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Comparative Study on the Use of Moringa Extract Coagulant in Production of Cheese from Various Milk Sources

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Abstract:
The milk was gotten from the Fulani's settlement in Kaduna State, Nigeria, West Africa. The milk was subjected to pasteurization, coagulation with various coagulants, pressing and packaging. The effect of different milk sources on the quality of cheese using Moringa extract was studied. The Moringa extract was gotten from Moringa seed. The cheeses are: (MGC) Moringa goat cheese, (MCC) Moringa cow cheese and (MSC) Moringa soya beans cheese. The effect of the coagulant on the yield, proximate composition, physiochemical properties, minerals and microbial were determined. The yield of the cheese produce ranges from (16.68% - 35.71) %. MSC has the highest yield, then MGC and MCC. The result for the proximate are moisture (37.5%-53.5%), protein (29.14% - 30.45%) fat (4.0% - 9.1%), ash (1.5-5.5) and carbohydrate (9.33 – 15%). MCC has the highest protein, fat and crude fibre, while MSC has the highest moisture. The pH ranges from (4.59 – 5.94%), titratable acidity (0.0112 – 0.077%). The result for minerals were calcium (0.67 – 1.34) mg/l, iron (0.0111 – 0.031) mg/l and magnesium (0.260 -0.033mg/l) respectively. The microbial analysis for mesophilic bacteria, yeast and mould and coliform bacteria was also carried out and were all isolated and identified. The cheese produce using different milk source was not significantly different (P<0.05) in taste and texture but was significantly different (P<0.05) in colour, flavor and overall acceptability, (MSC) was more preferable than MGC and MCC.

Keywords: *MGC – Moringa goat cheese, MCC – Moringa cow cheese MSC – Moringa soybeans cheese*

1. Introduction

Cheese is a food derived from milk produced in a wide range of flavor, texture and forms by coagulation of the milk protein casein. It comprises of protein and fat from the milk, usually the milk of cow, goat, buffalo, sheep and plant source such as soybeans (Frankhauser, 2007). During the production, milk is usually acidity, and adding the enzyme rennet causes coagulation, the solids (curds) are separated and pressed into final form. Some cheese melt at cooking temperature and curds are formed when an enzyme called rennet is stirred into milk, which encourage casein, one of the protein in milk to solidify and clump together or coagulate. Rennet (chymosin) is a proteolytic enzyme and its role in cheese making it to destabilize casein micelles and make them to coagulate rennet aids coagulation only if the milk is slightly acidic as it becomes sour (Gregory, 2015). There are other plant coagulants which the study is aimed at producing for the coagulation of milk from cow, goat and a plant source of milk, soya milk. Plant coagulants such as Moringa seed paste, lime juice, lemon juice and vinegar have been found to coagulate milk. The use of these coagulant (Moringa seed paste) is aimed at producing cheeses that is richer in nutrient because of the inclusion of Moringa seed paste. The objectives are to determine the physical and chemical properties (yield percentage, pH, titrat able acidity), the proximate analysis (protein, carbohydrate, ash, fat and mineral such as iron, calcium, magnesium), the microbial content and the sensory qualities the cheeses.

2. Materials and Methods

2.1. Sources of Materials

The soya beans and other ingredients like salt, moringa seed, magi were obtained at Kawo market, Kaduna Nigeria. The cow and goat milk were obtained at the Fulani herds farm at Maraba-Rido Kaduna.

2.2. Preparation of Coagulant

2.2.1. Moringa Oleifera Seeds

Moringa oleifera seeds were dehulled after which it was weighed and was introduced into a pot to be toasted for 3 minutes. The seeds were milled to powdered form using electrical blender and then the oil was extracted by the manual method by the use of hot water (little quantity) and the oil was squeeze out manually. The seed cake was now used as a coagulant.

2.3. Preparation of Soy Cheese

The soy beans were carefully sorted manually by hand picking the dirt, stones, sticks and bad seeds on a tray. 1.4kg of the sorted seeds was weighed, steeped in warm water for six hours, it was then dehulled, wet milled, mixed with water to form paste and sifted, the soy milk gotten was then pasteurized at 95^{o} C for 10 minutes. Ninety grams of Moringa seed paste was used on 3 litres of soymilk and was cooked for 10 minutes, cool and drained to separate the curds from the whey then cut into sizes and packaged. The soy cheese produced was subjected for further analysis.

