

Enrichment of Folic Acid in Herbal Candy

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Received date: June 22, 2022, Manuscript No. ipjhm-22-14184; Editor assigned date: June 27, 2022, PreQC No. ipjhm-22-14184 (PQ); Reviewed date: July 11, 2022, QC No. ipjhm-22-14184; Revised date: August 22, 2022, Manuscript No. ipjhm-22-14184 (R); Published date: August 29, 2022, DOI: 10.36648/2472-0151.8.5.003

Citation: Abinaya MK, Priya HM, Celsia R (2022) Enrichment of Folic Acid in Herbal Candy. Herb Med Vol:8 No:5

Abstract

Candy is a confectionery that features sugar as a principle ingredient. The main target of our candy is to prepare the candy preferring folic acid for pregnant women. In 210 ml of orange juice contains 110 mcg of folic acid, 100 g of pumpkin powder contains 16 mcg of folic acid and 340 g of honey contains 6.78 mcg of folic acid. Candy was formed using pumpkin powder, orange extract, ginger extract, sugar and honey based on sensory evaluation. Optimum composition was found to be 33.3% of honey, 8.3% of pumpkin powder, 4.2% of ginger extract, 20.8% of orange juice, 33.3% of crystallized sugar. Here all the ingredients were taken fresh and were boiled under 90°C for 7 to 10 minutes. This study describes that 8:2:1:5:8 of honey, pumpkin powder, ginger extract, orange juice and crystallized sugar gave perfect texture and glossiness. The proximate analysis for optimized sample (100 g) of protein, carbohydrate, ash content, moisture, fat, sugar, reducing sugar was 2.07%, 56.2%, 0.614%, 24.0%, 0.73%, 13.7%, 5.12% and microbial analysis of standard plate count is 12.0 CFU/g. Folic acid were determined using HPLC method. Herbal candy contains 420 mcg of folic acid which met the daily requirements OF pregnant *i.e.*, they can consume up to 400 to 800 mcg of folic acid per day. Candy preparation using pumpkin, orange can be done without any changes in their sensory attributes.

Keywords: Enrichment; Fortified; Hard boiled candy; HPLC; Folic acid

Introduction

Folic acid

Folic acid (vitamin B₉) is a water soluble B-vitamin that belongs to the folate family. It is basic micronutrient which cannot be biosynthesized by human body and must be obtained either from count calories or from supplements; it is required for fetal body digestion system, development in pregnant ladies. Folate are naturally present in green leafy vegetables, legumes, egg yolk, liver, and citrus fruits. In spite of the fact that folate and folic acid are comparatively similar in structure, foods with high amount of anti-oxidants can display a really steady folate

substance. The folate in orange is found in the form 5-methyltetrahydrofolic acid [1]. High Performance Liquid Chromatography (HPLC) is a technique that is also used to determine folic acid and folate applied in multivitamin tablets, foods and beverages are utilized for nourishment to avoid the incidence of neural birth defects.

Problem stated

Birth defects are one of the major problems within the human public health with estimates from centers for malady control and anticipation (CDC) (Wallingford) [2]. These come about to begin with highlighted that multivitamin or FA supplementation may play a significant part in incubation and may decrease the recurrence of NTD.

Health benefits of folic acid

- The lowest amount of folic acid required to prevent NTD is a critical situation. Though 400 µg of folic acid is recommended to prevent NTD.
- Taking folic acid supplements before and during pregnancy will help anticipate neural tube abnormalities within the fetus. It may moreover decrease the dangers of preterm birth, heart inconsistencies, and cleft palate, among other things.
- The purpose of this study is to incorporate folic acid in herbal candy for targeting pregnant women.

Candy

Candies are delicate, delicious treat that we all cherish. The word candy comes from Arabic word-qand, determined from Persian word-qand, meaning sugar. Candies have many flavors including chocolate, caramel, peppermint, dark chocolate, butter scotch and mint and different natural product flavors [3]. Moreover, there are numerous textures of candy such as chewing gum, hard candy, soft candy and all sorts of incredible delightful setups and shapes. These are rich in vitamins, minerals, antioxidants, energy and there are less or no calories which affect health.

