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Assessment of Quality Characters of Egg – Vegetable Sausage Type Product

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ABSTRACT. In this study an egg – vegetarian sausage type product was prepared by using egg, texturised vegetable protein (TVP), different types of binders (i.e. jak perianth, kurakkan flour (Finger millet), soya flour, black gram flour, wheat flour, kohila (Lasia spinosa) and bread fruit and a natural colouring agent, cactus juice (Napalea cochenillifera).

The objective quality measurements such as water holding capacity, shrinkage, pH, acid value, sensory quality characteristics and general acceptability of the products were evaluated during a storage period of 12 days at 5.5 C.

The sausage prepared by using flour of soya, kurakkan, black gram and wheat were not accepted by consumers. Sausage made from texturised vegetable protein, jak perianth, kohila (Lasia spinosa) and bread fruit were accepted by the taste panel and they were used for the final evaluation. The objective measurements showed that shrinkage and pH increased during storage in all sausage samples. Water holding capacity and acid value increased during the first 9 days of storage period and decreased there after.

The protein and fat content of sausages varied from 11.9 to 13.3% and 19.6 to 20.1%, respectively. There is not much variation in ash content. The sensory evaluation test indicated that there were significant differences among sausages with regard to texture, taste, juiciness, colour and general acceptability. Sausage made from jak perianth with 3% colouring agent was preferred by the panelists. General acceptability decreased during storage for all samples.

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INTRODUCTION

Comminuted meat products are widely consumed throughout the world. But the prices of the sausages are so high in developing countries where even the middle class people cannot afford to buy these products. Hence as an alternative there is an increasing interest now in the use of various plant proteins as functional ingredients in the manufacture of cheap meat products (Rakoshy, 1970; Wolf and Cowan, 1975).

Egg is a good source of animal protein and exhibits the properties of coagulation, emulsification and binding ability (Sladelman and Cottercill, 1977). Therefore it is possible to use egg and plant protein to prepare a special type of sausage for vegetarians (non meat eaters), who eat only eggs.

The binders which are commonly used in the preparation of sausages contribute to its cost. The use of *kohila* (*Lasia spinosa*), jak perianth and bread fruit which are readily available, will reduce the cost of production. The consumer acceptability of the product mainly depends on its colour. Synthetic colouring agents which are widely used in meat products are health hazardous (Fennema, 1976) and as a result natural colouring agents are becoming popular in the meat industry.

There is no information available on sausages made from egg, *kohila*, jak perianth and bread fruit. The present study was carried out to evaluate the quality characters of sausages prepared by using the above mentioned ingredients and to formulate a product for egg – vegetarian (non meat eaters) who eat only eggs.

MATERIALS AND METHODS

The basic composition of sausage used in this study was protein (9%), fat (18%), water (56.5%), binder (15%) and salt (1.5%). Eggs, texturised vegetable protein and black gram flour were used as protein supplement. *Kurakkan* flour, rusk, mature jak perianth, wheat flour and *kohila* were used as binders and cactus juice was used as colouring agent. These products were sensorily evaluated for consumer acceptance.

The preparation of sausage samples were carried out as follows: – TVP was soaked in egg contents for 2 hours. Peeled *kohila*, bread fruit, boiled jak perianth and TVP (previously soaked in egg contents) were ground separately. Boiled potato was mashed to a fine paste. According to recipes in Tables 1 and 2 sausage mixtures were made by using the Horbert Chopper (Model FC 27D). The above ingredients (Tables 1 and 2) were distributed in the chopper, the seasoning, rusk, salt and potato were added, followed by slow addition of ice water. Different combinations of binders and colouring agent were also used. The entire mass was chopped for 10 minutes to form a uniform batter and filled into reconstituted collagen casings with the help of a stuffer and stored in the refrigerator at 5.5 C for a period of 12 days.

The physical parameters were analyzed at regular intervals of 3 days and finally the proximate composition of the samples were also analyzed.

pH determination

pH of the sample was determined by a pH meter (Corning USA Model 10) using the filtrate of the homogenized sample.

Water Holding Capacity (WHC)

WHC was determined by the procedure of Grau and Hamm (1957), by placing 0.5 g of fresh sample in between 2 filter papers and pressing through a screw press. The WHC was calculated using the following formula (Trout, 1988).

$$\text{WHC} = \frac{\text{weight of the sample after pressing} - \text{weight of the sample after drying}}{\text{initial weight of the sample}} \times 100$$

Shrinkage (total cooking loss)

Each individual sausage was fried in thermostatically controlled greased pan at 105 C for 5 minutes. The shrinkage was expressed as follows (Chaudhray and Ledward, 1988).

Table 1. Composition of preliminary trial sausages.

