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Milk Composition Characteristics of Yellow Breed Cows in the Village Herd

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Abstract: ***Native breeds are valuable gene sources due to the fact they have adapted to difficult environments for generations and are commonly raised in traditional breeding, in barns in winter, and free grazing in the highlands in summer. Breeders were forced to dispose of native breeds because they were unable to compete under the demand of intensification. Some authentic indigenous breeds can still be found today in inaccessible mountain towns with a closed economy. Among Anatolian cattle, native Yellow Cattle is concentrated in the region ranging from the Taurus Mountains to the Amanos Mountains. The milk composition of Native Yellow Cattle has been demonstrated in this study. Milk was obtained from 38 head cows raised in Gürümze village, Feke District, 122 kilometers from Adana. Milk samples were analyzed using the MilkoScan FT120 (FOSS) milk analyzer, and the contents of dry matter, fat, non - fat dry matter, protein, casein, lactose, and urea were determined. In this study, the average total solids content of Native yellow cattle was 12.09, SNF 9.31, fat 2.85, and protein 3.50. However, the median values were determined as 11.74 for total solids, 9.29 for SNF, 2.56 for fat, and 3.40 for protein. Considering the minimum and maximum values, it is understood that there is significant variation. This could be an important cue for future breeding plans.***

Keywords: Native Yellow Breed, Milk Composition, Village Herds

1. Introduction

Turkey ranks ninth in the European continent in terms of its geographical regions, climatic features, flora and fauna features and biological diversity. Genetic variation is called the biochemical packages that are inherited and determine the physical and biochemical characteristics of existence (Turner, 1987). Native breeds are important gene sources that have adapted to harsh conditions, are extensively grazed in traditional breeding, barns in winter and freely grazed in summers (Bilgemre, 1945). However, as in many parts of the world, there are races in Turkey whose genes are under the threat of extinction (Anonymous, 2020; Rıza, 1935; AkıncıveBatu, 1942; Bilgemre, 1949, Düzgüneş 1987). Native breeds are animals that can make the best use of scarce resources in their own conditions, are resistant to regional diseases and are contented. Considering the economy, socio - cultural status and ecological status of these animals, raising and protecting them as a gene source are strategically important for future development. Historical records and anecdotal evidence, body measurements, conformational morphological evidence, genetic distance to other races, and biochemical evidence such as degree of homozygosity are used for racial identification criteria (Henson, 1992). Conservation of gene resources; It requires organization and management skills as well as knowledge, expense, space, and workforce. On the other hand, there are economic, scientific, cultural and ecological reasons for the protection of gene resources (Turner, 1987; Maijala, 1987; Ertuğrul and Aşkın 1988). Conservation of animal gene resources in Turkey started in 1980 with the protection of four cattle breeds with a high risk of extinction. Today, Gray breed, Native Black, Native Yellow, East Anatolian Red, Kilis (South Anatolian Red) breed and Zavot Cattle are under protection at the ministry level. Pure samples of indigenous breeds, are still found in mountain villages with a closed economy, which is difficult to access. Because in these regions only local breeds that have the least problems can provide added value to the regional economy. This breed, which starting from Mersin, includes Adana, Osmaniye, Kahramanmaraş, and Şanlıurfa, it spreads mainly to the regions between the Taurus and Amanos Mountains and the Mediterranean coastline and partially to the north and east of these mountains, is raised for both meat and milk. TAGEM, (2009), in the gene resources catalog, the birth weight of the native yellow breed is 12 - 14 kg, and the adult live weight is 150 - 250 kg; The withers height is reported as 105 - 115 cm. In addition, it is reported that 1500 - 2500 kg lactation milk yield with 3.5 - 4.5% fat in an average lactation period of 200 - 250 days. There are no other results of studies with this breed. However, in order to be prepared for possible developments, information on each gene source is needed. In the negativities caused by the increase in the world population, climatic changes, industrialization and urbanization, the properties of genetic resources, which are not yet known, are of critical importance. For these reasons, there is a need for information on the characteristics of native breeds. Although the native yellow breed has been defined within the Anatolian red cattle group until recently, it has been understood that it is a breed of different ecological conditions with its small structure and ability to survive in mountainous land areas, and the conservation program has been included. In this study, 12 milk components of 112 native yellow breed cows in the village herd, about which there are very few studies, were examined.