2.4. Preparation of Cheese from Cow and Goat Milk

Three litres of milk was pasteurized, moringa seed paste was reconstituted and added to the pasteurized milk and allowed to cook for 15 minutes for coagulation before cooling, drained to separate the whey from the curd, and it was then pressed and cut into sizes before packaging. The cheeses produced were subjected for further analysis.

Coagulants	Samples	Weight/Volume Used	Volume of Milk in Litres
MGC	A	30g/1L	1.7 litres
MCC	B	30g/1L	3 litres
MSC	C	30g/1L	3 litres

Table 1: Formulation for Product
MGC – Moringa Goat Cheese MCC – Moringa Cow Cheese
MSC – Moringa Soybeans Cheese

2.5. Proximate, Physical, Chemical and Microbial Analysis of Cheese Produce from Various Source of Milk (Goat, Cow and Soymilk)

Moisture, ash, fat contents of the cheeses was determined using process described by Gregory, 2015. AOAC, 2000 method was used for the determination of protein and carbohydrate. The yield percentage of the cheese produced was determined by dividing the weight of curds by the raw materials, Gregory, 2015 method was used to determine the pH, curdling temperature and AOAC, 2000 method was adopted for the total titratable acidity. Atomic absorption spectrophotometer was used in the determination of mineral elements in the cheeses. AOAC, 2002 methods were used in determination of the microbial content of the cheese while sensory evaluation of carried out using the 9-point hedonic scale.

3. Result and Discussion

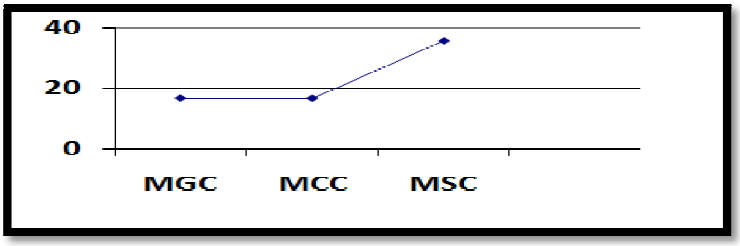

Figure 1: The Yield of Cheese Produce from Goat, Cow and Soybeans Milk Using Moringa Cake Extract

Sample	MGC%	MCC%	MSC%
Moisture	48.50	37.50	53.50
Protein	29.14	30.45	23.20
Fat	6.50	9.10	4.00
Crude fibre	0.03	3.00	1.50
Ash	5.50	3.00	1.50
Carbohydrate	9.33	14.9	15.00

Table 2: Proximate Composition of Cheese with Different Source of Milk Using Moringa Extract as Coagulant

Values represent the means of triplicate sample analysis result with respective standard deviation.

Sample	MGC%	MCC%	MSC%
pH	5.94	5.90	4.59
Titratable	0.077	0.112	0.056
Yield	16.76	16.69	35.71
Curdling temperature o^c	100±0	100±0	100±0

Table 3: Physiochemical Properties of the Produce Cheese from Different Milk Source

Parameters	MGC	MCC	MSC
Calcium mg/l	1.341	1.253	0.667
Iron mg/l	0.031	0.026	0.0111
Magnesium mg/l	0.260	0.261	0.033

Table 4: Minerals Analysis of the Cheese Produce from Cow, Goat and Soybeans

Sample Code	Colonies Count	Cfu/G	Grains Stain	Organism Identified
MGC	60 $x10^1$	6.0 x 10^2	Grain positive short rod	Bacillus species
MCC	64 x 10^1	6.4 x 10^2	Grain positive short rod	Bacillus species
MSC	60 x 10^1	6.0 x 10^2	Grain positive short rod	Bacillus species

Table 5: Microbial Results for Mesophilic Aerobic Bacteria Count, on the Cheese Produce from Goat, Cow and Soy Milk

