



Development and Sensory Evaluation of Therapeutic Chocolate Pound Cakes

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ABSTRACT

Lot of attention has been given towards natural healthy therapeutic foods by health professional and the common population for improving overall well being, as well as in the prevention of diseases. In this connection, many grains and fruits have been regarded as functional foods. When such ingredients are added into food preparation with an objective of imparting health benefit is the need of the hour. With this aim, a venture was made to develop a bakery product and evaluate its organoleptic attributes. A chocolate pound cake was formulated and in which desired proportions of kavanai rice and *Tribulus terrestris* fruit powder were added and thus 5 varieties of cakes were prepared and its sensory attributes were compared with the standard cake. 9 point hedonic scale was used to assess sensory characteristics via colour, appearance, flavour, taste and overall acceptability. Garrets ranking tool was employed to assess the ranking of hedonic score. The overall acceptability of cake 2 (80% Refined Wheat Flour and 20% *Tribulus terrestris* fruit powder) and cake 3 (100% Refined Wheat Flour and 10% *Tribulus terrestris* fruit powder) had the highest score of 8.55 and was comparable with standard cake. It was imperative that addition of 10% *Tribulus terrestris* fruit powder into chocolate cake without addition of Kavanai rice scores highest for its sensory attributes. It is concluded that kavanai rice and *Tribulus terrestris* fruit powder could serve as potential functional ingredients in the development of therapeutic foods.

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Introduction

Natural products and health foods have recently received a lot of attention both by health professionals and the common population for improving overall well being, as well as in the prevention of diseases including cancer. In this line, many of the fruits and grains have been reevaluated and regarded as functional foods. The great number of potentially active phytonutrients and multifunctional *Tribulus terrestris* (L) fruits and black purple pigmented rice (*Oryza sativa*) are found as perfect substances for the production of health promoting food supplements.

Tribulus terrestris is a flowering plant of genus *Tribulus* that belongs to the family *Zygophyllaceae*, comprises about 20 species in the world, of which three species, viz. *Tribulus cistoides*, *Tribulus terrestris*, and *Tribulus alatus*, are of common occurrence in India (Trease et al., 2002). Among them, *T. terrestris* (TT) is a well-patronized medicinal herb by Ayurvedic seers as well as by modern herbalists and native to warm temperature and tropical region. It can thrive even in desert climates and poor soil (Duk et al., 2002). The plant is used individually as a single therapeutic agent or as a prime or subordinate component of many compound formulations and food supplements. It is an annual shrub which is also found in Mediterranean, subtropical, and desert climate regions around the world, viz. India, China, southern USA, Mexico, Spain, and Bulgaria (Saurabh et al., 2014). However, this plant or its parts has been seldom tried as detoxifier or cell replenisher.

In China and India whose people constitute almost half the world's population, rice serves as the staple food for their daily life (Sasaki & Burr, 2000) and unsurprisingly, 95% of the world rice production is in Asian countries (Bhattacharjee et al., 2002). Pigmented rice varieties are usually named according to their bran colour formed by deposition of anthocyanins in the

pericarp, seed coat and aluerone (Chaundry, 2003). Pigmented rice is a potential source of antioxidants in various types of functional food production (Yawadio et al., 2007). Potential antioxidative phytochemicals such as acetylated procyanidin, anthocyanins, and other phenolic acids, which can be found in this pigmented rice, can help prevent oxidative stress, inhibits the initiation and formation of cancer, reduces plasma cholesterol levels and may prevent cardiovascular disease (Romero, 2009). Therefore, this is yet another reason why black-purple rice was also selected in the development of cake in place of usual millets.

In our previous study the same combination of *Tribulus terrestris* (L) fruit powder and kavanai rice were used in the formulation of cookies which was highly acceptable according to the sensory evaluation done by the panel of judges (Kannan eagappan et al., 2015).

