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QUALITATIVE ASSESSMENT OF EDIBLE OLIVE OIL MARKETED IN BANGLADESH

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ABSTRACT

Edible olive oils are prone to quality deterioration through oxidation and microbial degradation resulting in nutritional loss and off-flavors. Quality deterioration may contribute to the formation of oxidation products that are reactive and toxic, which ultimately pose health risks including cancer and inflammation. In Bangladesh, most of the populations are laying value the poverty line. They use of cheap oil for their daily cooking, long term use of such oil may cause myocardial infraction, dyslipidemia, obesity, etc. They don't know the quality of edible oil in Bangladesh. Now days, peoples are very aware about their health risk. That's why, the edible olive oil is the most preferred available type of vegetable oil among the elite society of Bangladesh with the respective health benefit. It is needed to know the quality of edible olive oil available in Bangladesh. In this research ten different brand of olive oil were collected from super shop of Dhaka, Bangladesh for assessment. The study was conducted in the biochemistry laboratory of Hamdard University Bangladesh. To assay the quality of edible olive oil, several physiochemical parameters e.g., color, odor, specific gravity, viscosity, moisture content, saponification value, and peroxide value were measured according to the AOAC (Association of Official Analytical Chemists) method. The result of this research revealed that the color of 60% samples were golden yellow and remaining 40% samples were light golden. The odor of all samples was fruity smell during analysis. Moister content was 0.09 – 0.12%, specific gravity was 0.825 gm/ml to 0.884 gm/ml, Acid value was 0.38 - 0.83 mgKOH/g, peroxide value was 14.66-19.53 meq O_2/kg and saponification value of samples of edible olive oil of this study showed from 187.66 to 195.66 mgKOH/g. These physiochemical parameters indicated that the samples of edible olive oil were fulfilled the basic quality of edible oil.

KEYWORD: Edible Olive oil, Physiochemical parameter.

1. INTRODUCTION

With its corresponding quality and health benefits, edible olive oil is the most preferred type of vegetable oil now accessible. A vital component of the contemporary diet are edible oils. In addition to providing the diet with numerous advantageous micronutrients, these oils serve as a source of energy. Certain edible oils as dietary supplements may be useful in improving cardiovascular health, despite the common belief that fat should be avoided. Nowadays, one of the main causes of death worldwide is cardiovascular diseases.[1] Phenolic chemicals found in olive oil are gaining more attention because of their impact on sensory attributes and scientific proof of their beneficial health effects.[2] Edible fats and oils can be found in the pulp of many fruits, in the seeds or leaves of many plants, in aquatic or terrestrial animals, and in the nuts or stones of many fruits. In addition to making food more appetizing, edible fats and oils are employed in a variety of items to provide functionality.[3] Edible oils are edible items that are made from the seeds of plants that are cultivated all over the world. They enhance the flavor and colour of the food we eat and are a good source of proteins, lipids, and fatty acids. In Bangladesh 10% of edible oil produce domestically and majority of edible oils and fats import from abord. This indicates that these nutrients are insufficient in the nation. Bangladesh uses three main types of edible oils: soybean, palm, mustard, and little amount olive oil. The most popular cooking oil in the past was virgin mustard oil.[4] Therefore, the aim of this

study was to prospect in detail about the physiochemical parameters of edible olive oil.

2. MATERIAL AND METHOD

2.1. Sample collection

Ten different bands of olive oil were collected from super shops of Dhaka city, Bangladesh. The samples were Jack natural olive oil (JN), Oillina olive oil (OL), Olio orolio olive oil (OO), Green harvest olive oil (GH), Lucy oliva olive oil (LO), Olitalia Olive oil (OT), Maril olive oil (MR), Span oliva olive oil (SP), Royal saldago olive oil (RS), and Gardenia olive oil (GD).

2.2. Chemical Analysis

Colour, odor, specific gravity, moisture content, acid value, saponification value and peroxide value were analyzed by using standard methods described by Association of Official Analytical Chemists (AOAC) method (AOAC, 2000).[5] All of the physiochemical analysis were conducted in the biochemistry laboratory of Hamdard University Bangladesh.

