Original Research Article

Effect of Incorporation of Different Levels of Algal Oil in Rice Based Ready to Eat Breakfast Cereal Mix

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A B S T R A C T

It is known that a plethora of clinical and epidemiological evidence relates to the beneficial effects of omega-3 fatty acids, as in fatty fish, and is especially strong in neurocognitive disease. Many authorities have made recommendations for intake of EPA and DHA because of their significant role in development, health and disease prevention. A ready-to-eat breakfast cereal mix was formulated by blending of roasted aromatic black rice and glutinous white rice was mixed with SMP, sugar, cocoa powder and Algal oil in different combinations. The contents of SMP, sugar, cocoa powder was constant for all the treatments. Four treatments namely T_A, T_B, T_C, T_D, T_E and T_F were studied for its physico-chemical and organoleptic analysis. The black rice: white rice ratio combinations of the treatments are 60:40 for T_A and T_B, 80:20 for T_C and T_D and 100:00 T_E and T_F respectively. The level of algal oil was maintained at 2% for treatment T_A, T_C and T_E while the level was kept at 3% for treatments T_B, T_D and T_F. The sensory analysis of the products was conducted by using 9point Hedonic scale by a team comprising of five judges. The scores revealed that T_A scores the highest in flavour and Organoleptic analysis. Therefore, treatment T_A was considered as the optimized product. Omega three fatty acids derived from algal oils emerging as a new functional ingredient and is being accepted by the consumers because of its health benefits.

Introduction

Breakfast is known to be the most important meal of the day. A ready-to-eat breakfast cereal is a food made from more or less processed grains. Consumption of breakfast provides energy for the brain and enhances learning. Eating of breakfast are also on one of the prominent provider of micro and macro nutrients. Incorporation of Algal oil in the food also makes the food rich in essential fatty acids.

The present investigation is to study the quality characteristics of ready-to-eat breakfast cereal mix prepared by mixing different combination of black rice and algal oil. Black rice has a good therapeutic value and is used for the treatment and it helps in prevention of diseases associated with chronic inflammation. Antioxidants of black rice help to preventing premature skin ageing and also promotes good health of the hair and skin.DHA and AA are the major PUFA in the membranes of brain and retinal cells and they have an impact on neuronal functions (Alessandri *et al.,* 2004). Moreover, DHA is essential for improving memory and learning ability as it is associated with brain functioning.

Materials and Methods

Procurement of materials

Roasted black rice and roasted glutinous white rice was collected from local market of Imphal, Manipur. Algal oil was procured from Vasta Biotech, Chennai.

Sugar was purchased from local market of Allahabad. SMP was procured from AMUL. Cocoa powder was procured from Wiekfield, Nalagarh, Himachal Pradesh. Multi Mineral mix cum vitamin mix was procured from DSM, Chandigarh.

Preparation of ready to eat breakfast cereal mix

The manufacturing process for preparing the Black rice based ready-eat breakfast cereal mix is discussed below. The two roasted rice were uniformly mixed. Then the rice was heated to 40-45° C for 5 minutes. The roasted and grounded black rice and white rice were blended with powdered sugar @ 10%, SMP @ 25%, cocoa powder @ 5%, mineral mix cum vitamin mix 2% and algal oil@ 2% and 3%. The product was uniformly mixed. Different treatments were formulated using different ratio of black rice and white rice. The different treatments were T_A, T_B, T_C, and T_D having a Black rice: White rice ratio combinations for T_A and T_B, are of 60:40 and 100:00 having 2% algal oil while T_C, and T_D also has a 60:40 and 100:00 but both having 3% algal oil. The present study was conducted to evaluate the effect of incorporation of algal oil in ready-to-eat foods on physico-chemical and organoleptic properties.

Physico-chemical analysis

Carbohydrates (%) was determined by Lane-Eyon Method described in IS: 1479, part ii (1961). Fat analysis was carried out according to the method of AOAC (1990). Protein estimation of sample was carried out using Kjeldahl method (AOAC, 2000). The total solid content of the ready-to- eat breakfast cereal mix was estimated by (Ranganna, 2009). The Ash content of Ready-to-eat breakfast cereal mix sample was estimated by the charring method described by AOAC (2000). Crude Fibre (%) Crude fiber of the Ready-to-eat breakfast cereal mix sample was estimated by the method given by AOAC, 2000. The Titratable acidity of the Ready-to-eat breakfast cereal mix sample was estimated lactic acid as described in Ranganna (2009).

