Studies on Availability and Evaluation of various Quality Characteristics of Ultra high-treated milk in Kashmir

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(2017-V-366-M)

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Thesis

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to my beloved Parents &

Major Advisor

Sher-e-Kashmir
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Certificate – I

This is to certify that the thesis entitled **"Studies on Availability and Evaluation of various Quality Characteristics of Ultra high-treated milk in Kashmir''**submitted in partial fulfillment of the requirements for the award of the degree of **Master of Veterinary Sciences (Division of Livestock Products Technology)** to the **Faculty of Postgraduate Studies, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir** is a record of bonafide research work carried out by **Dr. AfreenTramboo(Regd. No. 2017-V-366-M)** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

It is further certified that information received during the course of investigation has duly been acknowledged.

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Certificate – II

We, the members of the Advisory Committee of **Dr. AfreenTramboo (Regd. No. 2017-V-366-M)**, a candidate for the degree of **Master of Veterinary Sciences (Division of Livestock Products Technology)**have gone through the manuscript of the thesis entitled **"Studies on Availability and Evaluation of various Quality Characteristics of Ultra high-treated milk in Kashmir''**and recommend that it may be submitted by the student in partial fulfilment of the requirements for the award of the degree.

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Certificate – III

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ABSTRACT

The current investigation was undertaken with the aim of ascertaining the availability and utilization status of UHT milk in Kashmir and evaluating the quality of ultra high treated milk in Kashmir division for characterizing its sensory, physico-chemical, microbiological and adulteration profile. For this purpose a survey on various households and commercial establishments was undertaken. A total of 240 respondents from households and 120 from commercial establishments (wholesellers, retailers, tea stallers) were asked to respond to respective questionnaires. The results revealed that the households and commercial establishments preferred Amul brand and Toned class for UHT milk.

Tetrapacks were mostly preferred by the commercial establishments and used the UHT milk for making beverages. Marriage had a great influence on purchase of UHT milk. The majority of households on an average consumed 10 litres of UHT milk per month. Sensory attributes of Ultra high treated milk were found to be within acceptable limits. Microbiological quality of the samples of Ultra high treated milk collected from the three zones of Kashmir division were satisfactory and the physico-chemical properties of all the UHT milk samples, collected from three zones were found to be of approved quality, irrespective of the brand and class. Adulteration profile of Ultra high treated milk was seen to match completely to the standards.

Key words: Ultra high treated ,Survey, Physico-chemical, Adulteration, Microbiological

Signature of Student

Dated: _____

Signature of Major Advisor

Dated: _____

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Dr. Afreen Tramboo

Dated:

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Chapter - 1

INTRODUCTION

Milk production in India has witnessed a significant growth and is reported to have recorded about eight fold growth from about 22 million tones in 1970-1971 to 176.35 million tones in 2017-2018 (Rath, 2019).The growth in milk production has outpaced the growth in the population and food grain production, resulting in the significant increase from 112 grams per day in 1970-1971 to about 374grams per day in 2017-2018, thus contributing towards the nutritional security of masses. ICMR recommendation of milk percaptia per day is 280 grams. Increase in production has necessitated the need for employing effective methods of preservation of milk in order to prevent losses occurring due to spoilage of milk. This would also pave way to the regional and seasonal surpluses to be salvaged effectively.

Milk is highly perishable and spoiled within five hours after milking by bacterial contamination from different sources which serves as a good source of various pathogens (Shihabul*et al.,* 2016), thus limiting its shelf life. There have been many developments in recent years that have given thought for several methods for preservation of milk.Pasteurized milk is recommended to be consumed within seven days from the production, thus accounting for a short shelf life. As an alternative to pasteurization, Ultra high treatment processing represents one such innovative approach for milk utilization and preservation, which has been successfully practiced commercially. Application of this modern technology alters the most undesirable characteristic of milk, i.e. perishability and enables to exploit the unlimited potential of milk to meet the ever changing needs of the consumer population.

The Ultra high treatment of milk is the processing of milk at a sufficiently high temperature, higher than 130°C (usually l40-l50°C) for a holding period of few secondsusually 2-10 s)in a continuous heat exchanger to produce a commercially sterile product. Ultra high treated milk is usually stable at an ambient temperature

having a shelf life ofabout 6-9 months. It is of good commercial value and satisfies the commercial requirements and is also free from microorganisms and harmful toxins. It eliminates the cold chain requirements and also accounts for associated savings in storage and its distribution cost. There are two main types of Ultra high treatedheating: "*direct"* and "*indirect"*.Direct heating involves mixing of super-heated steam with milk, while indirect heating involves a heat exchanger which transfers heat across a partition between the milk and the heating medium which either besteam or pressurized hot water. The partition is usually the wall of a stainless steel tube or a stainless steel plate. Though a number of dairy processing companies are now supplying long shelf-life UHT milk, no research work has ever been focused on testing the quality of the product in this part of world. So, this study was undertaken with the aim of investigating the quality of UHT milk available in Kashmir division.

EVOLUTION

Jonas Nielsen had pioneered the first recorded Ultra high treated processing plant by 1913 and later developed an aseptic canning system. The modern trend towards Ultra high- treated, however, started in the late 1940s asplants started using higher processing temperatures, with correspondingly shorter holding times, so to give products a better bacteriological quality.

Tetra Pak launched tetrahedral paperboard cartons in 1952 in sweden. They made a commercial breakthrough in the 1960s, after its technological advances, combining carton assembling and its aseptic packaging technologies, followed by international expansion. In aseptic processing, the product and the package are sterilized separately then combined and sealed in a sterile atmosphere, in contrast to canning, where product and package is first combined and then sterilized. Parmalatintroduced Ultra high treated milk to the United States in June, 1993. In the 1960s Aluminium plant and vessel company, launched the first commercial steam infusion system under the brand name of Palarisator. (Chavan*et al*.,2011).

In India, a pilot plant was set up in 1970 at Baroda to produce aseptically packed UHT milk. Four packaging stations were started initially at Surat, Indore, Jaipur and Guntur.

MARKET SCENARIO OF UHT MILK

A recently released report by IMARC Group, titled "UHT Milk Market in India" critically examined the Indian UHT milk market. The report found that the market achieved around a CAGR of 25% during 2010-2017. Karnataka represents the largest market, accounting for the majority of the total share at present. It is followed by Maharashtra and Tamil Nadu. Some of the key Players operative in market are Nestle and Mother Dairy. In Kashmir the consumption of UHT milk has raised over years which is evident from the figures given here under:

Quantity of UHT milk imported in Kashmir division during last three years is as below:

a) 2014-2015: 1948.7 tones

b) 2015-2016: 2241.4 tones

c) 2016-2017: 2385.5 tones

(Commercial Excise&Taxation Department, Government of J&K, 2019)

CONCERNS

1 UHT milk is invariably imported to Kashmir in toto for human consumption and annual increase in the consumption has been witnessed as significant.

2 It has increased by about 15% from 2015 to 2016 and 6.4% from 2016 to 2017 in Kashmir division.

3 The mechanism for quality evaluation of UHT milk of all denominations at arrival or subsequently is apparently non-existent.

4 It seems, therefore plausible to ascertain the quality of the product under study for its conformation to various standards in order to safeguard the health and well being of consumers.

OBJECTIVES

1) To document the availability and utilization status of UHT milk in Kashmir.

2) To evaluate the UHT milk available in Kashmir for various quality characteristics.

3) To ascertain the status of UHT milk offered for sale in Kashmir with respect to possiblepresence of adulterants and preservatives.

Chapter – 2

REVIEW OF LITERTATURE

2.1 Survey on ultra high treated milk

Perkins and Deeth (2001) conducted a survey on of Australian consumers attitude towards the UHT milk. Pasteurized milk was the main type of milk used by the 80% of consumers whereas for UHT milk this figure was lower upto 10%. It was concluded that there was a low level of consumption of UHT milk in Australia with the reason, being its poor flavour and price.

Abewardhan*et al.* (2014) conducted a study on Ultra High Treated (UHT) milk in Sri Lanka to find out the influence of food safety attributes in consumption of UHT milk products in Gampaha district. A 135 of consumers were randomly selected through a questionnaire survey using choice cards. The data were analysed using a conditional logistic regression. The results revealed that the flavour, quality certification and fat content significantly affected the purchasing decision of a consumer. Further according to the results mentioned above, consumers were highly concerned about organoleptic properties (taste, flavour), food safety (quality certifications), and health benefits (fat content) of UHT milk products. It was concluded that the policy on quality standards had significant impact than pricing policy on consumer purchase decisions.

Basha*et al.* (2016) studied theconsumer preferences for ultra high treated milk in the Albania. Different types of consumers were randomly selected and their preference for ultra high treated milk was noted. The results revealed that from amongst the 200 interviewed consumers, only 86 wanted ultra high treated milk.

Kaya (2016) conducted a study on consumer's perception and attitude towards packaged milk as long-life (UHT, ultra-high temperature) and pasteurized fluid milk (PFM). in Turkey. 1222 consumers were interviewed in person, and the data were collected. The results revealed that 76.4% of urban consumers (UCs)

preferred UHT and in case of PFM the potential customer rate was 51.1% to 56.9%. 52.6% of consumers considered that there was a change in the composition of UHT and PFM during the production. The consumer groups (51.3%) thought that this change was due to the addition of additives. It was concluded that the main motivation factor for the negative attitudes of consumers towards UHT and PFM was the distrust of the technology in use.

Barad and Mehta (2017) carried a study on the consumer preference towards packed and unpacked fluid milk from the urban households of Veraval city.A questionnaire was devised to collect data containing close-ended questions. The results revealed that that 60.8% of respondents consumed unpacked fluid milk, 32.5% consumed packed fluid milk while 6.5%of respondents consumed both unpacked and packed fluid milk. It was suggested that the consumer always considers different factors like the standard quality of milk, fat level, price, freshness and availability before making a purchase.

Uzundumlu*et al.* (2018) examined the factors influencing consumer preferences for UHT milk consumption in Erzurum province. The primary data used in this research was derived from Palandoken, Yakutiye and Aziziye districts of Erzurum province in 2010. The factor analysis was used to find out the factors affecting consumer preferences for UHT milk. As for the segmentation of consumers and bringing out the profile of each segment, cluster analysis was used. The results revealed that 95.00% of households consumed UHT milk. The factor scores which were determined using factor analysis were divided into three clusters by cluster analysis. UHT milk for consumers entering the first cluster because of its homogenous nature, packaging properties for advertising and price advantage was preferred. UHT milk for consumers entering the second cluster had ease of preparation and transportation, and confidential properties because of which it was preferred. On the contrary, consumers entering the third cluster preferred UHT milk for a good diet product.

2.2 Sensory characteristics of Ultra high treated milk

Hassan *et al.* (2009) examined 4 different ultra high treated milk samples taken from local market. The samples were analyzed at an interval of one week to twelve week to diagnose sensorial changes during this period. The samples were stored at room temperature (25°C) to provide them similar conditions, as they are stored in market. It was concluded that the sensory characteristics showed a significant decrease in scores during storage.

Gaewalin*et al.* (2009) compared the differences in flavour and texture of 37 commercially available ultra high treated milk and sterilized milk samples including whole milk, 2% reduced-fat and low-fat milk obtained from markets in seven countries (France, Italy, Japan , Korea , Peru , Thailand and the U.S.A). Five highly trained panellists used flavour and texture profiling to describe the sensory properties of each milk sample. Data were analyzed by principal component analysis and hierarchical cluster analysis. The results disclosed that higher levels of processed, chalky, brown and cooked flavours were noted which generally corresponded to lower levels of fresh dairy flavour characteristics. The samples did not vary consistently within a country and the fat content did not correlate with dairy fat flavour or viscosity. It was suggested that companies manufacturing ultra high treated milk had more impact in determining sensory properties of ultra high treated milk than the country or fat content.

Arafat *et al.* (2015) evaluated the organoleptic characteristics of ultra-high temperature treated milk available in Gazipur and Mymensinghtown markets of Bangladesh.Organoleptic attributes like flavour , consistency, colour and appearance were tested. It was revealed that all the samples were similar in respect of colour, flavour, taste and texture, and no significant difference was observed with regard to any of the organoleptic attributes.

