Electronic Supplementary Material (ESI) for Food & Function.

Supplementary data

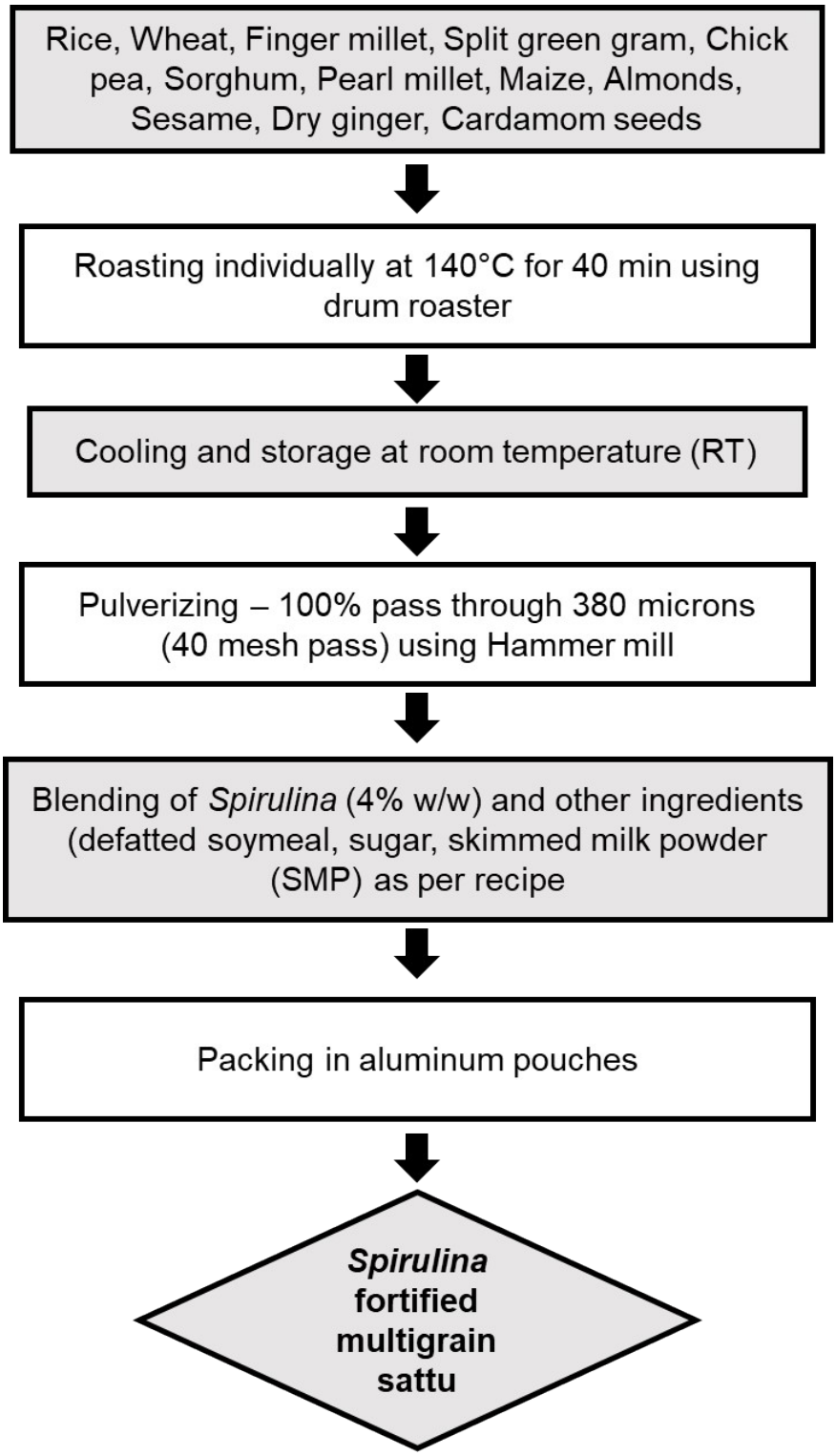


Fig. S1: Process flowchart for preparation of *Spirulina* fortified sattu