Sample Code	Colonies Count	Cfu/G	Grains Reaction	Organism Identified
MGC	60 $x10^1$	<1.0$x10^2$	White shining colonies	Yeast species
MCC	27$x10^1$	2.7$x10^2$	1.white powdering colonies 2. white shining colonies	mould species Yeast species
MSC	16$x10^1$	1.6$x10^2$	1.Black powdering with ring around 2.white shine colonies	mould species yeast species

Table 6: Microbial Result for Yeast and Mould Count from the Cheese Produce from Different Source

Sample Code	Colonies Count	Cfu/G	Grains Reaction	Organism Identified
MGC	22 $x10^1$	2.2 x 10^2	Gram positive rods	1.E. coli 2. klebsiellasp
MCC	20 x 10^1	2.0 x 10^2	Grams positive rods	1.E. coli 2. klebsiellasp
MSC	30 x 10^1	3.0 x 10^2	Grams positive rods	1.E. coli 2. klebsiellasp

Table 7: Microbial Result for Coliform Count

Sample	MGC%	MCC%	MSC%
Taste	6.20c	7.00b	7.05a
Color	7.50a	7.30b	5.95c
Flavor	7.15a	7.20b	5.75c
Texture	6.10c	6.70b	7.20a
Overall acceptability	5.95c	7.30a	7.30a

Table 8: Sensory Evaluation on the Cheese Produce from Various Source of Milk

4. Discussion

Cheese is made by coagulation of milk with rennet or similar enzymes to produces the curd, protein gel, which traps water, curd lipids and other constituents in the matrix. The cheese produce was first pasteurized at 75-95^{0}C, after which the Moringa was added as coagulant and allowed to boiled for 15 minutes before taking off from heat, and the curd was pack and transfer into a cheese cloth to drained off the whey. After draining off the whey was cheese was molded into desired shapes at store in refrigerator at 4^{0}c for further analysis and sensory evaluation

Fig 1: shows the result of the cheese yield. The result reveals that, soybeans gave the highest yield of the cheese curd. The result of the yield content indicated from the range of 16.69% to 35.71%, with sample A (MGC) 16.76%, sample B (MCC) 16.69% and sample C (MSC) 35.71% which is the highest.

This is an indication that the selected milk source, under consideration may not differ substantially in their yield ability but however, the difference could be as a result of the source of the milk that is the animal.

Table 2 shows the proximate analysis of cheese produce from various source of milk; soy bean cheese shows the highest content of moisture (53.5%) follow by goat cheese (48.5%) and cow cheese was the least (37.5%)

The protein content of the cheese indicates within range of 23.2% to 30.45% which was found to be of significance. Cow milk cheese was found to contain the highest amount of protein (30.45%) followed by goat cheese (29.14%) and soybean cheese was the least (23.2%). So, the cheese produce was within the range and the high protein content could be because of the protein contain in moringa oleifera seed which was transferred into the cheese. The normal commercial cheese contains about only (12%) reported by Prestamo et al, (2002) which is so different from the cheese produce using Moringa oleigera.

The fat content of the cheese produce using cow milk to produce was higher (9.1%) than goat cheese milk (6.5%) and soybeans cheese milk (4%). The percentage value of fat content in soybeans is however low than the value in commercial purchase soy cheese which is about 19%. (Prestamo, et al 2002).

The crude fibre content of the produce cheese using different source of milk and moringa cake extract as coagulate are 0.03%, 0.05% and 2.8% for goat cheese, cow and soy beans respectively.

The ash content of the cheese produce indicates that, goat contains the highest percentage (5.5 %), cow cheese (3.0%) and then least was (1.5%) ash content is a measure of the total amount of minerals presents.

The carbohydrate content indicates that, cheese produce using soybeans was higher of about (15.00%), cow cheese (14.9%) and the goat was the least (9.33%) of carbohydrate.

The amount of minerals in milk and milk product is essential to its nutritional quality to the developing of young and new born. Calcium, is one of the major constituents of milk and required by growing neonate for bone growth and development. The concentration of iron milk and its product is naturally low and is bound to lactoferrintransferringetc. and is essential in some other casein magnesium are core components in many tissue enzymes needed by the body (Underwood, 1981).