2. Material and Method

The study was carried out in Gürümze village of Feke District, 620 m above sea level, 122 km from Adana, between January, February, and March 2018. In Feke, winters are rainy (snow and rain), and summers are semi - arid and cool. It is 0 - 10 degrees in winter, 30 - 40 degrees in summer, and 15 - 20 degrees in highlands and villages. In the region, Native Yellow Cattle is mostly done in the form

of extensive rearing, which we can express as traditional rearing.

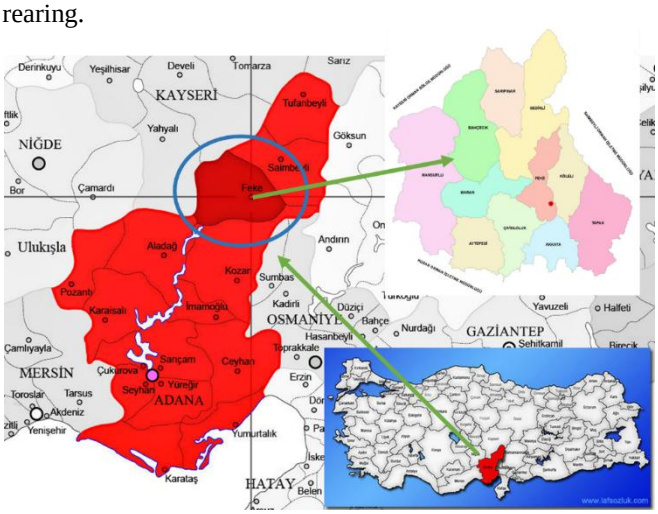

Figure 1: Location of Adana Province Feke District

In this region, animals are kept in barns in winter and raised on pasture in summer. During the months of November - April, the animals in the village are kept in the barn of the enterprise, which is usually under the houses, at night, and during the daytime they spread in the grassland and pasture areas around the village. The heat of the animals in the barns under the houses contributes to the heating of the house. Depending on the weather conditions, the animals are taken to the plateau of the village at the end of April and the beginning of May. No additional feeding is given to the animals that are grazed freely with their calves in the pasture. Animals that give birth at the beginning of September are taken to the barns, and in October - November, when the first snow falls, they are grazed around the village during the day and housed in the barns at night.

Picture 1: Adana Province Feke District Native Yellow breed time to return home

Picture 2: A view from the village herd

In the study, milk samples of 112 Native yellow cows within the scope of the Genetic Resources Conservation Project were studied (Picture 1). In the study, milk samples were taken from the cows in the period between November and April when the cows were kept in the barn. Milk samples were taken from the milking cup of each cow after milking

by the farmers. The samples taken were labeled and preserved until the time to be analyzed with the cold chain. Milk analyzes of the samples were carried out with MilkoScan FT120 (FOSS) milk analyzer for dry matter (KM), non - fat dry matter (SNF), fat, protein, casein, lactose, urea nitrogen (Urea - N), density, acidity, free fatty acids, citric acid and freezing point were determined.

Evaluation of the data obtained in the research was made with Excel and SPSS statistical package program. In order to define the herd milk composition values, the mean, standard error and standard deviation, minimum, maximum and median values are given in Table 1. The median (or median) value is the value that divides a population or sample data series into two when ordered from smallest to largest (Bek&Efe, 1995). Correlation analysis was used in SPSS17.0 program to define the relationship between milk components of Native yellow cows.

