PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 3 (6): 340-343, 2004

Effect of Edible Oils on Quality and Shelf Life of Low Fat Mayonnaise

A. Palma[1], M.G. Aziz[2], M.M. Chawdhury[3], M.B. Uddin[4] and M. Alam[5]
[1]ATDP, Bangladesh
[2]Department of Food Technology, and Rural Industries,
Bangladesh Agricultural University, Mymensingh, Bangladesh
[3]Consumer Testing Services, SGS Bangladesh Limited, Bangladesh
[4]Department of Food Technology and Rural Industries,
Bangladesh Agricultural University, Mymensingh, Bangladesh
[5]Spices Research Center, Bangladesh Agricultural Research Institute, Bogra, Bangladesh

Abstract: The study deals with the effect of edible oils on quality and shelf life of mayonnaise. Three mayonnaise samples were prepared using palm oil, soybean oil and mustard oil at 30% (weight basis) level. Another sample of mayonnaise manufactured from olive oil was purchased from local market. In addition to lipid ingredients, egg (whole) and vinegar were used at 20% and 12% level respectively. The samples were analyzed for proximate composition. The moisture, protein, fat, ash, acidity and total solid content in 4 samples were found in the range of 41.94-46.95%, 1.09-1.62%, 30.29-33.40%, 1.15-1.80%, 0.48-0.82% and 18.65-23.72% respectively. A panel of 10 judges evaluated the sensory acceptability of the product. No significant difference in colour and texture was observed among the samples. However, samples containing soybean and palm oil had significantly higher acceptability compared to other samples.

Key words: Edible oils, mayonnaise, palm oil, soybean oil

Introduction

"Mayonnaise is the semi-solid emulsion of edible vegetable oil, egg yolk, or whole egg, a vinegar, and/or lemon juice, with one or more of the following: salt, seasoning commonly used in its preparation, sugar and/or dextrose. The finished products contain not less than 50% edible vegetable oil"-according to the United States Food and Drug Administration in 1993.

Commercial mayonnaise manufacture is of comparatively recent origin, although products of this nature have been made in the home for many decades. The commercial manufacturer must turn out a product that is capable of retaining its desired characteristics, in spite of which tend to cause emulsions to "break" or separate. Mayonnaise is incapable of final sterilization because of its composition and structure, which consists of a suspension of very finely divided oil globules in water.

Materials and Methods

The experiment was conducted in the laboratories of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh during January through October 2003.

Soybean, mustard and palm oils, egg, sugar, powder milk, salt, mustard seeds, carboxymethyl cellulose (CMC), corn starch, vinegar, potassium sorbate and ethylene diamine tetra acetic acid (EDTA) were used in the preparation of mayonnaise.

Formulation of mayonnaise: Three different mayonnaises were prepared using three different edible oils such as soybean oil, mustard oil and palm oil keeping other ingredients same. The formulation used in manufacturing mayonnaise is shown in the following Table 1.

Table 1: Composition of mayonnaise

Ingredients	Amount (g)	Percentage
Eggs (whole)	100.0	20
Dried milk powder	10.0	2
Mustard (powder)	5.0	1
Carboxymethyl cellulose	7.5	1.5
Sugar (granulated)	10.0	2
Salt	5.0	1
Corn starch	25.0	5
Vinegar (2.5% white)	60.0	12
Soybean/palm/mustard oil*	150.0	30
Potassium sorbate and EDTA	0.5	0.1
Water	127.0	25.4
Total	500.0	100

*One oil is used for particular type of mayonnaise

Processing of mayonnaise: All ingredients mentioned in the formulation were weighed carefully. Eggs were beaten in a rotary mixer bowl until slightly thick, added milk powder, mustard powder, sugar, salt, cornstarch, carboxy methyl cellulose (CMC) and water into the mixing bowl with beaten egg and mixed well until evenly distributed. CMC was soaked in water before mixing. The mass was blended properly while adding vinegar to the mixture. Oil was added to the mixture drop by drop with stirring. Potassium sorbate and ethylene diamine

Table 2: Chemical composition of different mayonnaise samples

Product	Moisture (%)	Ash (%)	Acidity (%)	p^H	TSS (%)	Protein (%)	Fat(%)
M_1	43.64	1.78	0.74	4.34	20.0	1.48	33.40
M_2	41.94	1.56	0.82	4.30	20.5	1.62	31.16
M_3	46.21	1.15	0.69	4.39	20.0	1.39	32.60
M_4	46.95	1.8	0.48	4.50	21.0	1.09	30.29