Tribulus terrestris has significant importance in oriental medicine because they have been used as an aphrodisiac (Adaikan et al, 2000), diuretic (Kumari et al, 1967) and anthelmintic (Anand et al, 1994) also to treat coughs, kidney failure and sexual dysfunction. *Tribulus terrestris* (L) has been documented to have antimicrobial, antihypertensive, diuretic, ant acetylcholine, haemolytic activity, spermatogenesis and libido enhanced, antitumor activity and effects on cardiovascular system (Bowen et al, 1990).

With all the above mentioned credentials, *Tribulus terrestris* (L) fruit powder and the black purple rice were chosen for the incorporation into cakes and thereby to observe the sensory attributes using 9 hedonic scales.

Materials

Tribulus terrestris (L): The healthy plant samples of

Tribulus terrestris (L) plant were collected from Coimbatore District, Tamil Nadu, India. The plant material was authenticated by a skilled Taxonomist, at Botanical Survey of India and a voucher specimen (No.:BSI/SRC/5/23/2013-2014/Tech/1024) was deposited at the Tamil Nadu Agricultural University, Coimbatore.

Methods

Preparation of tribulus terrestris fruit powder

The Fresh fruit of *Tribulus terrestris* (L) was collected and were dried in the shade, powdered and stored in a sterile air tight opaque container for further use which was later incorporated into refined wheat flour and black rice (kavanai rice) cake formulation.

Preparation of kavanai rice flour

The black purple Kavanai rice was washed with running water, then it was soaked in water for 2 hours and later the water was drained completely. The soaked rice were spreaded on a cotton cloth and allowed to dry under shade. After drying it was milled into fine flour.

Preparation of chocolate pound cake

The cakes were prepared by supplementing kavanai rice flour and *Tribulus terrestris* fruit powder into refined wheat flour in the following proportion:

Cake 1: Standard

Cake 2: Maida 80%+ *Tribulus terrestris* fruit powder 20%

Cake 3: Maida 100% + *Tribulus terrestris* fruit powder 10%

Cake 4: Maida 100%+ *Tribulus terrestris* fruit powder 20%

Cake 5: Maida 80%+ Kavanai rice 20%+*Tribulus terrestris* fruit powder 10%

Cake 6: Maida 80%+ Kavanai rice 20%+*Tribulus terrestris* fruit powder 20%

Basic ingredients used were refined wheat flour (1 kg), sugar (1 kg), butter (1 kg), egg (1000gm), cocoa powder (300gm), baking powder (10gm), salt (10gm)

First the eggs and salt were mixed in the mixing bowl. Vertical mixture attached with whip was used to whip the eggs with high speed until it became light and fluffy. Sugar was added during whipping. Then sieved cocoa was added little by little while the egg mixture getting whipped. The sifted flour with baking powder was added little by little into the blended liquid mixture. And few drops of chocolate essence were added. For variation kavanai rice flour and *Tribulus terrestris* fruit powder was added along with wheat flour. Cake batter was poured into greased cake mould and baked at 180°C for 25 minutes, and then the temperature was reduced to 160°C and baking was continued for 10 minutes. Cakes were cooled to room temperature and packed in polyethylene bags.

Statistical Analysis

Garrett's ranking

Garrett's test has been used to analyse the factors influencing the preferences of the respondents for the overall acceptability of Kavanai rice with the addition of *Tribulus terrestris* fruit powder Chocolate cake. Under the garretts' ranking technique average score is calculated by multiplying the number of respondents ranking that factors as 9,8,7,6,5,4,3,2,1 by their respective table values given. Mean score is calculated by dividing average score by number of respondents. The respondents were asked to rank the five factors identified for the purpose of the study as 1, 2,3,4,5. Rank 1 is the highest percentage position whereas rank 5 is the least percentage position. It is said that according to Garretts' ranking the factors which induces respondents to show preferences of various recipes in different proportions are namely colour, appearance, aroma, taste, overall acceptability. Garrett's' ranking technique

is to find out the most significant factor which influences the respondent

Results & discussion

Comparison of different attributes of standard chocolate cake and chocolate cakes incorporated with different proportions of kavanai rice and *tribulus terrestris* (l) fruit powder

The following are the results of the various quality attributes namely colour, appearance, taste, sponginess, flavour and overall acceptability of the standard cake and cake incorporated with kavanai rice and the *Tribulus terrestris* (L) fruit powder.