3. Results and Discussion

Table 1 summarizes the findings of the examination of 703 milk samples from a total of 112 Native Yellow cows within the scope of the study. The average total solids content of Native yellow cattle in this research was 12.09, SNF 9.31, fat 2.85, and protein 3.50. However, the median values for total solids were 11.74, 9.29 for SNF, 2.56 for fat, and 3.40 for protein. When the minimum and maximum numbers are considered, it is clear that there is substantial fluctuation.

Table 1: Descriptive statistics of milk analysis results of Native Yellow breed cows

Contents	Average	Standard deviation	Standard error of mean	Median	Minimum	Maximum
Total solid (TS)	12, 09	1, 57	0, 06	11, 74	8, 88	20, 69
Non - fat dry matter (SNF)	9, 31	0, 73	0, 03	9, 29	6, 09	16, 10
Fat	2, 85	1, 52	0, 06	2, 56	0, 50	11, 50
Protein	3, 50	0, 70	0, 03	3, 40	1, 71	11, 17
Lactose	4, 98	0, 31	0, 01	5, 03	3, 57	5, 75
Casein	2, 89	0, 50	0, 02	2, 84	0, 22	8, 10
Urea	0, 02	0, 02	0, 00	0, 02	- 0, 14	0, 18
Density	1034, 16	3, 12	0, 12	1034, 54	1020, 00	1045, 00
Acidity	7, 14	2, 45	0, 09	6, 82	- 9, 07	33, 60
Free Fatty Acids (FFA)	1, 73	4, 45	0, 17	1, 90	- 13, 11	60, 71
Citric acid	0, 15	0, 04	0, 00	0, 14	0, 04	0, 28
freezing point (FPD)	0, 58	0, 04	0, 00	0, 58	0, 40	0, 98

As a result of the analysis of the milk samples of the Native Yellow breed cows, it is understood from Table 1 that the average total solids content is 12.09±0.06 and the median value is 11.74. The total solids content of cow's milk should be between 12 - 14%. However, this is an average value and varies depending on factors such as cow's milk total solids content, cow's nutrition, milking time and milk yield. In this study, although the milk total solids ratio is within the acceptable limits, it is seen that it is within wide limits between 8.88 and 20.69. The total amount of solids in milk refers to the total amount of solids in the milk. This amount is an important factor that determines the quality of milk. The total amount of solids in milk includes the milk fat ratio, protein ratio and lactose ratio.

Table 2 shows the distribution of total solids change limits for Native Yellow cows. Although the solid matter change limits of Native Yellow breed cows range from 8.88 to 20.69, 56.33% of the samples are in the 10 - 11 range and 36.70% are in the 12 - 14 range.

Table 2: Native Yellow breed cow's total solids, solids excluding fat and fat content classes

Total solid (TS)			Non - fat dry matter (SNF)			Fat		
Groups	Number	Percent	Groups	Number	Percent	Groups	Number	Percent
8 - 9	16	2, 28	<8, 5	41	5, 83	0 - 1	240	34, 14
10 - 11	396	56, 33	8, 5 - 9	598	85, 06	2 - 3	340	48, 36
12 - 14	258	36, 70	10>	64	9, 10	4 - 5	102	14, 51
15+	33	4, 69				6+	21	2, 99

Table 2 shows the distribution of SNF change limits. Milk samples had a mean fat - free solids percentage of 9.31±0.03, with a median value of 9.29 (Table 1). Lactose, vitamins, calcium, minerals, fat, protein, and other nutrients are all found in milk. These considerably add to the nutritious content of milk. Cow's milk must normally have more than 8.5% SNF. Non - fat dry matter (SNF) refers to milk constituents other than water and butter. It is component that remains after the water in milk has been completely evaporated. Although the SNF content fluctuation limits of Native Yellow cows are between 6.09 and 16.10, Table 2 shows that 85.06% of the samples are in the 8.5 - 9.0 range.