Richards *et al.* (2016) conducted a study based on consumers acceptance or rejection of milk of different storage ages and compared it with

fresh milk samples. UHT milk between 120 and 290 days of storage were evaluated. It was found that the consumers noted positive sensory attributes more frequently in fresher milk samples with an increase in negative attributes with storage. It was concluded that the hedonic scores for the milk decreased with increase in storage period

Jamal *et al*. (2018) evaluated the sensory quality of pasteurized milk and ultra high treated milk collected from different locations in Dhaka, Bangladesh. Sensory attributes with regard to colour and flavour were determined. It was concluded that the sensory attributes for pasteurized and ultra high treated milk samples were found to be satisfactory with a good overall score.

2.3 Microbiological characteristics of Ultra high treated milk

Saudi *et al.* (1990) examined forty random samples of UHT milk collected from different supermarkets in Giza city for their bacteriological quality and found that the mean of mesophilic bacterial count, coliform content and aerobic spore count were 2.92×10^4, $1.82\times10^3$and 9×10^3, respectively. *E. coli, Enterobacteraerogenes, Ent. cloacae, Klebsiellaaerogenes, K. ozone aeaerogenes, K. ozoenaea and K. oxytoca were* isolated at varying percentage ranging from 2.5 to 10% while *Bacillus sutilis, B. coagulans, B. breivis, B. cereus, B. firmus, B. larvae and B. polymexa*at percentage ranging from 7.5 to 47%.

Mohamed *et al.* (2001) conducted a comprehensive survey on microbiological qualities of raw milk used for processing ultra high treated milk. A total of 3420 raw milk samples were randomly collected from 38 Egyptian farms during 6 seasons over 18 months. These farms were located along Alex-Cairo and Al-Ismailia roads, and in Al-Dakahlia, Al-Gharbia, Al-Fayoum and Banisewifss governorates. The results disclosed that the average of antibiotic residues for all samples ranged from zero to one and coliform count ranged from 7×10^2 to 4×10^4 cfu/ml. The highest counts were found in most farms during summer except in Banisweif and Al-Fayoum farms. Mesophilic spores count ranged from 2×10^1 to 9×10^1 cfu/ml but little thermoduric spores count were found in all samples (from 3 to 2×10^1 cfu/ml). It was concluded that the

raw milk from the tested farms had acceptable microbiological qualities for the production of UHT milk.

Hassan *et al.* (2009) determined the microbiological changes of four different ultra high treated milk samples taken from the local market. The samples were analyzed at an interval of one week to twelve week. During this period, samples were stored at room temperature (25°C) to provide them similar conditions, as they are stored in market. The result reported that no colony was found on total plate count plates, coliform agar plates, *E. coli* plate*, B. cereus, B. subtilus*, and spore forming plates during storage. It was concluded that the shelf life of ultra high treated milk mainly depended on the quality of raw milk and better quality of milk could be achieved by better milk collection system.

Nagla*et al.* (2009) conducted a study on the microbiological changes of ultra high treated milk samples during storage. Microbiological analysis of UHT milk samples was done at 1, 10, 20 and 30 day intervals. The results revealed that the total bacteria and lactic acid bacteria count were found to significantly increase with time during storage period. The following genera were isolated *Bacillus, Micrococcus, Staphylococcus, Enterobacter, Pseudomonas, Streptococcus, Pediococcus*and *Lactobacillus*. It was concluded that heat treatment had a significant ($p<0.01$) effect in reducing the bacterial load.

Karima (2012) carried a study on the microbiological examination of 30 samples of ultra high treated milk to check the presence of some pathogens. It was revealed from the results that the collected samples of ultra high treated milk showed the presence of *coliforms, S. aureus,spore forming Enterobcteriacae*, yeast and mould in variable counts while both *Yersiniaenterocolitica and B. Cereus* were not detected in any of the samples.

Dey and Karim (2013) studied the effect of preservation on the microbial content of milk. Major tests conducted were Total viable count and coliform count. The results revealed that the initial average TVC in raw milk was 5.49 ± 0.69 log cfu /ml which increased to 6.25 ± 0.10 log cfu /ml. In case of pasteurized milk samples initial average total viable count was found to be 4.43 ± 0.17 log cfu/ml

which increased to 5.92 ± 0.05 log cfu /ml after six days of preservation. Ultra high treated milk samples also provided with initial average of total viable count of 3.32 ± 0.06 log cfu /ml and 3.59 ± 0.01 log cfu /ml during preservation at room temperature for four months. The initial average coliform bacteria were estimated 3.55 ± 0.12 log cfu /ml and 2.08 ± 0.11 log cfu /ml for pasteurized and UHT milk samples which increased to 3.81 ± 0.06 log cfu /ml for pasteurized milk after six days of preservation and 2.43 ± 0.10 log cfu /ml for UHT milk samples after four months of preservation. It was concluded that both raw and pasteurized milk samples showed an increase in microbial population during refrigeration and UHT milk consumed after three months from the production had an increased microbial content especially coliform bacteria.

Saxena and Rai (2013) conducted a study on the microbiological contamination in milk during preservation. Major tests conducted were total viable bacteria count (TVC) and Coliform count. The result revealed that the microbial population increased both in raw and pasteurized milk during refrigeration. On the other hand, it was concluded that UHT milk must not be purchased after three months from production due to increase in microbial content especially coliforms.

Banik*et al.* (2014) studied the microbiological quality of raw, pasteurized and UHT (Ultra High Treated) milk samples collected from different locations in Bangladesh. A total of 46 samples were studied including 22 raw milk samples from the local dairy markets and 24 different brands of pasteurized and ultra high temperature (UHT) treated milk manufactured in different beverage industries. The samples were examined for determining the total viable bacterial count (TVBC) and total coliform count (TCC). The results revealed that the raw milk samples were substandard in terms of TVBC and TCC. The range of TVBC and TCC in raw milk samples was 5.2×10^{8} to 1.3×10^{7}cfu/ml and 4.2×10^{4} to 1.0×10^{4} ml, respectively. On the contrary, the quality of pasteurized and UHT-treated milks was excellent. The TVBC range in pasteurized milk samples was from $1.8\times10^{3}$to 1.1×10^{2} cfu/ml, slightly lower than that recommended by the Bangladesh Standards and Testing Institution (BSTI). The three brand samples of

pasteurized milk had no growth at all both in terms of TVBC and TCC and none of the UHT processed milk contained any bacteria. It was concluded that both the types of processed milk were to be considered safe for consumption within the mentioned expiry date.

Arafat *et al.* (2015) conducted the experiment to evaluate microbiological quality of ultra-high temperature treated milk available in Gazipur and Mymensingh of Bangladesh. A total of 27 UHT milk samples from three different brands- Pran Dairy (A), Aarong Dairy (B) and Farm Fresh (C) were collected from local markets. It was revealed that the Total Viable Count and Coliform count were nil in all the ultra high treated milk samples

Deepika*et al.* (2015) conducted a study to find out the bacteriological characteristics of milk samples in Visakhapatnam district, Andhra Pradesh. The microbial isolation was done by streak plate method on nutrient agar and on selective media for their identification. It was revealed that the milk samples contained the bacterial isolates *of E.coli*and *Staphylococcus* which were highly pathogenic. So it was suggested that the poor quality of milk was recorded as the major risk factor for the dreadful diseases.

Udayalaxmijeppu*et al.* (2015) compared the microbiological quality of pasteurized milk with milk cooker-treated milk and the quality of fresh ultra-high-temperature (UHT) milk with that of ultra high treated milk close to expiry date. Milk samples were tested by methylene blue reduction test, coliform test, and colony count test. It was revealed that all milk samples passed the methylene blue test and UHT-treated milk passed the coliform test also. Out of the 30 fresh pasteurized milk samples, 07 (23.3%) passed the coliform test; but the same after milk cooker treatment, 16 (53.3%) passed the coliform test (P<0.05). 14 (46.6%) out of 30 fresh pasteurized milk samples failed the colony count test, but the same after milk cooker treatment only 08 (26.6%) failed the test (P=0.583). Only 07 out of the 60 UHT milk samples failed the colony count test and out of these 06 (20%) were close to expiry date (P<0.05). It was concluded that milk cooker-

treated milk appeared to be safer than the fresh pasteurized milk and fresh ultra hightreated milk was safer then ultra high treated milk close to expiry date.

Jamal *et al*. (2018) determined the microbiological quality of pasteurized milk, ultra high treated milk and flavoured milk samples collected from different locations in Dhaka, Bangladesh. Twenty pasteurized milk samples, fifteen UHT milk samples and fifteen flavoured milk samples of different brands were collected and different batches were analyzed for enumerating the total viable bacterial count (TVBC), total coliform count (TCC). The results revealed that TVBC in pasteurized milk samples was between 2.3×10^2 cfu/ml to 4.69×10^3 cfu/ml respectively. TVBC range of flavoured milk samples was between 5.0×10^1cfu/ml to 1.8×10^2 and no TVBC was detected for any of the UHT milk samples. No TVBC was found for flavoured milk samples of one of the company. Coliform bacteria were present only for pasteurized milk samples in one brand, though the count was under acceptable range according to BSTI recommendation (<10/ml coliform in pasteurized milk). It was concluded that the ultra high treated milk was safe for consumption within the mentioned expiry date without heat treatment.

2.4 Physico-chemical characteristics of ultra high treated milk

Singh *et al*. (2000) conducted a study on kinetics of deteriorative changes in stored ultra high treated milk, pH and acidity. Ultra high treated milk samples processed at 140°C were obtained from a commercial dairy and stored at 9, 15, 25, 35, 45 and 55°C. At periodic intervals, samples were analysed for change in pH and acidity. Both the reactions were dependent on storage temperature and followed zero order reaction kinetics. The Arrhenius model of temperature dependent functions was used for describing the rate of change in the reaction. The various kinetic parameters viz. activation energy, enthalpy, activation entropy and Gibb's free energy of activation were also obtained for both the reactions. The results obtained were used for developing protocols for close monitoring and quality control of UHT milk.

Mohamed *et al.* (2001) conducteda study on the physiochemical qualities of raw milk used for processing ultra high treated milk. A total of 3420 raw milk samples were randomly collected from 38 Egyptian farms during 6 seasons over 18 months. These farms were located along Alex-Cairo and Al-Ismailia roads, and in Al-Dakahlia, Al-Gharbia, Al-Fayoum and Banisewif governorates. The results revealed that average pH and the alcohol stability of raw milk samples ranged from 6.69 to 6.78 and from 0.066 to 0.666 respectively. In the same samples, the protein and fat contents ranged from, 3.04 to 3.25% and 3.47 to 3.77%, respectively. It was concluded that the raw milk from the tested farms had acceptable physiochemical qualities for the production of UHT milk.

Hassan *et al.* (2009) carried a study to find out the physiochemical changes of 4 different UHT branded milk samples taken from local market. The samples were analyzed at an interval of one week to twelve weeks. During this period, samples were stored at room temperature (25°C) to provide them similar conditions, as they are stored in market. The results revealed that there was an increase in sedimentation value, fat separation and titratable acidity, while a decrease was found in pH and protein% during storage of 12 weeks It was concluded that the excessive protein denaturation and fat separation was observed during storage.

Nagla*et al.* (2009) conducted a study to on the physiochemical changes of ultra high treated milk samples during storage. Physiochemical analysis of UHT milk samples was done at 1, 10, 20 and 30 day intervals to find out the titratable acidity and pH. The results revealed that the titratable acidity was 0.15 ± 0.00 on 1st day of production and then increased to 0.19 ± 0.00 on 30th day, the significant increase in acidity ($p<0.01$) corresponded by significant lowering in pH from 6.69 ± 0.00 on 1st day to 6.64 ± 0.01 at 30th day. It was concluded that the titratable acidity of all samples tested, increased with time during storage period while pH gradually decreased towards the end.

Arafat *et al.* (2015) conducted the experiment to evaluate physiochemical quality of ultra-high temperature treated milk available in Gazipur and

Mymensingh of Bangladesh. A total of 27 UHT milk samples from three different brands-Pran Dairy (A), Aarong Dairy (B) and Farm Fresh (C) were collected from local markets.Physicochemical parameters like specific gravity, acidity, total solids, solids-not-fat, fat, protein, lactose, and ash were evaluated. The results revealed significant differences ($p<0.05$) in case of specific gravity, acidity, total solids, solids-not-fat, and protein content. On the other hand, insignificant differences were found ($p>0.05$) in case of fat, lactose, and ash content. Milk samples of Farm Fresh UHT milk were superior to other brands of UHT Milk in terms of contents of total solids (119.2 3± 0.57 g/kg), fat (34.97 ± 0.35 g/kg), lactose (43.23±0.51 g/kg), and ash (7.00 ± 0.26 g/kg). It was concluded that all the milk samples conformed to the standard values for UHT milk.

