Far-East Asia Networking of Dairy Technology Connected with ICAR Guidelines for Young Farmers

Fatty Acid, Casein & Ketosis Screening of Cow Milk in Taiwan

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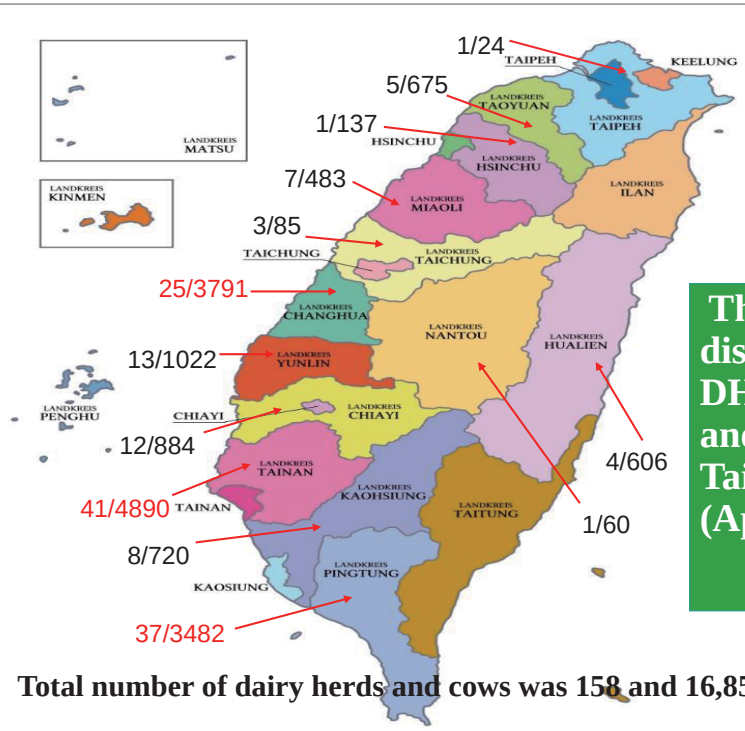
Outline

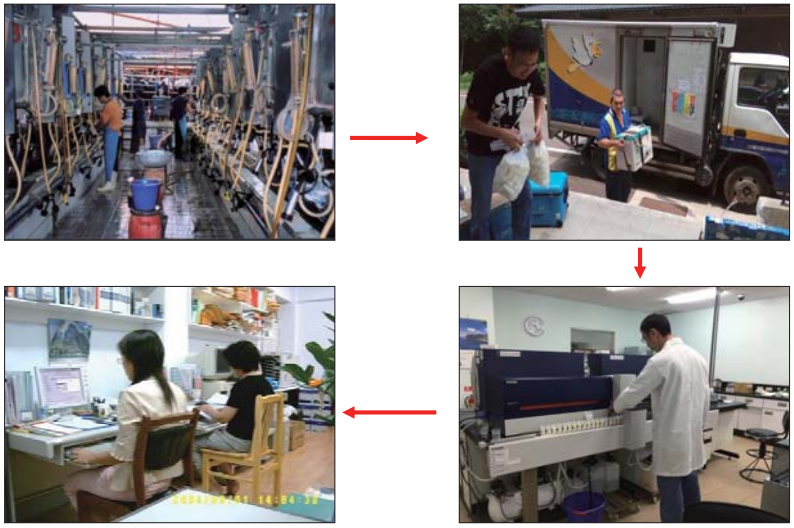
- Raw milk quality in DHI (Dairy Herd Improvement) analysis, Taiwan
- Application of fatty acids profile
- Application of free fatty acids (FFA) profile
- Application of casein
- Ketosis screening



The distribution of DHI herds and cows in Taiwan (April 2016)

Total number of dairy herds and cows was 158 and 16,859 individually.