Colour of Cake

Colour of any food product is an appealing characteristic which can determine the consumer's acceptance and preference. Based on the recipe or as a natural food each product has a distinct colour of its own which is actually recognised by the consumers. And if there is any variation in the colour due to processing method or addition of any other new ingredient, the consumers may have a different perception towards the originality of such products.

In the present study the colour of the standard chocolate cake was compared with the colour of the chocolate cake added with different proportions of kavanai rice and *Tribulus terrestris* (L) fruit powder. With regard to colour as usual the standard cakes had the maximum score of 8.65. However, cake 2 with 80% refined wheat flour and 20% Kavanai rice followed by the cake 3 with a combination of 100% Refined Wheat flour and 10% *Tribulus terrestris* (L) fruit powder respectively, were almost comparable with that of Standard cake with a score of 8.4 on the hedonic scale each. Similarly, cake 4 with 100% Refined wheat flour and 20% *Tribulus terrestris* (L) fruit powder and Cake 6 with 80% Refined Wheat flour and 20% *Tribulus terrestris* (L) fruit powder, 20% Kavanai rice had an identical score of 6.9 each. But in cake 5 (80% Refined wheat flour, 20% kavanai rice, 10% *Tribulus terrestris* (L) fruit powder) had a score of 7.2 that is better than cake 4 and cake 6 probably because only 10% of *Tribulus terrestris* (L) fruit powder has been added. Hence it is apparently understood that as the *Tribulus terrestris* (L) fruit powder proportion increases it could directly influence the colour of the cake. As all the cakes are basically chocolate cakes but it is vividly observed that the addition of *Tribulus terrestris* (L) fruit powder affects the colour of the cakes.

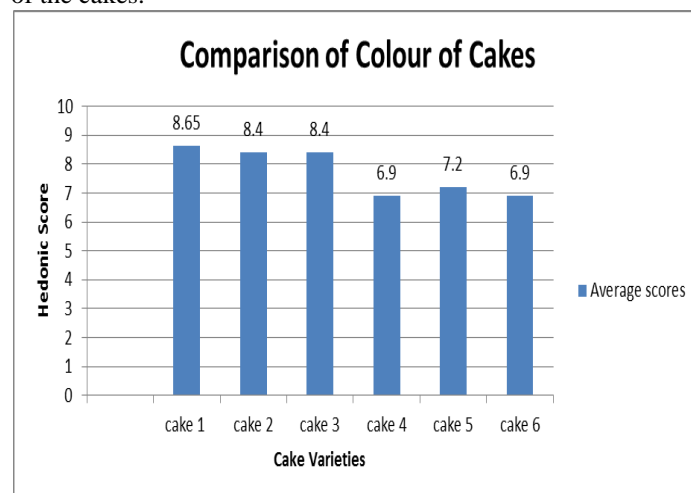


Figure 1

Appearance of cake

In comparison with the standard chocolate cake, cake 2 and cake 3 had the same hedonic score of 8.35 which was close to

the standard cake's score of 8.65. by these scores it is imperative that the combination of refined wheat flour 80% and 20% of *Tribulus terrestris* (L) fruit powder and that of cake 3(100% Refined wheat flour+10% *Tribulus terrestris* (L) fruit powder) had an appealing appearance than the cake 4, cake 5, and cake 6. Probably 20% of Kavanai rice and 20% of *Tribulus terrestris* (L) fruit powder would have varied the appearance to an inferior level.

