

Table 6: Mean Carbohydrate Analysis during Storage

Sample	Day 1		Day 3		Day 5		Day 7	
	10 ⁰ C	28 ⁰ C	10 ⁰ C	28 ⁰ C	10 ⁰ C	28 ⁰ C	10 ⁰ C	28 ⁰ C
A	26.53	25.70	26.45	25.58	26.38	25.52	26.28	25.49
B	40.50	39.55	40.20	39.30	39.80	38.95	39.36	38.70
C	40.52	39.56	40.22	39.32	39.82	38.96	39.38	38.72
D	40.55	39.60	40.24	39.33	39.83	38.96	39.38	38.73
E	36.81	36.20	36.50	35.70	36.45	35.10	35.40	34.80
F	36.80	36.18	36.48	35.68	36.44	35.07	35.40	34.78
G	36.82	36.15	36.52	35.46	36.46	35.05	35.41	34.75

Table 7 below reveals the mean values of pH of Nunu during the period of storage from first day to the seventh day at temperature of 10⁰C and 28⁰C.

Table 7: Mean pH Analysis during Storage

Sample	Day 1		Day 3		Day 5		Day 7	
	10 ⁰ C	28 ⁰ C	10 ⁰ C	28 ⁰ C	10 ⁰ C	28 ⁰ C	10 ⁰ C	28 ⁰ C
A	4.40	4.20	4.35	4.10	4.30	3.90	4.20	3.70
B	5.05	4.35	4.98	4.20	4.93	4.00	4.88	3.80
C	5.08	4.33	4.95	4.15	4.92	3.97	4.86	3.70
D	5.00	4.40	4.93	4.10	4.90	4.05	4.85	3.80
E	6.40	6.00	6.22	5.85	6.05	5.70	6.00	5.58
F	6.42	5.90	6.25	5.75	6.10	5.62	6.05	5.50
G	6.45	5.95	6.27	5.82	6.12	5.70	6.08	5.56

4. Discussion

Quantitative analysis on the physio-chemical composition of unpasteurized Nunu and Nunu pasteurized at low temperature of 63⁰C and by time exposure of 30minutes and high temperature of 72⁰C short time exposure of 15seconds were done prior to storage and during storage at different temperature.

The titratable acidity of the unpasteurized Nunu (2.14) mean value was the highest of the three (3) samples. The heat applied in the pasteurization of the other two (2) samples may be responsible for the low value of 1.98 and 1.90 recorded for LTLT and HTST, respectively. The titratable acids present could probably be very volatile hence the titratable acid value for HTST (1.90) was less probably due to heat more heat applied in pasteurization, making more of the volatile acid to reduce. The result shows that the more heat applied, the more the titratable acid would vaporize from the sample.

The descriptive statistical analysis of the physio-chemical composition of unpasteurized Nunu, using mean shows that Protein for unpasteurized sample A has mean value of 3.48 before storage and was 3.30 and 3.20 during the first day of storage at temperature of 10⁰C and 28⁰C, respectively. This decrease continues till the seventh day of storage where the protein content was 3.10 and 2.30 at temperature of 10⁰C and 28⁰C, respectively.

The Protein for pasteurized sample B has mean value of 3.31 before storage and was 3.32 and 3.30 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 3.26 and 3.00 at temperature of 10⁰C and 28⁰C respectively.

The Protein for pasteurized sample C has mean value of 3.31 before storage and was 3.33 and 3.28 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 3.28 and 2.98 at temperature of 10⁰C and 28⁰C respectively.

The Protein for pasteurized sample D has mean value of 3.31 before storage and was 3.32 and 3.28 during the first day of storage at temperature of 4⁰C and 28⁰C respectively. This decrease

continues till the seventh day of storage where the protein content was 3.27 and 2.99 at temperature of 10⁰C and 28⁰C respectively.

The Protein for pasteurized sample E has mean value of 2.57 before storage and was 2.70 and 2.66 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 2.64 and 2.58 at temperature of 10⁰C and 28⁰C respectively.

The Protein for pasteurized sample F has mean value of 2.52 before storage and was 2.69 and 2.65 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 2.63 and 2.57 at temperature of 10⁰C and 28⁰C respectively.

The Protein for pasteurized sample G has mean value of 2.53 before storage and was 2.69 and 2.67 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 2.64 and 2.57 at temperature of 10⁰C and 28⁰C respectively.

The physio-chemical composition of unpasteurized Nunu, the descriptive statistical analysis using mean shows that Carbohydrate for unpasteurized sample A has mean value of 26.32 before storage and was 26.53 and 25.70 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 26.28 and 25.49 at temperature of 10⁰C and 28⁰C respectively.

The protein content of HTST mean value (2.54) was the least compared to that of LTLT and unpasteurized Nunu with mean value (3.31) and (3.48) respectively. The result shows that heat is a major factor affecting the protein content of Nunu. The more of the heat applied the more of the protein that is destroyed with duration of exposure not having a prominent effect.