The procedure of DHI



***Reports: E-mail to individual DHI farmer or by mail.**

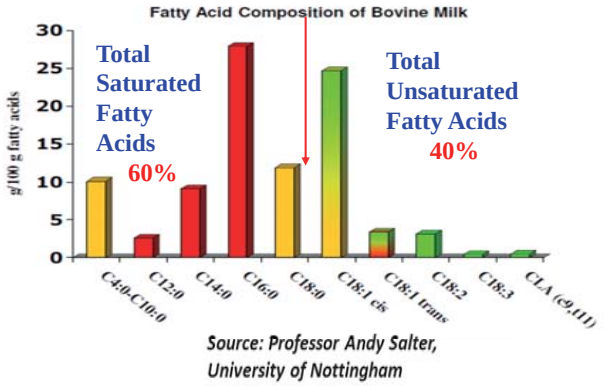
Raw milk components in DHI analysis

- **Before 1978**
  milk fat
- **1978 – 2002**
  milk fat, protein, lactose, solids-not-fat, total solids
- **2003 – 2013**
  milk fat, protein, lactose, solids-not-fat, total solids, urea nitrogen, citric acid
- **Since 2014**
  milk fat, protein, lactose, solids-not-fat, total solids, urea nitrogen, citric acid, fatty acids, free fatty acids, casein, ketone bodies

Function of new type milk components analyzer

New type milk component machine can analysis milk fat, protein, lactose, solids-not-fat, total solids, urea nitrogen, citric acid, fatty acids, free fatty acids, casein and ketone bodies immediately in the same time.

Fatty acid composition of bovine milk by GC



•We can exam milk fatty acid composition quickly by milk analyzer.
•However, it need calibration regularly by Gas Chromatograph method.

Fatty acids profile by milk component analyzer

- **Total Saturated Fatty Acids**
- **Total Unsaturated Fatty Acids**
  - **Mono Unsaturated Fatty Acids**
  - **Poly Unsaturated Fatty Acids**

How to improve milk fatty acids profile

- Short term by changes in feeding to produce high level of unsaturated fatty acids in milk.
- Long term by breeding in order to favor a specific fatty acid profile in milk.

Impact factors of free fatty acid（FFA）

* FFA is the result of “Lipolysis”, which is an enzymatic process in the milk.

* FFA are influenced by: hygiene (microrganism), disease (mastitis), stage of lactation, heredity, seasonality, nutrition (composition of fodder), milk handling on the farm and in the factory etc.

Why we test FFA in milk

- Raw milk with high FFA levels cannot be “repaired”, the damage is done, and the enzymatic process continues.
- Milk with high levels of FFA decreased shelf life of milk products.
- Farmers, who deliver milk with high FFA, can be helped to correct the problem.
- The milk industry faces increasing competition, and must have more and more knowledge and control over the raw material.

The reasons for measure casein content in milk

The casein content in milk can be influenced through “feed and breed”.

Data on casein content is needed to monitor changes.

Symptoms and screening of ketosis in dairy cows

- Ketosis can cause loss of appetite, slim, constipation, dull eyes, etc.
- Although the mortality rate is very low, but will reduced milk production, milk quality and cause reproductive disorders, endocrine disorders and other diseases (such as retained placenta, metritis, mastitis and ectopic fourth stomach). Leading to serious economic losses.
- Cow-side tests
- DHI milk analysis

Incidence of ketosis in Taiwan DHI dairy cows

Table 1. Percentage of subclinical ketosis in DHI cows

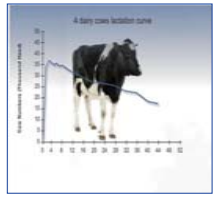
Year	Total sample number	Sample number of subclinical ketosis (%)
2014	44,496	3,104 (7.0%)
2015	93,288	8,337 (8.9%)

