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BIOLOGY SL

EXTENDED ESSAY

COMPARISON OF UHT MILKS ACCORDING TO TURKISH FOOD CODEX

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Abstract:

One of the products which everyone uses daily is milk which contains essential material for metabolic activities. Milk is benefical to the consumer in many aspects such as protection, growth and repair. However, there are several brands of UHT milk that everyone consumes everyday instead of dairy milk that is sold in convenient stores. UHT milks have longer shelf-life so they are economically favourable so we have lots of options on which to consume. The following paper will be a research on the UHT milks produced by the trusted companies throughout Turkey but which of the following milks have the best properties to be classified as the healthiest in terms of pH, protein and dry matter values according the Turkish Food Codex?

The brands were chosen randomly that were sold in the stores.By using Kjeldahl method for protein analysis it was found that the brand Danone was the best in terms of protein values. However, when we look at the literary values, brand Sek has the greatest protein value. In pH, measurement, brand Pınar had a value of 6.99 so it was less harmful to human health than other brands in terms of pH. In terms of dry matter, Pınar had the greatest value so we can say that Pınar is the best of the five brands of milks that were tested.

Contents:

Introduction:

For an organism to continue living it must gather certain organic and inorganic materials from various resources. Those essential materials are fat, carbonhydrates, proteins, minerals etc. One of those resources which is also consumed daily in the world is milk.

Milk is a fluid that has high nutritional values, produced by every female mammal to feed its offspring until it has the capability to live on its own. Main function of milk is to guarantee the development, existence and protection of the newborn mammals against external influences. Since life conditions of the mammals vary, the milk produced by them has different nutritional values. For instance; mammals which exists in arctic biomes has a higher value of fat inside their milk since fat prevents heat loss. (Metin,1)

The compounds inside milk make it not only a essential nutrient but also a protective nutrient. Protein inside milk has an amphoteric aspect. It protects the consumer against the gaseous states of acids and bases. The individuals who has occupations in chemical industries such as a chemical engineers are often suggested to consume protein containing food. We can state by these various examples that milk also protects us from diseases and toxic materials.(Metin, 2)

The milk is heated to 102±2°C and the remnants of the milk are called dry matter that consists of fat, lactose, minerals etc. Dry matter can be divided into two groups fat and non-fat molecules. Non-fat molecules are lactose, minerals and nitrogen containing compounds. The nutritious part of the milk is the dry matter since it has a high value of proteins it is used for everything in an organism's system When the nutritional values increase, dry matter also increases . The tests during the measurement of dry matter also proves that if the milk was watered down or not since water evaporates during the process. It also checks if the milk has the appropriate values according to the laws. (Öztürk, 120)

Milk contains acidic compounds as well which has physical benefits for the milk and chemical benefits for the consumer. If the acid value of milk is between 0.8%-1% bacteria reproduction is slowed down to minimal. (Metin, 6)

Type of Milk	Dry Matter(%)	Milk Fat(%)	Protein(%)	Lactose(%)
Human	12.4	3.8	1.0	7.0
Cow	12.7	3.7	3.4	4.8
Sheep	19.3	7.4	5.5	4.8
Goat	13.2	4.5	2.9	4.1
Elephant	23.4	14.3	2.5	6.2
Donkey	12.0	1.8	2.5	6.1
Dog	24.9	10.5	12.2	1.3
Camel	13.6	4.5	3.6	5.0
Cat	17.9	3.3	9.1	4.9
Mouse	30.9	14.8	11.8	2.8
Pig	20.5	8.8	7.3	3.3
Whale	37.5	22.0	12.0	1.8

Table 1 (Metin, 3)**:** The nutritional values of different type of milks are shown above. When the protein value of the milk increases the development of the offspring becomes faster. (Metin, 1)

There are also several methods to keep the milk fresh and bacteria free before the consumption. One of those methods is the UHT process. During the process the milk is heated to 135-150°C for 20-2 seconds.(Gürsel, 119) However some bacteria can produces enzymes which protects them from high temperatures so the milk is cooled down after the process. During the process the compounds in milk are affected as well. Since proteins are not very stable under high temperature, this process causes proteins in milk to degenerate. Also, this degeneration causes milk to change its colour to brown. (Gürsel, 138-139)

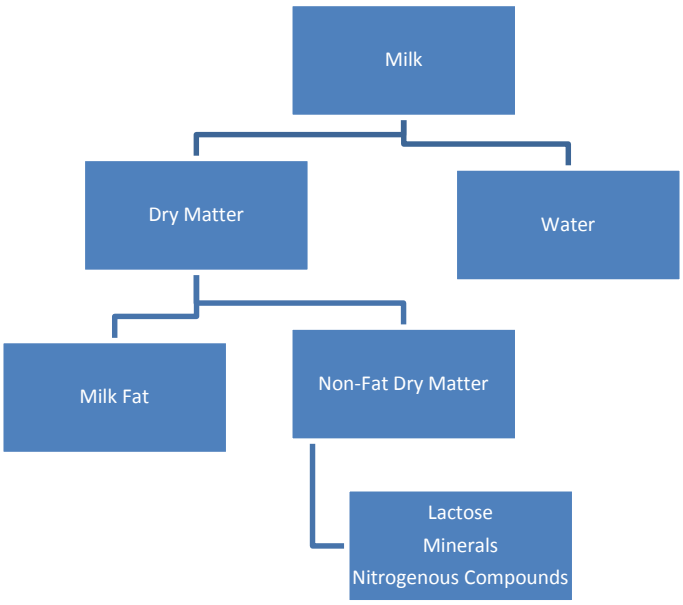


Table 2 (Metin, 4)**:** The content of milk which is water and dry matter is shown above. The nutritious part of milk consists of dry matter which also contain important substances for metabolic activities.

