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Analysis of Mustard and Sunflower oil available in local market of Baglung Bazaar

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Abstract

Two types of oil, including mustard oil and sunflower oil, were gathered for the study from the Baglung bazaar. Five separate physical-chemical characteristics, including moisture content, saponification value, acid value/free fatty acid, iodine value, and peroxide value, were determined. Consumer opinions were collected through a structured questionnaire on these edible oils. The physicochemical data were compared to the normative values advised by the Department of Food Technology and Quality Control (DFTQC), Babarmahal, Kathmandu, Nepal. For mustard oil and sunflower oil, the moisture content was found to be 0.24% and 0.38% respectively, which was greater than the standard value of 0.20%. The saponification value was found to be 157.64 mg KOH/g for mustard oil and 164.37 mg KOH/g for sunflower oil. For mustard oil and sunflower oil, the range of the acid value was 2.24 mg KOH/g and 3.36 mg KOH/g respectively. The iodine values of mustard oil and sunflower oil were found to be 107.95 and 125.60 g I_2/100 g respectively. Finally, the peroxide values for mustard oil and sunflower oil were found to be 4 and 6 meq/kg respectively. Except for moisture content, the other parameters fell within permitted values. The study's findings indicate that all of the oil samples are of acceptable grade and are safe for consumption by humans.

Keywords: Edible oil, Moisture content, Saponification value, Acid value, Iodinevalue, Peroxide value

Introduction

The compositional quality of oils is monitored using various physical and chemical characteristics. The physical properties of fats and oils are influenced by a wide range of factors such as degree of unsaturation, molecular structure, length of carbon chains, isomeric forms of fatty acids, and processing factors (Hamm et al., 2013). The chemical and physical characteristics of edible oils are mainly determined by their composition and temperature. Pure fats and oils are typically white or yellow solids and liquids, respectively. They are also odourless and tasteless (Otunola et al., 2009). In both human and animal diets, fats and oils are acknowledged as vital nutrients. They contain the highest concentration of energy source, essential fatty acids that are the building blocks for essential hormones, the prostaglandins, also act as carriers for fat-soluble vitamins, significantly enhancethe sense of satisfied feeling after eating, and improve the flavour of food (Johnson et al., 2009). Testing a variety of its linked factors can be used to evaluate the quality of cooking. The quality of cooking oils is assessed using a variety of physical and chemical factors. These include moisture content (MC), acid value (AV), saponification value (SV), iodine value (IV), free fatty acid (FFA), peroxide value (PV), and other physicochemical characteristics. These are all qualitative characteristics of oils that offer an overview of the overall unsaturation rather than revealing the location of double bonds or the quantity of olefinic carbon (Knothe & Dunn, 2003). The mass loss of the samples during heating at about 105°C under prescribed operating circumstances represents the moisture content of oils and fats (Badami, 1984). Calculating the weight loss during heating at 105 °C on a hot plate or in an oven yields the moisture content (volatile matter).

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There should not be any dirt or moisture discernible in a properly refined oil or fat (Aurand et al., 1987).

Saponification value/number of oils and fats (esters of long-chain fatty acids) is the number of milligrams of potassium hydroxide required to neutralize the free fatty acids produced by hydrolysis of 1 gram of oils or fats (Mendhan et al., 2013). Acid value is the amount of potassium hydroxide required to neutralize free fatty acids in 1 gram of fat or oil under specified conditions (Badami, 2007). The iodine value of oils/fats is the number of grams of iodine dissolved by 100 g of oil or fat when evaluated using Wij's solution (Horwitz, 2000).

A high peroxide value implies a high level of unsaturation, which leads to oxidative rancidity. Peroxides are the major initial products of autoxidation. Unsaturated fatty acids are abundant in cooking oils, particularly linolenic and linoleic acid, which oxidize 25 times faster than oleic acid (Eskin, 1990; Razzaq et al., 2001). Cooking oil oxidation can be inhibited by antioxidants. Polyphenolic compounds that are naturally found in food or intentionally added to cooking oils to lower the peroxide value can sometimes act as antioxidants (Dolores et al., 1993).

There is good potential for mustard production across the mid-hills and Terai ecological belts of Nepal (Thomas et al., 1992). Mustard oil is used in a variety of scientific, chemical, and traditional applications. Besides cooking and frying, it is used for infant massage, religious lighting, as a lubricant and fuel, and so on. Mustard oil is also used to treat diseases such as cough, asthma, headaches, and ear problems. Mustard oil adds a unique flavour to pickles and is especially popular in carrot, mango, and tomato pickles. In Nepal, sunflower oil is the second most consumed oil band after mustard oil. It is used for various purposes such as cooking, frying, salad dressing, snack foods, supplements, fuel etc. This oil is considered safe for patients with cardiovascular diseases, and diabetes.