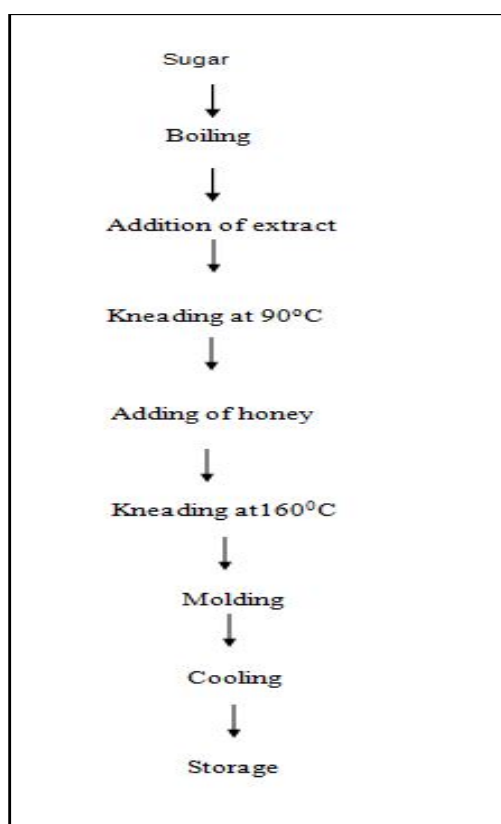
Materials and Methods

Orange is a dietary powerhouse, stuffed with vitamins and minerals. The foremost vital of these is vitamin C, a water

soluble antioxidant that avoids cell damage. Orange is a great natural source of folate. 1 cup of orange juice contains 110 mcg of folic acid. Pumpkin is a fantastically nutritious food. It is rich in vitamins and minerals and generally few calories. Pumpkin gives you a strong dosage of beta carotene, which is somewhat changed over into vitamin A. Vitamin A can offer assistance your body fight infections. 100 g pumpkin serves 16 mcg of folic acid. Ginger (*Zingiber officinale*), Roscoe belongs to the Family Zingiberaceae, could be a perennial herb with thick tuberous rhizomes. The rhizome contains a few proteolytic enzymes known as Zingibain [4]. Ginger contains up to 3% of oil that causes the scent of the flavor. Honey features a number of potential health benefits and plays a part in numerous home cures and alternative medicine treatments. It is rich in polyphenols. Honey is safe during pregnancy it may contain some bacterial spores but our immune system and stomach able to manage the bacteria. 340 g of honey contains 6.78 mcg of folic acid. The refined white crystalline sugar was obtained from local market and was used for candy preparation.

Formulation of hard candy

In order to select appropriate methodology for production of candy, the product was prepared by following the procedure and ingredients indicated in different recipes. The product was analyzed for sensory parameters.



Water and sugar were blended in a Saucepan and permit to boil included slight butter and salt [5]. Mixed the blend with a wooden spoon.

All extracts were added one by one with the assistance of spatula with consistent stirring. Flavoring agents and additive were included to the mixture.

Substance was poured instantly into the mould (Splashed with vegetable oil so that the blend does not adhere with the mould) and permitted to cooled by placing in the cooling racks. After cooling stored in a proper temperature (Table 1).

Table 1: Formulation for herbal candy preparation.

Ingredients	Quantity
Orange	20.8 ml
Pumpkin	8.3 g
Ginger	4.2 ml
Honey	33.3 ml
Sugar	33.3 g
Other ingredients are mentioned in ml, Pumpkin and sugar are mentioned in gram	

Proximate analysis

Moisture content: The powdered sample (2 g) was placed in a moisture dish and dried to a constant weight in an oven at 100-105°C. The loss of weight (in mg/g) of air dried was calculated as follows

% of moisture content=(initial weight of sample-final weight of sample/weight of sample) × 100

Ash content: The ash content of a food sample could be determined using a muffle furnace at a high temperature. 10 g of samples is weighed in a crucible and held at 560°C for 1 hour in a muffle furnace. The sample turns to ash after 1 hour, and the weight of the ash is measured.

Crude ash (Dry basis) (%)=[W₁/W₂] × 100

Where:

W₁=Weight after ashing

W₂=Weight before ashing

Nutritional analysis

Protein content: The Folin-Lowry technique was used to calculate the total soluble protein content of the samples. All the reagents were mix well, and set aside for 20 minutes in the dark. At 660 nm, the resultant color was measured.

Concentration of protein (%)=((OD(Test)/OD/(std)) × (conc. (std)/aliquot(test))) × 100

Carbohydrate content

The phenol-sulphuric acid method was used to calculate the total carbohydrate content. At 490 nm, the colorful compounds formed by condensing furfural or furfural derivatives with phenol are measured.

Concentration of carbohydrate (%)=((OD(Test)/OD/(std)) × (conc.(std)/aliquot(test))) × 100

Fat content

The fat content of the sample is determined according to the method as mentioned in AOAC. 250 mL hexane is added into the circular bottom flask of the Soxhlet apparatus. A 15 g sample is

obtained and placed in the thimble, which is then connected to the condenser. The flow rate is set to 2-3 drops per second, and the procedure is repeated five times for a total of six hours [6]. The solvent is separated using a rotating vacuum evaporator once the extraction is completed. The fat sample was then placed in hot air oven for 20 mins at 100 degree.