Type of sausage	Egg %	Soya flour	TVP %	Margarine %	Water %	Kurakkan %	Rusk %	Salt %	Black gram %	Wheat flour	Immature % Jak carpels
A	38.130	9.78	-	16.2	29.42	3.9	1.30	1.257	-	-	-
B	38.130	9.78	-	16.2	29.42	2.6	2.60	1.257	-	-	-
C	38.180	9.78	-	16.2	29.42	1.3	3.90	1.257	-	-	-
D	57.193	4.89	-	16.2	29.42	2.6	2.60	1.257	-	-	-
E	57.193	4.89	-	16.2	29.42	-	1.30	1.257	-	-	3.9
F	57.193	4.89	-	16.2	29.42	-	3.90	1.257	-	-	1.3
G	57.193	4.89	-	16.2	29.42	-	2.60	1.257	-	-	2.6
H	57.193	-	4.890	16.2	29.42	-	2.60	1.257	4.89	-	2.6
I	57.193	-	4.445	16.2	29.42	-	2.60	1.257	7.36	-	2.6
J	84.730	-	10.86	14.2	28.89	3.9	1.30	1.257	21.45	-	-
K	84.730	-	10.86	14.2	28.89	2.6	2.60	1.257	21.45	-	-
L	84.730	-	10.86	14.2	28.89	1.3	3.90	1.257	21.45	-	-
M	84.730	-	32.31	14.2	28.89	1.3	-	1.257	-	-	3.9
N	84.730	-	32.31	14.2	28.89	1.65	1.65	1.257	-	-	3.9
O	84.730	-	32.31	14.2	28.89	1.65	-	1.257	-	1.65	3.9

Table 2. Composition of sausage.

Sample	P	Q	R	S	T
Binder	Jak	Jak	Jak	Kohila	Breadfruit
Colouring agent	-	2.5%	3.0%	0.7%	0.7%
Water	2.7%	5.3%	4.8%	7.1%	7.1%

Following ingredients are same for all the samples.

Egg	34.50%
TVP (Ran soya)	14.45%
Potato	14.45%
Fat (Margarine)	12.45%
Rusk	6.35%
Binder	8.25%
Salt	1.75%
Spices	27.00 grams

$$\text{Shrinkage} = \frac{\text{initial weight} - \text{weight after frying}}{\text{initial weight}} \times 100$$

Acid Value

25 ml of diethyl ether was mixed with 25 ml of alcohol. A drop of 1% phenolphthalein and 5 g of minced sample were added to 25 ml of the above solution, and neutralized with 0.1 N NaOH. While heating it was titrated with 0.1 N NaOH until the pink colour persisted for 15 seconds (Pearson, 1970). Acid Value was expressed as follows :

$$\text{Acid Value} = \frac{\text{Titrate (ml)} \times 5.61}{\text{Weight of the sample}}$$

Sensory Evaluation

Fried sausages were served to a consumer type panel of eight judges who were consumers of meat and non meat products. Most of them were affiliated to the institute and had experience in sensory evaluation. They evaluated the products for appearance, colour, taste,

texture, juiciness and general acceptability on a 7 point hedonic scale, where 7 represented "like extremely" and 1 "dislike extremely". The results were computed by using Friedman's non parametric statistical test (Sendcor and Cochran, 1977), and Wilcoxson rank sum test was used to select the best product.

Proximate Analysis

Fat, protein and ash were measured according to standard methods (AOAC, 1975).

RESULTS AND DISCUSSION

The sausage types A to O which were prepared according to Table 1 were not accepted by the consumers. The product gave a starchy taste when soya flour was included. The addition of *kurakkan* flour and immature jak perianth gave a dark coloured product. The samples which were prepared by using black gram flour resulted in a sticky product. Hence, in order to get a better consumer acceptance the composition was changed according to the formula in Table 2 and these products were used for further study.

During storage, pH value decreased significantly ($P<0.05$) in all samples (Table 3). This may be due to the souring which generally takes place underneath the casing of sausage products. This may be due to the growth of lacto bacilli, strepto cocci and related organisms. The souring results from the utilization of lactose and other sugars with the production of acids (Jay, 1978). The sour taste was detected by the taste panel too. The pH values of samples of Q and R were significantly higher than that of sample P. This high pH may due to inclusion of cactus juice. The pH of samples S and T was lower than that of P, Q and R. This may be due to lower percentage of colouring agent and different type of binders used in the preparation of the respective samples.

WHC of sausage increased significantly ($P<0.05$) up to 9 days of storage period and there after decreased slightly (Table 4). Early increase in WHC may be due to the absorption of water by starch and pectin in potato and pentosans gums in bread crumbs (Wolfe, 1987;

Table 3. pH of sausage during storage at 5.5 C.

Sausage type	pH values			
	3	6	9	12
P	7.05^{aA}	6.83^{bA}	6.80^{bA}	6.80^{bA}
Q	7.90^{aB}	7.55^{bB}	7.30^{cB}	6.93^{dB}
R	7.90^{aB}	7.60^{bC}	7.35^{cC}	7.15^{dC}
S	-	6.70^{aD}	5.95^{bD}	5.55^{cD}
T	-	6.70^{aD}	6.25^{bE}	5.80^{cE}

a, b, c, d values within a row bearing the same superscript are not significantly different ($P < 0.05$).

A, B, C, D, E values within a column bearing the same superscript are not significantly different ($P < 0.05$).

Table 4. WHC of sausage during storage at 5.5 C.