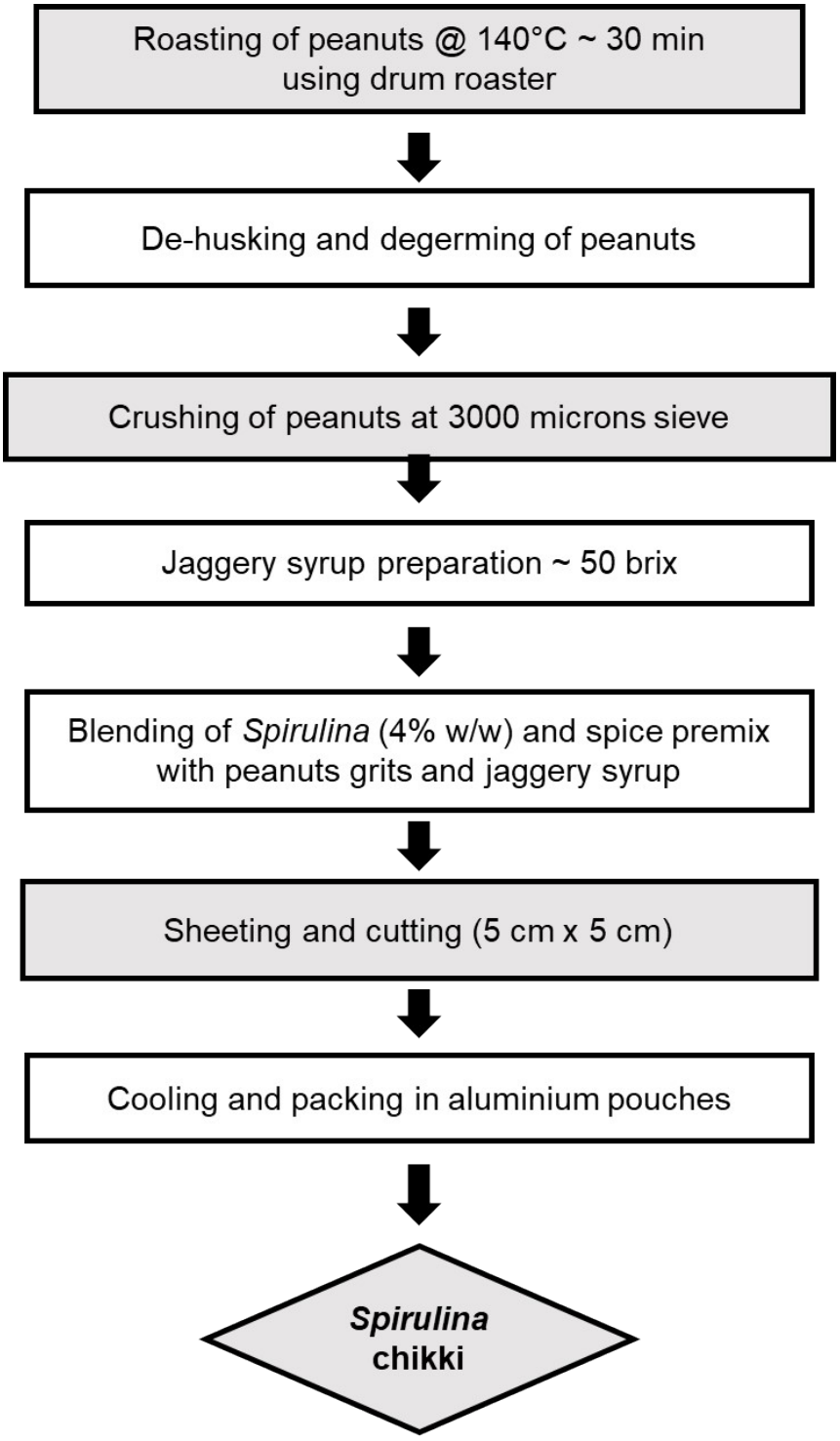
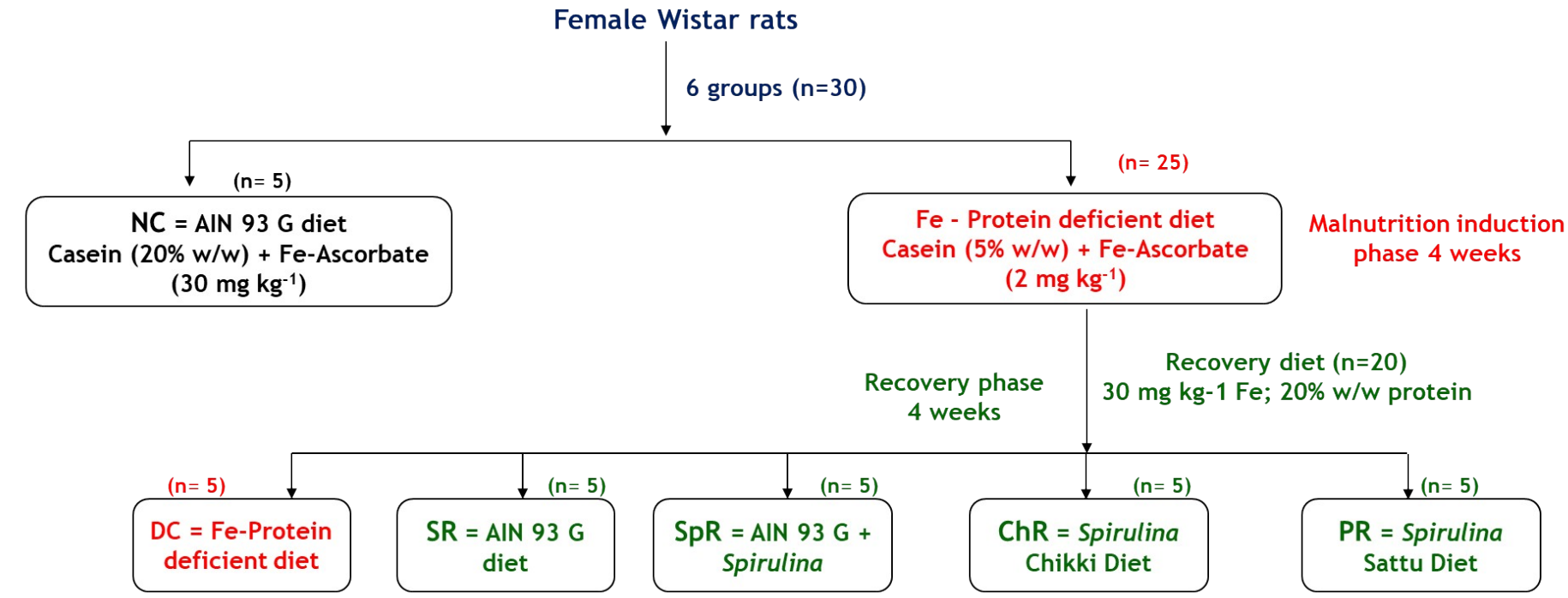