There is an issue going on about the quality of the UHT milks sold in stores in my country. The issue came to my attention during a TV show and I thought I should investigate on issue by finding out the nutritional values of milks produced by certain companies which were Sütaş, İçim, Danone, Sek and Pınar. All of the milks were UHT milks.

The aim of this experiment was to compare the five milks I have chosen in between them and compare their compatibility to the Turkish Foood Codex(TFC). I'm going to measure the pH, protein and dry matter values of the milks I have chosen and the values compatibility to the TFC. According to TFC, pH value of a cow milk in terms of percent should be between 0.135-0.200, the density of protein in cow milk in terms of percent should be 2.8 and dry matter in terms of percent should be 8.5. (Çiğ Süt Ve Isil Işlem Görmüş Içme Sütleri Tebliği)

The main focus of the following essay will be: Are there any differences in terms of nutrition(protein, dry matter and pH values)between UHT milks and their compatibility to the Turkish Food Codex that are produced by different companies that are known to be reliable in the milk production field in Turkey?

Hypothesis:

According to the majority of the society, UHT milks sold in the stores have less nutritional values than the fresh milk. The one of most affecting factors is the storage temperature. “Storage leads to physico-chemical changes in milk and, although some reactions such as acidification and proteolysis are known to be destabilizing, some of them are probably stabilizing to counterbalance the negative effects.”(Topçu, A.) Contrary to the belief of the society, the UHT process does not affect the body drastically. “Male rats were used for biological determination and it was found that the treatments did not affect the biological value of milk proteins, except for liver protein synthesis when rats were fed a diet based on boiled pasteurized milk.”(Moraes-Santos, T.) What’s more the process reduces the microbiological life inside the milk, therefore its more beneficial to the consumer. Milk contains dry matter that is important for daily life most of which used for metabolic activities.

The main cause of the difference in pH, protein and dry matter will be the conditions during the UHT treatment of milk. It can be said that the protein values will differ between the brands of UHT milks since these milks would be processed under different temperatures and time. Same situation counts for pH values since acidity will increase with temperature. Dry matter will also differ. Also the brands of milks will be checked if they are compatible to the Turkish Food Codex or not.

Method Development and Planning:

The pH values will be gathered by using a pH meter. For this process the indicator part of the device will put inside the sample and the values on the device will be noted down after the beep sound is heard. After the measurement of each sample the indicator part of the device will be cleaned so that the values of the other samples are not read incorrect.

For the protein analysis, the milk will be burned so that the liquid part of the milk could evaporate. Several catalysers will be used to fasten the process such as; K_2SO_4, $CuSO_4$, H_2SO_4. During the addition of these substances the color of the milk will alter. The process will continued until the milk will become colorless and white steam forms inside the tubes of the system which will take up to 2-2.5 hours.

After the combustion process the samples will be put in a desillator apparatus. Before this process samples of boric acid and methyl red will be prepared one for each sample of milk. Such solution will be prepared so that the color change can be observed. Afterwards, water and NaOH will be added. Water is added so the milk could boil and NaOH was added so protein would be seperated. HCl is added to the solution afterwards so NaOH that is added before will neutralise with the HCl. The samples were taken in a set of two for more accurate results. However some of the samples were taken in a set of three since twelve samples must be used. For the ones with the three samples only two close ones were used.

For determining the percentage of protein values inside the milk Kjeldahl Formula(Appendix 2) is used. With the formula total mass of nitrogen will be found. The reason total nitrogen is found that proteins contain a group with nitrogen inside.(Nitrogen Analysis By Micro-Kjeldahl Method)

For the dry matter process, the nickel container will be heated to high temperatures (100±2°C) so that moisture of the container will be reduced to minimum. The containers will be put inside a desiccator so they will not gain any moisture and the masses of the container will be measued. Afterwards, the milk will be poured inside the container and mass of the container will be measured again and burned at an high temperature(100±2°C) in the incubator so that the liquid part which consists of water mostly can be removed from the sample solution. The milk will be heated several times so that the error could be minimised and a limit of 0.0005 will be determined as the minimum change if the change of mass of the sample is less than 0.0005 the milk will not be heated again. Same as the protein analysis experiment the samples were taken in a set of three samples for accurate results, however for this experiment only a set of two samples were used.(Öztürk, 121)

For determining the percentage of dry matter values the following equation will be used which is done in two main steps(Appendix 2):

1) Finding the mass of the sample that was put inside the nickel container.
2) Finding the mass that was left after the burnining process.