Calculation of % fat=(weight of ether soluble material/weight of the sample) × 100

Energy

The energy content might be determined with a simple calculation. We know which chemical groups contribute to a food's energy content. We also know that how much energy is carried out by each of these molecules and how much energy they will deliver to your body. The formula given below is used to determine the energy.

Energy=(9 × fat(g)+(4 × carbohydrate(g)+(4 × Protein (g))

Microbial analysis standard plate count

SPC was used to determine the number of microorganism in the sample. It is an agar plate method for estimating bacteria [7]. The serial dilution of the cookies was prepared. 10 ml of nutrient agar media was added to the sterilized petri dish and allowed to solidify. 0.1 ml of sample solution is taken and spreaded with the help of L-rod. The colonies were counted after 2 days.

Yeast and mould

Dilute the sample with sterilized buffer solution at 121°C for 15 minutes, in ratio if 1:10 (10-1) and made if require more dilution, dilute the sample in same ratio in accordance with sample type. Carefully mix the inoculums with the medium and allow the mixture to solidify. After complete solidification, invert the prepared dishes and incubate at 25°C ± 1°C [8]. For determining yeast alone, add 0.25% sterile sodium propionate solution at the time of pouring.

HPLC

The HPLC system (e.g. Agilent 1260 Infinity II Prime) should consist of a quaternary gradient pump, an auto sampler (100 µL

maximum loop capacity) and a diode array detector with 60 mm path length for the highest sensitivity and 10 mm path flow cell. C18 column (e.g. Poroshell SB-C18 column, 3.0 × 100 mm, 2.7 μm or equivalent). The column oven temperature is maintained at 30°C. Flow rate 0.6 mL/min and detection at 280 nm. Injection volume: 10 μL. Mobile phase A (0.1% TFA in water) and B (acetonitrile) gradient program.

Sensory evaluation

The sensory quality characteristics of the herbal candy such as color, taste, texture, flavor and overall acceptability were evaluated by panel of semi-trained and untrained judges using nine point Hedonic scale.

Results and Discussion

We have done 9 trials. In trial 1, the flavor of pumpkin seed dominates the other ingredients which affects the candy texture and in trial 2 the candy doesn't settled properly and felt sticky [9]. In trial 3, the taste and appearance of the candy felt gummy, used palm jaggery instead of white sugar in trial 4 which dominates the actual taste of the candy. In trial 5 the consistency was not good. Mouth feel and texture was good but easily broken in trial 6. The addition of pumpkin increased in herbal candy which destroyed the texture in trial 7. The addition of pumpkin powder in trial 8 gives perfect texture and glossiness. In trial 9, decrease in quantity of pumpkin juice gives texture but felt sticky. Totally 9 trials were made among that trials 8th trial was optimized based on the sensory and textural

Table 2: The moisture content of herbal candy.

S. no	Characteristic	Test method	Unit	Results
1	Moisture	FSSAI/AOAC/IS	%	24
2	Ash	FSSAI/AOAC/IS	%	0.614

Nutritional analysis

The chemical compositions of herbal candy was found to be the protein as 2.07%, fat as 0.73% and carbohydrate as 56.2% [11]. Whereas in tomato candy was found to be 0.73% protein, 0.03% fat, 7.74% carbohydrate (Table 3).

Table 3: Nutritional analysis of proteins, carbohydrates and total fat content.

S. no	Characteristics	Test method	Unit	Results
1	Protein	FSSAI/AOAC/IS	%	2.07
2	Carbohydrate	FSSAI/AOAC/IS	%	56.2
3	Total Fat	FSSAI/AOAC/IS	%	0.73
Total energy=239.65 g				

Microbial analysis

The standard plate count for tomato candy was founded that nil with 40% and 50% of sugar solution and candy with 60% reported as 3 × 10¹ cfu/g comparatively the herbal candy

properties. The optimized herbal candy was estimated in terms of physical and chemical analysis [10] (Figure 1).



Figure 1: Herbal candy.

Proximate analysis

The moisture content of herbal candy was 24.0% and the ash content was observed to be 0.614%, similar study was conducted by Soe Wai Phyo, in citrus peel candy having moisture content of 8.09% and ash value of 0.62% (Table 2).

contains 12 cfu/g tested after 15 days of preparation. Total yeast and mould results from the laboratory and handling conditions of the product. Presence of yeast and mould are considered bad as it is harmful and dangerous which would affect the consumers. Total viable bacterial counts were found negative in

tomato candy after 15 days of storage [12-14]. Likewise herbal candy showed up yeast and mould count of no microbial growth

(Table 4). It shows that candy with 40%, 50%, 60% sugar solution contains no coliform count. It indicated herbal candy is safe for consumption (Figures 2 and 3).

