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Development of pudding with different levels of water chestnut (*Trapa bispinosa*) Powder

Shweta Singh and John David

Abstract
Water Chestnut flour is eaten during fasting in India. So, the aim of the present study was to provide ready to eat pudding during fasting. Water Chestnuts are dense with potassium and fiber. It barely contains any sodium or fat though Water Chestnut are high in carbohydrates. Usually when used as a thickner, stir in water before adding to hot sauce or liquid to reduce lumps. It is used for chappatis, paranthas, sweets, vadas, pancakes and other dough based recipes. It is used as a staple item during fasts. Singhara atta puris, halwa, pakoras are some of the delicacies relished during the Navratri fasts. Water chestnuts form a part of the phaldari diet followed during these fasts. The market demand for instant food is growing all over the world and consumers are seeing now tastes with health. Hence taking into consideration the market demand and consumer preferences attempts were made to prepare pudding from Water Chestnut flour and Honey. Different proportion of water chestnut and honey were used. A total of 17 combinations of water chestnut powder & Honey were prepared in five replication, including one as a control and remaining sixteen as experimental. All the standard ingredients were purchased from local market. The data obtained from organoleptic evaluation showed that the Pudding prepared from Water Chestnut and Honey, in the treatment W_1H_3 (20% WCN & 30% Honey) was found to be more acceptable in terms of Colour and Appearance, Flavour and Taste and Overall Acceptability. It can be concluded that the Water Chestnut can be well utilized for preparation of nutritional, palatable, low cost pudding.

Keywords: Pudding, water chestnut powder, sensory evaluation

Introduction
Trapa bispinosa is commonly grown throughout India and locally known as Singhara (Water Chestnut) (Singh *et al*., 2011) [9]. In addition to being important for aquatic ecosystems, *Trapa bispinosa* species are also food for humans and animals in India, China, and Southeast Asia. It is grown throughout Asia and tropical Africa in lakes and ponds and is often cultivated for its edible fruit. The medicinal values of the whole herb and fruit have long been recognized in folklore medicine as a cure for various diseases (Rahman *et al*., 2001) [8].

Trapa bispinosa is an annual aquatic plant found in tropical and subtropical and temperate zones of the world. Their natural range of growth includes Southern Europe, Africa and Asia. It has been grown in Europe since Neolithic times. It is commonly used as food by ancient Europeans as an easy growing plant; it has become neutralized in part of USA since it was first introduced into North America in 1874. It was found in slow moving rivers, ponds, lakes, and damps and is widely cultivated in Asia. It favours nutrient rich water with pH range between 6.7 and 8.2 and the alkalinity between 12 and 128 mg/L of calcium carbonate (Bhatiwal *et al*., 2012) [1].

The fruits are eaten raw or boiled. When the fruit has been dried, it is ground to a flour called singhare ka atta which is used in many religious rituals and can be consumed as a Phalahar diet on the Hindu fasting days, in Indian traditional festival "Navratri" (Chandana *et al*., 2013) [2].

Puddings are generally milk protein-based starch pastes, with the typical texture of a semi-solid food Lim & Narsimhan (2006) [4]. Due to these complex interactions among the different components of a pudding, it is likely that the substitution of milk with other dispersion media could cause drastic changes in the rheological behavior of the product. This aspect, however, has been little investigated in literature (Lim & Narsimhan, 2006; Nunes, Batista, Raymundo, Alves, & Sousa, 2003) [4, 7]. Besides ready-to-eat puddings, commercial powders are at consumers' disposal for the production of home-made desserts. Pudding powders are usually composed of starch, hydrocolloids, sugars, colorings and aromas and they are intended to be dissolved in milk (Vélez-Ruiz *et al*., 2006) [10].

Honey inhibits the growth of micro-organisms and fungi. The antibacterial effect of honey, mostly against gram-positive bacteria, is well documented Molan, P.C. (1992 & 1997) [6, 5]. The low water activity of honey inhibits bacterial growth. Honey glucose oxidase produces the antibacterial agent hydrogen peroxide, but the peroxide production capacity depends also on honey catalase activity Dustmann J.H. *et al*. (1971) [3].

The carbohydrates found in honey have the ability to improve the intensity of desirable fl avors and reduce the intensity of others. Honey enhances sweetness intensity, decreases sourness, decreases the bitterness intensity and increases the acceptability of savory products by modifying saltiness perception.