Shah *et al*. (2016) analysed shelf-life of pouch packed ultra high treated milk and its effect on physiochemical parameters. The analysis of raw milk subjected to ultra high treatment process revealed that there were no seasonal variations in any of the physicochemical parameters. The results revealed that during storage of ultra high treated pouch packed milk, significant changes were observed after 45 days for overall acceptability score, pH, protein content, lactose content at 37 ± 1°C. It was suggested that the Mallard browning was responsible for bringing pronounced changes in physicochemical parameters as well as decreasing the degree of overall acceptability of UHT milk.

Jamal *et al*. (2018)conducted a study to determine the physiochemical quality of pasteurized milk, ultra high treated milk samples collected from different locations in Dhaka, Bangladesh. Twenty pasteurized milk samples and fifteen UHT milk samples of different brands were collected and different batches were analyzed for enumerating physiochemical tests like alcohol test, acidity test, fat test, CLR test, SNF. The results revealed that acidity range for pasteurized milk samples was between 0.14-0.16, fat range was between 3.5-3.9% and SNF was between the ranges of 8-9.784%. For ultra high treated milk samples acidity range was between 0.13-0.16, fat range was between 3.5-3.8% and SNF was

between 8.034-9.012. It was concluded that the results of physiochemical tests for pasteurized and ultra high treated milk samples were found to be satisfactory.

2.5 Adulteration profile of ultra high treated milk

Swathi and Kauser (2015) carried a study on the adulteration of milk and milk products in 5 selected local vendors and food samples selected were milk, curd, buttermilk, butter and ghee. The results revealed that in most of milk samples the water content was more, but in few samples urea and starch was also observed. The milk samples collected also contained starch and detergent. The buttermilk & curd samples were found to be having not just excess water but also had added urea and detergent. The butter & ghee samples on other hand were loaded with all the four adulterants i.e. water, urea, starch and detergent. It was concluded that all the so collected milk and milk product samples had varied proportions of common adulterants which might be detrimental to human health, therefore a governing body should periodically check these products for presence of these harmful ingredients.

Deepika*et al. (*2015) conducted a study to find out the adulteration of milk samples in Visakhapatnam district, Andhra Pradesh. The adulteration assessment of milk was done by performing different tests like formalin test, boric acid test, vanaspati test, detergent test and ammonium sulphate test. The results revealed that the milk samples gave positive test for the adulterants and that the poor quality of milk was the major risk factor for the dreadful diseases.

Roy *et al.* (2017) conducted an experiment to find out the presence of adulterants in milk supplied to Delhi and its adjoining regions (Faridabad, Gurgaon and Noida). A comparative analysis was carried out for the extent of different adulterants present in both packaged and locally available milk samples. Seventy five milk samples were tested for the presence of neutralizers, skimmed milk powder, urea and detergent. The results revealed that most of the packed milk samples collected from Delhi and adjoining regions tested positive for neutralizers and skimmed milk powder, detergent and urea. Considerable number of

unpackaged milk samples showed presence of ammonium sulphate and detergents compared to packaged ones.

Nayak (2017) conducted a study on adulteration of natural milk with various illegal substances. A total of 20 samples were collected from different localities in Delhi for their qualitative analysis. The results revealed that only 10% of the samples were found to be adulterated by starch and sulphate, however other adulterants were found to be absent. It was concluded that the milk served in Delhi was approximately hygienic on the parameters analysed for the detection of adulterants as only two samples out of twenty were found to be adulterated.

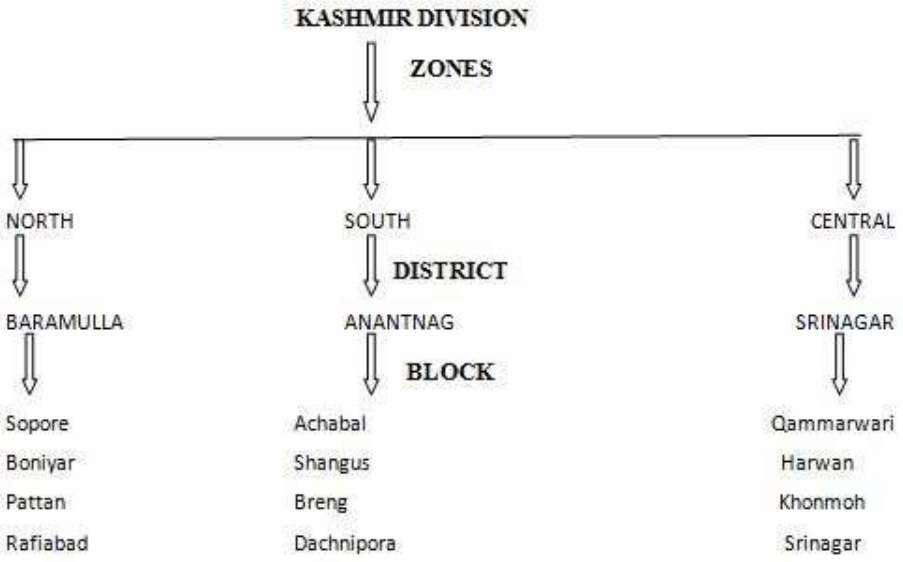
Chapter - 3

MATERIALS AND METHODS

3.1 Sampling plan

To find out the utilization status of ultra high treated milk in Kashmir division, a survey of various households and commercials was conducted. A purposive sampling plan was followed in which, the valley was divided into three zones: North, South and Central. Further from each zone one district was selected randomly and from each district four blocks were selected (randomly).

- A total of 240 respondents were selected from various households, and were asked to answer a questionnaire given in Appendix I.
- A total of 120 respondents in the relevant market supply chain including (wholesalers, retailers and tea stallers) were also requested to respond to the questions devised for them and is given in Appendix II.



3.2 Collection of Samples

To investigate the quality of ultra high treated milk in Kashmir division, samples were collected from each zone, based on the above sampling plan. A minimum of ten samples of UHT from both Double toned and Toned were collected from the market areas of each zone and evaluated for various quality characteristics.

3.3 Analysis of Samples

The Ultra high treated milk samples were analysed for the quality parameters given below.

3.3.1 Sensory Evaluation

The sensory evaluation of various UHT milk samples was carried out by trained and semi-trained experienced panel consisting of scientists of LPT division and PG students of F.V.Sc. & A.H, SKUAST-K. The panellists evaluated the samples of UHT milk for various sensory attributes viz., flavour, package, sediment and temperature according to the score sheet presented in Appendix III. (BIS,1980)

3.3.2 Microbiological analysis

The ultra high treated milk samples, on the very day of procurement were collected in original containers and transported as such to the laboratory of Divison of LPT, F.V.Sc. and A.H., SKUAST-K, and were subjected to microbiological analysis for Standard Plate Count and Coliform Count as per the method described by APHA (1993).

3.3.2.1 Sample preparation and serial dilution

10g of ultra high treated sample was aseptically weighed and transferred to pre-sterilized conical flask. A 90 ml volume of sterile 0.9 per cent peptone

water was added to it getting 10^{-1} dilution. For obtaining 10^{-2} dilution, 1 ml of this diluted solution was transferred to another tube containing 9 ml of sterile 0.9 per cent peptone water. This procedure was repeated to obtain 10^{-3} dilution and so on. All the procedures were performed in the sterilized environmental conditions of laminar air flow (NSW-201 Horizontal Laminar Flow cabinet).

3.3.2.2 Total Plate Count

For determination of TPC, plate count agar (Hi-Media Laboratories) was used. About 23.5 g of it was dissolved in 1000ml of distilled water followed by sterilization in an autoclave at 15 lb pressure (121^0C) for 15 minutes. With the help of sterile pipette about 1ml of inoculum from 10^{-1}, 10^{-2} and 10^{-3} dilution was taken and inoculated into a double set of pre-sterilised petridish. Then the inoculum and media in petridish were mixed thoroughly and uniformly by rotating the plates alternatively in clockwise and anticlockwise directions followed by back and forth motion on level surface. When media in plates solidified, they were inverted and incubated aerobically at 32 ± 1^0C for 48 ± 3 hours. The number of micro-organisms per ml/g of sample was calculated by selecting plates containing 25 to 250 cfu/ml or g or selecting plates with count closest to this range. The cfu/ml was calculated by using the formula:

$$\mathbf{N = \sum C/[(1\times n_1) + (0.1\times n_2)]d}$$

Where,

N = number of colonies per millilitre or gram of product

$\sum$C = sum of all colonies on all plates counted

n_1 = no of plates in lower dilution counted

n_2 = no of plates in next higher dilution counted

d = dilution from which the first counts were obtained

Finally, the cfu/ml was expressed as $\log_{10}$cfu/ml of sample

3.3.2.3 Coliform count

41.53 grams of Violet Red Bile Agar procured from Himedia laboratories Pvt. Ltd. Mumbai was dissolved in 1000 ml of distilled water followed by sterilizing in an autoclave at 15 lb pressure (121^{o}C) for 15 minutes. The 1ml inoculum from 10^{-1}, 10^{-2} and 10^{-3} dilution was inoculated into already sterilized double set of Petri dishes. About 15-20 ml of sterilized media maintained at about 45 ± 1^{o}C was poured in Petri dishes. Sample dilution and media was mixed thoroughly and uniformly by alternate rotation and back and forth motion of plate on level surface. The plates were incubated at 37°C for 24-48 hours. Colonies were counted from the plates. The cfu/g was calculated as per above formula and expressed as log cfu/ml of sample

3.3.3 Physico-Chemical Characteristics

3.3.3.1 pH

The pH of ultra high treated milk samples was recorded by directly dipping the combined electrode of digital pH meter (Tanco Lab. Equipments) after proper calibration and temperature adjustments of the instrument, into the samples. Two readings were taken for each sample and average pH recorded. (AOAC, 2000)

3.3.3.2 Fat

Fat estimation was done by Gerbers method. 10 ml of sulphuric acid (density between 1.807 to 1.812 g/ml at 27°C) was measured into a butyrometer tube, by use of an automatic dispenser, without wetting the neck of the tube. UHT milk sample were mixed gently and thoroughly and filled into the milk pipette above graduation line. The milk into the butyrometer tube was run along the side wall without wetting the neck and the pipette's tip was resting against the base of the neck of the butyrometer tube. 1ml of Amyl alcohol (density between 0.808 to 0.818 g/ml at 27°C) was added, butyrometer was closed with a lock stopper, shaken until homogenous, inverting it for complete admixture of the acid. It was

kept in a water bath for 5 min, at 65 ± 2^0C taking care to have casein particles if any to dissolve fully, and centrifuged for 4 min at 1100 rpm. The tubes were put in centrifuge, so as to conform to radial symmetry, and as evenly spaced as possible, in order to protect bearings of the centrifuge. The centrifuge was allowed to come to rest. The butyrometer tubes were removed and placed in water bath for 5 min at 65 ± 2^0C. The percentage of fat was read after adjusting the height in the tube as necessary by movements of the lock stopper with the key. Scale reading corresponding to the lowest point of the fat meniscus were noted and the surface of separation of the fat and acid. When readings were being taken, the butyrometer was held with the graduated portion vertical, the point being read was kept in level with the eye, and then the butyrometer was read to the nearest half of smallest scale division. (FSSAI, 2012)

3.3.3.3 Titratable Acidity

A 10 ml quantity of thoroughly mixed UHT milk sample was taken in a conical flask with the help of dry pipette. To this few drops of phenopthalein indicator was added.Then the milk was carefully titrated against 0.1N sodium hydroxide till faint pink colour appeared and remained persistent for one minute (FSSAI, 2012). The volume of 0.1N sodium hydroxide utilized was recorded and titratable acidity (expressed as percentage of lactic acid) was calculated as per formula:

% Titratable acidity (% lactic acid) = 0.09 X V

Where, V = Volume of 0.1 N NaOH

0.09 =Naoh equivalent

3.3.3.4 Specific gravity

For determination of specific gravity of UHT milk samples, Zeal type lactometer was used. After recording the temperature of the sample correctly lactometer reading was recorded. The corrected lactometer reading was calculated to arrive at the correct specific gravity. (FSSAI, 2015)

