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RESEARCH ARTICLE

Effectivenss of black pepper (*Pieper nigrum*) and clove (*Eugenia caryophyllus*) extract in preventing rancidity in butter fat

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ABSTRACT

Rancidity due to hydrosis and oxidation is a very common cause of spoilage among edible fats. At commercial level, many synthetic antioxidants are added to increase the shelf-life of fats, but they may be harmful to health in long term. Polyphenol extract of two very common spices black pepper and clove was used in 5%,10%, 15% concentration to see their effectiveness in preventing the development rancidity in butterfly as compared BHA (0.02%). Samples were kept in accelerated laboratory conditions at 80^0 C in the presence of copper catalyst. Onset of rancidity was checked by performing qualitative kreis test every hour and quantification of rancidity was done by estimating the acid value and peroxide value of samples after every five days. It was found that 5% conc. was not sufficient to prevent the deterioration of fats when compared to the standard. While 10% and 15% conc. were more effective than the standard. Black pepper extract was found to be more effective in preventing oxidative rancidity and clove extract was more effective to resist hydrolytic rancidity.

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Key words : BHA, Rancidity, Polyphenals

INTRODUCTION

Fat or oils are the most concentrated source of energy in the diet. Generally about thirty per cent of human energy requirements are met by fats (Manay and Shadashoraswamy, 1998). Fat and other lipids also contribute essential fatty acids and act as solvent for fat soluble vitamins (Meyer, 1987). Chemically fat and oils are glycerides of fatty acids. They are susceptible for spoilage due to the unsaturated fatty acids and enzymes found in them (Ajmani *et al.*, 1993). This spoilage is known as rancidity and it adversely affects the nutritional and sensory qualities of edible fats/oils. Generally, two types of rancidity are very commonly observed, oxidative and hydrolytic. Oxidative rancidity develops due to the oxidation of unsaturated fatty acids while hydrolytic rancidity is the result of hydrolysis of triglycerides and formation of free fatty acids. (Swaminathan, 1985). Butter fat or ghee is almost anhydrous milk fat having pleasing and appetizing aroma. Although it is not very rich in unsaturated fatty acid but is very prone to oxidative damage. At commercial level, a number of synthetic antioxidants like BHA and BHT (0.02%) are allowed in fatty foods but they may be teratogenic, carcinogenic and mutagenic (Hathway, 1966). Therefore, the present study was done to critically appraise the effectiveness of polyphenols derived from black pepper (*Piper nigrum*) and clove (*Eugenia caryophyllus*) in preventing rancidity in butterfat.

MATERIALS AND METHODS

Selection of the samples:

Butter fat used in study was prepared in the laboratory by traditional method. Blackpepper and clove were purchased from the whole seller of spices.

Pre-testing of samples:

Iodine value of fresh fat samples was estimated (Sharma, 2007). Polyphenols extraction was done from the spices by using in ethanol solvent in soxhlet apparatus and polyphenols concentration in extracts was estimated

by Folin – ciocalteau method (Sadasivam and Manicum 1992).

Incorporation of polyphones:

Polyphenols extracted from both spices were added in butter fat samples in three concentrations (Table 1) and samples were prepared in triplicates.

Table 1 : Polyphenol extracted from both spies and added in butter fat

Test sample	Concentration of Spice extract
A (A_1, A_2, A_3,)	5% Black pepper extract
B (B_1, B_2, B_3,)	10% Black pepper extract
C (C_1, C_2, C_3,)	15% Black pepper extract
D (D_1, D_2, D_3,)	5% clove extract
E (E_1, E_2, E_3,)	10% clove extract
F (F_1, F_2, F_3,)	15% clove extract

Three blank samples (G_1, G_2, G_3,) were also prepared to which no additive was added and standard samples (H_1, H_2, H_3,) were prepared by adding BHA (Butylated hydroxyanisole) in the concentration of 0.02%.

Incubation of test samples:

Same environmental conditions were provided to all the test samples. Samples were kept at 80^0C in the oven with copper chips (catalyst).

Rancidity tests :

For the detection of onset of rancidity, initially kreis test was applied every hour and thereafter for the quantification of rancidity peroxide value and acid value tests were done after every 5 days till a period of 25 days.

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below :

Onset rancidity:

Onset of rancidity was tested by Kreis test (Table 2).