Ngassapaand and Othamn (2001) researched the physico–chemical properties of some locally produced edible vegetable oils sold in Dares Salaam and found that depending on storage time and its mode, the physiological attributes of oil changed significantly. They found that the quality of oil degraded with storage time. They also found that the peroxide value of the oils and fats showed the highest change due to exposure to atmospheric oxygen and light whereas, oils stored in tightly sealed containers and dark places showed very small changes in their physiological characteristics.

Sharma et al. (2007) compared the stability of four edible oils (mustard, groundnut, soybean and safflower) against long-term storage and heat damage during frying. For this study, they prepared two kinds of samples: the first sample was prepared by storing the oil in colourless closed glass bottles for about three months while the other sample was prepared by heating the sample oil at high temperature with deep frying of potato chips and compared it with untreated fresh oil to analysis their iodine value, peroxide value, saponification value and fatty acid composition. Thus, they should not be stored for longer periods and also should not be used for deep frying. Instead, natural and fresh oil rich in natural antioxidants is the best choice both nutritionally and chemically.

Boateng (2011) investigated the quality of three coconut oil samples by evaluating their water content (WC), free fatty acid content (FFA), and acid value (AV) compared to international standards. According to the Codex standard, all oil samples had free fatty acids, an acceptable amount of acid value and no signs of rancidity.

Mehmood et al. (2012) evaluated the quality and safety of different kinds of cooking oils sold in Pakistan's market and found that the parameters such as weight, smell, peroxide, free fatty acid, and rancidity value have deviated from standard values set by Pakistan Standard Quality Control Authority.

Konuskan et al. (2019) evaluated the constitution of lipids in mustard, sunflower, olive, and peanut oils and found that canola oil and peanut oil had the greatest peroxide levels, whereas, sunflower oil had the lowest peroxide levels. They also found that out of 10 vegetable oils, peanut oil had the greatest concentration of unsaturated fatty acids, followed by rapeseed oil and sunflower oil.

Nondzor et al. (2015) researched consumers' perceptions regarding unrefined and refined edible oil. They found that consumers thought unrefined oil to be cheaper, with high fat, poor quality, taste, and packaging while they thought refined oil to be highly nutritious and branded properly.

Angayeand Maduelosi, (2015) "Comparative study of the physicochemical properties of some refined vegetable oils are marketed in mile one market and some departmental store in Nigeria" showed that vegetable oils exposed to heat and light resulted in their deterioration affecting their physical-chemical properties where they found that oils marketed in the open shop were more prone to damage than those in supermarkets.

Mender (2016) cooking oils are generally observed to be adulterated with cheap oil by unscrupulous traders. There have been some cases where soybean, sunflower, and groundnut oil were mixed with cheap cotton seed oil. This study also found that when mustard oil was contaminated

with cheap argemone oil it lead to dropsy disease.

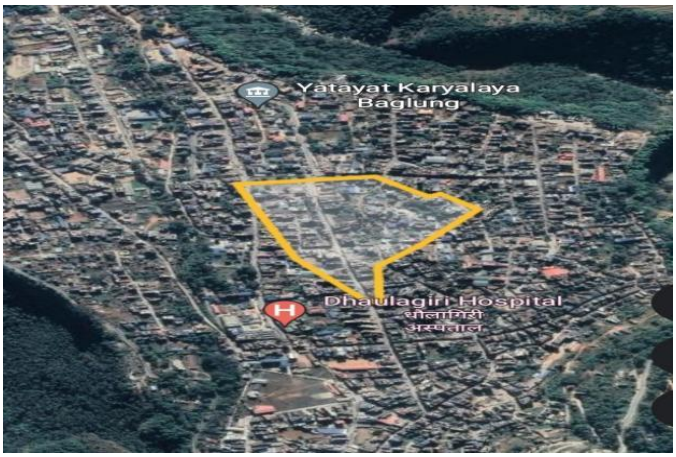
Methodology

Study Area

This research work was done in the Baglung district of Gandaki Province at latitude 28°20' 47.04" North, longitude 83° 14' 43.80" East. The total area of the Baglung Municipality is 98.01 km^2 (37.84 sq. m). This district is also called mini Nepal. The district was surrounded by Parbat in the East, Rukum and Rolpa in the west, Myagdi in the North and Gulmi in the South. The total area of this district is 1,784 Sq. Km. The average annual temperature is 14.9° C.

Figure 1

Map of Baglung Bazaar



Black, red and loamy soil is found and various types of plants like mustard, sunflower, rice, wheat etc are growing in this district. Among them mustard (October to March) and sunflower (mid-April to the end of May) plants are grown during the spring seasons. Local mustard oil was collected from the local people of Baglung bazaar and sunflower oil from the local market of Guthi-3, Baglung bazaar.