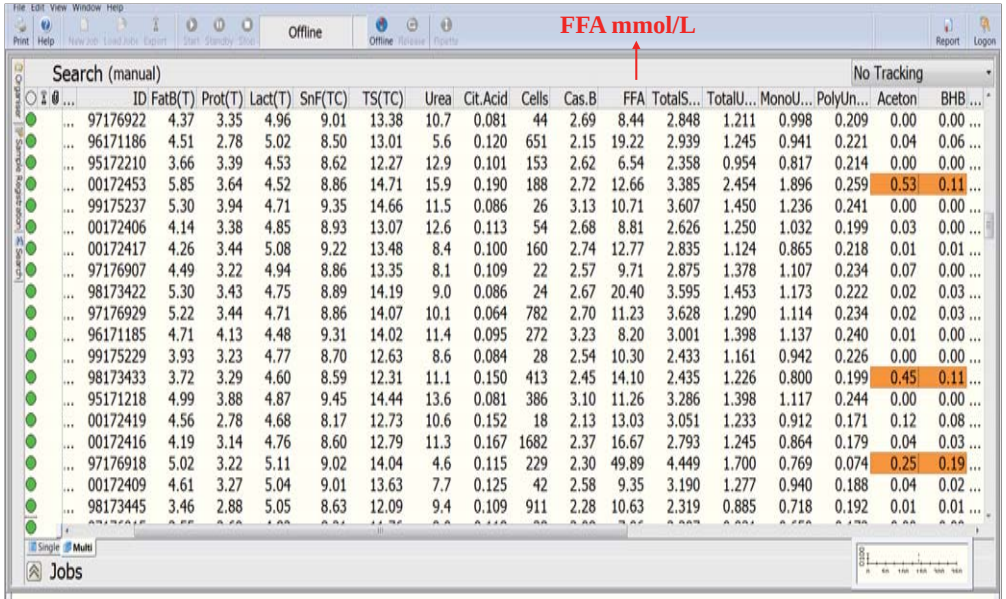
Table 2. Frequency distribution (%) of subclinical ketosis in DHI cows within 42 day stage of lactation

Year	≦7	8-14	15-21	22-28	29-35	36-42
2014	13.4	26.7	22.2	18.6	11.8	7.3
2015	15.4	26.2	39.3	17.5	12.1	8.7

Indicators of ketosis screening by milk component analyzer

Content of milk acetone over 0.15 mmol/L or milk BHB over 0.10 mmol/L means the incidence of ketosis.





Milk quality of DHI individual cow (raw data)