M_1 represents mayonnaise with palm oil, M_2 represents mayonnaise with soybean oil, M_3 represents mayonnaise with mustard oil
M_4 represents mayonnaise with olive oil (market product)

tetra acetic acid (EDTA) were added to the finished product in the required quantity. Filled the mass into pre-sterilized bottles and sealed airtight. Pasteurized the mayonnaise in boiling water for 20 minutes. Cooled the hot bottles to room temperature. Stored the product away from sunlight in a cool place. Three samples of mayonnaise were prepared as shown in Table 1.

Chemical analysis: Mayonnaises were analyzed for moisture, ash, protein, fat, total soluble solid and pH. The total soluble solids (TSS) was read directly from an Abbe's refractometer. All the determination were conducted adopting AOAC (1994) methods and the methods described by Ranganna, 1992.

Sensory evaluation of mayonnaise: The processed mayonnaise samples including commercial one purchased from local market were evaluated for color and texture, flavor and absence of defects by a panel of 10 panelists. The panelists were selected from the teachers, students and staff of Bangladesh Agricultural University, Mymensingh. Mayonnaise from each sample was presented to 10 panelists as randomly coded samples. The taste panelists were asked to rate the sample on the basis of color and texture, flavor and absence of defects where range of scores for color and texture, flavor, and absence of defects were 20-25, 40-50 and 20-25. The results were evaluated by Analysis of Variance and Duncan's New Multiple Range Test (DMRT) procedures of the MSTAT system.

Storage studies of mayonnaise: The mayonnaises were stored at room temperature (28-32°C) and refrigerated temperature (5°C and RH 50%). The storage parameters were observed at the expiry of 0, 2, 4 and 8 weeks.
The changes in color & texture, flavor and taste, acidity, TSS, p^H, and peroxide value were observed at different intervals. Mayonnaise was packed into wide-mouthed glass jars with plastic lids.

Results and Discussion

Composition of mayonnaise: The samples of mayonnaises were analyzed for moisture, ash, acidity, p^H, TSS, protein and fat content and result is shown in Table 2.

Moisture content: The moisture content of 4 different mayonnaise manufactured with different lipid ingredients were in the range of 41.94% to 46.95% (Table 2). Prescott, and Board (1993) stated the moisture content in mayonnaise in the range of 42.64 to 57.25%. Some variations in moisture contents in mayonnaise might be due to variation in the chemical composition of oils, blending time, length of heat treatment (pasteurization) and finally sealing condition of the containers.

Protein: The protein contents in different mayonnaise samples were 1.48, 1.62, 1.39 and 1.09% respectively (Table 2). Prescott and Proctor (1937) stated the protein content in mayonnaise in the range of 1.00 to 1.88%, which was very close to the findings of this study.

Fat: The fat content of different mayonnaise samples obtained from the analysis were 33.4, 31.16, 32.6 and 30.29% respectively (Table 2). Dudina *et al.* (1992) reported fat content in low-calorie mayonnaise between the range of 30 and 40%. The results of the study indicated that the processed mayonnaises were of low calorie category.

Ash: The ash content of the developed samples obtained in the range of 1.15 to 1.8%. Prescott and Board (1993) stated ash contents in different mayonnaise samples in the range of 1.04 to 2.04%. The results of the study were close to the findings of Prescott and Proctor.

Acidity: Total acidity of mayonnaise samples were observed as 0.74, 0.82, 0.69 and 0.43% respectively. Acidity contents of various mayonnaise products analyzed by Prescott and Board (1993) were between 0.29 and 0.44%. This is also in agreement with the findings of earlier researchers.

p^H: The p^H of different samples was between 4.30 and 4.50. These values were close to the pH value obtained by Radford and Board (1993), which were 4.1.

