Prediction of sheep milk chemical composition using milk yield, pH, electrical conductivity and refractive index

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Supplementary File.

Additional Materials and Methods

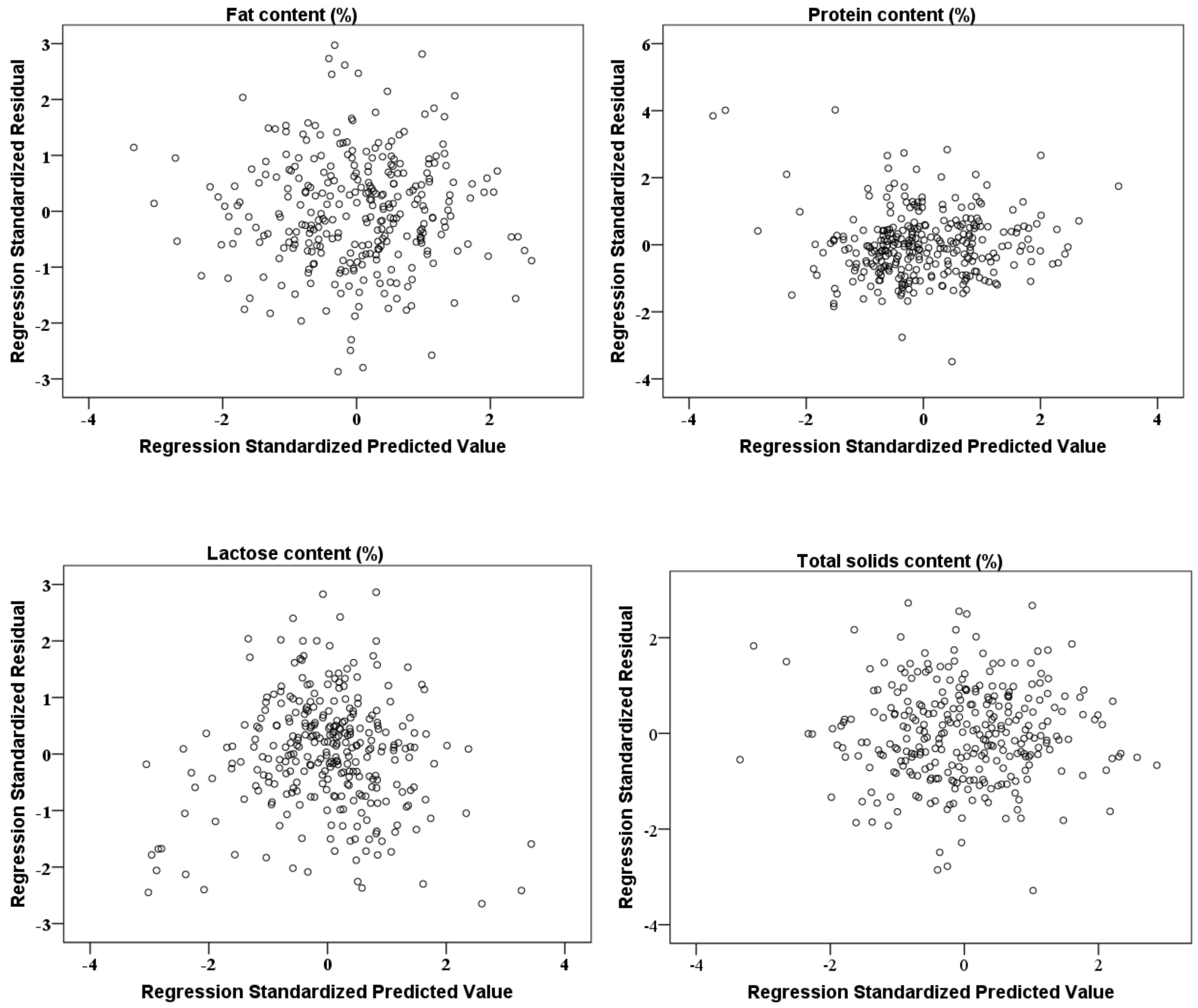
Sample collection and measurements

From each individual ewe, a composite milk sample was collected, obtained from a portable, ICAR-accredited (International Committee for Animal Recording) milk meter (Waikato MKV Milk Meter, Waikato Milking Systems) was collected in 50-mL capacity tubes with lids during milking. The samples were collected at the morning milking, during the milk yield recording procedure. Then, they were temporarily stored in refrigerated isothermal containers and transferred initially at the cooperative's laboratory where they were stored in the refrigerator under 3-5°C until to be measured. A portion of each sample was transmitted into an empty 50-mL tube and was placed into a heated water bath to reach the desired temperature. All the measurements were performed by the same person, within 12 hours after sampling. Before the measurements, the sample was mixed thoroughly. For each individual sample, MEC and pH were measured at 25°C, using a handheld pentype pH/conductivity meter (EZDO 7200, GMM Technoworld®). Before the first use and thereafter every 2 hours, the sensors were calibrated using standard buffer solutions (pH 7 and pH 4 solution for the pH sensor and 1413 μS/cm solution for the conductivity sensor) according to manufacturer's instructions. Between measurements, the sensors were cleaned using deionized water. Refractive index was measured using a portable optical refractometer (RHW-25ATC-BE, Hong Han Technologies) with a 0-25% measuring rangeon the Brix scale (°Bx); a drop of milk was placed on the refractometer's prism using a pipette and afterwards the refractometer was hold against a light source; the prism was thoroughly cleaned between samples and the instrument was calibrated every 10 samples using deionized water in order to adjust the blue line on its scale at zero value. Within 24 hours after milking the samples were transferred to the Laboratory of Milk Quality Control of ELOGAK, located at Ioannina, where the milk samples were assayed for fat, protein and lactose content, using an automatic infrared milk analyser (MilkoScan^{TM}, Foss). They were also assayed for SCC using Fossomatic^{TM} (Foss) in order to exclude from further analyses milk samples with SCC >10^6 cells/ml. Daily milk yield was calculated according to ICAR recommendations.

Costs of physical trait and milk quality trait analyses

