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Rejesh Kumar
Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Rekha Dahiya
Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Vaquil
Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Rekha Devi
Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Vikash Sharma
Department of Veterinary Pathology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

S.S. Ahlawat
Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Correspondence
Vaquil
Department of Livestock Products Technology, College of Veterinary Science, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar, Haryana, India

Development of healthy milk drink with incorporation of wheat grass juice

Rejesh Kumar, Rekha Dahiya, Vaquil, Rekha Devi, Vikash Sharma and SS Ahlawat

Abstract
The study was conducted with an objective to develop healthy flavored milk drink with incorporation of wheat grass juice in double tonned milk. Sugar (6 and 7%) and flavor *(rose and vanilla)* was selected on the bases of sensory evaluation. The experimental C_1 (without- autoclaved) and C_2 (with autoclaved) of flavored milk drink were developed with different combination of double toned milk and wheatgrass juice in the ratio of 6:1, 9:1, 12:1 and selected on the bases of sensory evaluation. The control product was prepared with the addition of sugar (6%) and *rose* flavour without wheatgrass juice. The different samples were evaluated for physic-chemical properties. The treatment C_2 with 12:1 milk and wheatgrass juice, 6% sugar and *rose* flavor was at par with the control in terms of organoleptic and physico-chemical attributes. It is concluded that wheat grass juice can be incorporated for development of healthy milk drink without compromising the palatability and quality of the product.

Keywords: Wheat grass juice, double tonned milk, healthy, flavored milk drink

Introduction
In modern era consumers are very much aware about their health. So the demand of functional foods is increasing day by day at global level (Singh et al., 2012) [1]. Nowadays, more and more people are adopting herbal way of life for their health benefits. There is also a need to find diverse technologies to add value to milk and its by-products (Pugazhenthi and Jothylingam, 2013) [2]

Wheatgrass Juice is an extract squeezed from the mature sprouts of wheat seeds and it is richest source of chlorophyll, active enzymes, vitamin A, B, C, E and K, calcium, potassium, iron, magnesium, sodium, sulphur and at least seventeen amino acids (Walters, 1992) [3]. Milk has always been a choice of innovation for food researchers to meet the ever changing consumer's preferences for newness in the products. Moreover, milk is consumed by people of all age can act as potent carrier for the herbs which can add functional attributes to the products (Informa Health Care, 2014) [4].

Milk is deficient in Fe (Kulshrestha, 2016) [5] whereas Wheatgrass is an inexpensive and efficient source of Fe and it also provides many required nutrients and medicinal benefits for a healthy and rejuvenating body (Singhal *et al*., 2012) [6]. The presence of 70 per cent chlorophyll, which is almost chemically identical to haemoglobin and because of this wheatgrass, is called 'Green Blood' (Ferruzzi and Blakeslee, 2007) [7].

Hence, an attempt has been made in this work to incorporate wheat grass juice in milk for development of healthy milk drink.

Material and methods
Wheatgrass of about 7-8 inches height was harvested and hand-washed in tap water 2-3 times and blanched in boiling distilled water and spread on filter paper. Fresh wheatgrass juice was extracted and filtrated through a muslin cloth as the procedure followed by Marwaha *et al*. (2004) [8].

Buffalo milk was obtained from Experimental Dairy Plant of the department of LPT, LUVAS, Hisar, and was standardized as Double Toned Milk with 1.5 percent fat and 9 per cent solid not fat. Sugar and flavors (vanilla/ rose) was procured from local market.

Preparation of flavoured milk drink
The flavored milk was prepared using double tonned milk. Sugar level (6 and 7%) and type of flavor *(rose and vanilla)* were selected on the bases of sensory evaluation (9 points hedonic scale) for preparation of both without autoclaved (C_1) and with autoclave (C_2) control samples.

The selected flavor and sugar level of milk drink in both C_1 and C_2 controls were treated with incorporation of wheatgrass juice (WGJ) at different ratio of milk: WGJ (T_1=6:1, T_2=9:1, T_3=12:1) followed by sterilization with autoclave and cooling in case of C_1.