Table 2 : Onset of Rancidity in butter fat samples

Sample	Oneset of rancidity in Hrs. (Mean ± S.D.)
A	48.0 ± 0
B	76.6 ± 2.3
C	80.0 ± 0
D	40.0 ± 0
E	73.0 ± 0
F	75.0 ± 0
G	32.0 ± 0
H	70.6 ± 0.9

Sample G (black) was the first sample to give pink colour, subsequently followed by D (5% clove extract) and A (5% black pepper extract) after a mean period of 40 hrs. and 48 hrs, respectively. In standard sample H (0.02% BHA) rancidity was developed after a mean period of 70.6 hrs. After that in E (10% clove extract), F (15% clove extract), B (10% black pepper extract) and D (15% black pepper extract) developed with a mean period of 73.0 ± 1.4, 75.0 ± 0, 76.6 ± 2.3, 80.0 ± 0 hrs. respectively. Hence, black pepper extract was found to be most effective in preventing rancidity while 10% and 15% concentration of both the spice were more effective than the BHA in preventing rancidity.

Effect on peroxide value:

Peroxide value gives a measure of oxidative rancidity in a fat samples (Table 3). The peroxide value of butter fat samples without any additive indicates that the development of peroxide was highest among all. The addition of spices extract offered resistance against auto – oxidation of butter fat. It was also seen that sample A (5% pepper extract) and sample D (5% clove extract) were not very effective when compared with sample H(Std 0.02% BHA). Sample C (15% black pepper extract) was most effective in preventing peroxide formations in butter fat. The rate of peroxide formation in decreasing order was as follows: G>D>A>H>E>B>F>C.

Table 3 : Effect of spices extract incorporation on the peroxide value

Days	Black pepper			Clove			Blank	Std. (0.02% BHA)
	Mean value ± S.D.			Mean value ± S.D.			Mean value ± S.D.	Mean value ± S.D.
	A (5%)	B (10%)	C (10%)	D (5%)	E (10%)	F (15%)		
5	1.3±0.01	0.8±0.05	0.6±0.18	1.4±0.05	1.1±0.02	0.9±0.047	1.9±0	0.9±0.20
10	2.1±0.02	1.3±0.16	1.1±0.12	2.3±0	1.5±0.09	1.1±0	2.8±0.14	1.9±0.47
15	4.2±0.08	2.5±0.12	1.8±0.05	4.6±0.09	2.9±0.08	2±0.024	5.1±0.18	3.8±0
20	5.8±0.05	3.8±0.09	2.5±0	5.9±0.08	4.2±0.16	2.8±0.094	6.4±0.05	5.1±0.08
25	6.3±0.2	5.2±0.81	3.7±0.08	6.6±0.81	5.5±0.05	3.9±0.081	7.2±0.08	6.0±0.29

Table 4 : Effect of spices extract incorporation on the acid value

Days	Black pepper			Clove			Blank	Std. (0.02% BHA)
	Mean ± S.D.			Mean ± S.D.			Mean ± S.D.	Mean ± S.D.
	A (5%)	B (10%)	C (10%)	D (5%)	E (10%)	F (15%)	G	H
5	1.5±0.094	1.9±0	2.0±0.12	1.6±0.030	1.2±0.01	1.0±012	2.4±0.047	1.4±0
10	2.8±0.014	3.2±0.018	4.0±0	3.8±0.047	2.3±0.012	1.9±0	5.6±0.47	2.6±0.047
15	5.8±0.094	6.4±0.16	6.8±0.094	6.2±0	4.4±0.047	3.8±0.094	7.4±0.12	5.6±0.047
20	6.5±0.047	7.2±0.094	7.9±0.18	7.4±0.0477	5.5±0.38	5.5±0.18	8.6±0	6.3±0.047
25	8.4±0.047	8.6±0.23	9.4±0.04	8.8±0.047	7.3±0	6.6±0.047	10.3±0.12	7.9±0

Effect on acid value:

Acid value reflects the quality of a fat in terms of free fatty acids formation due to hydrolysis of triglycerides and high acid value is an indication of deterioration of quality of fat/oils. The acid value of all fat samples enumerated in Table 4. It was seen that sample G (blank) had highest acid value 5%, 10% and 15% concentrations of black pepper extract were found to be effective but less effective as compared to the standard (0.02% BHA) samples. F sample (15% clove extract) had least value for hydrolysis, hence the most effective in preventing hydrolytic rancidity. 10% clove extract was also found to be more effective than the standard.

Conslusion:

Black pepper and clove extracts as a substitute of synthetic antioxidants were evaluated in terms of on set of rancidity, peroxide value and acid value in butter fat. It was found that spices extract delayed the on set of rancidity as compared to blank. Phenol extracts of both spices when used in 5% concentration were not sufficiently effective in preventing rancidity as compared to synthetic antioxidant. As the concentration of extract increased, effectiveness in terms of rancidity prevention also increased. Black extract in 15% concentration was found to be most effective to prevent oxidative rancidity on the other hand clove extract added in 15% concentration was most effective in preventing hydrolytic rancidity in butter fat. So it can be concluded that polyphenol constituents present in spices are active antioxidants and effective in preventing rancidity in edible fats. They are comparable to the synthetic antioxidants in potency when used in sufficient concentration.

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