Table 4: Herbal candy showed up yeast and mould count of microbial growth.

S. No	Characteristic	Test Method	Unit	Results
1	Standard Plate Count	FSSAI/AOA C/IS	CFU/g	12
2	Yeast and Mould	FSSAI/AOA C/IS	CFU/g	Nil



Figure 2: Yeast and mould.



Figure 3: Standard plate count.

High Performance Liquid Chromatography (HPLC)

60-70 mg of folate is naturally present in 240 ml of orange juice. Likewise 300-700 mg/l of folate present in citrus juice (dong). Folate content in cashew apple juice obtained to be higher concentration compared to the citrus juice, the folate content of cashew apple juice is 0.90 mg/l (neuhouse) [15,16]. The folate content of analyzed sample is 420 mcg in 100 g of candy which meets the required folate level of pregnant women as 400-800 mg in their daily diet for folate intake according to the US center of disease control and prevention (Figure 4 and Table 5) [17]. Comparative with different food compounds (egg yolk herbal (146 mcg), avocado (81 mcg), guava (49 mcg), mango (43 mcg), pomegranate (38 mcg) candy could be the best alternative (Figures 5).

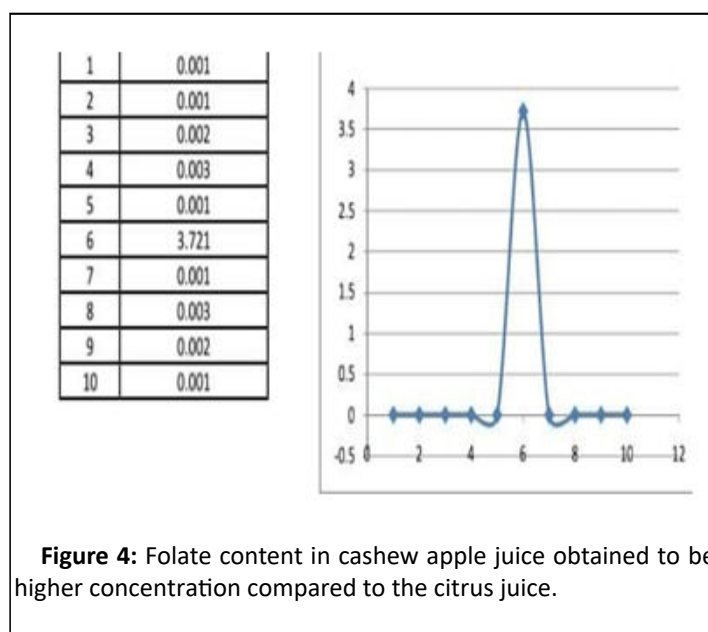


Figure 4: Folate content in cashew apple juice obtained to be higher concentration compared to the citrus juice.

Table 5: Testing of folic acid parameters.

S. no	Parameter	Test method	Unit	Results
1	Folic Acid (Vitamin-B ₉)	FSSAI-Methods of Analysis of Fortificants in Foods	mg/kg	4.2

Sensory analysis

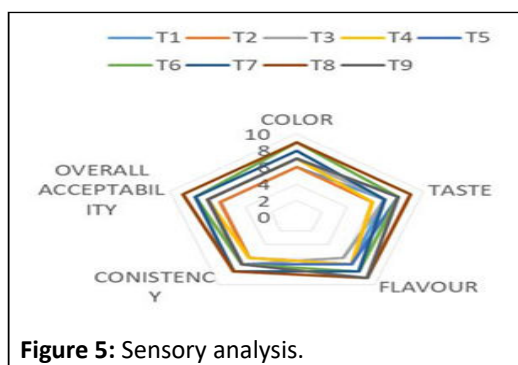


Figure 5: Sensory analysis.

Storage

The processed candy was stored up to one month in refrigeration condition at 4°C to 5°C using polyethylene and propylene pouch were hard and gave perfect texture. But were in room temperature it felt little bit sticky. And found that there was no difference in microbial and nutritional quality [18,19]. Similar studies said that the aonla candy had the storage time concentration 24 period up to 180 days under ambient conditions and the candy prepared using ginger had low browning effect and organoleptic score with increasing and decreasing trends with storage period up to 180 days [20].