Result and Discussion

Physico-chemical properties of edible oils

Two different oil samples were examined in total. The sample has been separated into two categories mustard oil and sunflower oil for the sake of interpretation and discussion of the findings. For each kind of oil, two samples were collected. The quality of the oil was evaluated using various criteria. For this, physicochemical parameters including moisture content (MC), acid value (AV), saponification value (SV), iodine value (IV), free fatty acid (FFA), and peroxide value (PV) were evaluated. The table below shows the physic-chemical properties of the sample oils. Physico-chemical characteristics of the oils as determined experimentally

Table 1

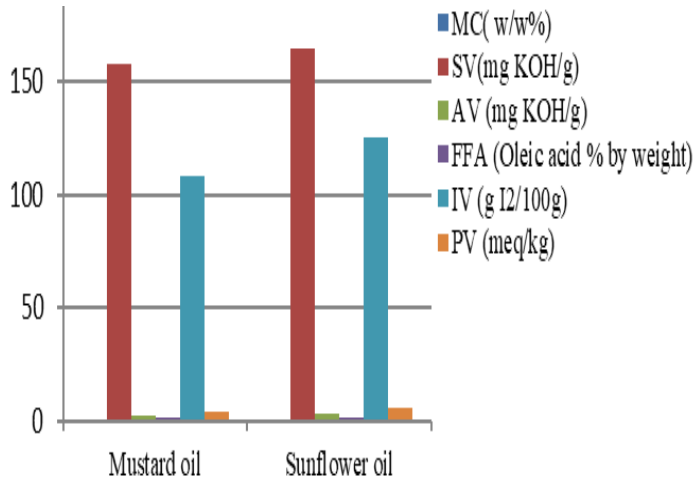
Physico-chemical characteristics of the oils as determined experimentally

Type of oil	Brand name	a	b	c	d	e	f
Mustard oil	Sajan	0.24	157.64	2.24	1.13	107.95	4
Sunflower oil	Sajan	0.38	164.37	3.36	1.68	125.60	6

Note: MC (w/w%)[a], SV KOH/g[b], (mgAVKOH/g[c], FFA Oleic acid % by weight[d] , IV (g I_2/100g)[e] , PV(meq/kg)[f]

Figure 2

Compound bar diagram



Moisture Content

Samples of sunflower oil and mustard oil contain 0.38% and 0.24% moisture respectively. The moisture content of mustard oil is lower than that of sunflower oil. Nonetheless, moisture content contained in vegetable oils should not exceed 0.20%, under the Codex Alientarius Commission (1987), as this substance is volatile above 105°C.

Saponification Value

According to the findings, mustard oil and sunflower oil had saponification values that varied from 157.64 to 164.37 mg KOH/g. When the number was compared to the range (168–177 mg KOH/g) established for mustard oil by the DFTQC, Nepal, it was discovered that the value was within the range. Mustard oil has a measured saponification value of 157.64 mg KOH/g. Similar to this, the sunflower oil's saponification result of 164.37 mg

KOH/g is within the DFTQC-recommended range of 188-194 mg KOH/g. All of the oil samples used in the experiment therefore fell within the allowed range for the saponification value.

Acid Value and Free Fatty Acid

All of the samples had acceptable acid values, as per the advice of DFTQC, Nepal, according to the findings of the research on acid value. According to the specified value of 6.0 mg KOH/g for mustard oil, the acid value of the mustard oil sample was found to be 2.24 mg KOH/g. The computed acid value for sunflower oil was 3.36 mg KOH/g, which is within the permitted range of 4.0 mg KOH/g. Because 1.99 times the FFA (in the form of oleic acid) equals the acid value (Badami, 1984), the same trends were seen for FFA content.

Iodine value

According to the DFTQC, Nepal's suggested range of 96–112 g I_2/100 mg, the iodine value for several brands of mustard oil was determined to be 107.95 g I_2/100 mg. It was determined that sunflower oil has an iodine content of 125.60 g I_2/100 mg, which is also within the required range (110-143 g I_2/100 mg). The study of the iodine value yields data indicating practically all of the oil samples had iodine values that are within the DFTQC, Nepal, and permitted range. The iodine levels of the investigated oil sample do not, however, differ significantly from one another.

Peroxide Value

The peroxide value, which assesses the hydro peroxides and aldehydic secondary oxidation products of the oils, complied with the requirements of DFTQC, Nepal's. The peroxides value recorded for the oil brand varied from 2 to 6 meq/kg, which is within the standard range of 10 meq/kg. It was discovered that mustard oil had a peroxide value of 4 meq/kg and sunflower oil had peroxide levels of 6 meq/kg.

Consumer's View on Edible Oils

From the survey conducted among 20 households from different localities of Baglung, almost all of the people (100%) were found to be using vegetable oil for cooking whereas no record was obtained in favour of animal ghee.

From Figure 3, it is clear that 54% of people considered vegetable oil safer than animal ghee with animal ghee weighing only 46%.

