STUDY OF MULTIPLE ATTRIBUTES OF TRADITIONAL AND COMMERCIAL YOGHURTS TRADED FOR HUMAN CONSUMPTION IN DISTRICT RAWALPINDI

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ABSTRACT: The present study was designed to evaluate the quality of traditional and commercial yoghurt brands and to acknowledge their health benefits for human consumption in district Rawalpindi. Nine types of samples collected from different resources were divided into three categories. A, B and C were from cow, buffalo, and mixed (cow and buffalo) samples respectively. D, E, and F were from local vendors while G, H, and I were from different commercial yogurt brands. These samples were evaluated thrice on weekly basis using standard protocols for sensory, physio-chemical, and microbiological attributes. It was concluded from the current study that the overall acceptability of commercial brand yoghurt was higher as compared to traditional ones. Physiochemical analysis of commercial yoghurt samples was consistent and showed a slight variation as compare to traditional yoghurt. Microbiological analysis revealed that total bacterial count of commercial yoghurt was lower as compared to traditional ones.

Key Words: Yoghurt, attributes, traditional, commercial brands.

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INTRODUCTION

Dairy products are a crucial group of foods which contain blend of nutrients and energy. Main nutrients are calcium, carbohydrates, proteins and fat. Consumption wise, fermented milk products make a large group of dairy products. Fermented milk products are processed by invading or overgrowing edible microorganisms to alter milk's flavor, aroma and texture which are more attractive for the consumers. Such products have longer life than milk and are easier to preserve and transport (Chowdhury, et al., 2011). Yoghurt is considered one of the main components of the cultural milk products in Pakistan. Isaac Carasso from Ottoman Salorika in 1919 commercialized yoghurt for the very first time. However it has been since last 30-40 years that it gained our attention. With the passage of time it attained gastronomies attention (Fabian, 2009). Organoleptic properties of yoghurt play a pivotal role in sensory appeal towards it and hence became popular among consumers (Routry and Mishra, 2011). There are reports that yoghurt sold by local vendors has variation from shop to shop as they are not following any standard protocols for fermented products (Aziz, 1985). Hence there is a need to evaluate different yoghurt samples sold at the local market either by local venders or via commercial brands for their quality. So, the present study was planned to compare physiochemical, organoleptic and microbiological attributes of traditional and commercial yoghurt brands commonly sold in the district Rawalpindi.

MATERIALS AND METHOD

Experiment Design: The samples for this study were collected from Rawalpindi city. Total nine types of yoghurt samples were collected from different sources thrice on weekly basis. These samples were then coded as A, B, C, D, E, F, G, H, and I. Weekly, three samples were collected from homemade yoghurt prepared from pure cow milk (A), pure buffalo milk (B), and mixed buffalo and cow milk (C). Three samples were collected from local vendors supplying yoghurt named as D, E, and F. Three samples of commercially available yoghurt brands named as G, H, and I were also collected from market.

Milk samples were analyzed for three attributes (Sensory, physio-chemical and microbiological). Each sample was evaluated in triplicate. Data collected was statistically analyzed using SPSS.

Sensory profiling: Sensory profiling of yoghurt was done using 5-point hedonic scale (5=excellent, 4= very good, 3= good, 4= Fair, 1= poor) (Eissa et al, 2010). Specific gravity was measured by using lactometer (AOAC, 2005).

Physio-chemical evaluation: Milk protein and total solids were determined using the method described by AOAC (2000). Ash contents were determined using

standard procedure as described by Marth (1978). Fat percentage was measured by Gerber method using butyrometer (AOAC, 2005). The pH was determined using Crison pH 25. Titratable acidity was determined via titration (AOAC, 2005).

Lactose percentage was calculated using following formula:

Lactose (%) = % total solids- (% fat + % protein + % ash) (Haj et al., 2007)

Microbiological evaluation: Bacterial analysis was done using the methylene blue reduction test (MBRT) and pour plate technique in accordance with International Dairy Federation (IDF, 2002)

RESULTS AND DISCUSSION

The present study was designed to evaluate the quality of commercial yoghurt brands and traditional yoghurt traded for human consumption in district Rawalpindi.

Sensory analysis: The physical evaluation of plant made yoghurt gained more consumer acceptability. As shown in table 1 taste and odor of samples G, H and I were significantly different from samples A, B, C, D, E and F. No significant variation was shown among the plant made yoghurt samples while traditional samples were significantly different from each other. The results were in line with Younus et al., (2002) who also reported similar results for traditional yoghurt.