From the table 3, goat cheese contained about (1.341mg/l) of calcium which was the highest, cow cheese (1.253) and the least was soybean (0.667) mg/l

The amount of iron was recorded in concentration of goat cheese as (0.031), cow cheese (0.026) and soy beans 0.0111 goat being the highest and the least was soy cheese and magnesium was recorded in concentration of 0.261 to 0.033 (goat, cow and soy cheese) respectively.

The results of the microbial analysis indicate that there was presence of coliform bacterial. The coliform bacterial isolated could be as a result of the source of water use and the lateness of carrying out the microbial analysis immediately after production.

The result of physiochemical properties of the produce cheese show in table 2, the pH indicates from the range of (5.94 to 4.59) which shows that soy cheese contains least pH value (4.59) and cow cheese (5.90) while goat (5.94). The titratable acidity was indicated as (0.077%, 0.112, 0.056) having goat, cow and soybeans milk cheese respectively.

The result of sensory evaluation is shown in table 7 which indicate that for taste there was no significant differences, for colour, the result indicates that, there was significance difference within the sample at $p>0.05$, sample MGC (goat cheese) was more preferred, followed by MCC (cow cheese) and the least preferred in color was MSC (soya cheese). The result of the cheese produce indicates that at 0.05% level there was significant different and sample (MGC) was more preferred in terms of flavor than sample MCC (cow cheese and sample (MSC)

The result also shows that, cheese of that of soybeans and cow cheese (MSC, MCC) was more acceptable than that of goat cheese (MGC) which was 7.40a, 7.30b and 5.95a

5. Conclusion

The result of this work reveals that cheese produce using Moringa cake extract as coagulant contain high amount of protein than the commercial cheese and it's coagulated the cheese produce using milk from animal source and plant source with high nutritional value and hypo cholesterolemic effect.

Cheese produce using MCC and MSC and Moringaoleifera cake extract has the highest overall acceptability, while goat cheese (MGC) has the least.

Also, the result also indicated that, the yield of the cheese produce using goat and cow and Moringaoleifera cake extract was not up to that of soy cheese. The concentration of minerals in milk varies from countries and is affected mainly by factors such as the growing condition of feed as well as the type of processing (Muller *et al*, 1996).

The result of this work reveals that goat milk and cow contain high amount of calcium, iron and magnesium than soy beans but with goat brand of milk been superior in calcium, and iron and cow been superior in term of magnesium, which explain their nutritive value.

6. References

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Appendix

Colour

Judges panelist	MGC	MCC	MSC	Total
1	8	5	5	16^2
2	9	8	9	26^2
3	9	8	9	26^2
4	4	9	9	26^2
5	9	9	7	25^2
6	8	9	8	25^2
7	7	9	6	22^2
8	8	9	4	21^2
9	6	4	8	18^2
10	5	5	7	17^2
11	8	4	2	14^2
12	6	9	4	19^2
13	6	7	6	19^2
14	8	8	4	20^2
15	6	7	4	17^2
16	8	8	6	22^2
17	8	4	8	20^2
18	7	8	4	19^2
19	8	8	4	20^2
20	8	8	7	23^2
Total	150	146	119	415
Mean	7.5	7.3	5.95	

Table 9

Correction factor :- (CF = grand Total sum):- Total no of observation

$= \frac{(415)^2}{60} = \frac{172225}{60}$

CF = 2870.4

Ss of total: - $8^2+9^2+9^2+8^2+9^2+8^2$----------8^2-CF

= 3079-2870.4

= 208.6

Ss of sample = sum of squares samples of total observation in a column / number of rows, - CF

$= \frac{150^2+146^2+119^2 - CF}{20}$

$= \frac{22500+21316+14161 - CF}{20}$

2898.9-2870.4

= 28.5

Ss of judges = sum of square of observation in a row / no of column then minus CF

$= \frac{16^2+26^2+26^2+26^2+25^2+25^2+22^2\text{----------}23^2 - CF}{3}$

$= \frac{256+676+676+676+625\text{----------}529 - CF}{3}$

$$= \frac{8853 - 2870.4}{3}$$

= 2951-2870.4

Ss of panelist 80.6

Ss of errors: - b (c+d)

208.6 (28.5+80.6)