The distribution of SNF change limits is given in Table 2. The mean fat - free solids content of milk samples was 9.31±0.03 and the median value was 9.29 (Table 1). The SNF in milk contains lactose, vitamins, calcium, minerals, fat, protein and other nutrients. These contribute significantly to the nutritional value of milk. Normally, cow's milk is required to contain more than 8.5% SNF. Substances in milk other than water and butter are called Non - fat dry matter (SNF). It is a residual component that remains after complete evaporation of water from milk. Although the SNF content variation limits of Native Yellow cows are between 6.09 and 16.10, it is understood from Table 2 that 85.06% of the samples are in the range of 8.5 - 9.0.

Table 1 shows that the fat contents range from 0.50% to 11.50%, with an average value of 2.85±0.06% and a median value of 2.56%. However, 48.36% of the samples had a fat ratio that varied by 2 - 3%.

Lactose levels were found to range between 3.57 to 5.75 in the research. Table 2 shows that the mean value is 4.98 0.01% and the median value is 5.03%. When the lactose content change limits of milk samples are shown in Table 3, it is observed that 54.34% of the samples are 5%; it is known that 44.24% have 4 lactose content.

In the research, the casein concentrations varied from 0.22 to 8.10. Table 1 shows that the mean value is 2.89±0.02% and the median value is 2.84%. When the distribution limits of casein content classes of milk samples are evaluated in Table 3, it appears that 70.55% of the samples are 2%; it is also known that 26.60% have 3 lactose content.

Table 3: Native Yellow breed cow's milk Protein, Lactose, Casein content limits

Protein			Lactose			Casein		
Groups	Number	Percent	Groups	Number	Percent	Groups	Number	Percent
1 - 2	79	11, 24	3	10	10, 00	<1	11	1, 56
3 - 4	615	87, 48	4	311	44, 24	2	496	70, 55
5>	9	1, 28	5	382	54, 34	3	187	26, 60
						4>	9	1, 28

The amount of urea ranged from - 0.14 to 0.18. Table 1 demonstrates that the mean and median values are the same (0.02±0.00%). When Table 3 is examined, 34.14% of the samples have a urea concentration of 0.02 - 0.03, whereas 29.73% have a urea concentration of 0.01 - 0.02. The urea concentration in milk is an essential indicator of ruminant feed energy and protein balance (Bendelja et al., 2011). Nutritional state, breed, lactation, body weight, quantity of milk and milk composition, feeding time, feeding method, digestible protein intake, season, milking, carbohydrate, and water consumption are all factors that affect milk urea concentration (Depatie, 2000; Nourozi et al., 2010).

The milk density determined in the study is between 1020.42 and 1045.02. It is understood from Table 2 that the mean and median values are 1034. When Table 4 showing the distribution limits of the density classes of milk samples is examined, it is understood that 90.04% of the samples are in the range of 1031 - 1039.

The milk acidity detected in the study is between - 9.07 and 33.60. It is understood from Table 2 that the average milk acidity is 7.14±0.09 and the median value is 6.82. The acidity level of the milk is determined to determine whether it is fresh and normal, whether it can withstand the temperature during processing, whether neutralizing agent has been added, whether the milk has mastitis, whether it is in accordance with the regulations, standards and codex. The acidity in milk depends on the pH value of the milk. Acidity in milk increases as the pH value of milk decreases. Acidity in milk is important for the quality and durability of milk. The acidity in milk prevents the reproduction of microorganisms that cause milk spoilage. The acidity value in milk should be between 0.14 - 0.18. Acidity in milk occurs when bacteria in milk convert the sugar lactose into lactic acid. As milk sours, it becomes more acidic and the pH drops.

Newly milked normal healthy milk shows an acidic reaction, this is called initial acidity or natural acidity. This acidity is primarily due to casein, phosphate and citrates in its composition; In the second degree, it comes from albumin, globulin, and carbon dioxide. Milk cannot maintain its initial acidity for a long time. Due to milking and holding conditions, different types of microorganisms are transmitted to milk in various ways. The activity of these microorganisms causes the acidity of milk to rise. Some acid - producing bacteria, especially lactic acid bacteria, break down milk sugar into lactic acid, causing an increase in acidity. Since this type of acidity develops later, it is called subsequent acidity or developing acidity. The total acidity in milk consists of the sum of the initial acidity and the developing acidity. When Table 4 showing the limits of the distribution of acidity classes of milk samples is examined, it is understood that 35.85% of the samples are in the range of 6 and 23.76% in the range of 7.