Fig. S2: Process flowchart for preparation of *Spirulina* fortified chikki



NC = Normal Control; DC = Disease control; SR = Standard recovery; SpR = *Spirulina* recovery; ChR = Chikki recovery; PR = Sattu recovery

Fig. S3: Experimental design for evaluating the nutritional quality of *Spirulina* fortified food products

Table S1: Composition of modified Zarrouk's medium for cultivation of *Spirulina platensis*

Component	Concentration (g/l)
$NaHCO_3$	8.00
$NaNO_3$	2.50
NaCl	1.00
K_2HPO_4	0.50
K_2SO_4	1.00
$MgSO_4.7H_2O$	0.20
$CaCl_2.2H_2O$	0.04
$FeSO_4.7H_2O$	0.02
Na_2EDTA	0.20
Micronutrient solution	1 ml
H_3BO_3	2.86
$Na_2Mo_7O_4$	0.02
$CuSO_4.5H_2O$	0.08
$ZnSO_4.4H_2O$	0.22
$MnCl_2.4H_2O$	1.81

Source: Madkour et al. 2012; Ragaza et al. 2020

1. Madkour, F. F., Kamil, A. E. W., & Nasr, H. S. (2012). Production and nutritive value of Spirulina platensis in reduced cost media. *The Egyptian Journal of Aquatic Research*, *38*(1), 51-57.
2. Ragaza, J. A., Hossain, M. S., Meiler, K. A., Velasquez, S. F., & Kumar, V. (2020). A review on Spirulina: alternative media for cultivation and nutritive value as an aquafeed. *Reviews in Aquaculture*, *12*(4), 2371-2395.

Table S2: Nutritional requirements for cereal based complementary foods as recommended by Bureau of Indian Standards

Nutrient	Requirement
Moisture, % by mass	NMT 4.0
Total protein, % by mass	NLT 15.0
Total carbohydrates, % by mass	NLT 55.0
Crude fiber. % by mass	NMT 1.0
Total ash, % by mass	NMT 5.0
Acid insoluble ash, % by mass	NMT 0.1
Iron, mg/100 g	NLT 5.0
Zinc, mg/100 g	NLT 2.5
Vitamin A (as retinol), µg/100 g	NLT 350.0
Vitamin C, mg/100 g	NLT 25.0
Thiamine, mg/100 g	NLT 0.5
Riboflavin, mg/100 g	NLT 0.3
Niacin, mg/100g	NLT 3.0
Folic acid, µg/100 g	NLT 20.0

NMT – Not more than; NLT – Not less than

Source: Processed-cereal based complementary foods - Specification 11536:2006, December 2006

Table S3: Colour values of *Spirulina* fortified food products

Colour Values	Control	*Spirulina* fortified food products^
	Sattu	
L*	78.71±0.07[a]	74.44±0.04[b]
a*	-3.825±0.01[a]	-5.65±0.01[b]
b*	13.995±0.02[a]	10.64±0.001[b]
ΔE	64.63±0.08[a]	59.76±0.004[b]
	Chikki	
L*	62.93±0.28[a]	45.83±0.17[b]
a*	-1.66±0.08[a]	-3.405±0.03[b]
b*	15.01±0.18[a]	0.86±0.30[b]
ΔE	49.98±0.33[a]	29.64±0.21[b]

Values are mean±SD (n=3).
Values carrying different superscripts are statistically different at $p<0.05$
^*Spirulina* incorporation at 4% w/w

Table S4: Contribution of *Spirulina* to the RDA of critical nutrients *viz.,* iron and protein

Nutrient/ Age group	Plain sattu	*Spirulina* fortified sattu	Plain chikki	*Spirulina* fortified Chikki
Protein				
Protein content [g 100 g^{-1} food product]*	12.59±0.65[a]	15.15±0.75[b]	16.35±0.82[a]	18.91±0.95[b]
Percent RDA for 3 years@	111.41	134.07	144.69	167.34
Percent RDA for 4-6 years@	79.18	95.28	102.83	118.93
Percent RDA for 7-10 years@	54.03	65.02	70.17	81.15
Iron				
Iron content [mg 100 g^{-1} food product]*	1.96±0.05[a]	3.58±0.15[a]	3.85±0.02[b]	5.47±0.27[b]
Percent RDA for 3 years@	24.5	44.75	48.12	68.38
Percent RDA for 4-6 years@	17.82	32.55	35.0	49.72
Percent RDA for 7-10 years@	13.06	23.87	25.66	36.47

*Values are represented as mean±SD [n=3], determined in the present study [n=3] [refer section 2.4 for methodology and Table 1 for detailed analysis]. Values carrying different superscripts are statistically different at $p<0.05$

@ Percent RDA determined based on the Recommended Dietary Allowances [RDA]/Estimated Average Requirements for the age group 3 to 10 years as recommended by Indian Council of Medical Research-National Institute of Nutrition, 2020.