3.3.3.5 Electrical conductivity

Electrical conductivity of samples was taken by dipping the electrode of Electrical digital conductivity meter (TANCO, India Lab. Equipments) into UHT samples after proper calibration of instrument. Two readings were taken for each sample and average electrical conductivity was calculated. (AOAC, 2000)

3.3.4 Detection of Adulteration

3.3.3.4.1 Detergent

1 ml of suspected UHT milk sample was pipetted into a 15 ml test tube.1 ml of Methylene blue dye solution was added, followed by addition of 2 ml chloroform. The contents were vortexed for about 15 sec and centrifuged at about 1100 rpm for 3 min. The intensity of blue colour was noted in lower and upper layer. Relatively, more intense blue colour in lower layer indicated presence of detergent in UHT milk. More intense blue colour in upper layer indicated the absence of detergent in UHT milk. (FSSAI, 2015)

3.3.3.4.2 Urea

This method was based on the principle that urea formed a yellow complex with p-Dimethyl Amino Benzaldehyde (DMAB) in a low acidic solution at room temperature. 1 ml of UHT milk sample was mixed with 1 ml of 1.6% DMAB reagent. Distinct yellow colour was observed in UHT milk containing added urea. The control (normal milk) showed a slight yellow colour due to presence of natural urea. (FSSAI, 2015)

3.3.3.4.3 Hydrogen Peroxide

About 2 ml of UHT milk sample was added in a test tube. Two drops of 2 % of para-phenylenediamine reagent were added and mixed well. The colour of the solution in the tube was observed .Blue colour was developed in presence of H_2O_2, whereas pure sample remained white in colour. (FSSAI, 2015)

3.3.3.4.4 Formalin

2ml of UHT milk sample was taken in a test tube and 2 ml of 90 percent of sulphuric acid was added containing traces of ferric chloride from the side of the test tube slowly. Formation of purple ring at the junction indicated formaldehyde was present in UHT milk sample. (FSSAI, 2015)

3.3.3.4.5 Neutralizers

2ml UHT milk sample was taken in a test tube and 2 ml alchohalicrosalic acid solution was added. The contents were mixed well. If alkali was present in UHT milk, a rose red colour appeared whereas pure milk showed only a brownish colour. (FSSAI, 2015)

3.3.3.4.6 Starch

About 5 ml of UHT milk sample was taken in a test tube. It was brought to boiling condition and allowed to cool at room temperature. 1-2 drops of iodine solution was added to the test tube. Development of blue colour indicated presence of starch which disappeared when sample is boiled and reappears on cooling. (FSSAI, 2015)

3.3.5 Statistical Analysis

The data from experiments samples were arranged and the results so generated were analysed statistically following the method of Snedecor and Cochran (1980) and Gomez and Gomez (1984). The data was processed in a computer using SPSS version 20 software package using one way ANOVA. The analysis of variance of group means was computed and significance of means tested by using least significant difference test at 5 per cent level of significance.

Chapter-4

EXPERIMENTAL FINDINGS

Quality of milk reaching to consumers is often unsatisfactory both from hygienic and nutritional point of view because of improper handling, insanitary conditions of production, exposure to temperature, adulteration with water and other substances. The problem of adulteration and the supply of substandard quality of food articles available in the market have reached at an alarming level, resulting in frequent health hazards amongst the consumers. In order to assess the quality and utilization status of UHT milk available for sale in Kashmir the current study plan was devised. For this purpose a survey of various households and commercial outlets was conducted. A purposive sampling plan was followed in which, the valley was divided into three zones: North, South, and Central. Further, from each zone one district was purposively selected and from each district four blocks were randomly selected. A total of 240 respondents from households and 120 respondents from the relevant market supply chain were requested to respond to the questionnaire devised for the purpose and the data obtained there from is presented below:

4.1 Household survey data

The data obtained from various Households is given below:

4.1.1 Personal profile of respondents

The personal profile of respondents includes Age, Gender, Family type and Family size and their respective details are given as under:

4.1.1.1 Age

Table-1 reveals that majority of the respondents (71.66%) belonged to young age group of 21- 40 years , followed by middle 41- 60 years and old 61- 80 years respectively.

4.1.1.2 Gender

Table -1 reveals that majority of the respondents in the study were males (52.08%).

4.1.1.3 Family type

Table-1 shows that majority of the respondents were living in nuclear families (79.58%) and comparatively less in joint families.

4.1.1.4 Family size

Table- 1 reveals that majority of the respondents belonged to small size group of 1-5 members (66.25%) followed by medium size group of 6-10 members and large size group of 11-15 members respectively.

4.1.2 Preference for consumption / Non consumption of UHT milk.

It was clear from the table-2 that while comparing the three zones in terms of consumption and non-consumption of UHT milk, it was found that most of the UHT milk was consumed by central zone (98.75%), followed by south (76.25%) and then north (83.75%) with an overall mean of 86.25%.

In terms of non-consumption of UHT milk, it was studied that highest non-consumption was found in south zone (23.75%), followed by north zone (16.25%) and least non -consumption was found in central zone (1.25%) with an overall average of 13.75%.

4.1.3 Reason for consumption or non consumption of UHT milk.

With respect to reasons for consumption of UHT milk as mentioned in table- 3, it was found that no boiling required reason was maximally given by north zone (77.50%), followed by south (63.75%) and then central (52.50%) with an overall mean of 64.58%. Long shelf life reason for the consumption of UHT milk was given in highest number by central (23.75%), followed by south (10.00%), and then north zone (3.75%) with an average value of 12.50%. The reason of hygienic and free from microbes for the consumption of UHT milk

Table 01: Distribution of respondents with respect to theirpersonal profile.

PROFILE	ZONES		OVERALL	
AGE (yrs)	**Central**	**South**	**North**	
Young (21-40)	49 (61.25)	67 (83.75)	56 (70.00)	172 (71.66)
Middle (41-60)	26 (32.5)	10 (12.50)	20 (25.00)	56 (23.33)
Old (61-80)	5 (6.25)	3 (3.75)	4 (5.00)	12 (5.00)
Grand total	**80**	**80**	**80**	**240**
GENDER				
Male	42 (52.50)	43 (53.75)	40 (50.00)	125 (52.08)
Female	38 (47.5)	37 (46.25)	40 (50.00)	115 (47.92)
Grand total	**80**	**80**	**80**	**240**
TYPE OF FAMILY				
Nuclear	66 (82.50)	55 (68.75)	70 (87.50)	191 (79.58)
Joint	14 (17.50))	25 (31.25)	10 (12.50)	49 (20.41)
Grand total	**80**	**80**	**80**	**240**
FAMILY SIZE				
Small (1-5)	58 (72.50)	35 (43.75)	66 (82.50)	159 (66.25)
Medium (6-10)	20 (25.00)	37 (46.25)	13 (16.25)	70 (29.16)
Large (11-15)	2 (2.50)	8 (10.00)	1 (1.25)	11 (4.59)
Grand total	**80**	**80**	**80**	**240**

Figures in parenthesis represent the percent of total respondents in the zone

Table 02: Distribution of respondents in terms of their preference of consumption / non- consumption of UHT milk.

Consumption/non-consumption	ZONES			OVERALL
	Central	South	North	
Non -consumption	1(1.25)	19 (23.75)	13 (16.25)	33 (13.75)
Consumption	79(98.75)	61 (76.25)	67 (83.75)	207 (86.25)
Grand total	80	80	80	240

Figures in parenthesis represent the percent of total respondents in the zone

Table 03:Distribution of respondents with respect to the reasons for consumption or non consumption of UHT milk.

Reasons	ZONES			OVERALL
	Central	South	North	
No boiling req.	42 (52.50)	51(63.75)	62 (77.50)	155 (64.58)
Long shelf life	19 (23.75)	8 (10.00)	3 (3.75)	30 (12.50)
Hygenic and free from microbes	16 (20.00)	1(1.25)	1 (1.25)	18 (7.50)
Good quality	2 (2.50)	1(1.25)	1(1.25)	4 (1.66)
Non consumption as unaware of UHT milk	1(1.25)	19 (23.75)	13(16.25)	33 (13.75)
Grand Total	80	80	80	240

Figures in parenthesis represent the percent of total respondents in the zone

among three zones was in highest number given by central (20.00%) followed by south and north (1.25%) with an overall mean value of 7.50%. The reason for consuming UHT milk because of its good quality was given maximally by central (2.50%) followed by north and south (1.25%) with an overall mean of 1.66%.

With respect to non-consumption of UHT milk, the reason of being unaware of UHT milk was given in highest number by south (23.75%), followed by north (16.25%) and then central (1.25%) with an overall mean of 13.75%.

4.1.4 Quantity of Ultra high treated milk consumed per month

Three zones i.e, central, south and north were compared amongst themselves in terms of the quantity of consumption pattern of UHT milk per month as given in table- 4. It was found that maximum consumption of upto 10 liters of UHT milk was seen in central zone (53.17%), followed by north (37.31%), and then south (24.59%) with an overall consumption of 39.61%. It was found that 36.06% of south zone consumed maximum of11- 20 liters of UHT milk, followed by central (35.44%) and then north (20.89%) with an overall consumption of 30.91%.

Further, 21-30 litres of UHT milk was largely consumed by south zone (32.78%), followed by north (13.43%) and then central (10.12%) with an overall consumption of 17.87%. It was found that maximum consumption of 31-40 litres was found in north zone (28.37%), followed by south (6.57%) and then central (1.28%) with an overall consumption of 11.59%.

4.1.5 Major utilization of Ultra high treated milk

The central, south and north zones were compared amongst themselves with respect to the utilization pattern of Ultra high treated milk as given in table-5. It was found that the highest utilization of UHT milk as liquid milk was seen in north zone (44.77 %), followed by south (36.08%) and then central (27.85%) with an overall consumption of 35.76%

It was found that (62.29)% of south zone utilized the UHT milk as beverage, followed by central (59.49%) and then north zone (53.73%) with an overall consumption of 58.45%. 12.65% of central zone utilized the UHT milk for product preparation followed by south zone (1.63 %) and then north zone (1.49%) with an overall consumption of 5.79%.

Table 04: Distribution of respondents with respect to the quantity of UHT milk consumed per month.

Quantity (litres)	ZONES			OVERALL
	Central	**South**	**North**	
Upto 10	42 (53.16)	15 (24.59)	25 (37.31)	82 (39.61)
11-20	28 (35.44)	22 (36.06)	14 (20.89)	64 (30.91)
21-30	8 (10.12)	20 (32.78)	9 (13.43)	37 (17.87)
31-40	1 (1.28)	4 (6.57)	19 (28.37)	24 (11.59)
Grand total	**79**	**61**	**67**	**207**

Figures in parenthesis represent the percent of total respondents in the zone

Table 05: Distribution of respondents in terms major of utilization of UHT milk.

Utilization	ZONES			OVERALL
	Central	**South**	**North**	
Liquid milk	22 (27.85)	22 (36.08)	30 (44.77)	74 (35.76)
Beverage	47 (59.49)	38 (62.29)	36 (53.73)	121 (58.45)
Product preparation	10 (12.65)	1 (1.63)	1 (1.49)	12 (5.79)
Grand Total	**79**	**61**	**67**	**207**

Figures in parenthesis represent the percent of total respondents in the zone

4.1.6 Seasonal and other influences on purchase of UHT milk

Central, south and north zones were compared within themselves to find out the influence of season or others on consumption pattern of UHT milk, as given in table- 6. It was found that south zone consumed highest UHT milk during marriages (57.37%), followed by north (55.22%) and then central (51.89%) with an overall consumption of 54.58%

It was found that 37.70% of south zone consumed highest UHT milk in winter, followed by north (37.31%) and then central (34.17%) with an overall

Table 06:Distribution of respondents in terms of seasonal and other influences on purchase of UHT milk.

Seasonal influence	ZONES			OVERALL
	Central	**South**	**North**	
Marriages	41 (51.89)	35 (57.37)	37 (55.22)	113 (54.58)
Winter	27 (34.17)	23 (37.70)	25 (37.31)	75 (36.23)
Summer	11(13.94)	3 (4.92)	5 (7.47)	19 (9.19)
Grand Total	**79**	**61**	**67**	**207**

consumption of 36.23%. 13.94% of central zone consumed highest UHT milk in summer followed by north (7.47%) and then south (4.92%) with an overall consumption of 9.19%.