Table 1: **Sensory analysis of yogurt samples (mean with standard error values) on 5-point hedonic scale.**

Sample	Color	Taste	Smell	General appearance
A	$3.33^{c} \pm 0.33$	$2.66^{bc} \pm 0.3$	$3.33^{c} \pm 0.33$	$3.00^{bc} \pm 0.0$
B	$2.33^{b} \pm 0.33$	$2.33^{ab} \pm 0.3$	$2.33^{abc} \pm 0.33$	$2.33^{ab} \pm 0.0$
C	$3.00^{bc} \pm 0.0$	$2.00^{b} \pm 0.0$	$2.66^{bcd} \pm 0.33$	$3.00^{bc} \pm 0.0$
D	$2.00^{ab} \pm 0.0$	$2.00^{b} \pm 0.0$	$2.00^{ab} \pm 0.0$	$2.00^{b} \pm 0.0$
E	$1.66^{a} \pm 0.33$	$1.00^{a} \pm 0.0$	$1.66^{a} \pm 0.33$	$1.66^{a} \pm 0.33$
F	$2.33^{ab} \pm 0.33$	$1.00^{a} \pm 0.0$	$1.66^{a} \pm 0.33$	$1.66^{a} \pm 0.33$
G	$3.00^{bc} \pm 0.57$	$3.33^{c} \pm 0.3$	$3.00^{cd} \pm 0.0$	$3.66^{c} \pm 0.33$
H	$3.00^{bc} \pm 0.0$	3.33^{c} 0.3	$3.33^{d} \pm 0.33$	$3.00^{bc} \pm 0.0$
I	$3.00^{bc} \pm 0.0$	3.33^{c} 0.3	$3.33^{d} \pm 0.33$	$3.66^{c} \pm 0.33$

^{a,b,c} Values with different superscript in rows are significantly different ($P<0.05$).

Whereas,

A= Cow Milk, B = Buffalo Milk , C = Cow & Buffalo milk , D = Local vendors (1), E = Local vendors (2), F = Local vendors (3), G = Commercial Brand (1), H = Commercial Brand (2) & Commercial Brand (3)

Physio-chemical analysis:

pH and specific gravity: As shown in table 2, the pH range in the present study was 3.76-4.31. The pH data is in accordance with the work done by Chowdhury et al. (2011). Similarly Green and Ibe (2005) concluded almost similar mean pH (3.82) of natural yoghurt. The range for specific gravity was from 1.036– 1.049. Similar results were also reported by Omola et al., (2014).

Titratable acidity%: Titratable acidity range in the present study was 0.7± 0.57 to 1.7±0.30. Minimum titratable acidity was observed in commercially available yoghurt brands. This might be due to controlled manufacturing conditions and post-production handling. Results shown in table 2 are supported by the results of Younus et al (2002) and Chowdhary et al.,(2011). However, work done by Green and Ibe (2005) showed higher titratable acidity values of plain yoghurt in comparison to findings of present study. Former study suggested that the elevation is due to lengthened storage period.

Total solids: The data of present study indicated that total solids were in the range of 12.0-20.3%. Findings of current study were also in harmony with Deb and Seth (2014). Results of the present study varied from the study conducted by Allai et al. (2015) who presented the range from 14 to 16.5 % This difference might be due to variances in milk standardization protocol among these brands.

Ash: The ash contents of our study are in line with Somer and Kilic (2012) study. Former study results presented an almost similar minimum value of ash i.e 0.65%. However, ash content values in the present study were lower in comparison to the findings of Allai et al (2015) study i.e 1.96-2.53%. This variation might be due to differences in milk concentration or adulteration.

Protein %: Protein percentage of all the samples is shown in table 2. Protein was in the range of 3.73 ± 0.33% to 4.26 ± 0.18%. Findings of study done by Khan et al . (2006) and Chowdhury et al .(2011) support the current results. However, Green and Ibe. (2005) found a very low protein content in plain yoghurt samples i.e 1.3

%. This might be due to non-addition of dry or skimmed milk in starter culture. Study conducted by Somer and Kilic (2012) found a higher protein percentage in comparison to current study. These elevated measurements might be due to strained yoghurt samples.

Fat %: Fat percentage was in the range of 3.00 ± 0.05% to 5.63 ± 0.08%.Lowest fat percentage was found in sample A with 2.07 ± 0.03% fat %, which might be due to its source being the cow's milk. Plant made yoghurt from G – I was in the range of 3.1 to 3.4% and thus were non-significant. Greater variation among the traditional yoghurt might be due to variation in manufacturing practices or milk sample composition which varies day to day or batch to batch. These results mentioned in table 2 were in line with findings of Hofi et al. (1978). These results were also in accordance with Younus et al . (2002) and Athar (1986).