Material and Methods

The experimental work was carried out in the research laboratory of department of Dairy, Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. Buffalo milk, Water Chestnut powder and Honey, Cocoa Powder, Corn flour was obtained from the local market of Allahabad city. Pudding prepared by buffalo milk (6% fat&9% SNF) and different levels of Water Chestnut Powder with Honey. There was total seventeen combination. Each was prepared in five replications. The different treatment combinations used in the experimental are as follows:

T_0= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 35%Corn flour and 25% Sugar

W_1H_1= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 20%WCN powder and 20%Honey

W_1H_2= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 20%WCN powder and 25%Honey

W_1H_3= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 20%WCN powder and 30%Honey

W_1H_4=Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 20%WCN powder and 35%Honey

W_2H_1= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 30%WCN powder and 20%Honey

W_2H_2= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 30%WCN powder and 25%Honey

W_2H_3= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 30%WCN powder and 30%Honey

W_2H_4= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 30%WCN powder and 35%Honey

W_3H_1= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 40%WCN powder and 20%Honey

W_3H_2= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 40%WCN powder and 25%Honey

W_3H_3= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 40%WCN powder and 30%Honey

W_3H_4= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 40%WCN powder and 35%Honey

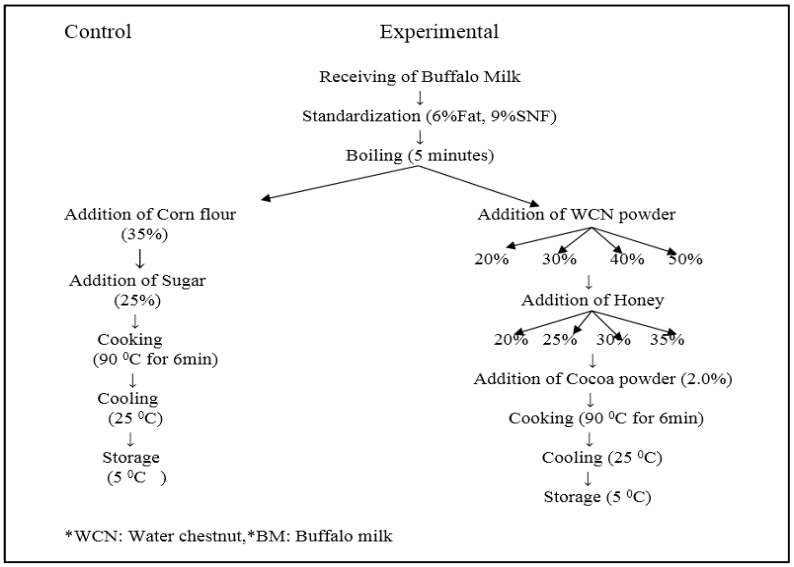
W_4H_1= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 50%WCN powder and 20%Honey

W_4H_2= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 50%WCN powder and 25%Honey

W_4H_3= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 50%WCN powder and 30%Honey

W_4H_4= Pudding prepared from Buffalo milk (6% fat&9%SNF) with addition of 50%WCN powder and 35%Honey

For the preparation of control pudding, standardized Buffalo milk (6% fat, 9%S.N.F) was added with corn flour and sugar. For the preparation of experimental Pudding, buffalo milk and Water Chestnut Powder is mixed and then honey is added then cooked was kept in refrigerator until used.



Source: Gasto´ n Ares *et al*, (2009).
http://unodivertimento.blogspot.in/2011/11/water-chestnut-pudding.html

Fig 1: Flow chart for Manufacturing Water Chestnut Pudding

For Experimental Pudding

Buffalo milk: Calculated amount of Buffalo milk was placed in stainless steel container.

Standardization of Milk for the Preparation of Pudding

In this experiment, since milk used and the sample obtained from student's training dairy, SHUATS, it had more than the desired SNF therefore the calculated quantity of skimmed milk powder for SNF was added into the milk to have the desired fat and SNF percentage. Buffalo milk were standardize to 6% fat and 9% SNF to preparing pudding.

Boiling: Standardized milk then boiled for 5 minutes then cooled to room temperature because addition in boiled milk can cause lump formation.

Addition of Water Chestnut Powder: Then calculated amount of WCN (i.e. 20%, 30%, 40% and 50%) added.

Addition of Honey: Addition of calculated amount of Honey (i.e. 20%, 25%, 30% and 35%) added.