4.1.7 Preference for particular classof UHT milk

Three zones i.e., central, south and north were compared in terms of preference for a particular class of UHT milk as given in table -7. It was concluded that that maximum consumption of toned UHT milk was seen in central zone (79.74%), followed by south (65.57%) and then north (56.72%) with an overall consumption of 58.75%.

Table 07:Distribution of respondents with respect to preference for a particular class of UHT milk.

Class	ZONES			OVERALL
	Central	**South**	**North**	
Toned	63 (79.74)	40 (65.57)	38 (56.72)	141 (68.12)
Double Toned	16 (20.26)	21 (34.43)	29 (43.28)	66 (31.88)
Grand Total	**79**	**61**	**67**	**207**

Figures in parenthesis represent the percent of total respondents in the zone

Further, in case of double toned UHT milk, it was found that north zone (43.28%) largely consumed double toned milk, followed by south zone (34.43%), and then central (20.26%) with an overall consumption of 31.88%.

4.1.8 Preference for a particular brand of UHT milk

While comparing the three zones with respect to Preference for a particular brand of UHT milk , it was found from the table-8 that Amul brand was consumed in highest number by north (98.51%), followed by south (98.36%) and then central (73.42%). with an overall consumption of 88.88%.

It was found that, the Go milk brand of UHT milk was consumed in highest number by central zone (26.58%), followed by south (1.64%) and then north (1.49%), with an overall consumption of 11.12%.

4.2 Market survey data

The data obtained from various market supply chains are given below:

4.2.1 Business establishment type

Table-9 reveals that the total percentage of wholesalers was 12.50%, that of retailers was 62.50% and tea stallers was 25.00%.

4.2.2 Personal profile of respondents

In the market survey data, the personal profile of respondents included Age and Gender and its details are given below.

4.2.2.1 Age

Table-10 reveals that majority of the respondents belonged to middle age group of 39-58 years (59.17%) followed by young 19-38 years and old 59-78 years respectively.

Table 08: Distribution of respondents in terms of preference for a particular brand of UHT milk.

Preference	ZONES			OVERALL
	Central	South	North	
Amul	58 (73.42)	60 (98.36)	66 (98.51)	184 (88.88)
Go milk	21 (26.58)	1 (1.64)	1 (1.49)	23 (11.12)
Grand Total	**79**	**61**	**67**	**207**

Figures in parenthesis represent the percent of total respondents in the zone

Table 09: Distribution of respondents with respect to their business establishment type.

Business establishment type	ZONES			OVERALL
	Central	South	North	Overall
Wholesaler	5(12.50)	5(12.50)	5(12.50)	15(12.50)
Retailer	25(62.50)	25(62.50)	25(62.50)	75(62.50)
Tea staller	10(25.00)	10(25.00)	10(25.00)	30(25.00)
Grand total	**40**	**40**	**40**	**120**

Figures in parenthesis represent the percent of total respondents in the zone

Table 10:Distribution of respondents with respect to their personal profile.

PROFILE	ZONES			OVERALL
	Central	South	North	
Age (yrs)				
Young(19-38)	6 (15.00)	20(50.00)	14(35.00)	40(33.33)
Middle(39-58)	31(77.50)	18(45.00)	22(55.00)	71(59.17)
Old(59-78)	3(7.50)	2(5.00)	4(10.00)	9(7.50)
Grand total	**40**	**40**	**40**	**120**
Gender				
Male	40(100.00)	40(100.00)	40(100.00)	120(100.00)
Female	0(0.00)	0(0.00)	0(0.00)	0(0.00)
Grand Total	**40**	**40**	**40**	**120**

Figures in parenthesis represent the percent of total respondents in the zone

4.2.2.2 Gender

Table-10 reveals that all the respondents in the study were males (100%).

4.2.3 Preference of commercial establishments in terms of packaging form of UHT milk

As seen from the table-11 while comparing the three zones it was found that Tetra packs as a packaging material were used in highest number by north (77.50%) , followed by central and least used by south. The overall mean was found to be 62.50%. Polypouches, as a packaging material were found to be used maximally by south (47.50%), followed by central and least used by north zone. The overall mean was 30.00%.

The results indicate that large wholesale packs were maximally used by central zone (10.00%), followed by south and least used by north with an overall mean of 7.50%.

Table 11:Distribution of respondents with respect to the packaging form of UHT milk preferred by commercials.

Packaging	ZONES			OVERALL
	Central	South	North	Overall
Tetra packs	26(65.00)	18(45.00)	31(77.50)	75(62.50)
Polypouches	10(25.00)	19(47.50)	7(17.50)	36(30.00)
Large wholesale packs	4(10.00)	3(7.50)	2(5.00)	9(7.50)
Grand total	40	40	40	120

Figures in parenthesis represent the percentof total respondents in the zone

4.2.4 Brand preference of commercial establishments while purchasing UHT milk

Table -12 reveals that, Amul brand was used in highest number by south (87.50%), followed by north and then central zone with an average of 75.00%. It was found that Go milk brand of UHT milk was in highest number used by north zone (22.50%) followed by central and then south with an overall mean of 17.50%.

Further, it was seen that Insta day brand of UHT milk was in highest number used by central zone (17.50%) followed by south and north with an overall mean of 2.50%.

Table 12: Distribution of respondents in terms of brand preference of consumers as perceived by commercials.

Company preferred	ZONES			OVERALL
	Central	South	North	
Amul	25(62.50)	35(87.50)	30(75.00)	90(75.00)
Go milk	8(20.00)	4(10.00)	9(22.50)	21(17.50)
Insta day	7 (17.50)	1(2.50)	1(2.50)	9 (7.50)
Grand total	40	40	40	120

Figures in parenthesis represent the percent of total respondents in the zone

4.2.5Class preference of consumers as perceived by commercial establishments

As seen from the table -13 while comparing the three zones it was found that double toned UHT milk was maximally consumed by central (45.00%) followed by south(32.50%) and then north (30.00%). The overall mean was 35.83%.

In case of toned UHT milk, it was found that north zone consumed it maximally (70.00%) followed by south zone and then central zone with an overall average value of 64.17%.

4.2.6 Quantity of UHT milk handled per month

As seen from the table-14 it was found that the majority of the wholesalers 9.18% handled 10000-15000 litres of UHT milk per month, the majority 31.66% of retailers handled 100-150 litres of UHT milk whereas majority of the tea stallers handled 5-10 litres of UHT milk per month.

4.2.7 Seasonal influence and others

It was found from the table-15, the influence of marriages on purchase of UHT milk was highest in north (80.00%), followed by central zone (72.50%) and then south (62.50%).The overall mean was found to be 71.66%.With regard to influence of summer on purchase of UHT milk, north zone and south zone was found to have highest influence (5.00%) followed by central zone (2.50%) with an overall average value of 4.16%.

In terms of influence of winter on the purchase of UHT milk, south zone was found to have maximum influence (32.50%) followed by central (25.00%) and then north (15.00%). The overall mean was found to be 24.18%.

Further, the information regarding quality of UHT milk sold in Kashmir division is not available and needs to be assessed. Hence, the quality assessment in terms of sensorial, Physico-chemical, microbiological

Table 13:Distribution of respondents in terms class preference of consumers as perceived by commercials .

Class preference of consumers	ZONES			OVERALL
	Central	**South**	**North**	
Double Tonned	18(45.00)	13(32.50)	12(30.00)	43(35.83)
Tonned	22(55.00)	27(67.50)	28(70.00)	77(64.17)
Grand total	**40**	**40**	**40**	**120**

Figures in parenthesis represent the percentof total respondents in the zone

Table 14:Distribution of respondents in terms quantity of UHT milk handled by commercials per month.

Quantity (litres)	ZONES			OVERALL
	CENTRAL	**SOUTH**	**NORTH**	
Whole seller				
10000-15000	3 (7.50)	4 (10.00)	4 (10.00)	11 (9.18)
15000-20000	3 (7.50)	2 (5.00)	3 (7.50)	8 (6.67)
Retailer				
100-150	13 (32.50)	16 (40.00)	9 (22.50)	38 (31.66)
150-200	7 (17.50)	6 (15.00)	14 (35.00)	27 (22.49)
Tea stallers				
5-10	6 (15.00)	6 (15.00)	8 (20.00)	20 (16.66)
10-15	8 (20.00)	6 (15.00)	2 (5.00)	18 (15.85)
Grand total	**40**	**40**	**40**	**120**

Figures in parenthesis represent the percent of total respondents in the zone

Table 15: Seasonal and other influences on purchase of UHT milk by consumers as perceived by commercials.

Seasonal Influence,if any	ZONES			OVERALL
	Central	South	North	
Summer	1(2.50)	2(5.00)	2(5.00)	5(4.16)
Winter	10(25.00)	13(32.50)	6(15.00)	29(24.18)
Marriages	29(72.50)	25(62.50)	32(80.00)	86(71.66)
Grand total	**40**	**40**	**40**	**120**

Figures in parenthesis represent the percent of total respondents in the zone

characteristics and detection of some adulterants in Ultra high treated milk sold in Kashmir division was carried out. For this purpose, a similar sampling plan was followed, in which twenty samples were taken from each zone containing ten samples of toned and ten of double toned milk. Data related for these quality parameters are also presented below.

4.3 Sensory characteristics:

4.3.1 Sensory Characteristics of Double Toned Ultra high treated milk

The data pertaining to various sensory characteristics of double toned ultra high treated milk is presented in table-16. Analysis of variance revealed that there was no significant difference ($p \geq 0.05$) amongst various zones studied as far as the package and temperature are concerned. Further the, attributes like package and temperature were awarded full score more or less uniformly. Since UHT milk is usually stable at room temperature or under ambient conditions, therefore, the measurement of the temperature holds no significance in this case. However, it was considered to be for reference. In case of sediment no significant difference ($p \geq 0.05$) was noted among the three zones. It would be apparent from the data presented in table that there elicited significant variation in flavour scores of UHT milk as revealed by ANOVA, in that the south zone differed significantly ($p \leq$

0.05) from north and central ones under study, having significantly lower scores the latter however did not differ significantly($p \geq 0.05$) within themselves.

Table16: Sensory characteristics of Ultra high treated milk (Double Toned) collected from various zones of Kashmir division.

Parameters	ZONES			Overall mean
	Central	South	North	
Flavour	9.65±0.047[b]	9.31± 0.045[a]	9.61±0.051[b]	9.52±0.029
Sediment	3.00±0.001[a]	2.8±0.001[a]	3.00±0.001[a]	2.9±0.001
Package	5.00±0.00[a]	5.00±0.00[a]	5.00±0.00[a]	5.00±0.00
Temperature	2.00±0.00[a]	2.00±0.00[a]	2.00±0.00[a]	2.00±0.00

Means ± SE, row wise with different superscripts, differ significantly ($p \leq 0.05$)

4.3.2 Sensory Characteristics of Toned Ultra high treated milk

The data pertaining to various sensory characteristics of Toned ultra high treated milk is presented in table-17. Analysis of variance revealed that there was no significant difference ($p \geq 0.05$) amongst various zones studied as far the package and temperature are concerned. Further the package and temperature were awarded full score. In case of sediment no significant difference ($p \geq 0.05$) was seen between the three zones. It would be apparent from the data presented in table that there elicited significant variation in flavour scores of UHT milk as revealed by ANOVA. It was found that all the three zones under study differed significantly ($p \leq 0.05$) within themselves in that the zone central exhibited significantly highest scores of 9.60 ($p \leq 0.05$) out of 10 followed by North which had a score of 9.45 and South with 9.28.

Table17: Sensory characteristics of Ultra high treated milk (Toned) collected from various zones of Kashmir division.

Parameters	ZONES			Overall mean
	Central	South	North	
Flavour	9.60± 0.047[a]	9.28±0.045[b]	9.45±0.050[c]	9.4± 0.028
Sediment	2.8±0.004[a]	3.00±0.001[a]	2.9±0.046[a]	2.9 ±0.046
Package	5.00±0.00[a]	5.00±0.00[a]	5.00±0.00[a]	5.00±0.00
Temperature	2.00±0.00[a]	2.00±0.00[a]	2.00±0.00[a]	2.00±0.00

Means ± SE, row wise with different superscripts, differ significantly ($p \leq 0.05$)

4.4 Microbial analysis:

4.4.1 Microbiological analysis of Double toned Ultra high treated milk

Total plate count and coliform count of all the experimental UHT milk samples in this study was found to be nil.