2.2.1. Colour and odor determination

Visual parallelism was used to evaluate the color of the oil samples. To identify any smells, distilled water and 4M HCl were used to rinse a glass stoppered conical flask. After adding half of the oil sample to the flask, it was vigorously smashed for approximately two minutes. Next, the stopper was opened, allowing the sense of smell to evaluate the odor.

2.2.2. Determination of Specific Gravity

The specific gravity is the ratio between the density of an object, and a reference substance. If a substance's relative density is less than 1 then it is less dense than the reference, if greater than 1 then it is denser than the reference. If the relative density is exactly 1 then the densities are equal; that is, equal volumes of the two substances have the same mass. If the reference material is water, then a substance with a relative density (or specific gravity) less than 1 will float in water. For example, an ice cube, with a relative density of about 0.91, will float. A substance with a relative density greater than 1 will sink.

Formula for determining the specific gravity is

$$\text{Specific gravity} = \frac{W_1 - W_0}{W_1 - W_0}$$

Where,

W_0 = Weight of empty relative density bottle in gram

W_1 = Weight of relative density bottle containing oil sample in gram

W_2 = Weight of relative density bottle containing distilled water in gram.

It is important that the temperature and pressure of each substance is the same so that the density values represent the properties under the same conditions. An important feature of specific gravity is that it can be calculated based on the specific of the components in a mixture.

2.2.3. Measurement of Moisture content

Moisture content is indicating how much water is in a product. It influences the physical properties of a substance, including weight, density, viscosity, conductivity, and others. It is generally determined by Wight loss upon drying. Moisture content of olive oil 0.14%.

Formula for determining the moisture content is

Moisture content was determined by using hot air oven method. About 10 g of oil sample was weighed into a dried crucible. Then in an oven the samples were dried at 105 ºC until a constant weight was determined.

$$\text{Moisture content (\%)} = \frac{(W1 - W2) \times 100}{W1}$$

Were,

W_1=Weight (g) of sample before drying.

W_2=Weight (g) of sample after drying.

Moisture content affects the physical, chemical aspects of food. Moisture in the lubricating oil can emulsify the oil, reduce viscosity, and oil film strength and even accelerate the oxidative deterioration of oil.

2.2.4. Determination of Acid Value

The acid value is a common parameter in the specification of fats and oils. It is defined as the weight of KOH in mg needed to neutralize the organic acids present in 1g of fat and it is a measure of the free fatty acids present in the fat or oil.

For determining the acid value

1. Take 0.1-0.3g of oil sample in a 100 ml Erlenmeyer flask.
2. Add [10] ml of n- Hexane and 1-2 drops of indicator.
3. Titrate the solution against 0.02N KOH solution. The end point is reached when pink (phenolphthalein) cooler persists for 30 seconds.
4. Carry out a blank test

$$\text{Acid value (mg/g)} = \frac{56.11 \times 0.02 \times (V_s - V_b)}{W}$$

Were,

V_s = Titration volume of sample (ml)

V_b = Titration volume of blank (ml)

W= Weight of fat in the volume of extract used (g)

F = Factor of 0.02 KOH solution

Where,

F = $\frac{5}{V_f}$: V_f is the volume of 0.02N KOH required to

neutralize 5 ml of the 0.02N H2SO4 solution.

56.11 = Molecular weight of KOH

0.02 = Concentration of KOH.

An increase or rise in acid value indicates rancidification of the oil. The lower the acid value of oil, the fewer free fatty acids it contains which makes it less exposed to rancidification.

2.2.5. Determination of Saponification Value

The saponification value is defined as "the number of milligrams of KOH needed to neutralize the fatty acids obtained by complete hydrolysis of 1gram of an oil sample.

Two grams of oil sample will be taken into 250 ml conical flask. About 25 ml alcoholic KOH (Potassium hydroxide) will be added and heated for 30 minutes with occasional shaking. When the solution homogenous it will be cooled under tap water. Then, the sample solution will be titrated against 0.5N HCl (Hydrochloric acid) with 0.5 ml phenolphthalein indicator. A blank titration will be carried out without oil. Following formula will be used to determine the saponification value.