Addition of Cocoa powder: Addition of calculated amount of cocoa (i.e. 2%) is added.

Cooking: Continuous stirring of Pudding was done. When the Pudding consistency reached cooking of Pudding stopped.

Cooling: Pudding cooled to room temperature.

Storage: Experimental Pudding stored at 5^0C temperature till serving.

Sensory Evaluation

The sensory evaluation of Pudding of different Treatments was conducted by a trained panel of 10 judges. Each judge was given a set of pudding separately in isolated booths and provided with a glass of fresh water to rinse their mouth before tasting the next sample. Each sample was evaluated for various quality attributes, viz. colour, consistency, aroma, overall acceptability, etc. as per the prescribed proforma. Judges were asked to rate the samples on a prescribed sensory evaluation proforma with earlier stated attributes. Samples were assessed organoleptically using a 9-point hedonic scale, where 9 correspond to "like extremely" and 1 corresponds to "dislike extremely".

Table 1: Average scores in various quality attributes of Pudding

Treatments	Colour & Appearance		Body & Texture		Flavour & Texture		Overall Acceptability	
To	8.8±	0.447	8±	0.000	8.8±	0.447	9.00±	0.101
W_1H_1								
	8.00±	0.707	7.60±	0.548	8.00±	0.000	8.20±	0.447
W_1H_2								
	8.40±	0.548	8.00±	0.000	8.20±	0.447	8.20±	0.447
W_1H_3								
	8.80±	0.447	7.80±	0.447	8.80±	0.447	9.00±	0.000
W_1H_4								
	8.00±	0.000	7.40±	0.548	7.80±	0.447	7.80±	0.447
W_2H_1								
	8.00±	0.000	7.40±	0.548	7.60±	0.894	7.60±	0.548
W_2H_2	8.00±	0.000	7.40±	0.548	7.60±	0.548	7.80±	0.447
W_2H_3	8.00±	0.000	7.40±	0.894	8.00±	0.000	7.80±	0.447
W_2H_4	8.00±	0.707	7.40±	0.548	7.80±	0.447	7.60±	0.548
W_3H_1	8.00±	0.000	7.40±	0.548	7.60±	0.548	7.60±	0.548
W_3H_2								
	8.00±	0.000	7.40±	0.894	7.40±	0.548	7.40±	0.548
W_3H_3								
	7.80±	0.447	7.20±	0.447	7.40±	0.548	7.60±	0.548
W_3H_4								
	7.80±	0.447	7.00±	0.707	7.00±	0.707	7.60±	0.548
W_4H_1	7.80±	0.447	6.60±	0.894	6.60±	0.548	7.40±	0.548
W_4H_2								
	7.80±	0.447	6.60±	0.548	6.20±	0.447	7.60±	0.548
W_4H_3	7.60±	0.548	6.80±	0.837	6.20±	0.447	7.40±	0.548
W_4H_4	7.60±	0.548	6.40±	0.894	5.80±	0.837	7.40±	0.548