4.4.2 Microbiological analysis of Toned Ultra high treated milk

The Total plate and Coliform counts of all the UHT milk samples were found to be nil except a very few samples of toned UHT milk in south zone, where some colonies were found in case of Total plate count but these were found to be inconsequential and of no significance.

4.5 Physico-chemical characteristics

4.5.1 Physico-chemical characteristics of Double Toned Ultra high treated milk

The data pertinent to the Physico-chemical characteristics of double toned Ultra high treated milk from various zones of Kashmir division is presented in table-18.

Table 18: Physico-chemical characteristics of Ultra high treated milk (Double Toned) collected from various zones of Kashmir division.

Parameters	ZONES			Overall mean
	Central	South	North	
Fat (%)	1.49±0.001[a]	1.48±0.002[a]	1.49±0.001[a]	1.49±0.001
pH	6.49±0.160[a]	6.58±0.367[a]	6.58±0.093[a]	6.55±0.144
Specific gravity	1.027±0.05[a]	1.028 ± 0.04[a]	1.028 ± 0.05[a]	1.027 ±0.016
Titratable acidity(%)	0.17±0.008[a]	0.17±0.005[a]	0.16±0.005[b]	0.17±0.007
Electrical conductivity (Siemens/cm)	0.004±0.003[a]	0.004±0.001[a]	0.005±0.001[a]	0.004±0.003

Means ± SE, row wise with different superscripts, differ significantly ($p \leq 0.05$)

The Fat percentage of samples from central, south and north zones were found to be of the order of 1.49%, 1.48% and 1.49% respectively with an overall mean of 1.49%. There was no significant difference ($p \geq 0.05$) between the zones in terms of fat percentage as revealed by ANOVA. The pH values of the samples from central, south and north zones were found to be 6.49, 6.58, and 6.58 respectively with an overall mean of 6.55. It was found that all the zones under study had no significant difference amongst themselves ($p \geq 0.05$).

The Specific gravity of the UHT test samples from various zones did not display any significant variation ($p \geq 0.05$), as revealed by analysis of variance. Specific gravity of central, south and north zones were 1.027, 1.026, and 1.026 respectively with an overall mean value of 1.026.The Titratable acidity of the samples from central zone was 0.17%, south: 0.17% and north: 0.16% with an overall mean of 0.17%. As revealed by the analysis of variance, north zone differed significantly ($p \leq 0.05$) from the other two zones in that it possessed

significantly ($p \leq 0.05$) lower scores, the latter however, did not differ among themselves.

Electrical conductivity as revealed by ANOVA did not vary significantly ($p \geq 0.05$) from zone to zone. Electrical conductivity of the samples from central, south and north zones were of the order of 0.004, 0.004, 0.005 Siemens/cm respectively with an overall average of 0.004 Siemens/cm.

4.5.2 Physico-chemical characteristics of Toned Ultra high treated milk

The data pertinent to the Physico-chemical characteristics of Toned Ultra high treated milk from various zones of Kashmir division is presented in table -19.

Table 19: Physico-chemical characteristics of Ultra high treated milk (Toned) collected from various zones of Kashmir division.

Parameters	ZONES			Overall mean
	Central	South	North	
Fat (%)	3.00±0.001[a]	2.98±0.009[a]	2.96±0.014[a]	2.98±0.006
pH	6.49±0.160[a]	6.57±0.362[a]	6.56±0.009[a]	6.54±0.144
Specific gravity	1.027±0.05[a]	1.026 ± .003[a]	1.026 ±0.004[a]	1.026 ±0.016
Titratable acidity(%)	0.16±0.004[a]	0.17±0.001[b]	0.17±0.001[b]	0.17±0.001
Electrical conductivity (Siemens/cm)	0.005±0.001[a]	0.004±0.001[a]	0.004±0.001[a]	0.0049±0.001

Means ± SE, row wise with different superscripts, differ significantly ($p \leq 0.05$)

The Fat percentage of the samples from central, south and north zones were found to be 3.00%, 2.98% and 2.96% respectively with an overall mean of 2.98%. There was no significant variation ($p \geq 0.05$) noticed between the zones in terms of fat percentage as revealed by ANOVA. The pH values of the samples

from central, south and north zones were found to be 6.49, 6.57, and 6.56 respectively with an overall mean of 6.54. It was found that all the zones under study had no significant difference ($p \geq 0.05$) amongst themselves with respect to pH values.

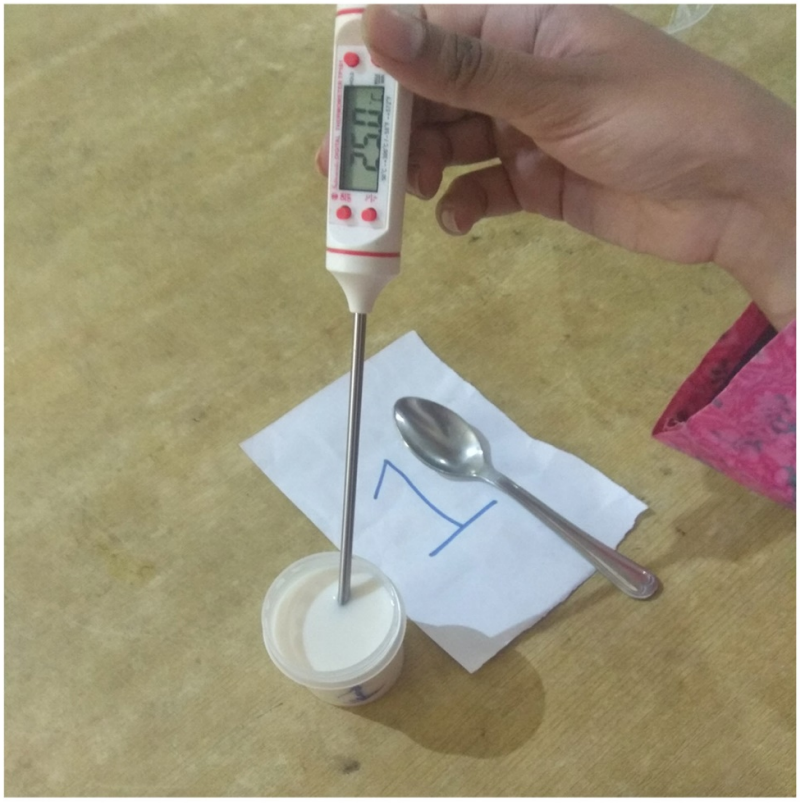
The Specific gravity of various samples under study did not display any significant variation ($p \geq 0.05$) amongst the zones, as revealed by analysis of variance in that the Specific gravity values of samples from central, south and north zones were 1.027, 1.028, and 1.028 respectively with an overall mean value of 1.027. The Titratable acidity values of the samples from various zones was: central 0.16%, south: 0.17% and north: 0.17% with an overall mean of 0.17%. As revealed by the analysis of variance, central zone exhibited significantly ($p \leq 0.05$) lower values compared to the other two zones under test, the latter, however, were noticed to be comparable ($p \geq 0.05$).

The Electrical conductivity of the test samples, as revealed by ANOVA did not vary significantly ($p \geq 0.05$) from zone to zone. The values of samples from central, south and north zones were 0.005, 0.004, 0.004 Siemens/cm respectively with an overall average of 0.0049 Siemens/cm.

4.6 Adulteration Profile of Ultra high treated milk

Samples of Ultra high treated milk (toned and double toned) were collected from the central, south and north zones and were tested for the presence or absence of adulteration. The samples were tested for various commonly encountered adulterants and preservatives viz., detergent, urea, hydrogen peroxide, formalin, neutralizers and starch. The results obtained in the current study were, however consistently suggestive of none of the samples under test of Ultra high treated milk being adulterated with any of the adulterants or preservatives mentioned above.

Microbiological analyses of uht milk samples



Sensory evaluation of uht milk

Adulteration analyses of unit milk

Chapter-5

DISCUSSION

This part of discussion deals with the study of Ultra high treated milk with respect to various households and commercial establishments. The critical appraisal of the data, with its logical interpretation and plausible explanations wherever possible from the core of discussion are presented under the various sub headings:

5.1 Personal profile of respondents (households and commercial establishments)

The findings regarding personal profile of the households and commercial establishment with respect to age indicate that majority of the households who consumed Ultra high treated milk belonged to young age group of 21-40 years. The results are contrary to the findings of Kardas*et al.,* (2016) who found that the UHT milk was mostly consumed by older age group.In case of commercials it was found that majority of respondents were of middle age group ie.39-58 years. The most probable reason for the result could be that the people of middle age group have a better combination of experience with a high enthusiasm to work.

The results pertaining to gender in case of households indicate that majority of the respondents were males (52.08%). The most probable reason for this could be the society's conservative nature and male dominancy, due to which most of the women had hesitation and were not willing to be interviewed for the research. In case of commercial survey it was revealed that all the respondents were males (100.00%).It might be due to the fact that women don't prefer to engage themselves in business establishments. Moreover the women are more confined to their homes and are supposed to look after the indoor house affairs.

The results regarding the type of family in case of households disclose that most of the families were of nuclear type (79.58%).Sakargaeye (2018) reported similar findings in his study and found that 59% of the respondents belonged

tothenuclear family. The result with respect to the family size reported that most of the families were of small size (66.25%). The most probable reason for small sized family might be due to huge expenditure on large sized family.

5.2 Consumption or non consumption of UHT milk by households

A cursory look at the results indicated that the overall consumption of Ultra high treated milk by the households was 86.25%. The results are more or less similar to the findings of Uzundumlu*et al.,* (2018) whocollected the data used in his research from Palandoken, Yakutiye and Aziziye districts of Erzurum and found that 95.00% of the households consumed Ultra high treated milk. However, the results are not in line with Liem*et al.,* (2016) who found that in Australia, only 10% of population consumed Ultra high treated milk even though the price between UHT and pasteurized milk was same. Thepercentage of households who don't consume Ultra high treated milk, in this study were found to be 13.75%.

Further, while comparing the three zones it was concluded that the highest consumption of Ultra high treated milk was found to be in Central. The most probable reason for the majority of consumption of UHT milk in central zone as compared to the north and south could be the hectic lifestyle of the city, more knowledge, increase in income and awareness of the Ultra high treated milk in central zone.

5.3 Reason for consumption or non consumption of UHT milk

A perusal look at the results clearly indicated that majority of the households (64.58%) consumed UHT milk because it did not require boiling. The reason was in highest number given by north zone. The results of the study of Uzundumlu*et al.,* (2018) revealed that the main reason for consumption of UHT milk was because of its long shelf life.

Further about 13.75% of the households did not consume Ultra high treated milkwhich was found to behighest in south zone. The most probable

reason of non consumption of UHT milk due to its unawareness could be due to less know how of the quality characteristics Ultra high treated milk in south zone.

5.4 Brand preference for UHT milk (households and commercial establishments)

With regard to the brand preference for UHT milk, it was found that the majority of the respondents 88.88% of households and 75.00% of commercial establishmentspreferredAmul brand. Similar findings were reported by Ramya and Ali (2018), who stated in their research that the buying behaviour of consumers with respect to Amul brand was high. The results are not in line with Liman*et al.,* (2019) who witnessed that the Chitale being the local brand of punecity was consumed in maximum whereas only 33% of the area consumed Amul.

5.5 Class preference for UHT milk(households and commercial establishments)

From the results one could access that the majority (68.12%) of the respondents of households had toned UHT milk as their preference. In case of commercials the majority (64.17%) of respondents also preferred toned milk. The most probable reason could be due to high fat content of 3% as compared to double toned milk. The results are in agreement with Nayak (2013) who reported that the preference of customers to buy toned milk from the retailers was high. The results are more or less similar to Chauhan*et al.,* (2006) who found in their study that maximum loss with respect to economics in their dairy plant was provided by double toned milk.

