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RESEARCH ARTICLE

DEVELOPMENT, EVALUATION AND ACCEPTANCE OF ANTHOCYANINS RICH PRODUCT TO IMPROVE MOOD AND COGNITION

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ABSTRACT

Anthocyanins are water soluble flavonoids which are rich in antioxidant properties and are present in foods such as black currants, blueberries, cranberries, black rice, sunflower seeds and purple cabbage. Anthocyanins and antioxidants are known to help in managing the stress levels in an individual, when consumed in food. They are also proven to play an important role in improving mood and cognition. A mousse jar was developed, which consisted of eight layers, was prepared, using anthocyanin and antioxidant rich ingredients such as black rice flour, cranberries, black currants and sunflower seeds, which upon sensory evaluation, was acceptable with the overall acceptability score of 8.58 and ideal for human consumption. The product underwent a proximate analysis and antioxidant test to assess the product's nutritive value. The results derived were for 100g of the developed product - CHO: 64.7g, protein- 7.07g, fats- 5.95g, crude fiber- 4.15, energy- 113.3g and antioxidant- 0.046g.

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INTRODUCTION

Anthocyanins and Antioxidants as a part of their diet majorly contributes in managing stress and anxiety. Flavonoids are a set of plant metabolites that provide health benefits through cell signaling pathways and antioxidant effects. These molecules are found in a variety of fruits and vegetables (Gary, 2003). Flavonoids are polyphenolic molecules containing 15 carbon atoms and are water soluble. Anthocyanidins, anthoxanthins are a few of the subgroups of flavonoids (Gary, 2003; Khoo, 2017). Anthocyanins are vacoular and water soluble pigments, depending on their pH, may appear red, purple, blue or black. Food plants rich in anthocyanins include the blackcurrants, blueberry, raspberry, black rice, and black soybean, among many others that are red, blue, purple, or black coloured plant sources (Khoo, 2017). Anthocyanins belong to a biggest class of molecules called flavonoids synthesized via the phenylpropanoid pathway. They are present in all tissues of higher plants, including leaves, stems, roots, flowers, and fruits. Anthocyanins are obtained from anthocyanidins by adding sugars. They are odorless and moderately astringent.Anthocyanins have varied health benefits: few of them are- antiviral, anticancer, anti-inflammatory (Khoo, 2017). Anthocyanins are used to treat a number of blood vessel related issues such as- high blood pressure, chronic venous insufficiency, diabetic retinopathy. Anthocyanins also play a major role in improving mood and cognition.

Keeping in mind the relationship between anthocyanins and stress levels a product was developed in which the key ingredients were Blackcurrant, Cranberries and Blackrice. Anthocyanins acts as a neuroprotector that also helps in protection of vulnerable neurons against inflammation, enhancement of existing neuronal function, increased blood flow to the brain and neurogenesis initiation in areas of the brain that are associated with cognition and mood improvement (Whyte, 2019; Robert Krikorian, 2010)

LITERATURE SURVEY

A single blind, randomized, placebo controlled experiment was conducted amongst healthy young adults. The study proved that the temporal profile of executive function (EF) and mood changes over a 6 h period following a mixed-berry intervention. Forty participants aged 20-30 years consumed 400ml of smoothie which contained a similar amount of blueberry, strawberry, blackberry and raspberry. Mood was assessed using the negative and positive affect schedule. The executive function was assessed using Modified Attention Network (MANT) and Task Switching Tasks (TST). The results acquired by the study was, in the placebo intervention, performance reduced as the participants became cognitively fatigued. Whereas, the mixed berry intervention gave significant results.

It was also seen that anthocyanin and flavonoid improved cerebrovascular blood flow and mediation of cell signaling pathways which enhanced cognition (Whyte, 2019). The participants maintained accuracy on the cognitive tasks throughout the day and showed quicker response to the Modified Attention Network (MANT)at 2, 4h and 6h. This study was conducted to see the association between estimated regular intake of dietary flavonoids and depression risk. Total of 10572 incidents of depression were found during the 10-years follow up. There were inverse associations between flavonol, flavone, and flavanone intakes and depression risk were observed. Participants who consumed flavonoids on a regular basis found to be on the lower risk of depression. Higher intakes of all flavonoid subclasses except for flavan-3-ols (Gary, 2003) were associated with significantly lower depression risk. Flavones and proanthocyanidins had the strongest association in lowering depression, stress and anxiety. The direct mechanism includes modulating signaling pathways responsible for maintaining neuron survival and inducing synaptic plasticity and indirect mechanisms include reducing neuroinflammation, improving blood flow, or reducing oxidative stress (Whyte, 2019; Shun-Chiao Chang, 2016) which reduces the risk of anxiety, depression and stress.

Blueberries are high in polyphenolic compounds, mostly anthocyanins, which are antioxidants and anti-inflammatory. Furthermore, anthocyanins have been associated to enhance neuronal signaling in brain centers, which mediates memory control, also improves glucose disposal, both of which help in preventing neurodegeneration (Whyte, 2019). It was also found that greater clearance of central beta-amyloid as well as enhanced signaling in memory centers with the effects of daily consumption of wild blueberry juice. At 12th weeks, the study observed improved paired associate learning and recall. They also observed reduced depressive symptoms and lower glucose levels. The results inferred from the study was that supplementation of blueberry has a positive effect on neurocognitive health (Robert Krikorian, 2010). A randomized, double-blind and placebo controlled study was conducted to analyze the relation between anthocyanin rich blackcurrant juice and mood and cognition. 9 young adults were given anthocyanin rich blackcurrant juice, standardized at 500mg polyphenols (Khoo, 2017). To assess the results EEG (Electroencephalography) was used to analyze the cognitive performance in prefrontal cortex neuronal activity. The results gained post EEG was suppression of alpha spectral power, and an increase in the slow wave and spectral powers. The study also saw that there was increased alertness and lower fatigue and increased neuroprotection and cell signaling (Watson, 2019). The results from Cog Track said that there was a slight increase in the reaction time during digital vigilance.

