c]	35.33±0.88	135.33±0.88
	1.00	258.33±2.19[c]	29.17±1.09	129.17±1.09	264.67±2.60[d]	32.33±1.30	132.33±1.30	284.67±2.03[d]	42.33±1.01	142.33±1.01
	F-test	66.717**			50.217**			70.681**		
	Sig. (p)	<0.001			<0.001			<0.001		
Cow	0.25	245.33±2.60[a]	22.67±1.30	122.67±1.30	254.33±1.20[a]	27.17±0.60	127.17±0.60	266.33±2.40[a]	33.17±1.20	133.17±1.20
	0.50	259.67±1.45[b]	29.83±0.73	129.83±0.73	274.67±2.03[b]	37.33±1.01	137.33±1.01	281.33±1.86[b]	40.67±0.93	140.67±0.93
	0.75	276.67±2.19[c]	38.33±1.09	138.33±1.09	285.67±1.76[c]	42.83±0.88	142.83±0.88	294.67±1.45[c]	47.33±0.73	147.33±0.73
	1.00	289.33±2.33[d]	44.67±1.17	144.67±1.167	300.33±0.88[d]	50.17±0.44	150.17±0.44	299.00±1.53[c]	49.50±0.76	149.50±0.76
	F-test	77.665**			159.039**			63.501**		
	Sig. (p)	<0.001			<0.001			<0.001		
t-test (p)		4.384** (<0.001)			4.871** (<0.001)			3.373** (0.003)		

F: F test (ANOVA) T-test: Student t-test

Different superscripts are significant: * Significant at p ≤0.05 ** Significant at p ≤0.01

a-b-c-d: Means the same columns with different subscriptions are significantly different (p ≤0.05

Table (7b): Effect of pH and protein concentration on the foaming capacity (FC) of casein co-precipitates prepared from camel and cow milks.

milk	Concentration (%)		pH 7.0			pH 7.5			pH 8.0			F-test (p)
			Total volume (ml)	FC%	FE%	Total volume (ml)	FC%	FE%	Total volume (ml)	FC%	FE%	
Camel	0.25	Mean	220.33[a]	10.17	110.17	223.67[a]	11.83	111.83	239.33[b]	19.67	119.67	33.083** (0.001)
		±SE	1.45	0.73	0.73	2.40	1.20	1.20	1.20	0.60	0.60	
	0.50	Mean	236.00[a]	18.00	118.00	240.33[a]	20.17	120.17	260.00[b]	30.00	130.00	23.247** (0.001)
		±SE	1.53	0.76	0.76	2.60	1.30	1.30	3.46	1.73	1.73	
	0.75	Mean	240.67[a]	20.33	120.17	251.67[b]	26.00	125.83	270.67[c]	35.33	135.33	51.825** (<0.001)
		±SE	2.33	1.17	1.30	2.19	1.26	1.09	1.76	0.88	0.88	
	1.00	Mean	258.33[a]	29.17	129.17	264.67[a]	32.33	132.33	284.67[b]	42.33	142.33	36.177** (<0.001)
		±SE	2.19	1.09	1.09	2.60	1.30	1.30	2.03	1.01	1.01	
Cow	0.25	Mean	245.33[a]	22.67	122.67	254.33[b]	27.17	127.17	266.33[c]	33.17	133.17	23.786** (0.001)
		±SE	2.60	1.30	1.30	1.20	0.60	0.60	2.40	1.20	1.20	
	0.50	Mean	259.67[a]	29.83	129.83	274.67[b]	37.33	137.33	281.33[c]	40.67	140.67	38.218** (<0.001)
		±SE	1.45	0.73	0.73	2.03	1.01	1.01	1.86	0.93	0.93	
	0.75	Mean	276.67[a]	38.33	138.33	285.67[b]	42.83	142.83	294.67[c]	47.33	147.33	24.300** (0.001)
		±SE	2.19	1.09	1.09	1.76	0.88	0.88	1.45	0.73	0.73	
	1.00	Mean	289.33[a]	44.67	144.67	300.33[b]	50.17	150.17	299.00[b]	49.50	149.50	12.636** (0.007)
		±SE	2.33	1.17	1.167	0.88	0.44	0.44	1.53	0.76	0.76	

F: F test (ANOVA)

Different superscripts are significant: * Significant at $p \leq 0.05$ ** Significant at $p \leq 0.01$

a-b-c-d: Means the same columns with different subscriptions are significantly different ($p \leq 0.05$

Table (8a): Effect of pH and protein concentration on the foaming stability (FS) of casein co-precipitates prepared from camel and cow milks.