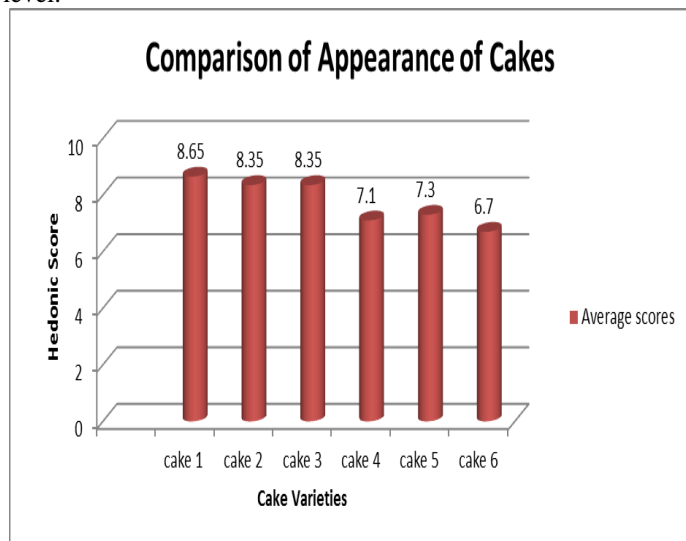


Figure 2

Sponginess of Cake

Cake 6 having a composition of 80% Refined wheat flour+20% kavanai rice +20% *Tribulus terrestris* (L) fruit powder had a least hedonic score of 6.9 whereas cake 2 and cake 3 with this quality attribute of sponginess recorded 8.3 respectively which was very close to standard cake (8.5).

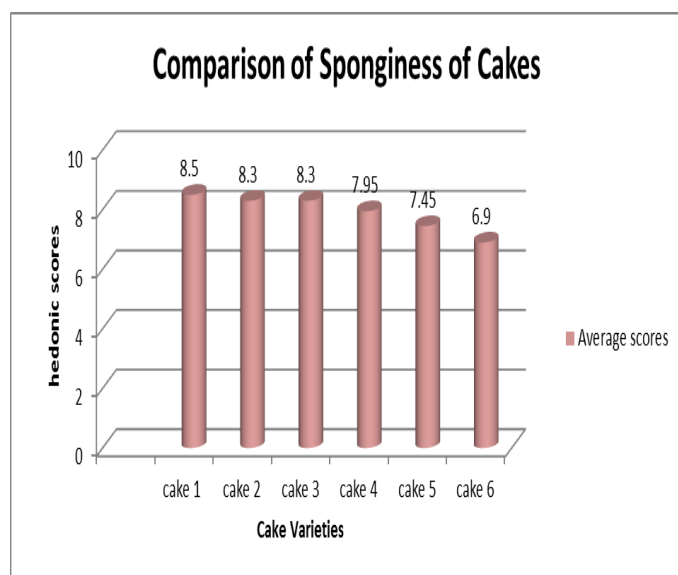


Figure 3

Taste of cake

Though all the cakes were made of chocolate cakes, yet the taste wise there was a marked difference depending on the proportion of *Tribulus terrestris* (L) fruit powder and kavanai rice. Obviously the standard cake received the highest score of 9 while cake 2 (Refined wheat flour 80%+20% *Tribulus terrestris* (L) fruit powder) and cake 3 (Refined wheat flour 100%+ 10% *Tribulus terrestris* (L) fruit powder) scored 8.55 respectively which were appreciably comparable with that of the taste of standard cake 1. As in the place of other quality attributes the

cake 4, cake 5, and cake 6 were inferior in taste wise and had a score of 6.7, 6.9, and 6.25 respectively.