Sausage type	WHC %			
	3	6	9	12
P	25.591^{aA}	27.176^{abA}	28.700^{bAD}	26.820^{aA}
Q	21.481^{aB}	29.079^{bB}	36.870^{cB}	32.678^{dB}
R	23.552^{aA}	28.566^{bB}	33.601^{cC}	27.450^{bA}
S	22.634^{aB}	24.151^{aC}	29.128^{bA}	28.492^{bA}
T	23.672^{aA}	24.825^{aC}	26.890^{bD}	24.429^{aC}

a, b, c, d values within a row bearing the same superscript are not significantly different ($P < 0.05$).

A, B, C, D values within a column bearing the same superscript are not significantly different ($P < 0.05$).

Pomeranz, 1985). The decrease in WHC after 9 days may be due to denaturation of egg white protein where the egg white protein becomes watery and there by loses the ability to hold water (Stadelman and Cotterill, 1977).

Shrinkage of samples P, Q, S and T increased significantly ($P<0.05$) during storage period. This may be due to the hydrolysis of soluble pectin polymers forming poly galacturonic acids and other monomers during storage (Fennema, 1976). Shrinkage was very high in samples where bread fruit was used as binder (Table 5). This may be due to the high pectin content of bread fruit compared to other binders.

Acid value of sausage samples showed a significant increase up to 9 days of storage period except in sample T which showed no significant difference (Table 6). The increased acid value of the sample may due to the oxidation of unsaturated fatty acids in margarine and egg. The reduction in the acid value after 9 days may be due to the unstability of the oleic acid ($C_{18:1}$) which was calculated as free fatty acid (Pearson, 1970). Acid value of sample T was lower than that of the other samples.

There were no significant differences in ash content of all samples (Table 7). Protein content was low in sample T, and this may be due to low protein content of bread fruit. The fat content was low in sample R where *kohila* was used as binder.

In sensory evaluation, the panel has given the highest score for the sample which had dark colour. The colour of the product changed from pale to light pink colour with inclusion of cactus juice. Appearance of sausages were not significantly different between different samples but colour, texture, taste, juiciness and general acceptability were significantly different (Table 8). Although all the products were accepted by the consumers sample R was the most preferred product.

Table 5. Shrinkage of sausage during storage at 5.5 C.

Sausage type	Shrinkage %			
	Storage period in days			
	3	6	9	12
P	7.750^{aA}	10.858^{bA}	14.253^{cA}	17.200^{dA}
Q	6.100^{aA}	8.563^{bB}	11.750^{cB}	13.420^{dB}
R	5.074^{aA}	5.462^{aC}	5.750^{aC}	5.990^{aC}
S	2.882^{aD}	6.766^{bD}	8.267^{cD}	14.567^{dB}
T	7.100^{aA}	15.430^{bE}	19.500^{cE}	31.000^{dD}

a, b, c, d values within a row bearing the same superscript are not significantly different ($P<0.05$).

A, B, C, D, E values within a column bearing the same superscript are not significantly different ($P<0.05$).

Table 6. Acid value of sausage during storage at 5.5 C.

Sausage type	Shrinkage %			
	Storage period in days			
	3	6	9	12
P	1.380^{aA}	1.990^{bA}	2.909^{cA}	1.327^{aA}
Q	0.718^{aB}	0.693^{aB}	3.300^{bA}	1.487^{aA}
R	0.900^{aB}	0.796^{aB}	3.560^{aA}	1.550^{aA}
S	-	2.467^{aA}	2.859^{aA}	2.233^{aB}
T	-	0.499^{aB}	1.488^{bB}	1.101^{bA}

a, b, c values within a row bearing the same superscript are not significantly different ($P<0.05$).

A, B values within a column bearing the same superscript are not significantly different ($P<0.05$).

Table 7. Proximate composition of sausage.

Sausage Type	Ash %	Protein %	Fat %
P	3.27[a]	13.21[a]	19.64[a]
Q	3.17[a]	13.21[a]	19.64[a]
R	3.21[a]	13.21[a]	19.64[a]
S	3.11[a]	13.31[a]	17.19[a]
T	3.04[a]	11.95[b]	20.13[a]

a, b values within a column bearing the same superscript are not significantly different ($P < 0.05$).

Table 8. Sensory evaluation of sausage products.*

	Sensory Characters					
Sausage	Appearance	Colour	Taste	Texture	Juiciness	Acceptance
P	5.00[a]	4.87[a]	5.27[a]	6.27[a]	4.87[a]	5.25[a]
Q	5.25[a]	5.25[b]	5.50[b]	5.25[b]	5.25[b]	5.50[b]
R	5.25[a]	5.37[a]	5.37[c]	5.62[c]	5.37[c]	5.65[c]
S	4.00[a]	4.22[d]	5.25[d]	5.37[d]	5.27[d]	5.12[d]
T	3.87[a]	4.12[e]	4.75[e]	5.25[e]	5.17[e]	4.75[e]

* All means are average of 8 scores.

a, b, c, d, e followed by the same superscript within a column are not significantly different ($P < 0.05$).

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