

Short Communication

Preparation and Evaluation of Gouda Cheese with Different Fat Levels from Buffalo Milk

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ABSTRACT

Gouda is a creamy ripened Dutch cheese. Owing to its nutritional and textural properties, it was planned to introduce it in Pakistan from buffalo milk. For the purpose, six-liter raw milk was first standardized to 6, 5 and 4% fat then 1% starter culture of *Lactococcus lactis* spp. *cremoris* (NRRL B-634) and *Lactobacillus helveticus* (NRRL B-4526), 1.25 g rennet, 2 mL CaCl_2 and 2 g NaNO_3 were added to each batch and proceeded for coagulation, cutting, whey separation, pressing, molding, waxing and ripening. Cheese so prepared was analyzed for moisture, fat, protein, ash and salt contents. The sensory evaluation was also carried out regarding flavor, color, taste, texture and overall acceptability along with the chemical analysis after every month during three months of ripening. A progressive increase in fat and protein while a gradual decrease in moisture contents was observed in each treatment during ripening. From sensory evaluation, the cheese containing 40% fat was highly acceptable followed by 34% fat and 46% fat cheese. From sensory and chemical analysis, it is concluded that Gouda cheese having 40% fat content was the best treatment.

Key Words: Gouda; Cheese; Fat; Starter culture; Additives; Sensory evaluation

INTRODUCTION

Cheese is fresh or matured product obtained by draining of whey after coagulation of milk, cream, skimmed or partly skimmed milk, buttermilk or a combination of some or all of these products (Van den Bery, 1988). Milk used for cheese is a dynamically balanced mixture of protein, fat, carbohydrates, vitamins, water, lactose, lactoglobulin, lactalbumin and water-soluble minerals. The milk has been considered a complete food as it contains all the nutrients essentially required for young child. Buffalo milk contains total solids 17.96%, fat 7.64%, protein 4.36% and lactose 4.83%. The buffalo milk can also yield excellent cheese (Considine, 1982). Cheese is an ancient, traditional food and is an important dairy product; Humans have been making and eating cheese since prehistoric times. The Romans raised cheese making to an art, mixing sheep's and goat's milk and adding herbs and spices for flavoring. During 6th middle ages, monks become innovators and developers and it is due to them that there are now many of the classic varieties of cheese marketed today (Widcom, 1978). The process of cheese making is an ancient craft that dates back thousands of years; the process of cheese making is still a complicated one that combines both art and science together (Ulfman, 1996). Among hard cheeses, Gouda occupies a prominent position. It is a creamy ripened cheese that has interior perforated by tiny holes and mild, nutty flavor that sharpens with age and has flattened sphere shape and coated with wax. It is named after a town near Rotterdam, Netherlands, where it has been made since the middle ages (5th-15th centuries). By the 13th century it was

being exported from the Netherlands to all over the world and many countries are producing Gouda domestically (MEE, 2002). Gouda cheese has got second prize in world cheese competition of 2002 (Ellner, 2002). From this contest it is clear that Gouda cheese is the 2nd most liked cheese in the world. In Pakistan, it is the first time that the project of Gouda cheese was planned for introducing the methods and techniques of production from buffalo milk to provide a consumer good quality cheese at low price, because only Cheddar and Mozzarella are available on commercial level. Purpose for preparation is to gather the interest of the people, because it is nutritious food, excellent source of fat has high calorific value, good source of protein and rich source of vitamin A, D, Ca and P.