Lactose %: Lactose percentage are shown in table 2. The values were 1.56 ± 0.08% to 3.71 ± 0.59 % for samples from local vendors (D,E,F), 5.14 ± 0.6% to 8.5 ± 0.27% for home- made cow and buffalo samples (A,B,C) and 11.69 ± 0.74 % to 12.18 ± 0.17% for branded yoghurts (G,H,I). Minimum values of lactose in samples D, E and F could be due to longer storage period. Maximum lactose percentage was observed in plant made yoghurt because of addition of synthetic flavor's or sugar in them to enhance its flavor for consumer's acceptance.

These results of lactose percentage were also supported by findings of Ayub and siddiq (2003). Green and Ibe. (2005) results showed 12.7% of lactose percentage in plain yoghurt while Khan et al. (2006) showed the lactose percentage in the range of 5.4 to 10.2 %.

Table 2 Physicochemical Analysis of yoghurt samples (A-I).

SAMPLE	T.S%	Sp Gr.	ASH %	pH.	TTA %	PROTEIN %	FAT %	LACTOSE%
A	13.83^{cd} ± 0.16	1.04^{abc} ± 0.001	0.66^{ab} ± 0.03	4.02^{bc} ± 0.13	1.37^{cd} ± 0.07	4.20^{b} ± 0.10	2.07^{a} ± 0.03	6.0^{d} ± 0.2
B	17.93^{e} ± 0.1	1.04^{abc} ± 0.005	0.70^{b} ± 0.0	4.03^{bc} ± 0.04	1.52^{cd} ± 0.33	4.03^{ab} ± 0.06	4.66^{c} ± 0.16	8.53^{e} ± 0.3
C	14.70^{d} ± 0.65	1.03^{ab} ± 0.002	0.65^{a} ± 0.02	3.97^{abc} ± 0.09	1.48^{cd} ± 0.20	3.76^{a} ± 0.03	5.13^{d} ± 0.31	5.14^{c} ± 0.6
D	13.20^{bc} ± 0.61	1.04^{bc} ± 0.02	0.69^{ab} ± 0.0	3.82^{ab} ± 0.03	1.00^{ab} ± 0.10	4.26^{b} ± 0.18	5.63^{e} ± 0.08	2.60^{ab} ± 0.6
E	12.00^{ab}	1.04^{ab} ± 0.001	0.70^{ab} ± 0.0	3.89^{abc} ± 0.06	1.70^{c} ± 0.30	4.16^{b} ± 0.06	5.56^{e} ± 0.12	1.56^{a} ± 0.1
F	11.13^{a} ± 0.59	1.03^{a} ± 0.003	0.69^{ab} ± 0.0	3.76^{a} ± 0.04	1.41^{cd} ± 0.24	3.73^{a} ± 0.03	3.00^{b} ± 0.05	3.71^{b} ± 0.6
G	19.50^{f} ± 0.75	1.036^{a} ± 0.003	0.67^{ab} ± 0.01	4.31^{d} ± 0.12	0.70^{a} ± 0.05	4.00^{ab} ± 0.05	3.13^{b} ± 0.03	11.69^{f} ± 0.7
H	20.33^{f} ± 0.33	1.04^{ab} ± 0.0	0.69^{ab} ± 0.0	4.12^{cd} ± 0.03	0.99^{ab} ± 0.04	4.16^{b} ± 0.16	3.30^{b} ± 0.0	12.18^{f} ± 0.2
I	20.26^{f} ± 0.26	1.05^{c} ± 0.0	0.75^{c} ± 0.0	4.09^{cd} ± 0.01	0.96^{ab} ± 0.06	4.03^{ab} ± 0.03	3.40^{b} ± 0.0	12.08^{f} ± 0.3

^{a,b,c} Values with different superscript in rows are significantly different (P< 0.05).
Whereas,
A= Cow Milk, B = Buffalo Milk , C = Cow & Buffalo milk , D = Local vendors (1) , E = Local vendors (2) , F = Local vendors (3) , G = Commercial Brand (1) , H = Commercial Brand (2) & Commercial Brand (3)
T.S = Total solids
Sp Gr = Specific Gravity
TTA = Titratable Acidity

4.3 Microbiological analysis

MBRT: Methylene blue reduction test (MBRT) basically indicates the time in which bacteria in yoghurt could reduce methylene blue dye color to white. The results of the present study have been shown in table 3. The range was 0.83 ± 0.33 to 2.33 ± 0.88 in case of traditional yoghurt while 8.33 ± 0.66 to 9.00 ± 0.00 for commercial yoghurt samples. There was no significant difference between commercial yoghurt while they were significantly different from traditional yoghurt.