Conclusion

Incorporation of folic acid in candy was developed in this studied. This work mainly focuses on pregnant ladies, as folic acid helps our body to produce and maintain new cells. As a medication, folic acid is used to treat folic acid deficiency in pregnant ladies. Pumpkin and orange is abundant in folic acid contents thus we used pumpkin and orange in different proportion along with ginger, sugar and honey for our candy preparation. Trial 8 shown perfect texture and glossiness and sensory score for trial 8 is higher in comparison with other trials. The amount of folic acid in our candy was found to be 420 mcg which is sufficient to meet the daily requirement of folic acid in pregnant ladies. The processed candy that we had stored in polyethylene and polypropylene pouch at ambient condition up to one month. We have found that the candies have become little bit sticky during this period and also we found that there was no difference nutritional and Microbial quality.

References

- Anand K, Lakshmy R, Janakarajan VN, Ritvik A, Misra P, et al. (2007) Effect of consumption of micronutrient fortified candies on the iron and vitamin A status of children aged 3-6 years in rural Haryana. *Indian Pediatr* 44:823-829
- Anderson LJ (1995) Hard candy, formulations, variations and effects. *Manuf Conf* 75: 33-36
- Adulyatham P (2001) Isolation and characterization of protease activity from ginger rhizome (*Zingiber officinale*). Department of Food Science. University of Leeds, UK.
- Shamrez B, Aftab S, Junaid M, Ahmed N, Ahmed S (2013) Preparation and Evaluation of Candies from Citron Peel. *IOSR J Environ Sci, Toxicol Food Technol* 21-24
- Dong FM, Oace SM (1973) Folate distribution in fruit juices. *J Am Diet Assoc* 62:162-166
- Ergun R, Lietha, R, Hartel RW (2010) Moisture and shelf life in sugar confections. *Crit Rev Food Sci Nutr* 50:162-192
- Gliszczynska-swiglo A (2007) Foliates as antioxidants. *Food chem* 101:1480-1483
- Gregory JF (1989) Chemical and nutritional aspects of folate research: Analytical procedures, method of analysis, stability, and bioavailability of dietary folates. *Adv Food Nutr Res* 33:1-101
- Gonzalez E, Montenegro MA, Nazareno MA, Lopez de Mishima BA (2001) Carotenoid composition and vitamin A value of an Argentinian squash (*Cucurbita moschata*). *Arch Latinoam Nutr* 51:395-399
- Gjergja R, Stipoljev F, Hafner T, Tezak N, Luzar-Stiffler V (2006) Knowledge and use of folic acid in Croatian pregnant women—a need for health care education initiative. *Reprod Toxicol* 21:16-20
- Hooda R (2015) Formulation development of an herbal candy for altitude health problems. *Res Rev J Pharmacogn Phytochem* 3:22-36
- Jun H, Lee CH, Song GS, Kim YS (2006) Characterization of the pectic polysaccharides from pumpkin peel. *LWT-Food Sci Technol* 39:554-561
- Kannaujiya A, Bunkar DS, Rai DC, Singh UP, Patel V (2018) Process optimization for the development of papaya candy and its shelf-life evaluation. *Pharma Innov J* 7:80-85
- Shrestha Ak, Arcot J, Yuliani S (2012) Susceptibility of 5-methyltetrahydrofolic acid to heat and microencapsulation to enhance its stability during extrusion processing. *Food Chem* 130:291-298
- Bailey RL, Dodd KW, Gahche JJ, Dwyer JT, McDowell MA, et al. (2010) Total folate and folic acid intake from foods and dietary supplements in the United States: 2003-2006. *Am J Clin Nutr* 91:231-237
- Sahin K, Onderci M, Sahin N, Gursu MF, Kucuk O (2003) Dietary Vitamin C and Folic Acid Supplementation Ameliorates the Detrimental Effects of Heat Stress in Japanese Quail. *J Nutr* 133:1882-1886
- Mehta U, Bajaj S (1984) Changes in the chemical composition and organoleptic quality of citrus peel candy during preparation and storage. *J Food Sci Technol* 21:422-424
- Patil M, Raizaday A, Raut V (2020) Formulation and Evaluation of Herbal Candy Based on Indian Medicinal Plants for Cancer Therapy via Immunomodulation. *J Pharmaceut Res Educ* 5:562-573
- Cui M, Lu XL, Lyu YY, Wang F, Xie XL, et al. (2021) Knowledge and intake of folic acid to prevent neural tube defects among pregnant women in urban China: a cross-sectional study. *BMC Pregnancy Childbirth* 21:432
- Neuhouser ML, Beresford SA, Hickok DE, Monsen ER (1998) Absorption of dietary supplemental folate in women with prior pregnancies with neural tube defects and controls. *J Am College Nutr* 17:625-630