行政院農業委員會畜產試驗所新竹分所

苗栗縣西湖鄉五湖村埤頭面207-5號 電話：037-911693#236 傳真：037-911700

乳牛群性能改良— 乳品質檢驗報表

測乳型態：一般送樣

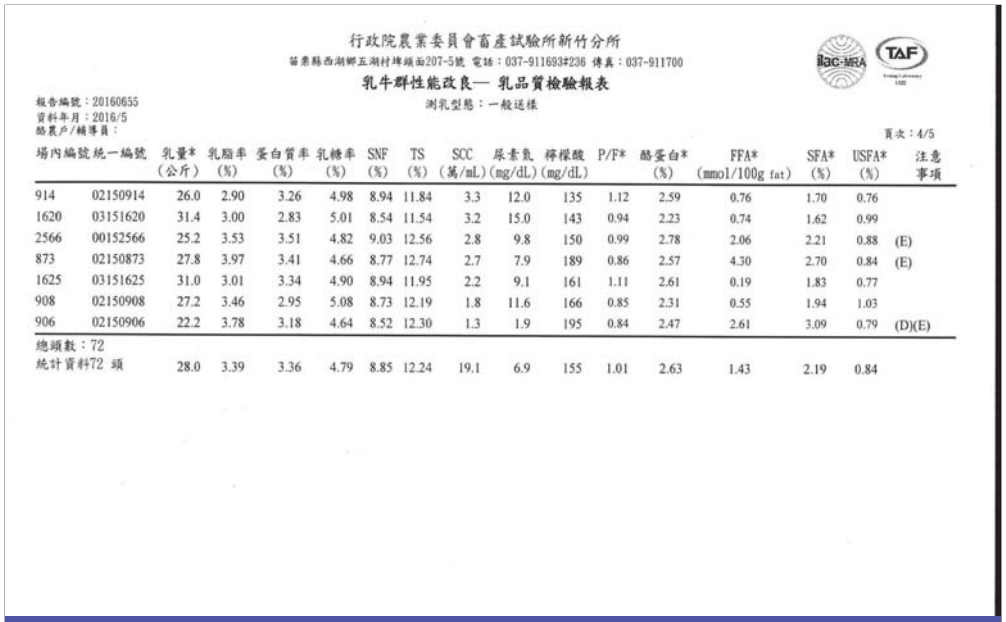
報告編號：20160655
資料年月：2016/5
酪農戶/輔導員：

FFA(mmol/100g fat)

頁次：2/5

場內編號	統一編號	乳量*（公斤）	乳脂率（%）	蛋白質率（%）	乳糖率（%）	SNF（%）	TS（%）	SCC（萬/mL）	尿素氮（mg/dL）	檸檬酸（mg/dL）	P/F*	酪蛋白*（%）	FFA*（mmol/100g fat）	SFA*（%）	USFA*（%）	注意事項
899	02150899	31.4	2.94	3.54	4.81	9.05	11.99	14.4	0.1	156	1.20	2.78	2.40	2.13	0.54	(D)(E)
5037	98155037	57.0	3.15	2.77	4.68	8.15	11.30	12.6	8.8	179	0.88	2.09	0.12	1.94	0.89	
907	02150907	26.0	4.22	3.13	4.96	8.79	13.01	12.2	6.5	143	0.74	2.35	3.12	2.95	1.33	(E)
1039-1	98151039	27.0	3.44	3.56	4.63	8.89	12.33	12.0	6.3	149	1.03	2.79	1.17	2.21	0.85	(D)
870	02150870	28.2	2.18	3.39	4.88	8.97	11.15	11.8	6.7	149	1.56	2.67	0.00	1.34	0.60	(D)
877	02150877	20.2	3.70	3.93	4.78	9.41	13.11	11.6	11.9	154	1.06	3.12	1.33	2.22	1.02	
886	02150886	27.6	4.16	3.51	4.71	8.92	13.08	11.5	5.2	178	0.84	2.75	1.72	2.81	0.94	(D)(E)
1615	03151615	23.4	3.01	2.74	5.24	8.68	11.69	10.7	15.4	206	0.91	2.16	0.49	1.70	0.88	
884	02150884	25.0	3.46	4.09	4.65	9.44	12.90	10.6	0.1	124	1.18	3.24	3.04	2.53	0.67	(D)(E)
863	02150863	24.6	3.83	4.33	4.55	9.58	13.41	10.0	0.1	164	1.13	3.42	3.56	2.67	0.85	(E)
1604	03151604	34.6	2.41	3.23	4.89	8.82	11.23	9.4	1.7	145	1.34	2.56	0.63	1.60	0.54	(D)
887	02150887	19.8	2.81	3.27	4.79	8.76	11.57	9.4	8.1	164	1.16	2.54	0.91	1.60	0.85	(D)
910	02150910	26.4	2.88	3.55	4.88	9.13	12.01	9.0	0.1	135	1.23	2.81	4.40	1.90	0.59	(E)
124	14150124	27.4	4.15	3.23	4.88	8.81	12.96	8.9	6.6	194	0.78	2.51	1.24	2.50	1.13	(D)
1611	03151611	27.2	3.35	3.56	4.94	9.20	12.55	8.9	0.1	153	1.06	2.81	4.27	2.64	0.49	(E)
915	02150915	27.0	3.47	3.34	4.74	8.78	12.25	8.7	0.1	175	0.96	2.59	2.72	2.33	0.73	(D)(E)
1607	03151607	24.2	3.77	3.24	4.93	8.87	12.64	8.6	9.7	154	0.86	2.57	0.74	2.52	0.92	
1618	03151618	23.0	3.73	3.26	4.95	8.91	12.64	8.6	9.6	169	0.87	2.58	0.99	2.37	0.88	
917	02150917	30.8	2.96	3.30	5.06	9.06	12.02	8.5	11.0	143	1.11	2.65	0.30	1.79	0.74	
1658	03151658	32.6	4.00	3.47	4.49	8.66	12.66	8.3	0.1	148	0.87	2.69	2.33	2.85	0.81	(D)(E)
875	02150875	19.2	4.69	4.26	4.69	9.65	14.34	8.3	0.1	143	0.91	3.39	4.64	3.49	0.85	(E)