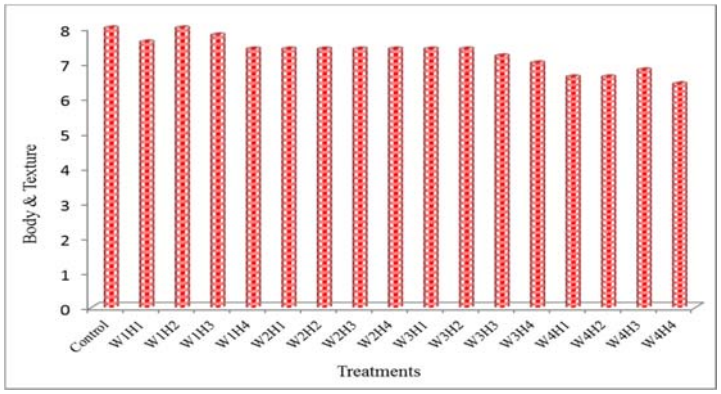


Fig 1: Average scores of Body and Texture of Pudding

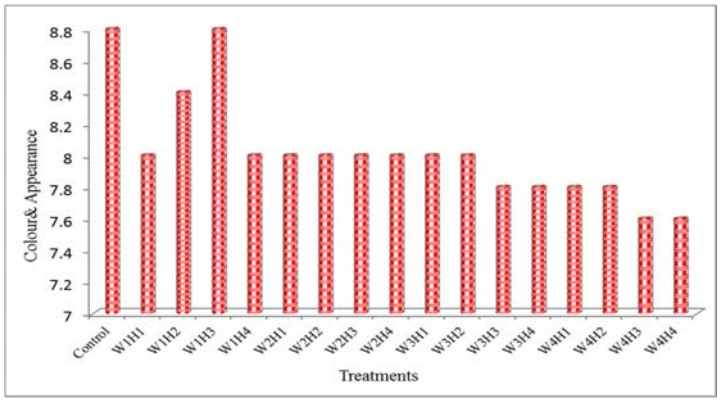


Fig 2: Average scores of Colour and Appearance of Pudding

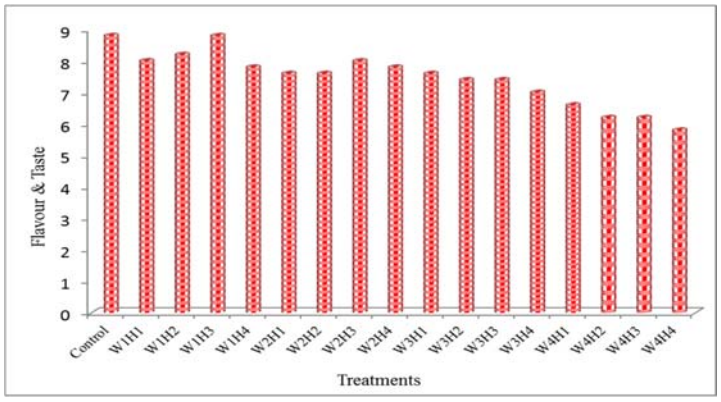


Fig 3: Average scores of Flavour and Taste of Pudding

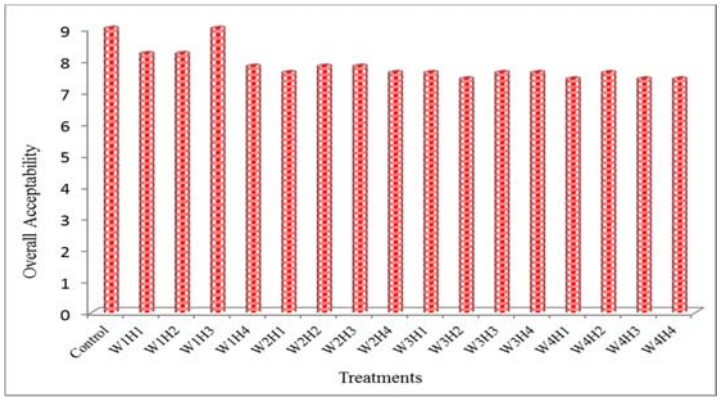


Fig 4. Average scores of Overall Acceptability of Pudding

Statistical analysis

All the treatments were carried out in 5 replicates. The experimental results were expressed as mean ± standard deviation. The data were analyzed using factorial Design and further analysed by CD technique.

Results and Discussion

Pudding production sounds common but the novelty of this work is the use of Water Chestnut and Honey which is nutritious and with antioxidant Property as well as all the essential characteristics for Pudding production. Cocoa imparts flavour and Colour to the pudding. The data obtained from organoleptic evaluation showed that the Pudding prepared from Water Chestnut and Honey, in the treatment W_1H_3 (20% WCN & 30% Honey) was found to be more acceptable in terms of Colour and Appearance, Flavour and Taste and Overall Acceptability. Reported that overall acceptability of the *kheer* depends on colour and appearance, consistency and flavour and further observed that with the increase in the proportion of rice, whole milk powder and sugar results in reduced score for overall acceptability. The results are also in close agreement with. In present study increase in the proportion of Water Chestnut result in reduce Score for overall Acceptability.

Conclusion

Water Chestnut Pudding production has been restricted to households and unorganized sector leading to lower quality and shelf life due to lack of proper scientific processing technology for their manufacture and storage. Basic ingredient of water chestnut pudding is Water Chestnut flour, milk, sugar replacer (Honey). The Pudding produced from water Chestnut has been found to be acceptable, as well as meeting all the standards required by a good Pudding in terms

of colour, flavour, taste, aroma and overall acceptability for a Pudding. Water Chestnut is readily available and it is cheap, thus it can be a good substitute during fasting in India.

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