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"AN ANALYTICAL REVIEW OF DESIGN OF EXPERIMENT USING CURD AS EXAMPLE"

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Abstract: This "In India, Curd is used in domestic purpose in every house. In dairy Industry, production of Curd plays important role. This research is useful to analyze the quality of Curd by using various method of preparation, packing of milk and type of milk. The aim of this research is observing the method of preparation, packing and type of milk is significant on Total solid of Curd, also find out which combination increase the quality of Curd. This aim is achieved by using statistical technique like factorial experiment and design of experiment. We observe that the combination of Buffalo milk, culture and unpacked gives highly acidic Curd. The combination of cow, culture and unpacked gives Total solid of Curd. Acidity of Curd increases day wise. Thus, the above combination (Buffalo, culture and packed) cannot be consumed after few days.

***Keywords*:** Design of Experiment, Curd product, TS, Acidity.

INTRODUCTION:

Indian curd, known as "Curd", is well known fermented milk product consumed by large sections of the population throughout the country, either as a part of the daily diet or as a refreshing beverage. In 1996, the production of Curd was estimated to be about 7.8% of the total milk production in India and 14% of milk used for the manufacture of dairy products.

Since conversion of milk into Curd is an important intermediary step in the manufacture of indigenous butter & ghee, it can be said that over 40% of total milk production in India today is converted into Curd. There are two types of Curd prevalent in the country for direct consumption, viz a sweet /mildly sour variety with a pleasant flavor, and a sour variety with a sharp, acid flavors. The micro-organisms responsible for these two types were also identified and are maintained in selected centers as freeze-dried cultures for safe to the industry and public alike.

Definition: "Curd" is the product obtained from pasteurized or boiled milk by Souring, natural or otherwise, by harmless lactic acid or other bacterial culture.

It should have the same percentage of fat and solids-not-fat as the milk from which it is prepared.

Classification: "Curd" may be classified into two types:

1. For churning into desi butter (makkhan);
2. For direct consumption.
3. Curd for direct consumption may be further classified into:
   Whole milk Curd; 2 skim milk Curd

OBJECTIVE:

- Which is the better combination of Curd based on Total solid?
- Which is the better combination of Curd based on Acidity?
- Which factor level is associated with Total solid of Curd?
- Which factor level is associated with Acidity of Curd?

METHOD OF PRODUCTION:

Traditional Method:

It invariably involves production on a small scale, either in the consumer's household or in the halwai's shop in urban areas. In the household the milk is boiled, cooled to body temperature, inoculated with 0.5-1 percent starter (previous day's Curd or buttermilk) & then allowed to set undisturbed overnight. In cooler weather, the Curd setting vessel is usually wrapped up with woolen cloth to maintain warmth.

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In the shops, the method is more or less the same except that the milk is concentrated somewhat before inoculation and the Curd is usually set in a circular earthenware mould.

Standardized Method:

Need:

The quality of market Curd presently sold in halwai shops in the country is generally sub-standard and variable. The factors responsible for this are:

- Use of low–quality milk.
- Use of unsuitable starter cultures.
- Unfavourable temperature of incubation.
- Contamination from badly-cleaned utensils.

In view of the nutritional and economic importance of Curd, it has long been realized that this product should be produced on scientific lines in the organized sector of the Indian dairy industry. The conditions of producing, packaging and distribution should be standardized so as to day to day.

METHODOLOGY:

As Curd is one of the important food product in domestic lives, we wanted to determine combination of type of milk (i.e cow or buffalo), method of preparation (i.e by using curd or culture) & type of packing (i.e packed or unpacked) makes any difference in the quality of Curd. To study this objective, we conducted experiment in the Food Tech. department of our college under the guidance of Dr. Wajid Khan. For packed milk we used "Gokul" milk for both cow & buffalo. Unpacked milk (cow & buffalo) was purchased from local vendor. We used two methods of preparation:

In first method we curd for preparation of Curd by Traditional method. In second method we used industrial bacteria namely Lact. Bulgaricus which we brought from Nandan dairy , Malegaon. Our factors are:

1. Type of milk
2. Method of preparation
3. Packing of milk each at two levels.

So, we used 23 factorial experiment to conduct the analysis. It took 2 days for the pilot study which showed that the 8 treatment combinations made considerable difference in our response variable i.e Acidity & Total solids. We took 3 replications. To maintain the homogeneity, we used incubator in the laboratory which maintains the standard conditions required for Curd.We required 2-3 liters of milk for our entire study. Levels and treatment combinations are as follows:

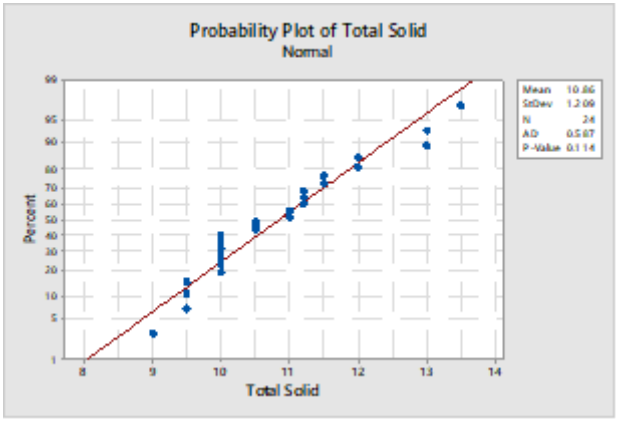
1. Level of type of milk
    a. 0: cow
    b. 1: Buffalo

2. Level of method of preparation
    a. 0: by using curd.
    b. 1: by using Industrial bacteria
3. Level of packing
    a. 0: unpacked
    b. 1: packed

Sr. No	Combination	Level Combinations	Combination
1	1	000	Cow milk + curd + unpacked
2	a	100	Buffalo + curd + unpacked
3	b	010	cow milk + industrial bacteria + unpacked
4	ab	110	Buffalo milk + Industrial Bacteria + Unpacked

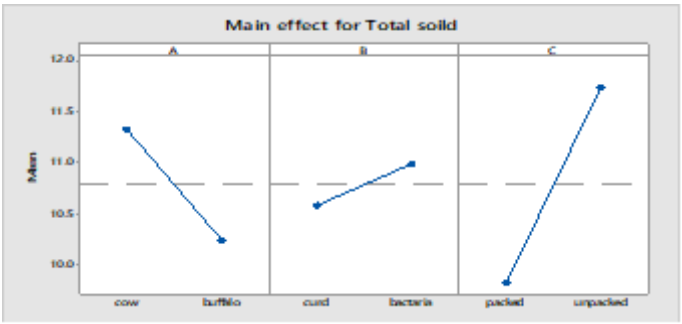
5	c	001	cow milk + curd + Packed
6	ac	101	Buffalo milk + curd +packed
7	bc	011	Cow milk + Industrial bacteria + Packed
8	abc	111	Buffalo milk + industrial bacteria + packed

EXPLORATORY DATA ANALYSIS:



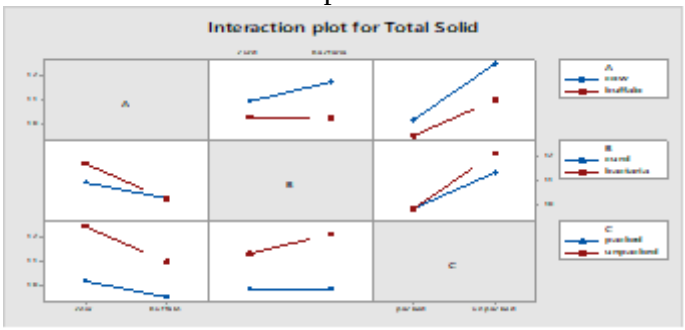
Interpretation: We observe that the content of Total solid is normally distributed. Similarly, acidity content is normally distributed.

Main effect plots for Total Solid:



Interpretation: Cow milk is givens more Total solid of Curd than the buffalo also bacteria and unpacked are associated with higher total solid.

Interaction effect plots for Total Solid:



Interpretation: From interaction effect plots, we observe that If we use combinations **of cow and unpacked** gives high total solid of Curd. also, the combination of **bacteria and unpacked milk** gives high total solid of Curd. C**ow milk and bacteria** also gives high total solid of Curd.