Total bacterial count: Total bacterial count of 10^{-7}, 10^{-8} and 10^{-9} dilutions were made and results are shown in the table 3. TBC^{-7} showed the range of 1.9 $x10^{2}$ - 2.9 $x10^{2}$. Minimum count has been shown by sample F while maximum count shown by commercial yoghurt. No

significant variation was observed in the commercial yoghurt in comparison to traditional yoghurt. These findings might be due to the use of defined culture and controlled processing protocol followed by commercial brands**.** While in case of traditional yoghurt no defined culture or protocols have been monitored. In 10^{-8} dilution bacterial range was1.6 $x10^{2}$ -2.5 $x10^{2}$ while in10^{-9} the range was reduced to 1.3 $x10^{-2}$-2 $x10^{-2}$. Davis and Mc Lachlan (1974) also concluded the same bacterial count. This TBC is in accordance with Younus et al (2002), as they reported that traditional yoghurt had more microbial count as compared to commercial brands yoghurt. According to them, possible reason for this higher microbial count might be due to usage of wild starter culture in traditional yogurt preparation and they don't follow any standard protocol regarding its manufacturing or storage technique.

The results of total bacterial count were in line with those of methylene blue reduction test, in which maximum count was observed in traditional yoghurt. Commercial brands use defined starter culture and are following a controlled fermentation protocol which resulted in less bacterial count in it (Masud et al., 1991).

Table-3: Microbiological analysis of yoghurt samples (A-I).

SAMPLES	MBRT	TBC-7	TBC-8	TBC-9
A	$0.83^{a} \pm 0.3$	$2.9\ x10^{2\ b} \pm 6.6$	$2.3\ x10^{2\ b} \pm 5.2$	$2.3\ x10^{2\ b} \pm 5.2$
B	$1.16^{a} \pm 0.2$	$2.6\ x\ 10^{2\ b} \pm 9.7$	$2.3\ x10^{2\ b} \pm 14.8$	$2.3\ x10^{2\ b} \pm 14.8$
C	$1.33^{a} \pm 0.8$	$2.5\ x10^{2\ b} \pm 24.1$	$2.4\ x10^{2\ b} \pm 23.3$	$2.4\ x10^{2\ b} \pm 23.3$
D	$1.00^{a} \pm 0.0$	$2.8\ x10^{2\ b} \pm 3.8$	$2.5\ x10^{2\ b} \pm 6.8$	$2.5\ x10^{2\ b} \pm 6.8$
E	$1.67^{a} \pm 0.0$	$2.4\ x10^{2\ ab} \pm 23.6$	$2.1\ x10^{2\ b} \pm 5.8$	$2.1\ x10^{2\ b} \pm 5.8$
F	$2.33^{a} \pm 0.8$	$2.2\ x10^{2\ ab} \pm 27.7$	$2.1\ x10^{2\ b} \pm 38.4$	$2.1\ x10^{2\ b} \pm 38.4$
G	$8.33^{b} \pm 0.6$	$2.0\ x10^{2\ ab} \pm 23.6$	$1.8\ x10^{2\ ab} \pm 5.8$	$1.8\ x10^{2\ ab} \pm 5.8$
H	$9.00^{b} \pm 0.0$	$1.9\ x10^{2\ a} \pm 5.5$	$1.6\ x10^{2\ a} \pm 16$	$1.6\ x10^{2\ a} \pm 16$
I	$9.00^{b} \pm 0.0$	$1.9\ x10^{2\ a} \pm 5.5$	$1.6\ x10^{2\ a} \pm 16$	$1.6\ x10^{2\ a} \pm 16$

^{a,b} Values with different superscript in rows are significantly different ($P< 0.05$).

Whereas,

A= Cow Milk, B = Buffalo Milk, C = Cow & Buffalo milk, D = Local vendors (1), E = Local vendors (2), F = Local vendors (3), G = Commercial Brand (1), H = Commercial Brand (2) & Commercial Brand (3)

MBRT = Methylene Blue Reduction Test

TBC = Total bacterial count

Conclusion: It was concluded from current study that overall acceptability of commercial brand yoghurt was more than traditional ones. Physiochemical analysis of commercial yoghurt samples was consistent and showed a slight variation as compare to traditional yoghurt. Microbiological count revealed that total bacterial count of commercial yoghurt was lower as compared to traditional ones.

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