Milk quality report of DHI cows-1



行政院農業委員會畜產試驗所新竹分所

苗栗縣西湖鄉五湖村埤頭面207-5號 電話：037-911693#236 傳真：037-911700

乳牛群性能改良— 乳品質檢驗報表

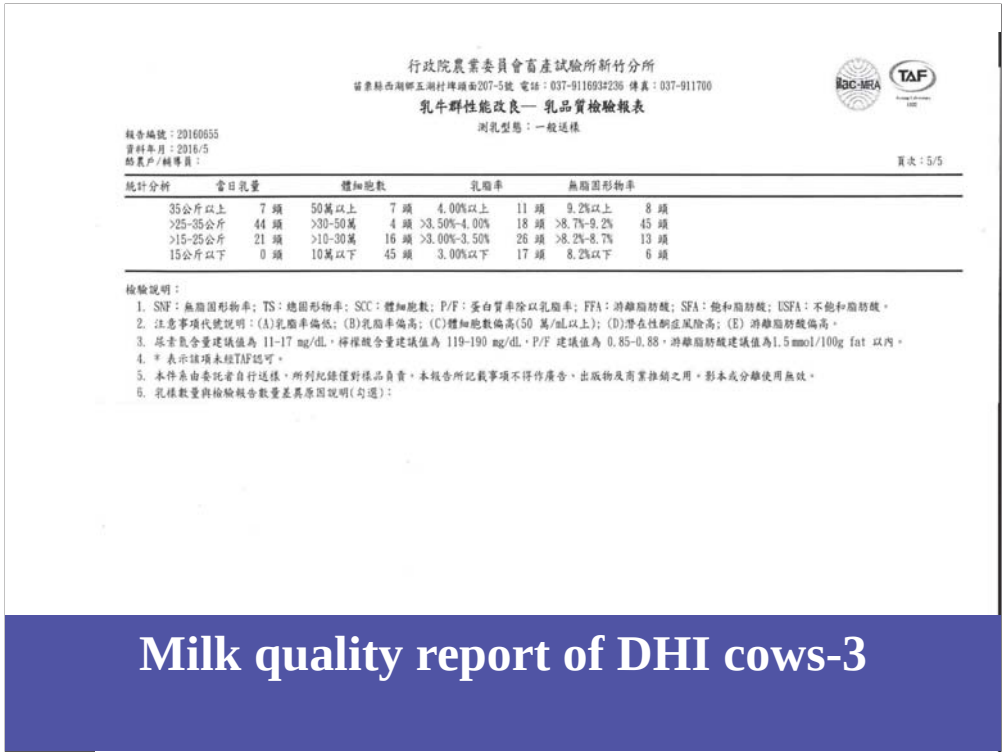
測乳型態：一般送樣

報告編號：20160655
資料年月：2016/5
酪農戶/輔導員：

頁次：4/5

場內編號	統一編號	乳量*（公斤）	乳脂率（%）	蛋白質率（%）	乳糖率（%）	SNF（%）	TS（%）	SCC（萬/mL）	尿素氮（mg/dL）	檸檬酸（mg/dL）	P/F*	酪蛋白*（%）	FFA*（mmol/100g fat）	SFA*（%）	USFA*（%）	注意事項
914	02150914	26.0	2.90	3.26	4.98	8.94	11.84	3.3	12.0	135	1.12	2.59	0.76	1.70	0.76	
1620	03151620	31.4	3.00	2.83	5.01	8.54	11.54	3.2	15.0	143	0.94	2.23	0.74	1.62	0.99	
2566	00152566	25.2	3.53	3.51	4.82	9.03	12.56	2.8	9.8	150	0.99	2.78	2.06	2.21	0.88	(E)
873	02150873	27.8	3.97	3.41	4.66	8.77	12.74	2.7	7.9	189	0.86	2.57	4.30	2.70	0.84	(E)
1625	03151625	31.0	3.01	3.34	4.90	8.94	11.95	2.2	9.1	161	1.11	2.61	0.19	1.83	0.77	
908	02150908	27.2	3.46	2.95	5.08	8.73	12.19	1.8	11.6	166	0.85	2.31	0.55	1.94	1.03	