The equipment purchase cost for the study was about 250 euros; the consumables needed for the measurements (50 ml tubes with lids, single use pipettes, latex gloves and deionized water) added a cost of about 0.30 euros per sample (which, though, can be reduced for next measurements, as the tubes and pipettes can be cleaned and re-used). The time required for the measurements was about one minute per sample. On the other hand, the cost of MQT analyses using mid-infrared spectroscopy is *ca.* 1 euro per sample (included the value of the tubes) plus the cost of packaging and transfering the samples to the lab. Based on the forementioned costs, in a 200-milking ewes farm, monthly assessment of MQT, across a 7-month milking period, utilizing milk yield and physical traits of milk, is expected to have an approximate annual cost of *ca.* 670 euros for the first year and 420 euros, thereafter; this assessment will also require 28 working hours per year (4 working hours per month), which adds 168 euros of labour cost (28 hours x 6 euros per working hour). Hence, the total annual cost of performing these measurements will be 838 euros for the first year and 588 euros, thereafter. The respective annual cost for laboratory analyses using mid-infrared spectroscopy will be *ca.* 1540 euros including the cost of analyses (1400 euros), packaging materials (56 euros) and transferring of the samples (84 euros); ten working hours for preparation and transfering of the samples will add 60 euros to the total cost which finally is 1600 euros. According to the forementioned calculations the prediction of MQT can be 762 to 1012 euros cheaper comparing to mid-infrared analyses.

Supplementary Figure S1.



Supplementary Figure S1. Scatterplots of the standardized residuals against standardized predicted values of fat, protein, lactose and total solids content.

Supplementary Table S2. Summary statistics, coefficient estimates *β* and results for the predictors in the stepwise linear regression analysis, after bootstraping, for the prediction of milk fat, protein, lactose and total solids content (%).

Bootstrap for Coefficients						
				BCa 95% CI for *B*		
MQT*	Predictor	*B*	S.E.	Lower bound	Upper bound	P
Fat	Intercept	7.93	3.81	-0.05	16.33	0.041
	RI, °Bx	0.57	0.11	0.38	0.78	0.001
	DMY, kg	-0.44	0.09	-0.60	-0.28	0.001
	pH	-1.11	0.52	-2.04	-0.25	0.037
	EC, ms/cm	-0.44	0.22	-0.87	0.00	0.042
Protein	Intercept	-3.27	0.58	-4.36	-2.19	0.001
	RI, °Bx	0.58	0.03	0.51	0.64	0.001
	EC, ms/cm	0.24	0.06	0.12	0.35	0.001
Lactose	Intercept	7.84	0.37	7.13	8.65	0.001
	EC, ms/cm	-0.48	0.05	-0.57	-0.40	0.001
	RI, °Bx	-0.10	0.02	-0.14	-0.07	0.001
	DMY, kg	0.08	0.02	0.05	0.11	0.001
Total solids	Intercept	6.59	1.87	2.89	9.88	0.001
	RI, °Bx	1.04	0.09	0.86	1.26	0.001
	DMY, kg	-0.38	0.08	-0.52	-0.24	0.001
	EC, ms/cm	-0.81	0.19	-1.17	-0.44	0.001

[*] MQT: Milk Quality Trait