5.6 Packaging of UHT milk preferred by commercial establishments

Findings of the results indicate that the majority of the respondents (62.50%) preferred tetrapacks as a packaging material for UHT milk. It might be due to the fact thatit has been made out of three basic materials i.e., paper (75%) to provide strength and stiffness, polythene (20%) to make the packages liquid tight and

provide a barrier to micro-organisms, aluminium foil (5%) to keep out air, light, off-flavours.The results are similar in findings ofKariyawasam*et al.,* (2006) who found that the majority of the consumers used tetrapacks for packaging.

5.7 Utilization of UHT milk by the households

The pursual look at the results revealed that the majority (58.45%) of the households used the UHT milk for beverages. The results are contrary to the findings of Islam and Jabbar (2010) who found that most of the people in Dhaka used UHT milk as liquid milk for drinking purposes.

5.8 Seasonal and other influences on purchase of UHT milk (households and commercial establishments)

From the results it was quite evident that the majority of respondents (54.58%) and (71.66%) from households and commercial establishments respectively found that the marriage had a great influence on the purchase of UHT milk. The most probable reason for this could be the fact that there is a large usage of milk for various purposes during marriages which cannot be met by the local milkmen.

5.9 Quantity of UHT milk consumed /handled (households and commercial establishments)

As evident from the results majority of the respondents (34.17%) from the households consumed upto 10 litres of UHT milk per month. The results are not in agreement withIslam and Jabbar(2010), who found that the households consumed 29 litres of UHT milk per month With respect to various commercials, it was clearly reported that majority of the respondents (9.18%) in case of wholesalers handled 10000-15000 litres of UHT milk. The majority (31.66%) of the retailers handled 100-150 litres whereas majority (16.66%) of tea stallers handled5-10 litres per month.

The below mention part of discussion deals with the quality evaluation of Ultra high treated milk in terms of its sensory , microbiological, physiochemical and adulteration characteristics:

5.10 Sensory Characteristics of Double Toned and Toned Ultra high treated milk

The results of sensory attributes including sediment, package and temperature of double toned and toned UHT milk samples did not exhibit any significant difference ($p \geq 0.05$) between the zones i.e. central, south, and north. However significant differences were observed with respect to flavour attribute of both double toned as well as toned UHT milk upon isolated comparison. In case of double toned UHT milk samples, flavour in south zone differed significantly ($p \leq 0.05$) from north and central, but the latter showed no significant difference between them ($p \geq 0.05$). The highest flavour scores of the UHT milk samples was found in central zone which was 9.65, followed by north with 9.61,and then south having 9.31 score. In case of toned UHT milk samples, flavour of all the three zones showed a significant difference among themselves in that the scores in descending order were central > north > south having 9.60, 9.45and 9.28 scores respectively. The results of this study are not in tune with the findings of Arafat *et al.,* (2015) who found that the flavour scores of all the UHT milk samples collected from various designated areas were similar. The reason for the difference in flavour may presumably be due to difference in the raw material and manufacturers of UHT milk. The scores however were noticed to be within acceptable limits.

5.11 Microbiological characteristics ofDouble Toned and Toned Ultra high treated milk

The Food Safety Standard Authority of India (FSSA, 2006) stipulates that the Total plate count and Coliform count in UHT milk should be nil or minimum. The microbial analysis in this studyrevealedthat the Total plate and Coliform counts of

all the UHT milk samples were found to be nil except a very few samples of toned UHT milk in south zone, where some colonies were found in case of Total plate count but these were of no significance as they were falling below the countable range as prescribed by APHA (1993).So, it was concluded that The Total plate and Coliform count of both double toned and toned UHT milk samplescollected from central, south, and north zones was inconsequential.

According to the definition of UHT process, presence of bacteria in UHT milk should be minimal or not at all present (Hassan*et al.*, 2009). As expectedTotal viable bacterial count of each of the UHT-processed milk in this study was nil. This was an indication that there might be no problem in UHT process. The reasons for the presence of bacteria in some UHT milk samples may be due to the initial milk quality, sanitation of process plant, status of packaging material and also the process of handling (Tekinsen*et al*., 2007). The absence of bacteria in UHT process milk reveals the fact that the UHT milk both double toned and toned were conforming to the prescribedqualitystandards. These results corroborate the findings of Banik*et al.,* (2014), who determined the microbiological quality of raw, pasteurized and UHT milk samples collected from different locations in Bangladesh and found that the UHT milk samples had no growth at all both in terms of Total plate count and Coliform count .So he concluded from his experiment that none of the UHT milk contained any bacteria. Similar findings have been reported by Jamal *et al.,* (2018) in which he took fifteen UHT milk samples, and found no Total plate count and Coliform count. Tekinsen*et al*., (2007) carried out a similar study and found that most of the UHT milk samples fromdifferentmanufacturers showed no aerobicmesophilic microorganisms. However, samples ofone particular manufacturer were determined to be positive, the reason for this being was stated to be the problem of contamination in raw milk that was chosen for ultra high treated milk. It is ofimportance to conclude that milk in the first place should be chosen with extreme care, and microbiological controls shouldbe done more frequently while choosing milk for the UHT.

5.12 Physico-chemical characteristics of Double Toned and Toned Ultra high treated milk

The results obtained with respect to the fat percentage of double toned samples of UHT milk in the three zones viz, central, south and north were in close conformity with the legal standards given by Food Safety Standard Authority of India. The overall mean value of the three zones was found to be about 1.49%.This was in accordance with legal standards, according to which the fat percentage in double toned milk should be of the order of 1.5%.It was found that there was no significant difference ($p \geq 0.05$) between the samples collected from central, south and north zones in terms of their fat percentage. Further, it was seen that the fat percentage of toned samples of UHT milk collected from the above mentioned zones also did not show any significant difference ($p \geq 0.05$) amongst themselves and each of the zones had the fat percentages in conformity with the legal standards laid down by Food Safety Standard Authority of India. The average value of fat percentage of toned UHT milk samples, from the three zones was 2.98%.This was almost found to be within the limits of legal standards according to which, the fat percentage of toned UHT milk should be 3%.

Our comparison of results of analysis of UHT milk samples with the standards reveal that the results are in agreement with Ali (2013) ,who showed that the mean Fat% of the examined UHT milk samples was 3.32, which was fulfilling the requirement of Egyptian standards according to which fat% in UHT milks must not be less than 3%.The results of our study also agree favourablywith Shihabul*et al.,* (2016) who found that all UHT milk samples satisfied minimum fat requirement set byFood and Drug Administration (FDA), however one of UHT milk sample failed to fulfil the minimum fat content requirement set by FDA.Arafat*et al.,* (2015), however collected data of 27 UHT milk samples from local markets and found that the average fat percentages of these experimental

samples were slightly lower than the recommended standard values. The lower fat content reportedly might be due to partial skimming or withdrawal of fat before processing or collection of raw milk with low fat content.

As evidenced from the results, pH of the double toned and toned UHT milk samples studied in the three zones i.e. central, south and north was conforming to the normal values set for milk. There was no significant difference ($p \geq 0.05$) between the zones in terms of both double toned and toned UHT milk with regard to pH.It was seen that the overall average pH values of the UHT samples from the three zones were6.55 for double toned and 6.54 for tonedsamples, which falls within the range of normal values i.e. 6.5-6.7.The results obtained are a little higher than observed byShihabul*et al.,* (2016) and a little lower observed bySiddique*et al.,* (2016) but are within the limits of normal range for milk.

While comparing the values of zones with respect to Specific Gravity of double toned and toned UHT milk samples, no significant difference($p \geq 0.05$)was found between central, south and north. The values obtained from the three zones did conform to the standards.Further, the overall mean value of 1.027for Double Toned and 1.026 for Toned UHT milk sampleswere comparably within the range of 1.025-1.032, as laid down by legal standards. Similar findings have been reported byShihabul*et al.,* (2016) who concluded that the range of specific gravity of UHT milk samples which they found in their study was within the standard range recommended for UHT milk. The values of the result are close to the values reported by Arafat *et al.,* (2015).

As indicated by the results, the values of Titratable acidity of double toned and toned UHT milk samples collected from central, south and north zones were in accordance with the legal standards. Further, the overall mean value of Titratable acidity for double toned and toned UHT milk samples was 0.17%, which conformed to the legal standards of 0.17%-0.18%, as laid down by FSSAI. However, it was found that North zone differed significantly ($p \leq 0.05$) from Central and South while the latter did not differ among themselves ($p \geq 0.05$).The results were comparable with Arafat *et al.,*(2015), who noted that acidity values

for experimental samples of UHT milk were within the normal range. Further, similar findings were found here also, in terms of a little higher acidity, which was found here in two samples. The reason of higher acidity might be slightly higher initial acidity of raw milk which might have got aggravated by high heat treatment. The results are also comparable with the findings ofShihabul*et al.,* (2016).

As signified by the results,Electrical Conductivity of double toned and toned UHT milk samples collected from central, south and north zones did match with the normal prescribed standards. The average value ofElectrical Conductivity for double toned was 0.004S $cm^{-1}$and 0.0049S cm^{-1} for toned UHT milk samples, which conformed to the prescribedstandards according to which the Electrical Conductivity should be in the range of 0.0040 -0.0055 S cm^{-1}.Further, no significant difference ($p \geq 0.05$) was found between the three zones with respect to the Electrical Conductivity.

5.13 Adulteration Profile ofDouble Toned and Toned Ultra high treated milk

As seen from the results, with respect to the Adulteration analysis of UHT milk with detergent, urea, hydrogen peroxide, formalin, neutralizers and starch it was found that all the samples of UHT milk both double toned and toned collected from three zones viz, central, south and north did not contain any sort of adulterant or preservative. It was apparent from the analyses that all the samples conformed to the legal requirements prescribed by the Food Safety Standards Authority of India (FSSAI). This result was in line with the finding of Shihabul*et al.,* (2016), who took four brands of UHT milk available in Bangladeshand observed that hydrogen peroxide, rosalic acid, formaldehyde, starch, carbonates, were not found in UHT milk samples. Desai *et al.,*(2017) however, detected presence of formalin, ammonium sulphate, glucose, detergents and benzoic acid in milk samples and found that, the samples did not meet the Food Safety Standards Authority of India (FSSAI) requirements. Singuluri and Sukumaran (2014) found thaturea, neutralizers, salt,formalin, detergents and hydrogen

peroxide were present in the milk samples .Their qualitative analysis proved that the milk did notconform to the legal standards and was adulterated with toxic chemicals which are injurious to health. However, in the current study the samples irrespective of the brand and class were observed to be free from all kinds of adulterants and preservatives mentioned above.

Chapter-6

SUMMARY AND CONCLUSION

The current investigation was undertaken with the objective of ascertaining the availability and utilization status of UHT milk in Kashmir and evaluating the quality of ultra high treated milk in Kashmir division for characterizing its sensory, physico-chemical, microbiological and adulteration profile. The salient findings of this study are summarized below:

The survey on various households and commercial establishments was undertaken. As per the data obtained from various households the majority of the respondents (71.66%) belonged to young age group of 21- 40 years, followed by middle and then old age group. The majority of the respondents in the study were males (52.08%), (79.58%) were living in nuclear families and (66.25%) belonged to small size group. With respect to consumption of UHT milk it was found that most of the UHT milk was consumed by central zone (98.75%), followed by south and then north with an overall mean of 86.25%. In terms of non-consumption of UHT milk, highest non-consumption was found in south zone (23.75%), followed by north zone and least non -consumption was found in central zone with an overall average of 13.75%. It was found that no boiling required reason was maximally given by north zone (77.50%), followed by south and then central with an overall mean of 64.58%. Long shelf life reason for the consumption of UHT milk was given in highest number by central (23.75%), followed by south and then north zone with an average value of 12.50%. The reason of hygienic and free from microbes for the consumption of UHT milk was in highest number given by central (20.00%) followed by south and north with an overall mean value of 7.50%. The reason for consuming UHT milk because of its good quality was given maximally by central (2.50%) followed by north and south with an overall mean of 1.66%. In case of non-consumption of UHT milk, the reason of being

unaware of UHT milk was given in highest number by south (23.75%), followed by north and then central with an overall mean of 13.75%.