METHODS AND APPROACH

AIM: To develop anthocyanin rich product which aids in reducing stress levels.

OBJECTIVES

- Development of anthocyanin rich product
- Sensory evaluation of the developed anthocyanin rich product
- Proximate analysis of the developed anthocyanin rich product
- Estimation of total antioxidant capacity of the developed product

PRODUCT DEVELOPMENT

The Product Development involves the following steps:

- Procuring ingredients and tools needed to make mousse jar
- Pre-preparation like washing, grinding, sifting etc.,
- Preparation of cranberry pulp
- Preparation of black rice flour and wheat cookies
- Preparation of mousse jar using the pulp and cookies

Measurements of mousse jar Layers:

Table 1. Layers of mousse Jar

LAYERS	GRAMS
LAYER 1: BLACK RICE COOKIE CRUMBS	5g
LAYER 2: CREAM CHEESE	5g
LAYER 3: BLACK RICE COOKIE CRUMBS	5g
LAYER 4: CRANBERRY PULP	10g
LAYER 5: BLACK RICE COOKIE CRUMBS	5g
LAYER 6: DRIED BLACKCURRANT	10g
LAYER 7: BLACK RICE COOKIE CRUMBS	5g
LAYER 8: ROASTED SUNFLOWER SEEDS	10g

DATA ANALYSIS

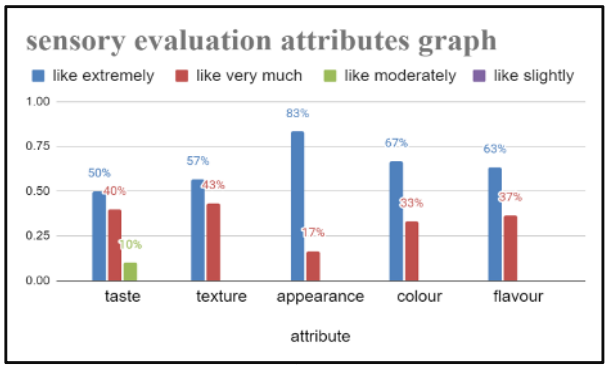
Sensory Analysis using 9 point Hedonic Scale: The developed product was subjected to sensory evaluation, to determine the rate, acceptance of the Food Product that was developed. Hedonic scale was used to determine the rate of acceptance where the scale ranges from 1= dislike extremely to 9= extremely like. The hedonic scale consists of different attributes which includes taste, smell, color, texture, etc.,

RESULTS AND DISCUSSION

The product developed was highly accepted and was considered to have good appearance according to the study conducted. Overall acceptability was 8.58.

Table 2. Sensory Evaluation Score

ATTRIBUTES	M±SD
TASTE	8.4±0.66
TEXTURE	8.5±0.49
APPEARANCE	8.8±0.4
COLOR	8.6±0.48
FLAVOR	8.6±0.48
OVERALL ACCEPTABILITY	8.58



Graph 1. Represent different attributes of sensory evaluation

PROXIMATE ANALYSIS OF THE SAMPLE

The proximate principles of the product were estimated and table 3 depicts the results of the analysis per 100g of the sample.

PROXIMATE ANALYSIS OF THE SAMPLE

Table 3. Proximate analysis value for 100g of the sample

PROXIMATE ANALYSIS	M±SD
MOISTURE g/100g	21.2±0.058
TOTAL ASH g/100g	1.27±0.024
CARBOHYDRATES g/100g	64.7±0.044
PROTEINS g/100g	7.07±0.008
FAT g/100g	5.95±0.024
CRUDE FIBRE g/100g	4.15±0.029
ENERGY g/100g	113.3±160.27

ANTIOXIDANT TEST OF THE SAMPLE

The developed anthocyanin rich product was subjected to an antioxidant assay by DPPH (2,2-diphenyl-1-picrylhydrazy) method and from the results, the antioxidant capacity is 0.046g for 100g of the sample.

Table 4 antioxidant test value for 100g of the sample

ANTIOXIDANT TEST	M±SD
ANTIOXIDANT g/100g	0.046±0.009

CONCLUSION

The above study was based on food product development rich in anthocyanin and antioxidants and the ingredients used were black rice flour, cranberry, and blackcurrants. The product also underwent sensory evaluation (hedonic scale) with the trained panelist and the study derived that the product developed was highly acceptable for human consumption in terms of taste, appearance, color and the overall acceptability score was 8.58. Developed anthocyanin rich product also underwent proximate analysis and antioxidant capacity tests. The product developed also has health benefits, acts as an anti-inflammatory and can provide neuroprotection inturn improving the mood and cognition when consumed regularly.

FUTURE SCOPE

- To find the effect of developed anthocyanin rich product on mood and cognition by conducting a human trial
- Based on the effect of anthocyanins on the mood and cognition to globally market the anthocyanin rich product.

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