208.6-109.1

= 99.5

Degree of freedom, samples: 1st is calculated by subtracting one from the number sample

df, samples = 3-1

= 2

df of judges If is calculated by subtracting on from number of judges.

df, judges = 20-1

= 19

Degree of freedom, total is calculated by subtracting one from number of judgment

df, judges = 60-1

=59

Degree of freedom, total is calculated by subtracting the df for others source from the df for the total

df, error = 59-(19+2)

(59-21)

df error 38

Means square (MS) for any variable is determined by dividing the sum of square for each viable by its respective degree of freedom

MS / sample 28.5/2

=14.3

MS/ judges = 80.6/19

= 4.24

MS / errors = 99.5/38

= 2.62

Two variance ratios are determined by dividing the MS for judges by the MS for error.

F / judges = 4.24/2.62

= 1.62

F / samples = 14.3/2.62

= 5.46

Analysis

Source of Variation	Df	Ss	Ms	F
Samples	2	28.5	14.3	5.46
Judges	19	80.6	4.24	1.62
Error	38	99.5	2.62	1.62
Total	59	208.6		

Table 10: Table of Variance Table

There are significance differences because the calculated F value 5.46 is greater than tabulated F value 3.24

Flavour

Panelist	Mgc	Mcc	Msc	Total
1	1	4	4	9
2	7	8	8	23
3	7	9	4	20
4	8	8	8	24
5	8	9	2	19
6	8	9	9	26
7	5	9	9	23
8	6	5	5	16

Panelist	Mgc	Mcc	Msc	Total
9	6	7	7	20
10	9	8	6	23
11	7	7	2	16
12	6	8	5	19
13	9	8	6	23
14	8	8	6	22
15	8	4	2	14
16	8	8	8	24
17	8	4	8	20
18	7	7	2	16
19	8	8	8	24
20	9	6	6	21
Total	143	144	115	402
mean	7.15	7.2	5.75	

Table 11

Correction factor CF = $(402)^2$/ (3x20)

$$= \frac{161604}{60}$$

Ss, of total= $1^2+7^2+7^2+8^2+8^2+$--------$+6^2$ – CF0.

Ss of total = 2950-2693.4

Ss of total = 256.6

Sum of squares samples =

$$\frac{143^2+144^2+115^2 - CF}{20}$$

$$\frac{20449+20736+13225 - CF}{20}$$

$$= 54410 \frac{- 2693.4}{20}$$

= 2720.5 – 6693.4

= 27.1

Sum of the square/ judges =

$$= \frac{9^2+23^2+20^2+24^2+19^2---------21^2 - CF}{3}$$

$$= \frac{8412 - CF}{3}$$

= 2804 – 2693.4

= 110.6

Sum of squares / error =

256.6 – (27.1-110.6)

= 118.9

Degree of freedom / sample = 3-1 = 2

Degree of freedom / judges = 20-1 = 19

Degree of freedom / total = 60-1 = 59

Degree of freedom / error = 59-19-2

= 38

Mean squares =

MS / samples = 27.1/2 = 13.6

MS / judges = 110.6/19 = 5.82

MS / error = 118.9/38 = 3.13

Variance ratio / sample: - F value

F / sample = 13.6/3.13

= 4.35

F / judges = 5.82/3.13

=1.86

There is significant difference since calculation value is greater than tabulated value

Source of Variance	Df	Ss	Ms	F
Samples	2	27.1	13.6	4.35
Judges	19	110.6	5.82	5.82
Error	38	118.9	3.13	5.82
Total	59	256.6		

Table 12

Since there is significant among the samples, this one that is different is determine using turkey test.