The milk acidity measured in the research ranged from - 9.07 to 33.60. Table 2 shows that the mean value is 7.140.09 and the median value is 6.82. When the distribution limits of the acidity classes of the milk samples are studied in Table 6, it is clear that the samples have an acidity value of 61, 45% above 7. The acidic response of freshly milked normal healthy milk is known as initial acidity or natural acidity. Milk cannot keep its acidity for an extended period of time. Different bacteria are transferred to milk in diverse ways as a result of milking and keeping conditions. Milk's acidity rises due to the action of these microbes. The milk grows more acidic as it ages, and the

Table 4: Limits milk urea content of Native Yellow breed cows

Urea			Density			Acidity		
Groups	Number	Percent	Groups	Number	Percent	Groups	Number	Percent
<0, 001	19	2, 70	1020 - 1030	59	8, 39	<6	74	10, 53
0, 00 - 0, 009	43	6, 12	1031 - 1039	633	90, 04	6 İle 8	197	28, 02
0, 01 - 0, 02	209	29, 73	1040+	11	1, 56	7>	432	61, 45
0, 02 - 0, 03	240	34, 14						
0, 03 - 0, 04	121	17, 21						
0, 04 - 0, 05	60	8, 53						
0, 05>	11	1, 56						

The milk FFA contents detected in the study ranged from -13.11 to 60.71. It is understood from Table 1 that the mean value is 1.73±0.17 and the median value is 1.90. Low Milk FFA Levels As a result of the natural process of Normal Lipolysis, all milk is expected to have low FFA levels. These normal levels range from 0.5 to 1.2 mmol/100g of fat, making up only 0.1% of milk fat (Månsson, 2008). When Table 6 showing the change in FFA content of milk samples is examined, it is seen that 25.46% of the samples were 1; It is understood that 21.34% has 2 FFA content.

The milk citric acid levels in the samples range from 0.04 - 0.28. Table 2 shows that the mean value is 0.15±0.00 and the median value is 0.14. Cow's milk contains a citric acid level ranging from 0.07 to 0.33%, with an average of 0.18 percent (Sherwood and Hammer, 1926). When the distribution limits of citric acid content classes of milk samples are shown in Table 5, it is clear that 75.68% of the samples fall within the range of 0.11 - 0.19. Citric acid is recognized as a natural component of milk. However, there is still considerable debate about the forms in which it appears in this product. Citric acid was found in 0.21 percent of fresh milk (Bosworth and Prucha, 1910). In most cases, 0.1 to 0.2 percent citric acid is incorporated in one form or another (Supplee and Bellis 1921).

It is understood from Table 2 that the FPD contents of the samples are 0.40 - 0.98, the mean value and the median value are at the same point as 0.58±0.00. When Table 5 showing the distribution limits of the FPD content classes of milk samples is examined, it is understood that 80.80% of the samples are in the range of 0.51 - 0.60

Table 5: Change in milk FFA content of Native Yellow breed cows

Free Fatty Acids (FFA)			Citric Acid			Freezing Point (FPD)		
Groups	Number	Percent	Groups	Number	Percent	Groups	Number	Percent
< 0	124	17, 64	0, 04 - 009	48	6, 83	0, 40 - 0, 50	19	2, 70
0	73	10, 38	0, 1	37	5, 26	0, 51 - 0, 60	568	80, 80
1	179	25, 46	0, 11 - 0, 19	532	75, 68	0, 61 - 0, 70	112	15, 93
2	150	21, 34	0, 2	35	4, 98	0, 71+	4	0, 57
3	93	13, 23	0, 21 - 3	51	7, 25			
4	43	6, 12						
5	41	5, 83						

4. Correlations

The correlation coefficients between the milk content of Native Yellow cows are summarized in Table 6. When Table 6 showing 66 correlations between milk components is examined, SNF and Lactose and Citric Acid; with fat, protein, acidity and FFA; FFA with Density; The correlations between acidity and Citric acid were found to be statistically insignificant. The correlations between urea's FFA and FPD were found to be significant at the p <.05 level. While 7 of the 66 correlations detected were statistically insignificant, 2 were significant at 0.05. Of the 57 correlations that were found to be statistically significant, 16 were found to be negative high correlations.