The fat content of the Nunu displayed some level of heat volatility. The unpasteurized having highest fat content of 7.02 (mean value) than that of LTLT with 2.52 (mean value) recorded. However, the HTST had less fat content mean value compared to LTLT. This may be due to oil of the fat becoming more volatile at high temperature of 73⁰C used for HTST.

The Carbohydrate for pasteurized sample B has mean value of 41.68 before storage and was 40.50 and 39.55 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 39.36 and 38.70 at temperature of 10⁰C and 28⁰C respectively.

The Carbohydrate for pasteurized sample C has mean value of 41.68 before storage and was 40.52 and 39.56 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 39.38 and 38.72 at temperature of 10⁰C and 28⁰C respectively.

The Carbohydrate for pasteurized sample D has mean value of 41.68 before storage and was 40.55 and 39.60 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 39.38 and 38.73 at temperature of 10⁰C and 28⁰C respectively.

The Carbohydrate for pasteurized sample E has mean value of 37.55 before storage and was 36.81 and 36.20 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 35.40 and 34.80 at temperature of 10⁰C and 28⁰C respectively.

The Carbohydrate for pasteurized sample F has mean value of 37.58 before storage and was 36.81 and 36.20 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 35.40 and 34.78 at temperature of 10⁰C and 28⁰C respectively.

The Carbohydrate for pasteurized sample G has mean value of 37.55 before storage and was 36.82 and 36.15 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 35.41 and 34.75 at temperature of 10⁰C and 28⁰C respectively.

The physio-chemical composition of unpasteurized Nunu, the descriptive statistical analysis using mean shows that pH for unpasteurized sample A has mean value of 4.55 before storage and was 4.40 and 4.20 during the first day of storage at temperature of 10⁰C and 28⁰C respectively.

This decrease continues till the seventh day of storage where the protein content was 4.20 and 3.70 at temperature of 10⁰C and 28⁰C respectively.

The pH for pasteurized sample B has mean value of 5.28 before storage and was 5.05 and 4.35 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 4.88 and 3.80 at temperature of 10⁰C and 28⁰C respectively.

The pH for pasteurized sample C has mean value of 5.28 before storage and was 5.08 and 4.33 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 4.86 and 3.70 at temperature of 10⁰C and 28⁰C respectively.

The pH for pasteurized sample D has mean value of 5.28 before storage and was 5.00 and 4.40 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 4.85 and 3.80 at temperature of 10⁰C and 28⁰C respectively.

The pH for pasteurized sample E has mean value of 6.60 before storage and was 6.40 and 6.00 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 6.00 and 5.58 at temperature of 10⁰C and 28⁰C respectively.

The pH for pasteurized sample F has mean value of 6.70 before storage and was 6.42 and 5.90 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 6.05 and 5.50 at temperature of 10⁰C and 28⁰C respectively.

The pH for pasteurized sample G has mean value of 6.98 before storage and was 6.45 and 5.95 during the first day of storage at temperature of 10⁰C and 28⁰C respectively. This decrease continues till the seventh day of storage where the protein content was 6.08 and 5.56 at temperature of 10⁰C and 28⁰C respectively.

The result of the physio-chemical analysis reveals the protein, carbohydrate and pH levels of the Nunu samples decreased during the period of storage each day. This decrease was more noticed

in the unpasteurized samples and the samples stored at 28⁰C. This is in line with the work of Nebedum and Obiakor, (2007) that Protein levels decreased in both the preserved and unpreserved nunu, indicating proteolysis. This was highest in the unpreserved sample, ranging from 3.26 - 2.20 mg/ml by the 7th day. Changes were least in the sample preserved with sodium benzoate. Adesokan, *et al.*, (2011) opined that pH of Nunu samples decreased as fermentation progressed which is in agreement with Oyewole (1990) who stated that the acidity of fermented milk is normally noticeable when the pH falls to about 5.5.

5. Conclusion

Nunu is an excellent refreshing and nourishing drink that is used by nomadic cattle rearers. The lactic acid content determines the sensory and rheological properties of the milk and also makes it more easily digestible. Nunu, which is very much like yoghurt, is being produced in limited daily consumable quantities due to its poor keeping quality. Knowledge of the biochemical and microbial changes that are associated with its spoilage and the various methods of preservation will obviously enhance the production and proper utilization on a larger scale. An attempt was made to assess the impact of pasteurization temperature and storage temperature on Nunu milk. The results indicated that pasteurization at 72⁰C for 15 seconds has a positive impact on Nunu milk shelf life and sensory analysis. Nunu milk pasteurized at 72⁰C for 15 seconds showed better sensory characteristics and higher pH compared to the Nunu milk pasteurization at 63⁰C for 30 minutes. Therefore, Nunu milk pasteurized at 72⁰C for 15 seconds could be an interesting way to produce on an industrial scale, a uniform product of constant quality with improved sensory characteristics.

Reference

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