It was found that maximum consumption of 10 liters of UHT milk was seen in central zone (53.17%), followed by north and then south with an overall consumption of 39.61%. It was found that 36.06% of south zone consumed maximum of 20 liters of UHT milk, followed by central and then north with an overall consumption of 30.91%. Further, 30 litres of UHT milk was largely consumed by south zone (32.78%), followed by north and then central with an overall consumption of 17.87%. It was found that maximum consumption of 40 litres was found in north zone (28.37%), followed by south and then central with an overall consumption of 11.59%. It was found that the highest utilization of UHT milk as liquid milk was seen in north zone (44.77%), followed by south and then central with an overall consumption of 35.76%. It was found that (62.29%) of south zone utilized the UHT milk as beverage, followed by central and then north zone with an overall consumption of 58.45%. 12.65% of central zone utilized the UHT milk for product preparation followed by south zone and then north zone with an overall consumption of 5.79%. It was found that south zone consumed highest UHT milk during marriages (57.37%), followed by north (55.22%) and then central (51.89%) with an overall consumption of 54.58%.

It was found that 37.70% of south zone consumed highest UHT milk in winter, followed by north and then central with an overall consumption of 36.23%. 13.94% of central zone consumed highest UHT milk in summer followed by north and then south with an overall consumption of 9.19%. It was concluded that that maximum consumption of toned UHT milk was seen in central zone (79.74%), followed by south and then north with an overall consumption of 58.75%. Further, in case of double toned UHT milk, it was found that north zone (43.28%) largely consumed double toned milk, followed by south zone and then central with an overall consumption of 31.88%.TheAmul brand was consumed in highest number by north (98.51%), followed by south and then central with an overall consumption of 88.88%. It was found that, the Go milk brand of UHT

milk was consumed in highest number by central zone (26.58%), followed by south and then north (1.49%) with an overall consumption of 11.12%.

The results pertaining to the market or commercial establishment survey indicated that the total percentage of wholesalers was 12.50%, that of retailers was 62.50% and tea stallers was 25.00%.The majority of the respondents belonged to middle age group of 39-58 years (59.17%) followed by young and then old and all the respondents (100.00%) in the study were males. It was found that Tetra packs as a packaging material were used in highest number by north (77.50%), followed by central and least used by south. The overall mean was found to be 62.50%. Polypouches, as a packaging material were found to be used maximally by south (47.50%), followed by central and least used by north zone. The overall mean was 30.00%. The results indicate that large wholesale packs were maximally used by central zone (10.00%), followed by south and least used by north with an overall mean of 7.50%.The Amul brand was used in highest number by south (87.50%), followed by north and then central zone with an average of 75.00%. It was found that Go milk brand of UHT milk was in highest number used by north zone (22.50%) followed by central and then south with an overall mean of 17.50%. Further, it was seen that Insta day brand of UHT milk was in highest number used by central zone (17.50%) followed by south and north with an overall mean of 2.50%.The double toned UHT milk was maximally consumed by central (45.00%) followed by south (32.50%) and then north (30.00%). The overall mean was 35.83%. In toned UHT milk, it was found that north zone consumed it maximally (70.00%) followed by south zone and then central zone with an overall average value of 64.17%. The majority of the wholesalers 9.18% handled 10000 litres of UHT milk per month, the majority 31.66% of retailers handled 100 litres of UHT milk whereas majority of the tea stallers handled 5 litres of UHT milk per month. The influence of marriages on purchase of UHT milk was highest in north (80.00%), followed by central zone and then south. The overall mean was found to be 71.66%.With regard to influence of summer on purchase of UHT milk, north zone and south zone was found to have highest

influence (5.00%) followed by central zone with an overall average value of 4.16%. In terms of influence of winter on the purchase of UHT milk, south zone was found to have maximum influence (32.50%) followed by central and then north. The overall mean was found to be 24.18%.

In case of double toned UHT milk there was no significant difference ($p \geq 0.05$) amongst various zones studied as far as the package and temperature are concerned. Further the, attributes like package and temperature were awarded full score more or less uniformly. Sediment showed no significant difference ($p \geq 0.05$) among the three zones. There elicited significant variation in flavour scores of UHT milk as revealed by ANOVA, in that the south zone differed significantly ($p \leq 0.05$) from north and central ones, the latter, however, did not differ significantly ($p \geq 0.05$) within themselves. With respect to sensory characteristics of toned UHT milk there was no significant difference ($p \geq 0.05$) amongst various zones studied as far the package and temperature are concerned. The package and temperature were awarded full score. Sediment had no significant difference ($p \geq 0.05$) between the three zones. Significant variation in flavour scores of UHT milk, as revealed by ANOVA was noticed. It was found that all the zones differed significantly ($p \leq 0.05$) within themselves in that the zone central exhibited the significantly highest scores of 9.60 ($p \leq 0.05$) out of 10 followed by North which had a score of 9.45 and South with 9.28. Total plate count and coliform count in all of the experimental double toned UHT milk samples was found to be nil. The Total plate and Coliform counts of all the toned UHT milk samples were found to be nil except a very few samples of UHT milk in south zone, where some growth of colonies was noticed in case of Total plate count but these were found to be inconsequential and of no significance. In double toned UHT milk samples, the fat percentage of samples from central, south and north zones were found to be of the order of 1.49%, 1.48% and 1.49% respectively with an overall mean of 1.49%. There was no significant difference ($p \geq 0.05$) between the zones in terms of fat percentage as revealed by ANOVA. The pH values of the samples from central, south and north zones were found to be 6.49, 6.58, and 6.58 respectively with an

overall mean of 6.55. It was found that all the zones under study had no significant difference amongst themselves ($p \geq 0.05$).The Specific gravity of the UHT test samples from various zones did not display any significant variation ($p \geq 0.05$), as revealed by analysis of variance. Specific gravity of central, south and north zones were 1.027, 1.028, and 1.028 respectively with an overall mean value of 1.027.The Titratable acidity of the samples from central zone was 0.17%, south: 0.17% and north: 0.16% with an overall mean of 0.17%. As revealed by the analysis of variance, north zone differed significantly ($p \leq 0.05$) from the other two zones, the latter however did not differ among themselves. Electrical conductivity as revealed by ANOVA did not vary significantly ($p \geq 0.05$) from zone to zone. Electrical conductivity of the samples from central, south and north zones were of the order of 0.004, 0.004, 0.005 Siemens/cm respectively with an overall average of 0.004 Siemens/cm.

With respect to toned milk, the fat percentage of the samples from central, south and north zones were found to be 3.00%, 2.98% and 2.96% respectively with an overall mean of 2.98%. There was no significant variation ($p \geq 0.05$) noticed between the zones in terms of fat percentage as revealed by ANOVA. The pH values of the samples from central, south and north zones were found to be 6.49, 6.57, and 6.56 respectively with an overall mean of 6.54. It was found that all the zones under study had no significant difference ($p \geq 0.05$) amongst themselves with respect to pH values. The Specific gravity of various samples under study did not display any significant variation ($p \geq 0.05$) amongst the zones, as revealed by analysis of variance in that the Specific gravity values of samples from central, south and north zones were 1.027, 1.026, and 1.026 respectively with an overall mean value of 1.026. The Titratable acidity values of the samples from various zones was: central 0.16%, south: 0.17% and north: 0.17% with an overall mean of 0.17%. As revealed by the analysis of variance, south zone differed significantly ($p \leq 0.05$) from the other two zones under test, the latter, however, were noticed to be comparable ($p \geq 0.05$).The Electrical conductivity of the test samples, as revealed by ANOVA did not vary

significantly ($p \geq 0.05$) from zone to zone. The values of samples from central, south and north zones were 0.005, 0.004, 0.004 Siemens/cm respectively with an overall average of 0.0049 Siemens/cm. Samples of Ultra high treated milk (toned and double toned) were collected from the central, south and north zones and were tested for the presence or absence of adulteration. The samples were tested for various commonly encountered adulterants and preservatives viz., detergent, urea, hydrogen peroxide, formalin, neutralizers and starch. The results obtained in the current study were, however consistently suggestive of none of the samples under test of Ultra high treated milk being adulterated with any of the adulterants or preservatives mentioned above.

Based on the results obtained from the study, the following conclusions could be drawn:

- The highest consumption of ultra high treated milk was found to be in central zone.
- The majority of households and commercial establishments preferred Amul brand for UHT milk.
- Toned milk was the choice of both households and commercials in comparison to double toned UHT milk.
- Tetrapacks were mostly preferred by the commercial establishments for the packaging of UHT milk as compared to polypouches etc.
- The majority of the households used the UHT milk for making beverages like tea, coffee etc rather than for drinking or product preparation.
- Marriage had a great influence on purchase of UHT milk in case of both households and commercial establishments. During marriages the sale and purchase of UHT milk showed an increase.
- The majority of households on an average consumed 10 litres of UHT milk per month.
- Sensory attributes of Ultra high treated milk were within acceptable limits.

- Microbiological quality of the samples of Ultra high treated milk collected from the three zones of Kashmir division were satisfactory as indicated by Total viable loads and coliform bacteria, to be within prescribed limits.
- The physiochemical properties of all the UHT milk samples, collected from three zones viz, Central, South and North zone were found to be of approved quality, irrespective of the brand and class.
- Ultra high treated milk marketed in Kashmir division conformed to the legal prescribed standards as far as various physicochemical quality parameters are concerned.
- With respect to the physiochemical characteristics of Ultra high treated milk, all the physiochemical parameters did not show any significant difference between the three zones except Titratable acidity that too was observed to fall within prescribed limits..
- Adulteration profile of Ultra high treated milk was seen to match completely to the standards. None of the tested harmful adulterant was found in Ultra high treated milk

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Appendix -I

Division of livestock products and technology, Faculty of Veterina
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HOUSEHOLD DATA QUESTIONNAIRE.

Personal profile of respondents:

1) Name of respondent:

2) Area name:

3) Contact details:

4) Age:

5) Gender: Male / Female

6) Type of family: Joint / Nuclear

7) Family Size:

AVAILIBILITY OF UHT MILK

8) Preference: Consumption / Non-consumption

9) Quantity of UHT milk consumed per month (litres):

10) Utilization of UHT milk as: Liquid milk / Beverages / Product preparation.

11) Seasonal influences and others: Winter / Marriages / Summer

12) Reasons for consumption / non-consumption of UHT milk:

No boiling required /Long shelf life/ Hygenic& free from microbes/ Good quality/non- consumption as unaware of UHT milk

13) Preference for a particular class: Tonned / Double toned UHT milk

13) Preference for a particular brand: Amul / Go milk

Appendix -II

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MARKET DATA QUESTIONNAIRE

Personal profile of respondents:

1) Name of the establishment/ respondent:

2) Area name:

3) Contact details:

4) Age:

5) Gender: Male/Female

INFORMATION REGARDING UHT MILK

6) Business establishment type: Wholesaler / Retailer/ Tea stalls

7) Packaging: Tetra brick pack /Poly Pouch / Large wholesale packs / Otherpacks.

8) Company preferred while purchasing UHT milk: Amul / Go milk / Insta day

9) Class preference of consumers, if any: Double Toned / Toned

10) Quantity of product (UHT milk) handled annually (litres):

11) Seasonal or other influences, if any: Summer/ Marriages / Winter

Appendix -III

SCORE CARD FOR ULTRA HIGH TREATED MILK

Name:

Date:

	Criticism	Sample number				
Flavour Maximum Score 10	Nor					
	Ac					
	Astrir					
	Bar					
	Bitter					
	Cooked					
	Cowy					
	Feed					
	Fermented					
	Flat					
	Foreign					
	Garlic					
	Lacks Freshness					
	Malty					
	Oxidized (light induced)					
	Oxidized (metal induced)					
	Rancid					
	Salty					
	Unclean					
Sediment Maximum Score 3						
Package Maximum Sore 5	No defect					
	Dented/Defective					
	Dirty inside/outside					
	Leaky /not full					
	Heat seal defective					
	Illegible printing					
	Labelling /code incorrect					
Bacteria Maximum Score 5	SPC					
	Coliform count					
Temperature Maximum Score 2						

signature of Judge

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CERTIFÍCATE

Certified that all the corrections/amendments as suggested by External Examiner **Dr. Sunil Kumar,** Professor & Head Division of LPT, FVSc. & AH, SKUAST-J, R.S.Pura, Jammu during evaluation and viva-voce examination held on **21-01-2020** have been incorporated in the manuscript entitled, **Studies on Availability and Evaluation of various Quality Characteristics of Ultra high-treated milk in Kashmir** submitted by **Dr. AfreenTramboo (2017-V-366-M)**

Dr. Mohammad Ashraf Pal
Chairman
Advisory Committee