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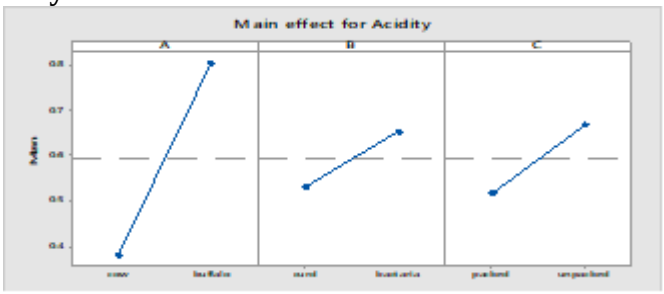
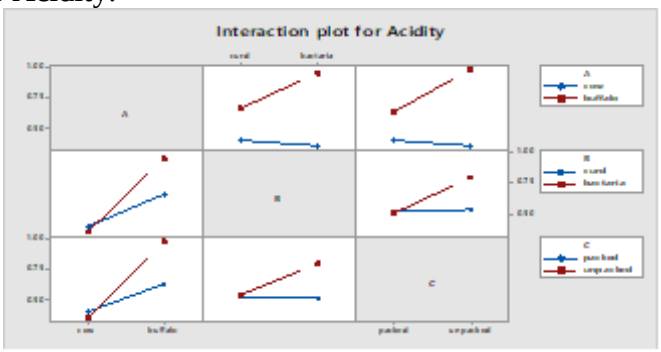
Main effect plot for Acidity:



Interpretation: Buffalo milk, bacteria and unpacked milk are associated with higher acidity.

Interaction effect plot for Acidity.



Interpretation: From interaction effect plots, we observe that If we use combinations **of buffalo and unpacked** gives high acidity of Curd. also the combination of **bacteria and unpacked milk** gives high acidity of Curd. **Buffalo milk and bacteria** also gives high acidity of Curd.

EXPLANATORY ANALYSIS:

For total solid of Curd:

To test:

H_{01} : Blocks are not significant.

Vs

H_{11} : Blocks are significant.

H_{02} : Main effect Type of milk is not significant on Total solid of Curd.

Vs

H_{12} : Main effect Type of milk is significant Total solid of Curd.

H_{03} : Main effect Method of preparation is not significant Total solid of Curd.

Vs

H_{13} : Main effect Method of preparation is significant Total solid of Curd.

H_{04} : Main effect Packing of milk is not significant Total solid of Curd.

Vs

H_{14} : Main effect Packing of milk is significant Total solid of Curd.

H_{05} : Interaction effect of Type of milk and Method of preparation is not significant Total solid of Curd.

Vs

H_{15} : Interaction effect of Type of milk and Method of preparation is significant Total solid of Curd.

H_{06} : Interaction effect of Method of preparation and Packing of milk is not significant Total solid of Curd.

Vs

H_{16} : Interaction effect of Method of preparation and Packing of milk is significant Total solid of Curd.

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H_{07} : Interaction effect of Type of milk and Packing of milk is not significant Total solid of Curd.

Vs

H_{17} : Interaction effect of Type of milk and Packing of milk is significant Total solid of Curd.

H_{08} : Interaction effect of Type of milk, Method of preparation and Packing of milk is not significant Total solid of Curd.

Vs

H_{18} : Interaction effect of Type of milk, Method of preparation and Packing of milk is significant Total solid of Curd.

ANOVA Table

	D.F	sum of squares		MSE	F RATIO	F TABLE	Decision
block	2	SSR	1.0803	0.5404	7.7797	3.738	reject
A	1	SSA	7.3707	7.3704	106.1037	4.600	reject
B	1	SSB	0.920	0.9204	13.250	4.600	reject
C	1	SSC	21.4704	21.470	309.08	4.600	reject
AB	1	SSAB	1.0004	1.0004	14.401	4.600	reject
BC	1	SSBC	1.0837	1.0837	15.601	4.600	reject
AC	1	SSAC	1.0004	1.0004	14.401	4.600	reject
ABC	1	SSABC	0.0704	0.0704	1.013	4.600	accept
ERROR	14	SSE	0.972	0.0694			
TOTAL	23	TSS	34.969				

1. The main effect **A, B, C** are significant.
2. The interaction effect of **AB, BC and AC** are significant.
3. The interaction effect **ABC** is not significant.

For acidity of Curd:

To test:

H_{01} : Blocks are not significant.

Vs

H_{11} : Blocks are significant.

H_{02} : Main effect Type of milk is not significant on acidity of Curd.

Vs

H_{12} : Main effect Type of milk is significant acidity of Curd.

H_{03} : Main effect Method of preparation is not significant acidity of Curd.

Vs

H_{13} : Main effect Method of preparation is significant acidity of Curd.

H_{04} : Main effect Packing of milk is not significant acidity of Curd.

Vs

H_{14} : Main effect Packing of milk is significant acidity of Curd.

H_{05} : Interaction effect of Type of milk and Method of preparation is not significant acidity of Curd.

Vs

H_{15} : Interaction effect of Type of milk and Method of preparation is significant acidity of Curd.