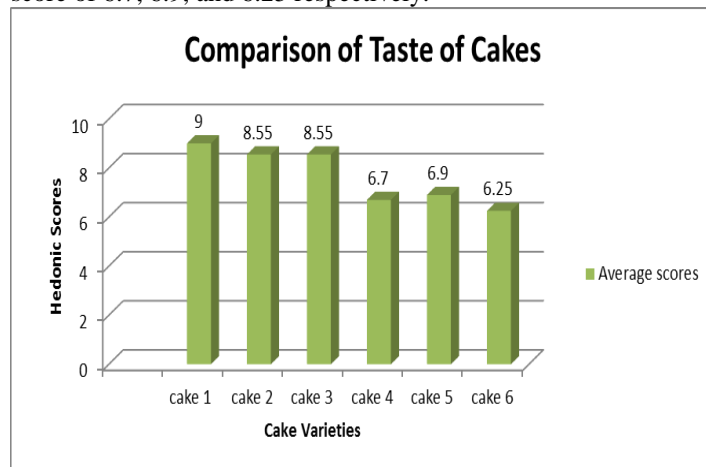


Figure 4

Flavour of cake

With reference to flavour of the chocolate cakes usually, a high score is expected as it is made with cocoa powder but in the present study, the hedonic score for the sensory attribute was only 8.65 for standard cake 1 itself. Nevertheless, cake 2 and cake 3 had similar scores of 8.15 respectively. Whereas, cake 4(Refined wheat flour 80% and *Tribulus terrestris* (L) fruit powder 20%) had a least score of 5.8. While that of cake 5(Refined wheat flour 80%, Kavanai rice 20% and 10% *Tribulus terrestris* (L) fruit powder) and cake 6 (Refined wheat flour 80%, Kavanai rice 20% and 20% *Tribulus terrestris* (L) fruit powder) had a score of 6.65 and 6.15. The obtained scores clearly indicates that as the quantity of *Tribulus terrestris* (L) fruit powder is more (20%) the score for flavour comes down. Similarly, the cake 4 which did not include kavanai rice had the least score (5.8) and comparatively cake 6 though it had kavanai rice since it was with 20% *Tribulus terrestris* (L) fruit powder rendered inferior flavour score of 6.15. However, cake 5 with same ingredients but 10% less of *Tribulus terrestris* (L) fruit powder scored (6.65) better than cake 6. Such reduction in the scores of flavour of cakes with high concentration of *Tribulus terrestris* (L) fruit powder and without kavanai rice, suggest that *Tribulus terrestris* (L) fruit powder could contribute aggressive herbal smell whereas the kavanai rice, plausibly having some bioactive compounds that could contribute to a favourable flavour and acceptable texture.

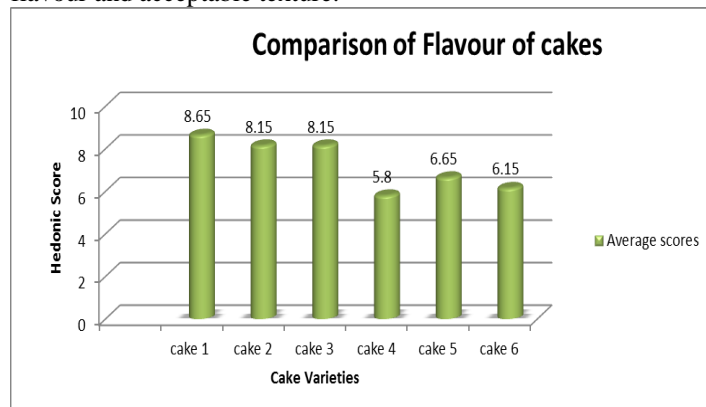


Figure 5

Overall acceptability of cake

In comparison with standard cake 1, the overall acceptability scores of cake 2 and cake 3 had a highest score 8.55 respectively whereas, the overall acceptability score of standard cake 1 was 9. However, the scores of cake 4, cake 5 and cake 6 were 6.3, 6.9 and 6.85 respectively. Among these

three cakes, cake 5 having a proportion of 80% Refined wheat flour, 20% kavanai rice and 10% *Tribulus terrestris* (L) fruit powder scored better than cake 4 and cake 6 which can be owed to the reason since it had only 10% *Tribulus terrestris* (L) fruit powder while other two cakes had 20% *Tribulus terrestris* (L) fruit powder.