MATERIALS AND METHODS

Raw milk was procured from local dairy farm near university. Raw milk was tested for fat, SNF, acidity and pH following the methods of (A.O.A.C., 1990; Kirk & Sawyer, 1991). Starter Culture of *Lactococcus lactis* spp. *cremoris* (NRRL B-634) and *Lactobacillus helveticus* (NRRL B-4526) obtained from Microbial Genomics and Bioprocessing Research Unit in United State Department Of Agriculture (USDA). Three batches of each 6-liter milk were standardized to 6, 5 and 4%, fat respectively. Milk was poured into processing vat, heating the milk to renneting temperature i.e. 29°C. Mother culture (1%) was prepared from *Lactococcus lactis* spp. *cremoris* (NRRL B-634) and *Lactobacillus helveticus* (NRRL B-4526) separately; which was obtained in freeze-dried form, after preparation, 10 mL

Table I. Effect of treatments on chemical composition

Treatments	Fat	Moisture	Protein
T ₁	46.500a	39.012b	12.722b
T ₂	41.722b	39.213b	12.938b
T ₃	33.333c	45.080a	16.492a

Table II. Effect of storage on chemical composition

Storage (days)	Fat	Moisture	Protein
0	40.073b	42.250a	13.077c
30	39.778b	41.234b	13.851b
60	40.222b	41.167b	14.579a
90	42.000a	39.756c	14.697a

Table III. Effect of treatments on sensory evaluation

Treatments	Taste	Flavor	Texture	Overall Acceptability
T ₁	5.450	6.800	5.650	5.850
T ₂	5.700	6.700	6.250	5.850
T ₃	5.600	6.500	5.600	5.700

Table IV. Effect of storage on sensory evaluation

Storage (days)	Taste	Flavor	Texture	Overall Acceptability
0	6.600a	7.000	6.933a	6.000
30	5.867a	6.467	5.800b	5.400
60	5.000b	6.400	5.333b	5.733
90	4.867b	6.800	5.267b	6.067

mixed culture of 1% was added to each 6 L milk. Then other additives like rennet of 1.25gm, calcium chloride of 2 mL (35%) and saltpeter (NaNO₃) of 2 g was added and mixed thoroughly. Coagulum formed was checked for cutting purpose after 10-15 min; during cutting the size of cubes should be of 1cm³, while 1/3 of volume, which escape from coagulum after cutting should be drained. During 1st and 2nd cooking at 32°C, hot wash water was added and stirred to settle down it for 10-15 min, and then whey is removed. Curd was forward for molding, pressing, brining (strength 12 Be) and waxing. At the end cheese was left to ripen in a storeroom for three months at 6-12°C (DTCF, 1989). Yield of each treatment was calculated after whey separation. Cheese samples were analyzed for fat, moisture and protein, following the methods of (A.O.A.C., 1990; Kirk & Sawyer, 1991) and evaluated organoleptically for taste, flavor and texture by scoring method as described by Larmond (1977). Statistically analysis of the data was carried out by using analysis of variance technique and comparison of mean differences was made by applying Duncan's Multiple Range Test (DMR Test) as described by Steel *et al.* (1996).

RESULTS AND DISCUSSION

Physico-chemical analysis. Results showed that there was a progressive increased in fat, protein, ash and salt contents

Fig. 1.

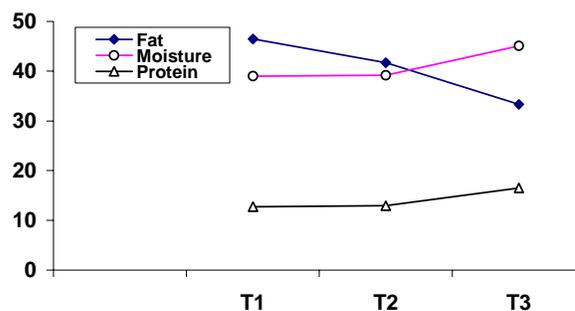
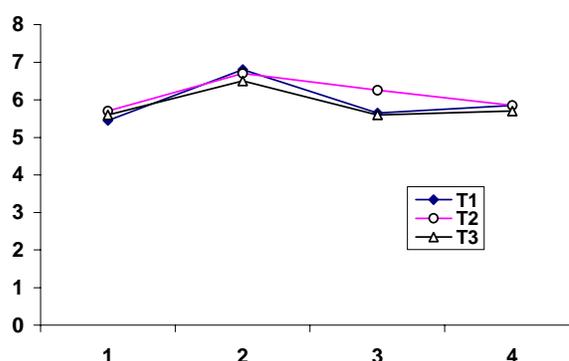


Fig. 2.



during storage period in each treatments. During storage a gradual decrease in moisture contents was observed in each treatments. Fat, moisture and protein contents showed a highly significant difference between treatments and storage days. The result of fat, moisture and protein contents agrees with the result of (Tarannum, 1986; Licitra *et al.*, 2000) while ash with (Berg, 1988).