906	02150906	22.2	3.78	3.18	4.64	8.52	12.30	1.3	1.9	195	0.84	2.47	2.61	3.09	0.79	(D)(E)
總頭數：72 統計資料72 頭		28.0	3.39	3.36	4.79	8.85	12.24	19.1	6.9	155	1.01	2.63	1.43	2.19	0.84	

Milk quality report of DHI cows-2



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測乳型態：一般送樣

報告編號：20160655
資料年月：2016/5
酪農戶/輔導員：

頁次：5/5

統計分析	當日乳量		體細胞數		乳脂率		無脂固形物率	
35公斤以上	7 頭	50萬以上	7 頭	4.00%以上	11 頭	9.2%以上	8 頭
>25-35公斤	44 頭	>30-50萬	4 頭	>3.50%-4.00%	18 頭	>8.7%-9.2%	45 頭
>15-25公斤	21 頭	>10-30萬	16 頭	>3.00%-3.50%	26 頭	>8.2%-8.7%	13 頭
15公斤以下	0 頭	10萬以下	45 頭	3.00%以下	17 頭	8.2%以下	6 頭

檢驗說明：

1. SNF：無脂固形物率；TS：總固形物率；SCC：體細胞數；P/F：蛋白質率除以乳脂率；FFA：游離脂肪酸；SFA：飽和脂肪酸；USFA：不飽和脂肪酸。
2. 注意事項代號說明：(A)乳脂率偏低；(B)乳脂率偏高；(C)體細胞數偏高(50 萬/mL以上)；(D)潛在性酮症風險高；(E) 游離脂肪酸偏高。
3. 尿素氮含量建議值為 11-17 mg/dL，檸檬酸含量建議值為 119-190 mg/dL，P/F 建議值為 0.85-0.88，游離脂肪酸建議值為1.5 mmol/100g fat 以內。
4. * 表示該項未經TAF認可。
5. 本件系由委託者自行送樣，所列紀錄僅對樣品負責。本報告所記載事項不得作廣告、出版物及商業推銷之用。影本或分離使用無效。
6. 乳樣數量與檢驗報告數量差異原因說明(勾選)：