Sensory evaluation of mayonnaise:

Table 3: Mean score for colour and texture, flavour and absence of defects

Product type	Sensory attributes		
	Colour and Texture	Flavour	Absence of defects
M_1	23.1	46.1^a	22.8^a
M_2	21.1	44.3^{ab}	23.0^a
M_3	21.3	42.2^b	21.4^b
M_4	21.4	43.3^{ab}	23.0^a

Table 4: Storage studies of different mayonnaise at refrigeration temperature (5°C)

Storage period (week)	Sample code	Observations			TSS (%)	Acidity (%)	pH	Fungal growth	Peroxide value (ml.eq/kg)
		Color	Texture	Flavor and taste					
0	M_1	White	Soft-smooth	Pleasant	20.0	0.74	4.34	NO	6
	M_2	White	Soft-smooth	Pleasant	20.5	0.82	4.30	NO	5
	M_3	Slightly yellow	Soft-smooth	Slightly sharp	20.0	0.69	4.39	NO	4
	M_4	Slightly brown	Soft-smooth	Pleasant	21.0	0.48	4.50	NO	6
2	M_1	White	Soft-smooth	Pleasant	20.0	0.77	4.31	NO	7
	M_2	Slightly brown	Soft-smooth	Pleasant	20.5	0.83	4.28	NO	6
	M_3	Slightly yellow	Soft-smooth	Sharp	20.0	0.70	4.36	NO	5
	M_4	Slightly brown	Soft-smooth	Pleasant	21.0	0.50	4.47	NO	7
4	M_1	White	Soft-smooth	Pleasant	19.5	0.78	4.29	NO	10
	M_2	Slightly brown	Soft-smooth	Pleasant	20.5	0.83	4.25	NO	9
	M_3	slightly yellow	slightly hard	Sharp	20.0	0.72	4.33	NO	8
	M_4	Slightly brown	Slightly hard	Pleasant	21.0	0.52	4.44	NO	12
8	M_1	White	Soft-smooth	Pleasant	19.0	0.80	4.26	NO	20
	M_2	Slightly brown	Soft-smooth	Slightly rancid	20.0	0.84	4.22	NO	19
	M_3	Slightly yellow	Slightly hard	Rancid & sharp	19.5	0.73	4.29	NO	18
	M_4	Slightly brown	Slightly hard	Pleasant	20.5	0.58	4.39	NO	21

Table 5: Storage studies of different mayonnaise at room temperature (28°C)

Storage period (week)	Sample code	Observations			TSS (%)	Acidity (%)	pH	Fungal growth	Peroxide value (ml.eq/kg)
		Color	Texture	Flavor and taste					
0	M_1	White	Soft-smooth	Pleasant	20.0	0.74	4.34	NO	6
	M_2	White	Soft-smooth	Pleasant	20.5	0.82	4.30	NO	5
	M_3	Yellowish	Soft-smooth	Slightly sharp	20.0	0.69	4.39	NO	4
	M_4	White	Soft-smooth	Pleasant	21.0	0.48	4.50	NO	6
2	M_1	Slightly brown	Soft-smooth	Pleasant	20.0	0.77	4.31	NO	7
	M_2	White	Soft-smooth	Pleasant	20.5	0.83	4.28	NO	6
	M_3	Yellowish	Soft- smooth	Slightly sharp	20.0	0.70	4.36	NO	5
	M_4	Slightly brown	Soft- smooth	pleasant Moderate	21.0	0.50	4.47	NO	7
4	M_1	Slightly brown	Soft- smooth	Slightly rancid	19.5	0.78	4.29	NO	10
	M_2	White	Soft- smooth	Slightly rancid	20.5	0.83	4.25	NO	9
	M_3	Yellowish	Soft- smooth	Slightly rancid	20.0	0.72	4.33	NO	8
	M_4	Slightly brown	Soft- smooth	pleasant Moderate	21.0	0.52	4.44	NO	12
8	M_1	Slightly brown	Soft- smooth	Rancid	19.0	0.80	4.26	YES	20
	M_2	White	Soft- smooth	Rancid	20.0	0.84	4.22	YES	19
	M_3	Yellowish	Soft- smooth	Rancid	19.5	0.73	4.29	YES	18
	M_4	Slightly brown	Soft- smooth	Rancid	20.5	0.58	4.39	YES	21

Color and texture: The mean scores for color & texture of different mayonnaise samples were 23.1, 21.1, 20.2, and 21.4 respectively. It is showed from Table 3 that the mayonnaise prepared with palm oil secured the height score and that was followed by commercial product produced with olive oil.

Flavor: The mean scores for flavor of different mayonnaise were 46.1, 44.3, 42.2 and 43.3 respectively. The samples were not equally acceptable in term of flavor preference. The results presented in Table 3 indicated that the mayonnaise prepared with palm oil secured the highest score and mayonnaise with mustard oil secured the lowest score whereas mayonnaise with soybean and mayonnaise with olive oil secured the same score and were equally acceptable.