Formula for determining the Saponification value is

$$\text{Saponification value (mg KOH/g)} = \frac{(B-S)\times N\times 56.1}{W}$$

Where,
B= ml of HCl required by blank.
S= ml of HCl required by oil sample.
N= Normality of HCl.
W= Weight (g) of oil.

A high saponification value indicates that the sample has a shorter fatty acid chain and a lower molecular weight. A low saponification value indicates that the sample has a longer fatty acid chain and a higher molecular weight. Saponification of palm oil 231.30mg KOH/gm.

2.2.6. Determination of Peroxide Value

The peroxide value is defined as the amount of peroxide oxygen per 1 kilogram of fat or oil. Traditionally this was expressed in units of mill equivalents (1mEq of O2 =0.5 mmol of O_2). The peroxide values of the fresh oil sample were low (0.00 – 10.40mEq/kg).

Formula for determining the peroxide value is
About 5 g of will be taken into a 250 ml conical flask, 30ml mixture of acetic acid and chloroform will be added in it and mixed vigorously. Saturated solution of KI (Potassium iodide) (0.5 ml) will be added, mixed and kept in dark for few minutes and finally 30 ml of distilled water will be added. Then the mixture will be titrated against 0.1N $Na_2S_2O_3$ (Sodium thiosulfate) solution with starch indicator. A blank titration will be also carried out without oil.

$$\text{Peroxide value (meq } O_2\text{/kg)} = \frac{(S-B)\times N\times 1000}{W}$$

Where,
B= Titer value of blank.
S= Titer value of sample.
W= Weight (g) of oil.

Peroxide value is an indication of the initial stage of fat and oil deterioration. It is an indicator to determine the amount of hydroperoxides, the primary oxidation product of oil and fat .It gives a measure of the extent to which an oil sample has undergone primary oxidation, extent of secondary oxidation may be determined from p-anisidine test (Anisidine value test is used to assess the secondary oxidation of oil or fat, which is mainly imputable to aldehydes and ketones, and is therefore able to tell the oxidation "history" of an oil or a fat.). The double bonds found in fats and oils play a role in autoxidation.

If oxidation proceeds for long, it makes the oil rancid and gives an unpleasant smell to the substance. This phenomenon is influenced by temperature of preservation and by the contact with air and light.

3. RESULTS AND DISCUSSION

Table 1: Physical parameters of edible olive oils available in Bangladesh.

Sample	Color	Odor	Specific Gravity (g/ml)
JN	Golden yellow	Fruity smell	0.834±0.231
OL	Golden yellow	Fruity smell	0.835±0.230
OO	Golden yellow	Fruity smell	0.839±0.225
GH	Light golden	Fruity smell	0.884±0.231
LO	Light golden	Fruity smell	0.865±0.226
OT	Golden yellow	Fruity smell	0.862±0.235
MR	Light golden	Fruity smell	0.858±0.238
SP	Golden yellow	Fruity smell	0.825±0.236
RS	Light golden	Fruity smell	0.870±0.225
GD	Golden yellow	Fruity smell	0.844±0.228

Note: Mean ± SD are listed in the column where JN = Jack natural olive oil, OL = Oillina olive oil, OO = Olio orolio olive oil, GH = Green harvest olive oil, LO = Lucy oliva olive oil, OT = Olitalia Olive oil, MR = Maril olive oil, SP = Span oliva olive oil, RS = Royal saldago olive oil, GD = Gardenia olive oil.

Table 2: Chemical parameters of some edible olive oils available in Bangladesh.