Loose bulk density, Packed bulk density and Flowability was analysed as per the method as

described by Bandyopadhyay *et al*., (2016). Dispersibility was determined by the method described by Kulkarni *et al*., (1991). Wettability and oil absorption capacity Emulsification capacity and Gelatinization temperature was estimated as per the method described by Onwuka (2005). Foaming capacity and stability of the flour samples were studied according to the methods described by Desphande *et al.,* (1982). The viscosity of the samples was determined with a Brookfield dial viscometer. Insolubility index analysis by the method in IS: SP: 18(Part XI), (1981). Colour L*, a* and b* (Hunterlab, Hunter Associates Laboratory, Reston, Verginia USA) the values were analyzed by Hunter Colourrimeter.

Sensory analysis

The evaluation was done by a 5 trained panelists at Warner College of Dairy Technology, SHUATS, Allahabad. Judgments for Ready-to-eat breakfast cereal mix were carried out through rating products on a 9-point hedonic scale (Ranganna, 2009).

Statistical analysis

Statistical analysis all the experiments were conducted in triplicate and the mean and standard deviation were calculated using MS Excel software and WASP. The data were subjected to one-way analysis of variance (ANOVA).

Results and Discussion

Effect of algal oil supplementation of chemical properties

From the above investigation the physico-chemical properties of the different treatments are observed as the following. Carbohydrate content was observed to be 66.96, 65.70, 65.93, 65.07l, 64.91 and 64.21 respectively in

the treatments of T_A, T_B, T_C, T_D, T_E and T_F. The Fat percent was observed to be 3.81, 4.81, 4.05, 50.1,4.33 and 5.31respectively in the treatments of T_A, T_B, T_C, T_D, T_E and T_F.While the Protein percent was observed to be 19.69, 19.66, 20.09, 20.09, 20.36 and 20.30respectively in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Total solid percent was observed to be 94.53, 94.54, 95.58, 94.59, 94.64 and 94.65 respectively in the treatments of T_A, T_B, T_C, T_D, T_E and T_F. Ash percent was observed to be. 5.12, 4.98, 5.20, 5.21, 5.43 and 5.50respectively in the treatments of T_A, T_B, T_C, T_D, T_E and T_F. Crude Fibre percent was observed to be 0.52, 0.51, 0.68, 0.66, 0.81l and 0.79in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively.

Titratable acidity percent was observed to be0.245, 0.240, 0.248, 0.243, 0.243 and 0.245respectively in the treatments of T_A, T_B, T_C, T_D, T_E and T_F. From the above observations it can be observed that the values of Carbohydrate decreases with the increase level of black rice and algal oil. The values of parameters such as Fat, Protein, Total solid, Ash and Crude fibre showed increasing order with the increase level of black rice and algal oil. Whereas the Titratable acidity values were not dependent of increase or decrease level of both black rice and algal oil.

The Loose bulk density values were observed as 0.45, 0.44, 0.44, 0.43, 0.44 and 0.43for treatments forT_A, T_B, T_C, T_D, T_E and T_F respectively.Packed bulk density values were observed as0.56, 0.55, 0.55, 0.54, 0.55 and 0.54in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Flowability values was observed as 1.25, 1.25, 1.25, 1.25, 1.25 and 1.25in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Dispersibility values was observed as84.03, 83.08, 79.03, 78.07, 72.49 and 71.54in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively.

Wettability values were observed as1.49, 1.42, 1.68,1.61,1.82 and 1.81in the treatments of T_A, T_B, T_C, T_D, T_E and T_F. respectively. Fat absorption capacity values were observed as 1.12, 1.18, 1.21, 1.24, 1.34 and 1.36in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Foaming capacity values were observed as1.93, 1.96, 2.12, 2.14, 2.36 and 2.38 in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Emulsification capacity values were observed as58.40, 58.40, 63.00,62.20,66.60 and 66.80in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Gelatinization temperature values were observed as75.00, 74.90, 76.10, 76.40, 78.00 and 78.50in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Viscosity values were observed as 0.278, 0.271,0.238, 0.234, 0.191 and 0.18 in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively.Colour L* values were observed as 67.23, 67.20, 66.33, 65.41, 65.69 and 64.29in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Colour a* values were observed as 8.24, 8.16, 8.54, 8.45, 8.78 and 8.74 in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. Colour b* values were observed as12.16, 12.32, 12.52, 12.64, 12.79