Method :

Materials and Apparatus:

- 5 different brands of UHT milk (Sek, Danone, İçim, Pınar, Sütaş)
- pH meter
- 5 beakers(200 mL)
- K_2SO_4(1.7 g per beaker)
- $B(OH)_3$(0.04 concentration 5 mL per beaker)
- $CuSO_4$(0.5 % concentration 1 mL per beaker)
- H_2SO_4(5 mL per beaker)
- NaOH(50 ml per sample 4.0% concentration)
- HCl(10% concentration)
- Scale
- Pipette(5mL)
- Desiccator
- Destillator Apparatus
- Heat resistant nickel containers
- Incubator
- 10 Test Tubes(250 mL)
- 12 Erlenmeyer Flasks(100 mL)

Measuring the pH:

1. The milk inside the containers were poured inside the beakers.
2. The tip of the pH meter is cleaned.
3. The tip of the pH meter is insterted inside the beaker.
4. After the beep sound the value on the pH meter is read and the tip of the pH meter is cleaned for other measurements.
5. Same steps are done for other milks and four more trials.

Measuring the dry matter:

1. Heat resistant nickel containers are heated in an incubator at 100±2°C for 1-2 hours until their masses become stable.
2. After the heating process the containers are put inside a desiccator for 15-30 mins until they cool down.
3. After cooling down the masses of the containers are measured and noted down.

4. 5 mL of milk is added to each of the containers and the containers mass is measured and noted down.
5. After the measurements the containers are heated in an incubator at 50°C for 1 hour and afterwards at 105°C for 2 hours. After each hour the containers' mass are measured again and the masses are noted down.
6. During measurements each time the containers are put inside the desiccator.
7. Until the mass difference becomes less than 0.005(values near are accepted as as well) the same process are done.
8. The steps above are done for 5 more trials.

Measuring the protein:

1. Mass of the test tubes are measured.
2. 1 mL of milk is poured inside test tubes at 20°C and the mass of the milk is measured.
3. 1 ml of $CuSO_4$ is poured inside the milk.(the milk turns blue.)
4. 1.5 grams of K_2SO_4 is added inside the solution.(Both of the compounds are used as catalysers to fasten the burning process)
5. 5 mL of H_2SO_4 is added.(helping for the milk to combust.)
6. The samples are put inside an oven, the poisonous substances are removed with the help of water.
7. The process is continued until the samples turn white and the gas from the reactions are gathered on top the tubes.
8. After the burning process the flasks are cooled down.
9. The second important step distillation is started afterwards, the samples are mixed with 35 mL of water and 30 mL of NaOH in 4 minutes.
10. After the distillation, titration is done by adding HCl inside solution, the values of the HCl are slightly different because of the volume of NaOH inside the solution.
11. The steps above are taken for four more trials after the process the volume of HCl is noted down and the kjeldahl formula is used for measuring the protein values.

Results:

Results for pH:

Brand of Milk	Trial	pH(±0.005)
Sütaş	1	6.83
	2	6.87
	3	6.93
	4	6.90
	5	6.85
İçim	1	6.90
	2	6.98
	3	6.94
	4	7.00
	5	6.95
Danone	1	6.76
	2	6.71
	3	6.87
	4	6.82
	5	6.78
Sek	1	6.81
	2	6.82
	3	6.93
	4	6.84
	5	6.88
Pınar	1	6.91
	2	7.00
	3	7.06
	4	6.97
	5	7.02

Table 3: T he results of the measurements of pH for the UHT milks that were chosen are shown below under different temperature.

Results for protein:

Brand of Milk	Sütaş									
Trial	1		2		3		4		5	
Mass of Sample(±0.05)(g)	1.09	1.02	1.03	1.05	1.01	1.00	1.06	1.05	1.02	1.04
Volume of HCl(±0.05)(mL)	7.3	7.1	7.1	7.0	5.4	5.6	7.2	7.2	6.9	7.0

Table 4: Mass of the sample of milk collected for Sütaş and volume of HCl used is shown above. The collected data will be used in Kjeldahl Formula(See Appendix 2) to determine the percentage of protein value.

Brand of Milk	İçim									
Trial	1		2		3		4		5	
Mass of Sample(±0.05)(g)	1.04	1.04	0.94	1.05	1.02	1.05	1.00	1.06	1.03	1.04
Volume of HCl(±0.05)(mL)	6.9	7.0	6.7	7.0	2.2	4.2	6.9	7.1	6.9	7.0

Table 5: Mass of the sample of milk collected for İçim and volume of HCl used is shown above.

Brand of Milk	Danone									
Trial	1		2		3		4		5	
Mass of Sample(±0.05)(g)	1.07	1.05	1.10	1.09	1.05	1.07	1.04	1.02	1.05	1.01
Volume of HCl(±0.05)(mL)	7.8	7.8	8.1	7.9	6.1	6.5	6.6	6.8	6.9	6.8

Table 6: Mass of the sample collected of milk for Danone and volume of HCl used is shown above.