Concentration (%)		PH 7.0							PH 7.5							PH 8.0						
		Volume of foam (ml) at 20ºC after time, min.																				
		0	5	10	15	20	25	30	0	5	10	15	20	25	30	0	5	10	15	20	25	30
Camel	0.25	40.33 ±0.88	14.33 ±1.20	9.67 ±2.60	4.67 ±2.03	0.00 ±0.00	0.00 ±0.00	0.00 ±0.00	55.67 ±1.76	25.67 ±1.20	14.33 ±1.76	4.33 ±1.20	0.00 ±0.00	0.00 ±0.00	0.00 ±0.00	64.67 ±2.03	30.33 ±2.03	19.67 ±0.88	11.33 ±1.86	4.67 ±1.45	0.00 ±0.00	0.00 ±0.00
	0.50	60.33 ±2.03	35.33 ±1.45	19.00 ±1.53	10.33 ±2.03	5.33 ±0.88	0.00 ±0.00	0.00 ±0.00	75.33 ±2.60	35.33 ±2.03	20.67 ±1.20	14.33 ±1.76	4.33 ±1.20	0.00 ±0.00	0.00 ±0.00	94.00 ±2.08	59.67 ±2.03	45.33 ±2.03	24.67 ±0.88	15.67 ±1.20	4.67 ±1.45	0.00 ±0.00
	0.75	66.00 ±2.08	45.33 ±2.03	35.33 ±1.45	19.67 ±3.18	14.67 ±0.88	4.33 ±1.76	0.00 ±0.00	79.00 ±2.08	45.33 ±2.60	29.67 ±1.45	19.33 ±2.33	15.33 ±0.88	4.67 ±0.88	0.00 ±0.00	99.67 ±0.88	69.00 ±2.08	45.33 ±1.45	30.33 ±2.03	16.33 ±2.40	6.33 ±1.86	0.00 ±0.00
	1.00	74.67 ±2.03	49.00 ±2.08	25.33 ±0.88	15.33 ±1.45	10.33 ±0.88	4.67 ±0.88	0.00 ±0.00	94.33 ±1.20	56.33 ±2.40	35.67 1.76	24.33 ±1.20	15.67 ±1.76	10.33 ±0.88	0.00 ±0.00	121.33 ±3.21	88.33 ±2.19	54.33 ±1.76	36.67 ±2.19	14.67 ±2.03	10.6 ±1.76	0.00 ±0.00
Cow	0.25	65.67 ±1.20	45.67 ±1.76	40.33 ±2.60	34.33 ±2.33	30.67 ±2.91	24.67 ±1.45	23.00 [a] ±2.52	70.33 ±2.03	49.33 ±2.33	44.33 ±1.76	39.33 ±5.22	34.33 ±3.48	30.33 ±1.45	24.67 [a] ±0.88	84.33 ±1.20	64.67 ±2.03	60.33 ±0.88	54.67 ±1.76	50.33 ±1.45	46.33 ±1.86	38.67 [a] ±1.86
	0.50	75.67 ±1.76	55.33 ±0.88	51.33 ±2.96	46.00 ±1.53	38.67 ±2.96	34.33 ±1.76	28.33 [a] ±2.19	94.33 ±2.33	71.00 ±2.08	64.67 ±2.60	61.00 ±2.91	59.67 ±1.45	54.33 ±1.20	50.33 [b] ±2.03	96.33 ±2.40	74.33 ±1.20	69.67 ±2.03	66.67 ±1.76	60.67 ±2.33	55.67 ±1.76	50.33 [b] ±0.88
	0.75	95.67 ±2.33	69.67 ±2.03	65.33 ±3.18	59.67 ±0.88	54.00 ±2.08	50.33 ±2.03	44.67 [b] ±2.03	109.33 ±1.76	85.33 ±2.03	80.67 ±1.20	75.67 ±1.53	69.00 ±2.08	65.33 ±2.60	60.67 [c] ±1.20	122.00 ±2.52	96.00 ±2.08	90.33 ±2.03	84.33 ±2.60	81.00 ±2.08	79.00 ±2.08	75.33 [c] ±1.45
	1.00	115.33 ±3.18	95.33 ±2.03	86.00 ±2.08	80.33 ±2.03	78.3 ±2.19	75.33 ±1.45	69.67 [c] ±2.60	128.33 ±3.79	105.33 ±0.88	98.67 ±2.96	95.67 ±2.33	95.67 ±1.20	91.6 ±2.19	84.33 [d] ±1.76	134.67 ±2.60	111.67 ±2.19	104.67 ±0.88	98.33 ±2.19	95.33 ±2.03	89.33 ±1.76	85.33 [d] ±0.88
	F (p)							79.938** (<0.001)							258.980** (<0.001)							262.891** (<0.001)
t (p)								7.441** (<0.001)							8.474** (<0.001)							11.001** (<0.001)

F: F test (ANOVA) T-test: Student t-test

Different superscripts are significant: * Significant at p ≤0.05 ** Significant at p ≤0.01

a-b-c-d: Means the same columns with different subscriptions are significantly different (p ≤0.05