The selected wheat grass juice milk drink (WGJMD) were subjected to nutritional and physico-chemical quality evaluation.

Parameters studied

Proximate composition was determined by following the standard methods of AOAC (2002) [9]. Total carbohydrates was calculated by difference method and total energy was calculated by applying the formula as Total Energy (calories/g) = Fat per cent x 9.3 + Protein per cent x 4.1 + carbohydrate per cent x 4.1. The data generated was analyzed using simple Complete Randomized Block Design (CRD) and two factor factorial CRD (Sheoran and Pannu, 1999) [10].

Results and discussion

Table 1: Sensory score of different levels of sugar and different flavor. (Mean ± SE, n=12)

Sensory Attributes	Sugar levels and flavors			
	6%		7%	
	Rose	Vanilla	Rose	Vanilla
	C_1			
Flavour	8.08^{a}± 0.14	7.75^{ab} ± 0.13	7.83^{a} ± 0.15	7.66^{ab} ± 0.11
Consistency	7.75^{a} ± 0.12	7.50^{b} ± 0.15	7.66^{a} ± 0.14	7.58^{ab} ± 0.13
Colour and appearance	7.83^{a} ± 0.11	7.66^{a} ± 0.12	7.75^{a} ± 0.12	7.60^{ab} ± 0.13
Overall acceptability	7.88^{a}± 0.14	7.62^{ab}± 0.14	7.70^{a} ± 0.11	7.55^{ab}± 0.14
	C_2			
Flavour	8.41^{a} ± 0.14	8.16^{ab} ± 0.15	8.25^{a} ± 0.14	8.08^{ab} ± 0.15
Consistency	8.25^{a} ± 0.13	7.91^{ab} ±0.14	8.10^{a} ±0.14	7.83^{ab} ± 0.14
Colour and appearance	7.91^{a} ± 0.14	7.75^{a} ± 0.12	7.83^{a} ± 0.15	7.66^{a} ± 0.13
Overall acceptability	8.20^{a} ± 0.15	7.91^{ab} ± 0.14	8.00^{a} ± 0.13	7.91^{ab} ± 0.15

Means bearing different superscripts in a row differ significantly (P<0.05).

C_1= without autoclave, C_2= with autoclave

It was observed that the flavour score for 6 per cent sugar level (Table 1) was found better in comparison to 7 per cent sugar, whereas the rose flavour was again found to be liked very much than vanilla flavour in same per cent sugar by the panel of judges. The lowest sensory score was with vanilla flavor and with 7 per cent sugar level showing "liked moderately to liked very much".

However, in case of color and appearance there was no significant (P<0.05) difference was observed among the different levels of sugars with different flavours but the sensory score for consistency and overall acceptability with 6 per cent sugar level with rose flavour was higher.

Table 2: Sensory score of different levels of milk and wheat grass juice. (Mean ± SE, n=12)

Sensory Attributes	Controls	Milk : Wheatgrass juice ratio		
	C1	T1	T2	T3
Flavour	8.25^{a}±0.13	6.66^{c}±0.14	7.00^{c} ±0.12	7.83^{b} ±0.11
Consistency	8.25^{a} ±0.13	6.50^{d} ±0.15	6.91^{c} ±0.14	7.50^{b} ±0.15
Colour and appearance	8.00^{a} ±0.12	6.66^{c} ±0.14	7.16^{b} ±0.11	7.66^{a} ±0.14
Overall acceptability	8.16^{a} ±0.16	6.58^{c} ±0.14	6.91^{c} ±0.14	7.58^{b} ±0.14
	C2	T1	T2	T3
Flavour	8.33^{a} ± 0.14	6.83^{d} ± 0. 11	7.25^{c} ± 0.13	7.91^{b} ± 0.14
Consistency	8.25^{a} ± 0.13	6.66^{c} ± 0.14	7.00^{c} ± 0.12	7.58^{b} ± 0.14
Colour and appearance	8.08^{a} ± 0.14	6.50^{d} ± 0.15	7.00^{c} ± 0.12	7.50^{b} ± 0.15
Overall acceptability	8.25^{a} ± 0.13	6.66^{d} ± 0.14	7.08^{c} ± 0.14	7.66^{b} ± 0.14

Means bearing different superscript in a row differ significantly (P<0.05).