Brand of Milk	Sek									
Trial	1		2		3		4		5	
Mass of Sample(±0.05)(g)	1.05	1.18	1.12	1.19	1.04	1.02	1.05	1.09	1.08	1.04
Volume of HCl(±0.05)(mL)	7.2	7.8	7.6	7.3	5.8	5.7	6.9	7.0	7.0	6.7

Table 7: Mass of the sample collected of milk for Sek and volume of HCl used is shown above.

Brand of Milk	Pınar									
Trial	1		2		3		4		5	
Mass of Sample(±0.05)(g)	1.03	1.04	1.05	1.04	1.00	1.01	1.03	1.04	1.02	1.00
Volume of HCl(±0.05)(mL)	7.1	6.9	7.0	6.9	5.6	5.4	7.0	7.1	6.7	6.4

Table 8: Mass of the sample of milk collected for Sütaş and volume of HCl used is shown above.

Results for dry matter:

Trial	Tare (±0.00005)(g)	Tare+Sample (±0.00005)(g)	T+1.DM (±0.00005)(g)	T+2.DM (±0.00005)(g)	T+3.DM (±0.00005)(g)	T+4.DM (±0.00005)(g)
1	26.6677	31.8572	27.2650	27.2650	27.2639	27.2632
	26.6595	31.8281	27.2447	27.2450	27.2444	27.2440
2	26.6643	31.9408	27.2710	27.2645	27.2636	27.2626
	26.0979	31.2861	26.7018	26.6886	26.6868	26.6868
3	26.6486	32.1241	27.1624	27.1492	27.1485	27.1481
	26.6492	31.9862	27.1734	27.1586	27.1572	27.1570
4	26.5975	31.8735	27.5073	27.5048	27.5045	
	26.6837	31.8926	27.3946	27.3923	27.3921	
5	26.7436	32.0683	27.5260	27.5226	27.519	27.5146
	26.5641	31.9724	27.4510	27.4493	27.4482	27.4476

Table 9: The table above shows the raw data collected for dry matter during the experiment for Pınar.

Trial	Tare (±0.00005)(g)	Tare+Sample (±0.00005)(g)	T+1.DM (±0.00005)(g)	T+2.DM (±0.00005)(g)	T+3.DM (±0.00005)(g)	T+4.DM (±0.00005)(g)
1	26.1815	31.1203	26.7603	26.7591	26.7588	
	26.2854	31.2342	26.8645	26.8639	26.8636	
2	26.4762	31.5890	27.0750	27.0596	27.0585	27.0575
	26.4032	31.4825	26.9950	26.9829	26.9523	26.9817
3	26.3758	31.5734	27.0542	27.0516	27.0504	26.997
	26.4750	31.8464	27.1031	27.1022	27.1016	27.0998
4	26.3675	31.7465	27.0372	27.0361	27.0349	27.0337
	26.7403	32.3895	27.3162	27.3154	27.3146	27.3137
5	26.5740	32.0538	27.1957	27.1944	27.1937	27.1935
	26.4821	31.8351	27.1483	27.1477	27.1469	27.1467

Table 10: The table above shows the raw data collected for dry matter during the experiment for Danone.

Trial	Tare (±0.00005)(g)	Tare+Sample (±0.00005)(g)	T+1.DM (±0.00005)(g)	T+2.DM (±0.00005)(g)	T+3.DM (±0.00005)(g)	T+4.DM (±0.00005)(g)
1	26.6776	31.7765	27.2462	27.2456	27.2445	27.2437
	26.7197	31.8174	27.2889	27.2878	27.2868	27.2864
2	26.9896	32.1719	27.5793	27.5700	27.5690	27.5686
	26.6808	31.7670	27.2640	27.2496	27.2455	27.2484
3	26.7239	32.5933	27.3672	27.3661	27.3657	
	26.8454	32.7343	27.5092	27.5083	27.5079	
4	26.4964	31.9254	26.9367	26.9361	26.9354	26.9347
	26.7344	31.5329	27.2954	27.2946	27.2639	27.2637
5	26.3967	31.5489	26.8268	26.8258	26.8252	26.8250
	26.9573	32.4892	27.5837	27.5829	27.5818	27.5813

Table 11: The table above shows the raw data collected for dry matter during the experiment for Sek.

Trial	Tare (±0.00005)(g)	Tare+Sample (±0.00005)(g)	T+1.DM (±0.00005)(g)	T+2.DM (±0.00005)(g)	T+3.DM (±0.00005)(g)	T+4.DM (±0.00005)(g)
1	26.9836	32.1075	27.5526	27.5523	27.5510	27.5503
	26.6861	31.8542	27.2575	27.2567	27.2557	27.2555
2	26.6762	31.6964	27.2388	27.2327	27.2314	27.2304
	26.8542	31.7435	27.4033	27.3952	27.3939	27.3934
3	26.7849	32.3734	27.1736	27.1728	27.1717	27.1708
	26.9373	32.5023	27.2964	27.2952	27.2944	27.2940
4	26.2947	31.3051	26.9481	26.9468	26.9462	26.9459
	26.3473	31.4283	27.1753	27.1745	27.1738	27.1735
5	26.4034	31.6284	27.1834	27.1822	27.1820	
	26.8345	32.3602	27.3864	27.3858	27.3855	

Table 12: The table above shows the raw data collected for dry matter during the experiment for İçim.