and 12.88 in the treatments of T_A, T_B, T_C, T_D, T_E and T_F. respectively. Insolubility index values were observed as1.84, 1.80, 1.72, 1.70 ,1.64 and 1.58 in the treatments of T_A, T_B, T_C, T_D, T_E and T_F respectively. For Loose bulk density and Packed bulk density the values showed a decreasing order with the increased level of black rice and increase level of algal oil. Whereas the Flowability value remained unchanged for all treatments. The values of Dispensability were observed to be decreasing with increased level of black rice. The values of Wettability were observed to be increasing with increased level of black rice.For parameters such as the Fat absorption capacity, Foaming capacity. Emulsification capacity and Gelatinization temperature the values showed a trend of increasing order with the increase level of black rice and algal oil. The values of Colour L* Colour a* values was observed to be decreasing with the increase level of black rice whereas the values Colour b* values was observed to be increasing with the increase level of black rice. For Insolubility properties it was observed to be decreasing with increased level of black rice and algal oil.

Fig.1 Graph representing average sensory scores in different treatments
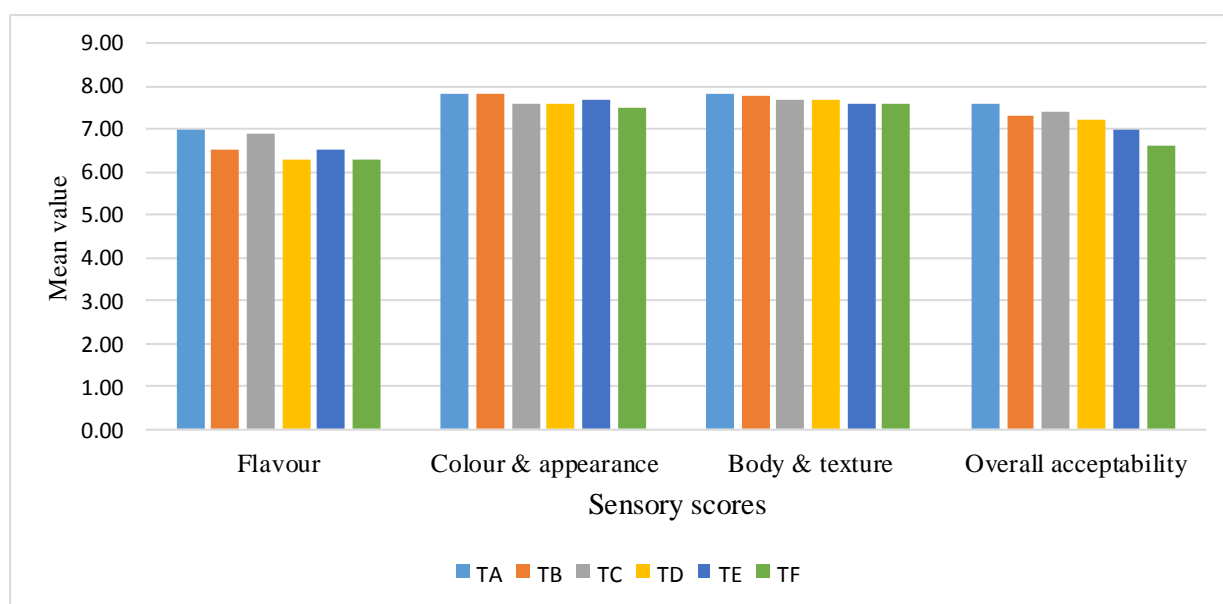
Effect of algal oil supplementation of sensory score

On the analysis for organoleptic properties, the highest Flavour score was observed by T_A scoring 7.00 and 6.28 the lowest as scored by T_F. For Colour and appearance scores as highest as 7.80 points for both ta and T_B while T_F observed the lowest 7.50. Highest Body and texture was observed by T_A 7.8 and the lowest as 7.58 as scored by T_F. On analysis for Overall acceptability T_A observed the highest scores7.50 while the minimum value was scored by T_F 6.60. On flavour it was observed that as the level of algal oil increases there is decrease in the score. On analysis for Colour and appearance it was observed that the colour and appearance decreases with the decrease in algal oil. Also for analysis for Body and texture it was observed that there is decrease in with the decrease in algal oil. Also for analysis for it was observed that there is decrease in with the decrease level of algal oil.

In the present study it was concluded that with increased level of algal oil, Flavour score decreases. This decrease can be attributed to the fact that algal oil has a fishy flavour which is not well perceived by the experts. There was no change in Colour and appearance as well as Body and texture. The overall acceptability scores decrease from 7.50 to 6.60 suggesting that the increase in algal oil contributes to the fishy flavour which decreases the score. Algal oil of sea origin is an emerging functional ingredient and is being consumed in large scale throughout the world because of the plethora of health benefits imparted by it.

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