Sample scores

MGC	MCC	MSC
143	144	115

Table 13

Divide by number of judgment for each sample
143/20 144/20 115/20
The mean is arranged according to magnitude

MGC	MCC	MSC
7.15	7.2	5.75

Table 14

$$SE = \sqrt{\frac{3.13}{20}} \sqrt{0.16} = 0.39$$

Least significance difference
3.44x0.39
= 1.34

MGC	MCC	MSC
7.15	7.2	5.75

Table 15

A-C=7.15-5.75=1.4>1.34
A-B=7.15-7.2=0.05<1.34sample A flavor was significantly different from C but sample A and B is not different.
B-C=7.2-5.75=1.45>1.34
Sample B flavor was significantly different from sample C
These results can be shown by using letter to indicate difference

MGC	MCC	MSC
7.15	7.2	5.75

Table 16

Texture

Judges	Mgc	Mcc	Msc	Total
1	1	6	4	11
2	8	8	9	25
3	8	8	9	25
4	4	8	8	20
5	2	7	7	16
6	8	5	3	16
7	7	6	9	22

Judges	Mgc	Mcc	Msc	Total
8	6	8	8	22
9	6	5	8	19
10	8	6	6	20
11	6	7	8	21
12	6	8	8	22
13	5	7	8	20
14	8	4	8	20
15	7	4	9	20
16	8	7	8	23
17	5	7	8	20
18	4	8	1	13
19	8	8	7	23
20	7	7	8	22
total	122	134	144	400
mean	6.1^{c}	6.7^{b}	7.2^{a}	

Table 17

CF = $(400^2)/(3x20)$

= 160000/60

= 2666.7

Ss, of total = $\frac{12^2+8^2+8^2+4^2\text{--------}8^2 - CF}{20}$

$= \frac{14884+17956+20736 - CF}{20}$

$= \frac{53576 - 2666.7 - 266.7}{20}$

= 12.1

Sum of square judges = $\frac{11+25+25+20\text{----------} - CF}{3}$

$= \frac{8248}{3} - 2066.7$ = 82.6

Sum of squares error

= 266.3 – 12.1 – 82.6 = 171.6

Degree of freedom, samples = 3 – 1 = 2

Degree of freedom judges = 20 – 1 = 19

Degree of freedom total = 60-1 = 59

Degree of freedom error = 59-19-2 = 38

Means square

MS / samples = 121/2 = 6.05

MS / judges = 82.2/19 = 4.32

MS error = 171.6/38 = 4.52

Variance of ratio sample the variance of ratio of F value =

F sample = 6.05/4.52 = 1.4

F judges = 4.32/4.52 = 0.96

Source of Variance	Df	Ss	Ms	F
samples	2	12.1	6.05	1.4
Judges	19	82.6	4.32	0.96
Error	38	171.6	4.52	
Total	59			

Table 18

There is no significant different in the texture.

Over all accessibility

Judges	Mgc	Mcc	Msc	Total
1	3	8	8	19
2	9	9	9	27
3	9	5	9	23
4	7	8	8	23
5	9	9	9	27
6	8	9	8	25
7	6	9	7	22
8	4	9	8	21
9	8	4	6	18
10	7	5	5	17
11	2	4	8	14
12	4	9	6	19
13	4	7	6	17
14	4	8	8	20
15	6	7	6	19
16	6	8	8	22
17	8	4	6	18
18	4	8	7	19
19	4	8	8	20
20	7	8	8	23
total	119	146	148	413
mean	5.95	7.3	7.4	

Table 19

$CF = (413)^2 / (3x20)$
$= 170569 / 60$
$= 2842.82$
Ss of total = 3+9+9+7+-------8 – CF
= 3051 – 2842.82
208.18

$$\text{Ss of sample} = \frac{(119^2+146^2+148^2) - CF}{20}$$

$$= \frac{57381 - 2842.82}{20}$$

= 2869.05 – 2842.82
26.23

$$\text{Ss of judges} = \frac{19^2+27^2+232^2+232^2\text{-------}23^2 - CF}{3}$$

$$= \frac{8745}{3} - 2842.82$$

= 72.2
Ss of error = 208.18-26.23-72.2
= 109.78
Df = samples = 3-1 = 2
Df = judges = 20-1 = 19
Df = total = 60-1 = 59

Df = error = 59-19-2 = 38
Means square
MS / samples = 26.23/2 = 13.1
MS / judges = 72.2/19 = 3.8
MS / error = 109.8/38 = 2.89
Variance ratio
F / samples = 13.1/2.89 = 4.5
F / judges = 3.8/2.89 = 1.3