Trial	Tare (±0.00005)(g)	Tare+Sample (±0.00005)(g)	T+1.DM (±0.00005)(g)	T+2.DM (±0.00005)(g)	T+3.DM (±0.00005)(g)	T+4.DM (±0.00005)(g)
1	26.4018	31.3700	26.9611	26.9601	26.9596	
	26.4726	31.4298	27.0314	27.0298	27.0297.	
2	26.8965	31.8861	27.4703	27.4607	27.4596	24.4585
	26.6601	31.6745	27.2352	27.2281	27.2257	27.2248
3	26.8364	32.2067	27.4815	27.4807	27.4797	27.4795
	26.2375	31.4820	26.8926	26.8918	26.8909	26.8906
4	26.9445	32.3104	27.4917	27.4910	27.4908	
	26.4853	32.5926	27.1643	27.1636	27.1635	
5	26.1954	31.4082	26.7962	26.7953	26.7947	26.7945
	26.8573	32.2701	27.3954	27.3946	27.3938	27.3935

Table 13: The table above shows the raw data collected for dry matter during the experiment for Sütaş.

Data Analysis:

For all of the experiments:

- The mean, standart deviation, standart error, t value and 95% confidence interval values are calculated for each of the UHT milks.
- Bar graphs will be drawn for mean values of pH, protein and dry matter each of the brands of UHT milks.
- And anova test will be done for the mean values on the different brands of milks

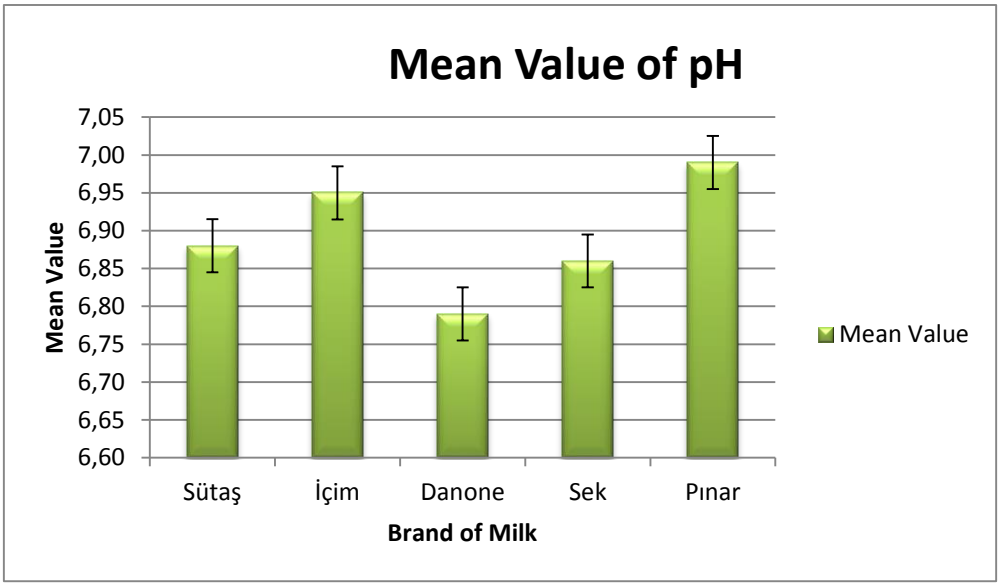
pH analysis:

H_0: There is not a statistically significant difference between the mean pH values of different brands of UHT milks.

H_1: There is statistically significant difference between the mean pH values of different brands of UHT milks.

Type of Milk	Sütaş	İçim	Danone	Sek	Pınar
Mean	6.88	6.95	6.79	6.86	6.99
Standart Deviation	0.04	0.04	0.06	0.05	0.06
Standart Error	3.08	3.11	3.04	3.07	3.13
T Inverse	2.78	2.78	2.78	2.78	2.78
95% Conf. Int.	0.11	0.11	0.16	0.13	0.16

Table 14: The table above shows the mean, standart dev. and error, t value and 95% confidence interval values calculated for the brands of UHT milks in terms of pH.



Graph 1: The graph shows the mean values of the pH of the milks.

From these values we can see that the best UHT milk in terms of pH is Pınar since it has a value of 6.99 which is mostly neutral in terms of acidity.However, for a more precise calculation we should do the anova test on the gathered data as well.

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Sütaş	5	34.38	6.876	0.00158		
İçim	5	34.77	6.954	0.00148		
Danone	5	33.94	6.788	0.00367		
Sek	5	34.28	6.856	0.00243		
Pınar	5	34.96	6.992	0.00317		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F-crit*
Between Groups	0.131024	4	0.032756	13.28305	1.93E-03	2.866081
Within Groups	0.04932	20	0.002466			
Total						

Table 15: The anova test for the values of pH is shown above.

From the anova test, the p-value(1.93E-03) is less than 0.05, we can say that H_1 can be accepted as true and H_0 is rejected. It can be seen from the mean values that the milks differ in terms of pH but there was not a presence of major difference.