Table S5: Comparison of nutritional quality of *Spirulina* fortified food products [Sattu and Chikki] with commonly consumed foods

Nutrients	Canned green beans[#]	Raw Broccoli[#]	Ripe Banana fruit[#]	Cooked Chicken[#]	Canned fish, Tuna[#]	Cooked, pan fried Sausage [Pork][#]	*Spirulina* fortified Sattu^	*Spirulina* fortified Chikki^	RDA requirements for 3 to 10 years@
Macronutrients									
Moisture g 100 g^{-1}	93.60	90.00	75.30	69.90	79.00	50.90	3.64	2.89	-
Total Energy**, KCal 100 g^{-1}	24.00	39.00	98.00	149.00	85.00	317.00	409.05	510.42	1110 - 1700 KCal/day
Crude Protein g 100 g^{-1} (N × 6.25)	1.04	2.57	0.74	23.90	19.00	18.20	15.15	18.91	12.50 - 23.00 g/day
Total Fat, g 100 g^{-1}	0.39	0.34	0.29	5.95	0.94	26.20	3.65	23.54	25.00 - 30.00 g/day
Total Carbohydrates, g 100 g^{-1} (by difference method)**	4.11	6.27	23.00	0.00	0.08	2.15	75.31	55.73	130.00 g/day
Minerals									
Total Ash g 100 g^{-1}	0.89	0.83	0.70	0.98	NR	2.63	2.25	1.82	--
Iron, mg 100 g^{-1}	0.78	0.69	0.40	0.94	1.67	1.29	3.58	5.47	8.00-15.00 mg/day
Magnesium, mg 100 g^{-1}	12.70	21.00	28.00	22.40	22.70	18.60	122.69	170.45	90.00-175.00 mg/day
Calcium, mg 100 g^{-1}	36.00	46.00	5.00	12.00	18.00	12.00	177.52	81.97	500.00-650.00 mg/day
Zinc, mg 100 g^{-1}	0.19	0.42	0.16	2.54	0.66	2.41	2.35	1.75	3.30-5.90 mg/day
Phosphorus, mg 100 g^{-1}	23.00	67.00	22.00	184.00	137.00	145.00	350.49	285.41	1000.00 mg/day
Potassium, mg 100 g^{-1}	97.00	303.00	326.00	239.00	176.00	310.00	735.68	595.93	3500.00 mg/day

**Calculated value; (--) No recommendations; NR – Not Reported

[#]USDA, 2019 [U.S. Department of Agriculture, Agricultural Research Service. Food Data Central [FDC], 2019. fdc.nal.usda.gov].

FDC ID: Canned Beans – 321611; Raw Broccoli – 747447; Ripe Bananas – 1105314; Cooked Chicken – 331897; Canned fish Tuna – 334194; Cooked, pan fried Sausage - 746780

^Values from the present study [refer Table 1 for the detailed nutritional composition of Spirulina fortified foods].

@Recommended Dietary Allowances [RDA]/Estimated Average Requirements for the age group 3 to 10 years as recommended by Indian Council of Medical Research-National Institute of Nutrition, 2020.

Table S6 - Essential amino acid scoring of *Spirulina* fortified food products

Amino acid scoring	His	Ile	Leu	Lys	SAA	AAA	Thr	Trp	Val
EAA requirements for 3 yrs to 10 yrs mg/g protein (FAO 2007)	16.00	31.00	61.00	48.00	24.00	41.00	25.00	6.60	40.00
Spirulina fortified chikki mg/g protein	20.10	24.85	58.70	44.42	38.60	72.98	72.98	8.99	32.26
Spirulina fortified Sattu mg/g protein	13.59	19.48	48.48	40.33	21.30	43.95	24.92	20.39	24.92
Spirulina biomass mg/g protein	8.45	23.78	44.27	27.38	42.87	55.38	30.04	14.22	31.60
AA Scoring Chikki	1.26	0.80	0.96	0.93	1.61	1.78	2.92	1.36	0.81
AA scoring sattu	0.85	0.63	0.79	0.84	0.89	1.07	0.99	3.09	0.62
AA scoring *Spirulina* biomass	0.53	0.77	0.73	0.57	1.78	1.35	1.20	2.15	0.79