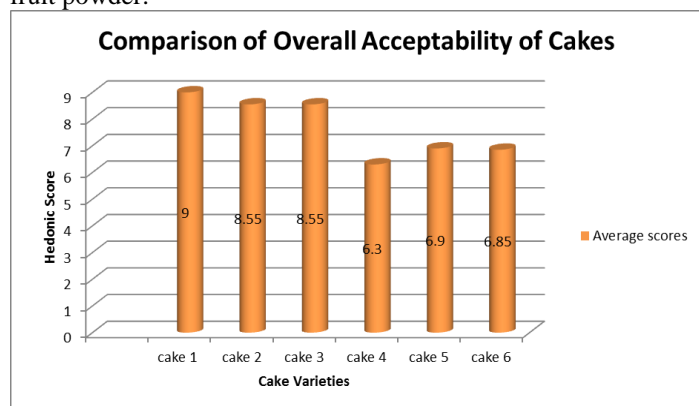


Figure 6

Except sponginess the cake 4, cake 5 and cake 6 score inferiorly than the cake 2 and cake 3. The plausible reason could be addition of 20% *Tribulus terrestris* (L) fruit powder and 20% kavanai rice affects the sensory characteristics of colour, taste and overall acceptability.

Discussion

Bakery products are the group of food products which are most liked by the consumers because of its high palatability, taste and texture. Among such baked foods, cakes are the most preferred and it has been known to refer in the idiom as “selling like hot cakes” for anything which is sold with a demand from the consumers. The palatability of cake depends upon various quality attributes like colour, aroma, sponginess (texture) and taste. Among these the colour depends on the type of the ingredients added.

In a study done by Emanuel et al (2013), observed that the sensory analysis of millet based sponge cake lead to accomplish high scores towards colour and appearance for the variety of cakes with wheat flour alone and for the cakes with the wheat flour 360gm and millet flour 150gm and the sample with wheat flour 300gm and that of 200gm millet. Whereas, in the present study as far as colour of the chocolate cake concerned it was noted down as the amount of *Tribulus terrestris* fruit powder was increased the scores were decreasing. In standard chocolate cake without addition of *Tribulus terrestris* fruit powder and Kavanai rice received the highest score of colour from the panel of judges.

Appearance wise, in comparison with standard cake, cake 2 and cake 3 had a comparable appearance since both these variations of cakes did not include kavanai rice at all.

Among all the quality characteristics of cakes, sponginess is given more attention as it determines the texture and influences mouth feel of the person who consumes it. Altogether, if sponginess is good, the cake will also be soft. The cake 6 had the lowest score for sponginess as it was added with 20% of kavanai rice and *Tribulus terrestris* fruit powder respectively. Plausibly addition of these two ingredients at 20% level would have contributed to a little harder texture with sponginess; again cake 2 and cake 3 were comparable with standards obviously as no addition of kavanai rice would have rendered a better texture. As kavanai rice is basically glutaneous rice and as probably this rice may have more amylopectin which inturn would have altered the texture. In a study conducted by Samia (2013) revealed that addition of cladodes flour influenced the sensory qualities of the

sponge cake incorporated with it. His control cake scored high in all quality attributes but he observed as the concentration of cladodes flour increased, there was a decreasing trend in the scores of all the sensory attributes. However, addition of only 5% cladodes flour did not affect significantly any of the characteristics including overall acceptability. Similar to his study, present study also proved that the lowest concentration of *Tribulus terrestris* fruit powder at 10% level irrespective of kavanai rice was very much acceptable and was indeed comparable with the standard cake.

Conclusion

Based on the above results, it could be concluded that the Kavanai Rice flour and *Tribulus terrestris* fruit powder can be used as a potential source for functional food ingredients and in addition, it could be further processed into therapeutic functional food products.

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