Organoleptic Evaluation. During organoleptic evaluation of Gouda cheese, the sensory evaluation data indicated that T₃ is highly rated for overall acceptability by five judges on zero days, while T₂ on 90th day. T₁ fetched more score in taste and flavor when freshly prepared, at the end of storage, T₂ is the best treatment in case of taste and flavor due to mild and nutty flavor. T₂ is the best treatment for texture on zero days and 90th days as well.

Analysis of variance of data on sensory evaluation indicated highly significant effect of storage on taste and texture after storage for 30, 60 and 90th days, while effect of treatment on taste, flavor, texture and over all acceptability were non significant at the end of storage period. Pleasant sensation with regard to taste, flavor and texture were recorded in the freshly prepared cheese. The keeping quality of cheese was found satisfactory at 6 - 12 degree centigrade except the hardness during storage of 90 days. Mean values showed that non-significant decrease in the keeping quality of cheese during poor storage.

CONCLUSION

It is concluded that Gouda cheese having 40% fat content is the best treatment in all at the end of storage period, this treatment (T₂) has shown remarkable stability with 40% of fat at the end of 90th day with all the characteristics such as taste, flavor, texture and over all acceptability.

REFERENCES

- A.O.A.C., 1990. *Official Methods of Analysis*. The Association of Official Analytical Chemists, Arlington, USA
- Berg, J.C.T., 1988. *Dairy Technology in the Tropics and Sub tropics*, Pudoc. Pub. Co. Inc, Wageningen, Holland
- Considine, M. 1982. *Foods and Food Production Encyclopedia*. New York, Van Nostrand, Inc., USA
- DTCF.1989. *Production of Dutch Farm Cheese (Gouda Type)*, Dairy Training Center. Fries Land, Netherlands
- Ellner, R., 2002. 2002 World Championship Cheese Contest. *DMZ, Lebensmittelindustrie und Milchwirtschaft*, 123: 13–7
- Kirk, R.S. and R. Sawyer, 1991. *Pearson's Composition and Analysis of Foods*. Longman Scientific and Technical. Harlow, Essex, UK
- Larmond, E., 1977. *Laboratory Methods for Sensory Evaluation of Foods*. Research Branch, Canada. Deptt. Agriculture, Publication, 637
- MEE, 2002. *Microsoft Encarta Encyclopedia (Gouda Cheese)*. Microsoft Corporation, USA
- Licitra, G., P. Campo, M. Manenti, G. Portelli, S. Carpino and D.M. Barbano, 2000. Composition of Ragusano Cheese During Aging. *J. Dairy Sci.*, 83: 404–11
- Steel, R.G.D., J.H. Torrie and D. Dickey, 1996. *Principles and Procedures of Statistics: A Biometrical Approach*. 3rd Ed. McGraw Hill Book Co., New York, USA
- Tarannum, S.A., 1986. Effect of Different Processing Techniques on the Quality of Cheddar Cheese. *M.Sc. (Hons) Thesis*. Deptt. Food Tech. Univ. of Agri. Faisalabad, Pakistan
- Ulfman, J., 1996. *Cheese Making is an Art*. Veeopro, Holland, 26: 18–9
- Van den Berg, J.C.T., 1988. *Dairy technology in the tropics and subtropics*. Pudoc Wageningen
- Widcom, R., 1978. *The Cheese Book* (www.cheese.com), USA

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