Milk quality report of DHI cows-3

Milk quality of bulk milk of dairy farmers

	脂肪	蛋白質	乳糖	無脂固形物	總固形物	酪蛋白	總飽和脂肪酸	總不飽和脂肪酸	單元不飽和脂肪酸	多元不飽和脂肪酸	游離脂肪酸
	Fat	Prot	Lact	SNF	TS	Cas	TotalSa	TotalUnsa	MonoUnsa	PolyUnsa	FFA
ID	%	%	%	%	%	%	%	%	%	%	mmol/100g Fat
1	3.73	3.18	4.75	8.63	12.36	2.46	2.22	1.02	1.00	0.11	2.46
2	3.83	3.18	4.78	8.65	12.48	2.47	2.32	1.05	1.03	0.09	1.24
3	3.04	2.89	4.69	8.27	11.31	2.21	1.61	0.94	0.96	0.08	0.74
4	3.08	2.79	4.57	8.06	11.14	2.11	1.62	0.97	0.96	0.08	0.53
5	3.94	3.21	4.86	8.77	12.71	2.50	2.43	1.05	1.01	0.09	0.50
6	3.91	3.21	4.85	8.76	12.67	2.49	2.40	1.05	1.03	0.11	0.42
7	3.72	3.20	4.72	8.63	12.34	2.49	2.24	1.02	1.01	0.09	0.36
8	3.76	3.21	4.76	8.67	12.43	2.50	2.25	1.03	0.98	0.09	0.31
9	3.34	3.09	4.72	8.51	11.85	2.39	2.01	0.85	0.86	0.09	0.27
10	3.39	3.04	4.72	8.47	11.85	2.35	2.09	0.86	0.84	0.06	0.24
11	3.30	3.35	4.73	8.78	12.07	2.61	1.86	0.97	0.96	0.09	0.24
12	3.60	3.23	4.85	8.78	12.38	2.51	1.99	1.11	1.05	0.11	0.21
13	3.67	3.23	4.71	8.64	12.31	2.51	2.33	0.95	0.89	0.05	0.19
14	3.94	3.22	4.69	8.61	12.55	2.50	2.49	1.00	0.97	0.07	0.18

Milk quality of cow fresh milk

	脂肪	蛋白質	乳糖	無脂固形物	總固形物	酪蛋白	總飽和脂肪酸	總不飽和脂肪酸	單元不飽和脂肪酸	多元不飽和脂肪酸	游離脂肪酸
	Fat	Prot	Lact	SNF	TS	Cas	TotalSa	TotalUnsa	MonoUnsa	PolyUnsa	FFA
ID	%	%	%	%	%	%	%	%	%	%	mmol/100g Fat
1	3.48	3.25	4.71	8.66	12.1	2.51	2.14	0.85	0.81	0.09	0.84
2	3.49	3.24	4.71	8.65	12.1	2.51	2.13	0.87	0.80	0.09	0.63
3	3.72	3.20	4.61	8.51	12.2	2.47	2.05	1.10	1.05	0.13	0.49
4	3.81	3.24	4.67	8.61	12.4	2.51	2.22	1.03	0.99	0.11	0.42
5	3.74	3.22	4.68	8.60	12.3	2.49	2.21	1.00	0.95	0.11	0.36
6	3.73	3.24	4.69	8.63	12.4	2.50	2.16	1.02	0.96	0.13	0.31
7	3.77	3.10	4.62	8.42	12.2	2.39	2.15	1.07	0.99	0.12	0.27
8	3.78	3.10	4.62	8.42	12.2	2.40	2.13	1.08	1.03	0.11	0.24
9	3.78	3.10	4.62	8.42	12.2	2.39	2.10	1.09	1.04	0.13	0.22
10	3.73	3.20	4.67	8.57	12.3	2.49	2.24	0.95	0.89	0.10	0.21
11	3.72	3.21	4.66	8.57	12.3	2.49	2.22	0.96	0.92	0.11	0.19
12	3.78	3.06	4.49	8.25	12.0	2.33	2.20	1.04	0.97	0.11	0.17
13	3.72	3.21	4.66	8.57	12.3	2.49	3.76	2.22	0.96	0.92	0.11
14	3.78	3.06	4.49	8.25	12.0	2.33	2.87	2.20	1.04	0.97	0.11

Challenges in modern dairy farming

- **Disease prevention-ketosis**
- **Feeding**
  - **To improve milk fatty acids profile**
  - **Decrease content of free fatty acids**
  - **Increase content of casein**
  - **Decrease incidence of ketosis**

Thank you !