Table 6: Correlations between milk content of Native Yellow breed cows

	TS	SNF	Fat	Prot.	Lact.	Cas.	Urea	Dns.	Acid.	FFA	CitricA
SNF	, 29**	1, 00									
Fat	, 89**	- , 168**	1, 00								
Protein	, 46**	, 869**	0, 06	1, 00							
Lactose	- 0, 2**	0, 059	- , 240**	- , 408**	1, 00						
Casein	, 56**	, 895**	, 153**	, 973**	- , 270**	1, 00					
Urea	- , 230**	, 307**	- , 433**	, 178**	, 159**	, 168**	1, 00				
Density	- , 347**	, 737**	- , 697**	, 443**	, 352**	, 444**	, 396**	1, 00			
Acidity	, 397**	, 806**	0, 001	, 871**	- , 261**	, 866**	, 347**	, 404**	1, 00		
FFA	, 151**	, 297**	- 0, 013	, 303**	- 0, 069	, 284**	, 084*	- 0, 004	, 326**	1, 00	
Citric A.	- , 244**	0, 004	- , 261**	- , 261**	, 370**	- , 257**	, 241**	, 142**	0, 028	- , 113**	1, 00
FPD	, 541**	, 632**	, 251**	, 548**	, 191**	, 596**	, 079*	, 246**	, 613**	, 154**	, 191**

** Correlation is significant at the 0.01 level and * at the 0.05 level (2 - tailed).

Zhang et al (2018) reported that milk yield was negatively correlated with milk fat percentage, milk protein ratio, somatic cell number and milk urea nitrogen (P<0.01), while milk fat percentage was correlated with milk protein ratio, somatic cell number and milk urea nitrogen. reports a positive (P<0.01) correlation. They reported that milk protein ratio correlated positively (P<0.01) with somatic cell count and negatively (P<0.01) with milk urea nitrogen. Chandrakar et al (2017) found significant (p<0.01) positive correlations between fat and SNF (0.792), fat and protein (0.330), and fat and lactose (0.482); The correlation between SNF and protein (0.333) and lactose (0.345) was reported as positive and significant (p<0.01). Yoon et al. (2003) reported that there is a positive correlation between the increase in milk urea content and milk fat content in Holstein cows. Dehinenet et al. (2013) reported that positive and negative significant (P<0.01) correlations were detected between protein level, lactose and freezing point. In studies on the relations between milk components in cows, different results are reported since many factors affecting milk content such as region, season, cow breed, age, number of births, live weight, dry period, diseases, feed, milking (Göncü, 2021) are included. It is possible that these factors have an effect on the differences in the results of this study.

5. Conclusions

Gene resources are important for the development of living things because they contain genes that provide resistance to different conditions. Information about the breeds in which these genes are found is extremely important for breeding studies. In the negativities caused by the increase in the world population, climatic changes, industrialization and urbanization, the properties of genetic resources, which are not yet known, are of critical importance. For these reasons, there is a need for information on the characteristics of native breeds. In this study, the average total solids content of Native yellow cattle was 12.09, SNF 9.31, fat 2.85 and protein 3.50. However, the median values were determined as 11.74 for total solids, 9.29 for SNF, 2.56 for fat and 3.40 for protein. Considering the minimum and maximum values, it is understood that there is significant variation. Indigenous races have the characteristics of different geographies, reflect the characteristics of different ecological environments, and respond to the requirements of agricultural activities and changing conditions over time. Therefore, more detailed and long - term research results are needed on these issues.

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