C_1= without autoclave, C_2= with autoclave, T1= 6:1 proportion of milk and wheatgrass juice,

T2= 9:1 proportion of milk and wheatgrass juice, T3= 12:1 proportion of milk and wheatgrass juice

The score for sensory parameters (flavour, consistency, colour and appearance and overall acceptability) increased as level of wheat grass decreased (Table 2). This might be due to bright/dark green colour, slightly characteristic aroma and acrid taste of wheatgrass juice as earlier also reported by Ashok (2011) [11] but because of the curdling of the WGJMD prepared from C_1 treatment, it was rejected and not carried for further study.

The T_3 proportion score were higher showing "liked moderately to liked very much" among the other proportions of milk drink, which was found nearest to the control (C_2) score showing "liked very much". These findings are in accordance with the line of Singhal *et al*. (2012)6. There was change in colour from bright green to dull olive green in T_1 and T_2 treated WGJMD. Schwartz and Elbe (1983) [12] and Mangos and Berger (1997) [13] reported that chlorophyll is highly susceptible to degradation during thermal processing; it undergoes isomerization which results in colour changes in the product. Vongsawasdi *et al.* (2010) [14] also reported that juice colour evidently changed from bright green to dull olive green or olive yellow. This change coincided with chlorophyll degradation of the juice. So, C_2 control and T_3 proportion of WGJMD with 6 per cent sugar level and rose flavour were selected for the further nutritional study.

Table 3: Nutritional composition of wheatgrass juice added milk drink. (ME ± SE, n=9)

Parameters	Control	T_3 (12:1)
Moisture (%)	84.14^{b}±0.19	85.39a±0.16
Energy(kcal)	69.83^{a}±0.86	64.43^{b}±0.84
Carbohydrates (%)	10.69^{a}±0.21	9.71^{b}±0.18
Protein (%)	3.12^{a}±0.07	3.00^{a}±0.09
Fat (%)	1.42^{a}±0.04	1.28^{b}±0.04
Ash (%)	0.64^{a}±0.01	0.59^{b}±0.06

Means with different superscripts within a column differ significantly (p<0.05).

The percent moisture content of WGJMD was significantly higher in T_3 because incorporation of wheatgrass juice in WGJMD. Ihekoronye and Ngoddy (1985) [15] reported that the essential component of any beverage is the water that it contains; other components such as stimulants, coloring and flavoring ingredients may perform some useful functions but they are not essential for the proper physiological function of the body. In similar way fat, protein, ash, carbohydrate and energy content of T_3 was significant ($p\leq0.05$) lower than control except protein of T_3 which was insignificant ($p\leq0.05$). This might be due to lower fat, protein, ash, carbohydrate and energy content in wheatgrass juice. Present findings of milk drink are in line with that of reported studies of Ayub *et al.* (2007) [16] and Awais (2013) [17] who reported relatively low fat, carbohydrate, protein content and high moisture content due to addition of extraneous water in milk. Results are also in agreement with those reported by some researchers Paradkar *et al*. (2000) [18]; Hossain *et al.* (2010) [19]; Mansor *et al.* (2012) [20], they reported that adulteration of extraneous water in milk apparently affects the physical and chemical quality of corresponding milk. Andrews (1977) [21]; Fox and McSweeny (1998) [22] also reported that proteins are more heat liable and fats are least affected by sterilization treatment.

Conclusion

The treatment C_2 (autoclaved) with 12:1 milk and wheatgrass juice, 6% sugar and *rose* flavor was at par with the control in terms of organoleptic and physico-chemical attributes. It is concluded that wheat grass juice can be incorporated for development of healthy flavoured milk drink without compromising the palatability and quality of the product.

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