Analysis

Source of Variance	Df	Ss	Ms	F
Samples	2	26.23	13.1	4.5
Judges	19	72.2	3.8	1.3
Error	38	109.8	2.89	1.3
Total	59	208.18		

Table 20

There is significant difference, because this calculation F value is 4.5 greater than tabulated F value 2.32
The simple means is arranged according to magnitude

MGC	MCC	MSC
7.4	7.3	5.95

Table 21

$SE = \sqrt{2.89/20}$

$\sqrt{0.14}$

$= 0.37$

Least
Significance difference
= 3.44x 0.37
= 1.27

MGC	MCC	MSC
7.4	7.3	5.95

Table 22

A-C = 7.4-5.95=1.45>1.27
B-C = 7.3-5.95= 1.35>1.27
Sample A was more acceptable than C and B was also more accepted than C because there were significant different for sample A and C and B and C
Finally, test to see if B differs from C
B-C = 7.3-5.95=1.36>1.27
Sample B was more acceptable than C.
These results can be show using letters to indicates their difference

MGC	MCC	MSC
7.4a	7.3b	5.95c

Table 23

Determination of Fat Content

S/N	Sample Code	Wt of Sample	Wt of Flask	Wt of Flask +Fat	Wt of Fat	%Fat
1	A	10	108.82	109.47	0.65	6.5%
2	B	10	100.46	101.37	0.97	9.1%
3	C	10	101.51	101.91	0.4	4%

Table 24

Determination of Crude Fibre

S/N	Sample Code	Wt of Sample	Wt of Dried Sample	Wt of Ash	Wt Loss of Dried Sample	%Crude Fibre
1	MGC	3.0	0.111	0.11	0.0009	0.03%
2	MCC	3.0	0.062	0.06	0.0015	0.05%
3	MSC	3.0	0.114	0.03	0.084	2.8%

Table 25

Result of Moisture Content Determination

S/N	Sample Code	Wt of Sample (G)	Wt of Dish	Wt of S+D Before Drying	Wt of S+D After Drying	Wt of Loss Sample	% Moisture
1	MGC	2.0	45.00	47.00	46.03	0.97	48.5
2	MCC	2.0	33.88	35.88	35.13	0. 75	37.5
3	MSC	2.0	43.40	45.40	44.13	1.27	53.5

Table 26

Results for Ash Content Determination

S/N	Sample Code	Wt of Sample	Wt of Crucible	Wt f C+ Ash	Wt Of Ash	% Ash
1	MGC	2.0	26.76	26.87	0.11	5.5%
2	MCC	2.0	27.44	27.50	0.06	3.0%
3	MSC	2.0	21.05	21.08	0.03	1.5%

Table 27

Results for Carbohydrate Determination

S/N	Sample Code	Moisture	Fat	Protein	Ash	Crude Fibre	Cho
1	MGC	48.5	6.5	29.14	5.5	0.03	9.33
2	MCC	37.5	9.1	30.45	3.0	0.05	14.9
3	MSC	53.5	4.0	23.20	1.5	2.8	15.00

Table 28

Result for Protein Determination

S/N	Sample Code	Initial Value	Final	Volume	%
1	MGC (1) MGC (2)	9.6 0.00	4.29 32.5	33.3 32.5	33.3X0.0041 X 100+6.25=29.14% 1
2	MCC (1) MCC (2)	0.00 0.00	34.8 31.9	34.8 31.9	34.8X0.0014 X 100X6.25 = 6.25% 1
3	MSC (1) MSC (2)	0.00 0.00	26.5 26.00	26.5 26.00	26.5X0.0014 X 100X6.25 = 23.2% 1

Table 29

Titre Table Acidity

Samples	Titre Value	Conversion Factor	Acid In (G)	% Acid
A	1.1	0.007	0.0077	0.077
B	1.6	0.007	0.0112	0.112
C	0.8	0.007	0.0056	0.056

Table 30

Yield of the cheese

= % total dry matter yield = dry matter in cheese x 100

Dry mater in sample

A (MGC) = $\frac{285 \times 100}{1700}$ = 16.76%

B (MCC) = $\frac{445 \times 100}{2665.5}$ =16.69%

C (MSC) = $\frac{500 \times 100}{1400}$ = 35.71%