Sample	Moisture content (%)	Acid Value (mgKOH/g)	Saponification value (mgKOH/g)	Peroxide Value (meq O_2/kg)
JN	0.11±0.097	0.79±0.24	191.66±0.99	19.00±0.193
OL	0.11±0.098	0.65±0.23	187.66±0.99	18.26±0.198
OO	0.11±0.096	0.83±0.24	195.33±0.98	18.36±0.197
GH	0.11±0.099	0.66±0.24	192.33±0.98	16.65±0.165
LO	0.11±0.097	0.79±0.24	185.33±0.99	17.68±0.175
OT	0.09±0.098	0.63±0.24	194.66±0.99	19.53±0.193
MR	0.11±0.095	0.56±0.23	195.66±0.99	14.66±0.185
SP	0.12±0.094	0.88±0.25	189.66±0.98	18.84±0.198
RS	0.12±0.090	0.38±0.21	195.33±0.99	17.23±0.176
GD	0.12±0.089	0.63±0.20	194.66±0.99	15.42±0.175

Note: Mean ± SD are listed in the column where JN = Jack natural olive oil, OL = Oillina olive oil, OO = Olio orolio olive oil, GH = Green harvest olive oil, LO = Lucy oliva olive oil, OT = Olitalia Olive oil, MR = Maril olive oil, SP = Span oliva olive oil, RS = Royal saldago olive oil, GD = Gardenia olive oil.

Two different colors were observed in this study (Table - 1). Among ten samples 60% samples were golden yellow and the remaining 40% samples were light golden. The odor of all samples was a fruity smell during analysis.

The moisture content of edible olive oil samples ranged from 0.09 – 0.12% which indicates the quality of the samples was good because the normal value of moisture content of edible olive oil is 0.098 – 0.12%. A study conducted by Negash et al, (2019) found that the moisture content of olive oil was 0.33%.[7] Another study was conducted by Zhao et al, (2021) in their study they found moisture content of olive oil 0.13%.[9] Dudi et al., (2021) reported in their study that the moisture content of olive oil was 0.15%.[8]

The specific gravity of the edible olive oil in this study ranged from 0.825 gm/ml to 0.884 gm/ml and the normal value of specific gravity for olive oil is 0.790 - 0.920. Negash et al., (2019) reported in their study the specific gravity of olive oil was 0.807 - 0.823.[7] Another study was conducted by Zhao et al., (2021) they found specific gravity of olive oil was 0.823.[9]

The acid value of the edible olive oil samples of this study was found 0.38 - 0.83 mgKOH/g, whereas the normal value of olive oil is 0.7 - 2.00 mgKOH/g. Negash et al., (2019) found the acid value of their research was 0.98 - 2.43 mgKOH/g.[7] High values of free acidity in olive oil can be due to different factors such as production from unhealthy olives (due to microorganisms and molds contamination or attacked by flies and parasites), bruised olives, delayed harvesting, and storage before processing. Another Study conducted by Dudi et al, (2021) reported that the acid value of their olive oil was 0.78 mg/gm.[8]

The peroxide value of edible olive oil samples of this study showed 14.66-19.53 meq O_2/kg and the normal range of olive oil is 20 meq O_2/kg. A study conducted by Negash et. al., (2011) found peroxide value of their samples of olive oil was 8.15 - 16.25 meq O_2/kg.[7] High peroxide levels indicate that oil has been damaged by free radicals and will give rise to aldehydes and ketones that can cause oil to smell musty and rancid. These reactions are accelerated by heat, light, and air.

The saponification value of samples of edible olive oil in this study showed 187.66 to 195.66 mgKOH/g and the normal range of saponification value for olive oil is 184 - 196 mgKOH/g. A study was conducted by Dudi et al., (2021), They found that the saponification value of olive oil was 70.57 - 80.75 mg KOH/g.[8]

4. CONCLUSION

The edible olive oils sold in Bangladesh by different super shops are good in physiochemical quality. These parameters indicated that the samples collected from marketed Olive oil were fulfilled the basic quality of edible oil and the results are comply with Codex standard for olive oil.[6] However, it is advised that more research be done to assess the nutritional content, heavy metal profile, and antibacterial properties of various branded edible olive oils.

5. CONFLICTS OF INTERESTS

No conflicting interests are stated by the authors.

6. ACKNOWLEDGMENT

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