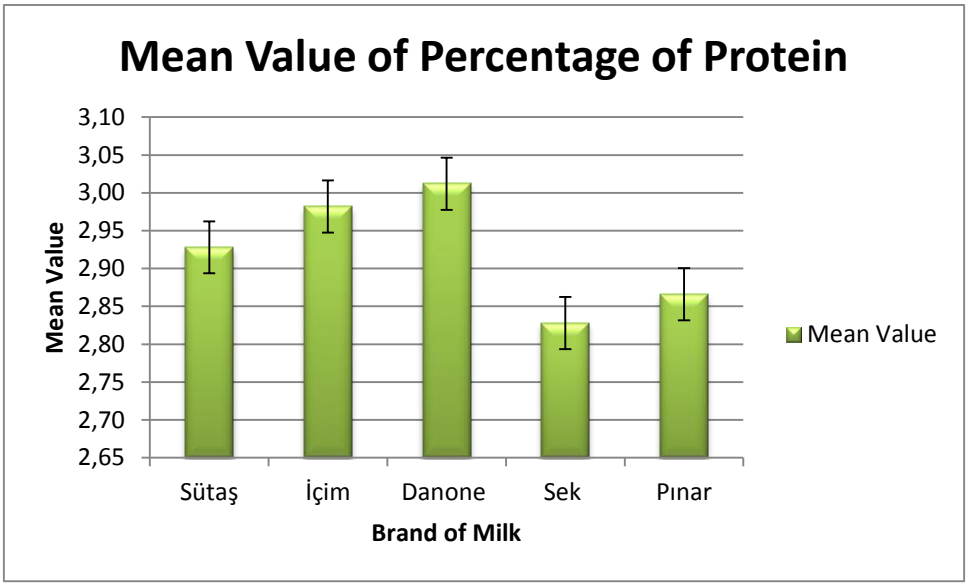
Protein Analysis:

H_0: There is not a statistically significant difference between the means of the percentage of protein values of different brands of UHT milks.

H_1: There is a statistically significant difference between the means of the percentage of protein values of different brands of UHT milks.

Brand of Milk	Sütaş	İçim	Danone	Sek	Pınar
Mean	2.93	2.98	3.01	2.83	2.87
Standart Deviation	0.28	0.10	0.26	0.20	0.24
Standart Error	1.31	1.33	1.35	1.26	1.28
T Inverse	2.78	2.78	2.78	2.78	2.78
95% Conf. Int.	0.77	0.27	0.72	0.55	0.66

Table 16: The mean, standart deviation and error, t-value and 95% confidence interval values are calculated in terms of protein values. Two samples were used for each trial so a mean value was calculated.



Graph 2: The graph above shows the mean values for the percentae of protein calculated by the kjeldahl formula.

From the mean values we can say that Danone is the best brand of milk in terms of protein with a value of 3.01.

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Sütaş	5	14.64	2.928	0.07577		
İçim	5	14.91	2.982	0.00932		
Danone	5	15.06	3.012	0.06517		
Sek	5	14.14	2.828	0.03827		
Pınar	5	14.33	2.866	0.05963		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.118504	4	0.029626	0.596913	0.669038	2.866081
Within Groups	0.99264	20	0.049632			
Total	1.111144	24				

Table 17: The anova test for the values of percentage of protein is shown above.

The p-value calculated from the anova tests is higher than 0.69038 than 0.05 so H_0 is accepted and H_1 is rejected. The mean values are closer to each other so this was expected.

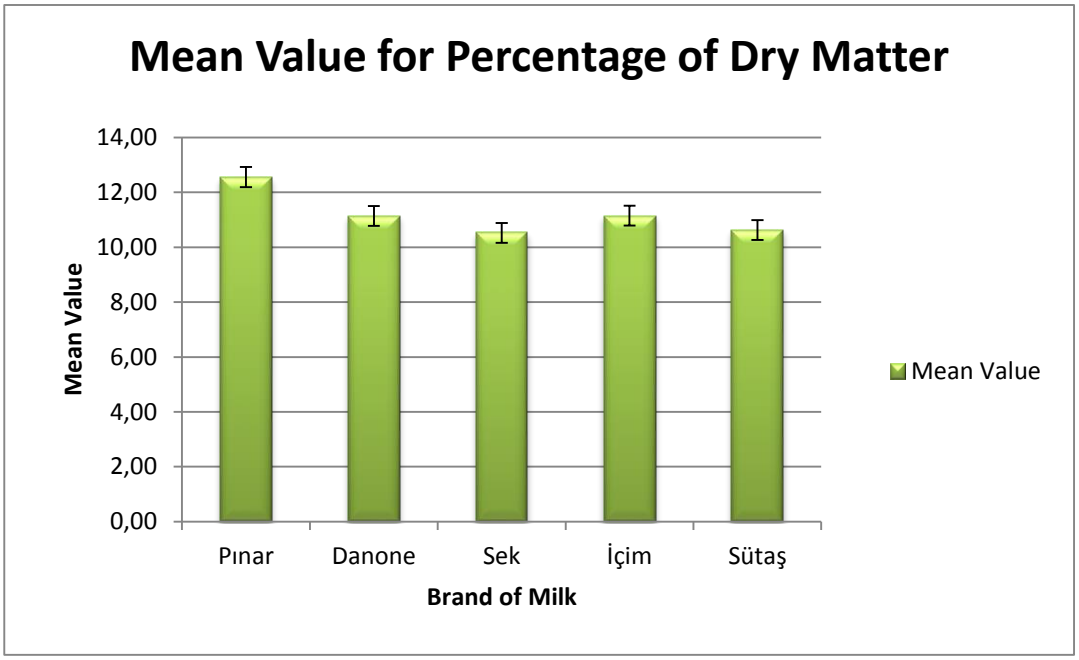
Dry Matter Analysis:

H_0: There is not a statistically significant difference between the means of the percentage of dry matter values of different brands of UHT milks.

H_1: There is a statistically significant difference between the means of the percentage of mean dry matter values of different brands of UHT milks.

Brand of Milk	Pınar	Danone	Sek	İçim	Sütaş
Mean	12.56	11.14	10.53	11.15	10.63
Standart Deviation	2.72	0.97	0.79	2.91	1.67
Standart Error	5.62	4.98	4.71	4.99	4.75
T Inverse	2.78	2.78	2.78	2.78	2.78
95% Confidence Interval	0.75	0.27	0.22	0.80	0.46

Table 18: The table above shows the mean, standart dev. and error, t value and 95% confidence interval values calculated for the brands of UHT milks in terms of percentage of protein.



Graph 3: The mean values for the percentage of dry matter is shown above with a graph.

From the mean values we can say that the brand Pınar is the best brand in terms of dry matter which means it is more nutritious.

SUMMARY						
Groups	Count	Sum	Average	Variance		
Pınar	5	62.79	12.558	7.39737		
Danone	5	55.7	11.14	0.9437		
Sek	5	52.63	10.526	0.61943		
İçim	5	55.75	11.15	8.49015		
Sütaş	5	53.13	10.626	2.79058		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F-crit
Between Groups	13.17008	4	3.29252	0.81332	0.531495	2.866081
Within Groups	80.96492	20	4.048246			
Total	94.135	24				

Table 19: The table above shows the data gathered from the mean percentage of dry matter.

When we check the anova test, we can clearly see that the p-value(0.531495) is higher than 0.05 so an unexpected conclusion was reached and H_0 was accepted, however from the mean values we can see that there is a difference between groups.

Conclusion and Evaluation:

The aim of this investigation is to compare the five brands of UHT milks that were chosen, in terms of pH, protein and dry matter values and their compatibility to the Turkish Food Codex. Before starting the experiment it seemed that there would not be any difference between the brands of UHT milks since all of the milks produced by the companies are sold everywhere around Turkey.

According to the values gathered by the pH measurement apparatus, all of the pH vales were close to each other and the analysis which was done with anova suggested that there would be much difference between groups since the p-value which was 1.93E-05 is less than 0.05.However, from the mean values(which were 6.88 for Sütaş, 6.95 for İçim, 6.79 for Danone, 6.86 for Sek, 6.99 for Pınar), it can be seen that there is not a major difference between groups since the highest pH value is 6.99 and the smallest is 6.79. Standard deviation values(which were 0.04 for Sütaş and İçim, 0.05 for Sek and 0.06 for Danone) suggest that the data gathered was regular. The 95% confidence interval values(which were 0.11 for Sütaş and İçim, 0.13 for Sek and 0.16 for Danone and Pınar) suggest that there is a low probability of getting such results.The graph also supports this hypothesis showing that there is not a significant difference in most of the brands except Danone which was more acidic.

Protein values were calculated by the Kjeldahl formula in terms of percentage. From the mean values(which were 2.93 for Sütaş, 2.98 for İçim, 3.01 for Danone, 2.83 for Sek, 2.87 for Pınar) we see that there is not a major difference between brands of UHT groups which was expected. Standart deviation values(which were 0.28 for Sütaş, 0.10 for İçim, 0.26 for Danone, 0.20 for Sek, 0.24 for Pınar) show that the brand Sütaş has an unstable mean value since the standart deviation value is the highest. 95% Confidence Interval values(which were 0.77 for Sütaş, 0.27 for İçim, 0.72 for Danone, 0.55 for Sek, 0.66 for Pınar)suggest that there is a high probability of getting the same results from this experiment for Danone and Pınar but same can not be said for Sütaş. The graph also suggests that one of the brands has a lesser protein value in terms of percentage which was the brand Sek. From the anova test, the calculated p-value(0.66938) was higher than 0.05 so this was also supported since H_1 was rejected and H_0 was accepted.