EAA – Essential Amino acids
FAO – Food and Agriculture Organization
SAA – Sulphur containing amino acids
AAA – Aromatic amino acids

Table S7– Amino acid composition of *Spirulina* fortified food products

Amino acids	Plain Sattu	*Spirulina* fortified sattu	Plain chikki	*Spirulina* fortified chikki	*Spirulina* biomass	Casein^
Total protein (N x 6.25)	12.59±0.65[a]	15.15±0.75[b]	16.35±0.82[a]	18.91±0.95[b]	63.92±0.47	92.00
Alanine	0.75±0.02[a]	0.86±0.02[b]	0.73±0.02[a]	0.85±0.02[b]	3.62±0.14	3.40
Arginine*	0.68±0.02[a]	0.72±0.09[b]	0.55±0.02[a]	0.59±0.01[b]	1.56±0.06	4.10
Aspartic Acid	1.65±0.05[a]	1.92±0.05[b]	2.20±0.08[a]	2.63±0.07[b]	4.04±0.16	7.40
Cystein+Cystine	0.28±0.01	0.30±0.01	0.53±0.02	0.58±0.02	2.06±0.08	0.40
Glutamic acid	3.62±0.11[a]	4.58±0.11[b]	3.41±0.12[a]	4.64±0.13[b]	6.63±0.26	23.20
Glycine	0.90±0.03[a]	1.03±0.02[b]	1.62±0.06[a]	1.91±0.05[b]	3.74±0.15	2.10
Histidine*	0.30±0.01	0.31±0.01	0.37±0.01	0.38±0.01	0.54±0.02	3.20
Isoleucine*	0.43±0.01	0.46±0.01	0.44±0.01	0.47±0.01	1.52±0.06	6.60
Leucine*	1.07±0.03[a]	1.19±0.03[b]	0.98±0.03[a]	1.11±0.03[b]	2.83±0.11	10.0
Lysine*	0.89±0.03[a]	0.95±0.02[b]	0.78±0.03[a]	0.84±0.02[b]	1.75±0.07	8.10
Methionine*	0.19±0.01	0.20±0.01	0.15±0.01	0.15±0.01	0.68±0.03	3.20
Phenylalanine*	0.60±0.02[a]	0.64±0.02b	0.75±0.03[a]	0.81±0.02[b]	1.75±0.07	5.40
Proline	1.03±0.03	1.07±0.03	0.91±0.03	0.95±0.03	1.075±0.04	11.80
Serine	0.76±0.02	0.80±0.02	0.95±0.03	1.01±0.03	1.43±0.06	6.60
Threonine*	0.55±0.02[a]	0.59±0.01[b]	1.27±0.04[a]	1.38±0.04[b]	1.92±0.08	4.30
Tyrosine*	0.37±0.01	0.40±0.01	0.53±0.02	0.57±0.01	1.79±0.07	5.80
Tryptophan*	0.45±0.01	0.47±0.01	0.17±0.01	0.18±0.01	0.909±0.04	1.30
Valine*	0.55±0.02	0.59±0.02	0.56±0.02	0.61±0.02	2.02±0.08	7.50
ΣEAA[#]	6.08	6.52	6.57	7.09	17.27	59.50
IVPD%	88.00±0.80	89.00±0.44	88.37±0.6	89.00±0.45	83.00±1.15	97.00

*Essential amino acids. [#]Sum of essential amino acids. Values expressed as g 100 g^{-1} food product. Values are mean±SD of triplicate analysis, values carrying different superscripts are statistically significant at p≤0.05

^Source

1. Devendra C. 1980. Milk production in goats compared to buffalo and cattle in humid tropics. J Dairy Sci 63(10):1755–67.
2. Park YW. 2011. Milks of other domesticated mammals (Pigs, Yaks, Reindeer, etc.). In: Fuquay JW, Fox PF and McSweeney PLH (eds.), Encyclopedia of Dairy Sciences, Second Edition, vol. 3, pp. 530–537. San Diego: Academic Press.

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