Absence of defects: The mean scores for absence of defects of mayonnaise samples were 22.8, 23.0, 21.4, and 23.0 respectively. The mayonnaise samples with palm oil, soybean oil and olive oil secured the almost same score and were equally acceptable whereas mayonnaise sample with mustered was different in acceptance and secured the lowest score. However, The mayonnaise samples with soybean oil and olive oil ranked highest equal scores (23.0) and did not differ in absence of defects at 5% level of significance.

Storage studies of mayonnaise: The changes in color, texture, flavor, taste, acidity, TSS, pH, and peroxide value were observed at different intervals. The mayonnaise samples were packed into wide-mouthed glass jars with plastic lids. Two sets of test conditions were used for storage periods of 0, 2, 4 and 8 weeks i.e. 5°C/50% RH (refrigerated truck conditions) and 28°C/70% RH (room conditions). It is shown from the Table 3 that all

Table 6: Microbiological studies of different mayonnaise products

Storage	Type of microbes	Storage (week)	Products			
			M_1	M_2	M_3	M_4
5^0C.	Aerobic plate count	0	$1.11x10^3$	$1.12x10^3$	$1.10x10^3$	$1.11x10^3$
		2	$1.25x10^3$	$1.24x10^3$	$1.23x10^3$	$1.25x10^3$
		4	$1.52x10^3$	$1.52x10^3$	$1.52x10^3$	$1.53x10^3$
		8	$2.00x10^3$	$2.01x10^3$	$2.00x10^3$	$2.02x10^3$
28^0C.						
	Aerobic plate count	0	$1.11x10^3$	$1.11x10^3$	$1.11x10^3$	$1.11x10^3$
		2	$3.22x10^3$	$3.42x10^3$	$3.31x10^3$	$3.24x10^3$
		4	$8.26x10^3$	$8.23x10^3$	$8.39x10^3$	$8.34x10^3$
		8	$10.2x10^3$	$10.3x10^3$	$10.4x10^3$	$10.1x10^3$

This study indicates a bright prospect of manufacturing mayonnaise with great commercial value. Quality and shelf life of mayonnaise samples were investigated within limited period of time. Further investigation is necessary before going to commercial production.

the samples remained unchanged during 4 weeks of storage. Mayonnaise with soybean oil and mayonnaise with pal oil became rancid after eight weeks of storage at refrigeration temperature.

It is also shown from Table 5 that color, flavor and taste went deterioration after four weeks of storage. Peroxide value also increased with increasing storage period.

Microbiological load of mayonnaise: The shelf life of mayonnaise samples was studied by evaluating microbiological load. Results of microbiological study are presented in Table 5. Initial bacterial load in the mayonnaise samples was within the generally accepted limit (1 Õ 10^4 to 5 Õ 10^4, David & Norah, 1993). The load was increased slowly in the final products stored at 5^0C till 8^{th} week of storage (Table 6).

On the other hand, total bacterial count progressively increased in the products stored at room temperature (28^0C) and at 4^{th} week, they became rancid and unsuitable for consumption. The bacterial content was in quite acceptable limit up to 2^{nd} week of storage at 28^0C. The products stored in refrigeration and room temperatures were completely free from coliform bacteria up to 14^{th} day of storage.

References

AOAC Method, 1994. Official Method of Analysis, 11^{th} Edition, Association of Official Agricultural Chemists, Washington DC, USA.

David, F.S. and F.S. Norah, 1993. Principles and practice for the safe processing of food. Butterworth-Heinemann Ltd., Paperback edition. Oxford OX 28DP.

Dudina, Z.A., I.A. Ruzina, N.A. Kalasheva, A.I. Askinazi, Yu.M. Kulikov and L.I. Tarasova, 1992. Manufacture of mayonnaise. [Cited from Food Science and Technology Abstracts 25(5), 1993].

Prescott, S.A. and R.G. Board, 1993. Food Technology, 1^{st} Eddision. McGraw-Hill Book Co., Inc., NY and London.

Radfors, S. A. and R.G. Board. 1993. Review: Fate of pathogens in home made mayonnaise and related products. J. of Food Microbioogy as cited in Food Sci. & Tech. Abs. 10(4):269-278

Ranganna, S. 1992. Hand book of analysis and quality control for fruit and vegetable products. 2^{nd} Ed. TATA McGrow-Hill Pub. Co. Ltd. New Delhi, India.