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H_{06} : Interaction effect of Method of preparation and Packing of milk is not significant acidity of Curd.

Vs

H_{16} : Interaction effect of Method of preparation and Packing of milk is significant acidity of Curd.

H_{07} : Interaction effect of Type of milk and Packing of milk is not significant acidity of Curd.

Vs

H_{17} : Interaction effect of Type of milk and Packing of milk is significant acidity of Curd.

H_{08} : Interaction effect of Type of milk, Method of preparation and Packing of milk is not significant acidity of Curd.

Vs

H_{18} : Interaction effect of Type of milk, Method of preparation and Packing of milk is significant acidity of Curd.

ANOVA FOR ACIDITY:

	D.F	sum of squares		MSE	F RATIO	F TABLE	Decision
BLOCK	2	SSR	0.0432	0.0216	6.222222	3.738892	Reject
a	1	SSA	1.0584	1.0584	304.8889	4.60011	Reject
b	1	SSB	0.0864	0.0864	24.88889	4.60011	Reject
ab	1	SSAB	0.16335	0.16335	47.05556	4.60011	Reject
c	1	SSC	0.135	0.135	38.88889	4.60011	Reject
ac	1	SSAC	0.22815	0.22815	65.72222	4.60011	Reject
bc	1	SSBC	0.10935	0.10935	31.5	4.60011	Reject
abc	1	SSABC	0.135	0.135	38.88889	4.60011	Reject
error	14		0.0486	0.003471			
Tss	23		2.00745				

Results: The main effects A, B & C are significant.
The interaction effects AB, BC, AC and ABC are significant.

RESULTS AND DISCUSSION:

Through the whole process of our experiment, several useful conclusions are drawn the total solid of Curd may be depend on the interaction effects like Type of milk and Method of preparation, Method of preparation and packing of milk, Type of milk and packing of milk. Acidity of Curd may be depend on interaction effects like Type of milk , Method of preparation and packing of milk, Type of milk and Method of preparation, Method of preparation and packing of milk, Type of milk and packing of milk. Total solid and acidity of Curd may depend on the factors like type of milk, Method of preparation and packing of milk. Cow milk is givens more Total solid of Curd than the buffalo also bacteria and unpacked are associated with higher total solid. Buffalo milk, bacteria and unpacked milk are associated with higher acidity.

BIBLIOGRAPHY:

1. Adeyl, F.M.M., 1998. Studies on the physical, chemical and microbiological quality of misti dahi of different districts of Bangladesh. M.Sc. Thesis, Bangladesh Agricultural University, Mymensingh, Bangladesh.
2. Akter, S. 2004. Qualitative characteristic of dahi prepared from reconstituted milk. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.
3. Alam, S. 1998. A study on the preparation of dahi from soymilk. M.S. Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.
4. Aggarwala, A.C. and S.D. Ahmed, 1940. A Laboratory Manual of Milk Inspection. 2nd Edn., Messrs Gulab Chand Kapur and Sons, Lahore, Pakistan.

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5. AOAC International. 2003. Official methods of analysis of AOAC International. 17th edition. 2nd revision. Gaithersburg, MD, USA, Association of Analytical Communities.
6. APHA (American Public Health Association). 1998. Standard Methods for Examination of Dairy Products.20th edition, Washington. D.C., USA.
7. Avlesen, K., Abrahmsen, R.K. and Steimstholt, K. 1979. Production of yogurt powder for acidification of frozen yogurt. Meieriposten. 68 (6): 167-170.
8. Begum, J. 2004. Qualitative characteristics of dahi prepared from non-fat dry milk fortified with vegetable oil. M.S. Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.
9. Chakrabarty, M. 1998. A study on the preparation of dahi from whole milk of cow, buffalo and their different proportionate mixtures. MS Thesis, Department of Dairy Science, Bangladesh Agricultural University, Mymensingh.
10. Desai, S.R., Toro, V.A. and Joshi, S. 1994. Utilization of different fruits in the manufacture of yoghurt. Indian Journal of Dairy Science. 47(10): 870-874.
11. Nelson, J.A. and G.M. Trout, 1948. Judging Dairy Products. The Olsen Publishing Co., Wisconsin.
12. Venkateshaiah, B.V., C. Kempanna and H.M. Jayaprakash, 1996. Effect of different levels of fat, S.N.F and acidity on the sensory qualities of frozen yoghurt. Ind. J. Dairy Bio. Sci., 7: 38-40.