The dry matter values were calculated by using the formula which was stated in the Method Development and Planning section. The mean values(which were 12.56 for Pınar,11.14 for Danone, 10.53 for Sek, 11.15 for İçim,10.63 for Sütaş) that were calculated explains that there is a major difference between the values of dry matter in percentage. The highest value is 12.56 and the smallest value is 10.53. There is a 2.3 percent difference between the brands of UHT milks. In terms of nutrition, this is an important issue. The standart deviation values(which were 2.72 for Pınar, 0.97 for Danone, 0.79 for Sek, 2.91 for İçim, 1.67 for Sütaş) shows that some of the brands can not be trusted. The 95% Confidence interval values(which were 0.75 for Pınar, 0.27 for Danone, 0.22 for Seki 0.80 for İçim, 0.46 for Sütaş) suggest that when the investigation is carried again only İçim and Pınar has a high value of reaching the same results.According to the anova analysis, H_1 was declined and H_0 was accepted. The graph shows that the difference between brands is negligible since all of them are close.

The difference between the milks might have been caused by the storage time since the components of the milk is affected by the storage time. Since after sometime some compounds will start to denaturate.” Quantification of about 40 volatile components in whole milks showed no changes until 90 days (the legal shelf-life in Spain); the main change was the increase of methyl ketones. New components appeared in skimmed samples after 65 days storage”(Martínez-Castro, I., 51–58) This change was out of our control since the companies sell the milks to the markets and the decision of shelf-life is decided by the laws.

Storage temperature also affects the components of milk.” Failure rates of experimentally-produced UHT milks were much higher in products manufactured from raw milks stored at 6°C for 4 days than those produced from raw milks stored at 2°C for 4 days. The main cause of failure was due to thermostable bacterial protease associated with high levels of bacterial growth in the raw milks. Other causes of failure included spore-forming bacteria, which may have survived UHT processing, and other organisms probably introduced as contaminants on filling.”(Griffiths, M.W., 75–87) We can say that temperature affects the number of the microorganisms inside milk which affects the composition of the milk which might have caused a difference in the results of this experiment. Since we can not decide the storage temperature this difference was out of our control. However, during the experiment the samples of milk could have been stored at constant temperatures so the effect could be minimized.

At the end of the experiment, we can see that pH values are close to each other and fit for human consumption. According to Turkish Food Codex, all of the brands had a higher value of pH than the implemented one(between 5.5-6) but all of the proteins can be consumed safely since all of them are nearly neutral in terms of acidity.(6.88 for Sütaş, 6.95 for İçim, 6.79 for Danone, 6.86 for Sek, 6.99 for Pınar) Protein values in terms of percentage calculated were also close to each other and all of them were above the border that was set by Turkish Food Codex which is 2.8. (2.93 for Sütaş, 2.98 for İçim, 3.01 for Danone, 2.83 for Sek, 2.87 for Pınar) Same thing accounts for the dry matter values in four(Sek, Sütaş, Danone, İçim) of the brands. The one that had the higher value had a major difference between the other brands.(12.56 for Pınar,11.14 for Danone, 10.53 for Sek, 11.15 for İçim,10.63 for Sütaş) When we look at the overall values of dry matter all of the brands have a higher value than the normal values according to Tukish Food Codex which is 8.5.

In conclusion, all of the brands had a higher value than the one implemented by Turkish Food Codex in terms of pH, protein and dry matter. According to the processed data the best brand is Pınar in terms of percentage of dry matter and pH and Danone is the best brand in terms of percentage of protein.

Appendix 1:

Literary Values for UHT Milks(for 100 mL):

Pınar:

Energy(kJ)	253.1
Protein(g)	3.0
Fat(g)	3.3
Carbohydrate(g)	4.7
Calcium(mg)	120.0

Sek:

Energy(kJ)	240.0
Protein(g)	3.1
Fat(g)	3.0
Carbohydrate(g)	4.5
Calcium(mg)	110.0

Sütaş:

Energy(kJ)	239.0
Protein(g)	3.0
Fat(g)	3.0
Carbohydrate(g)	4.5
Calcium(mg)	120.0

İçim:

Energy(kJ)	246.5
Protein(g)	3.0
Fat(g)	3.1
Carbohydrate(g)	4.7
Calcium(mg)	112.0

Danone:

Energy(kJ)	238.5
Protein(g)	3.0
Fat(g)	3.0
Carbohydrate(g)	4.5
Calcium(mg)	100.8

Appendix 2:

Definition of UHT Milk:

Ultra-heat treatment is the sterilization of food by heating it for an extremely short period, around 1–2 seconds, at a temperature exceeding 135°C which is the temperature required to kill spores in milk. The most common UHT product is milk. UHT milk has a typical shelf life of six to nine months, until opened.(UHT Processing)

Kjeldahl Formula:

$$Total\ Nitrogen = \frac{1.4xNormality\ of\ HClx\ Volume\ of\ HCl\ spent}{Mass\ of\ Sample} x\ 6.38$$

Normality of HCl = 0.05

Measuring the Dry Matter:

$(T + DM_1) - T$

$[(T + DM_n) - T] - [(T + DM_1) - T]$

$A - B = Dry\ matter$

T: Tare of the sample

DM_1: First dry matter measurement after the milk is burned

DM_n: n^{th} dry matter measurement after the milk is burned(at most 5)

The percentage of dry matter will be calculated by:

$\frac{(A - B)}{B} x\ 100$

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