Figure 3

Bar graph showing idea people of Baglung about which one they think safer for health: animal ghee or vegetable oil.

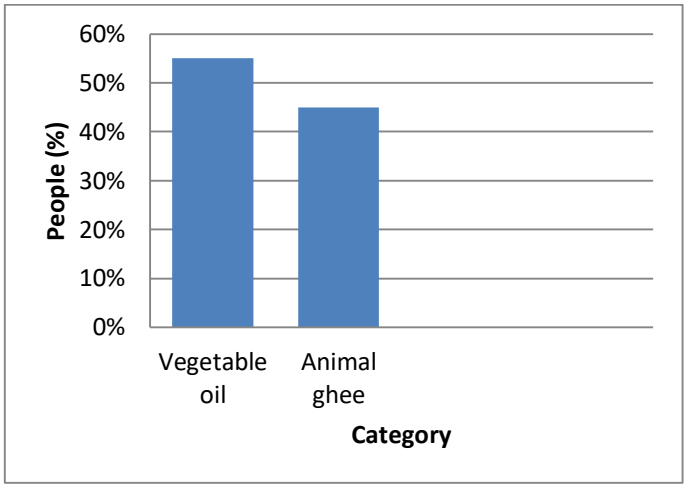
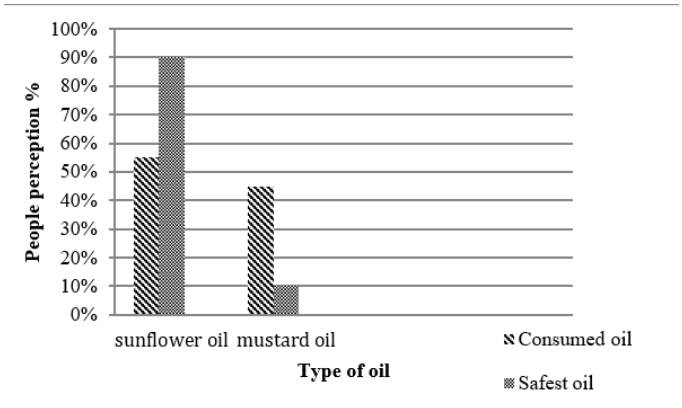


Figure 4

Bar-graph showing oil consumption and consumers' view about the safeness of different oils in Baglung bazaar.



The first bar chart of figure 4 reveals that sunflower oil was mostly consumed oil with 55% of the total respondents followed by 45% for mustard oil. In the answer to the question, "Which oil do you think is safer for your health?" 55% of the total respondents felt that sunflower oil is the safest one whereas 45% of responses were recorded in favour of mustard oils.

Figure 5

Bar graph representing the reasons of inspiration for using the oil

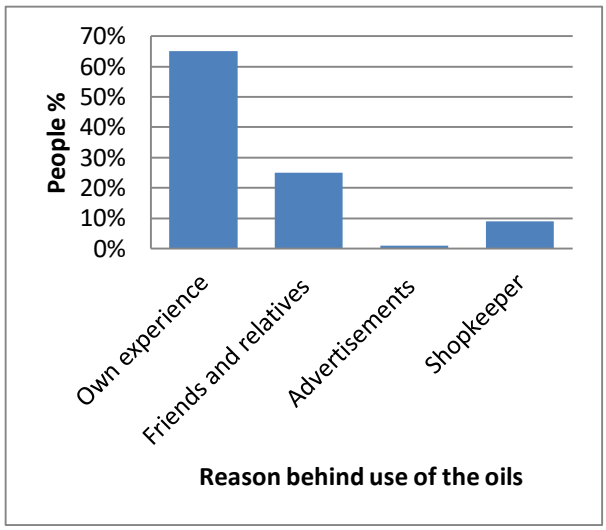
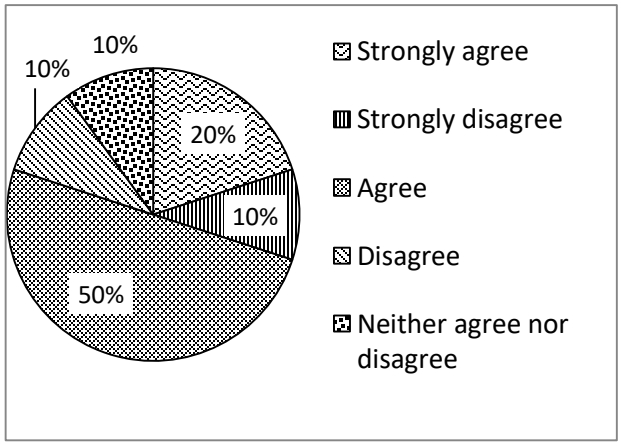


Figure 5 illustrates that a large majority of the people (65%) relied on their own experience to use the oil brand they are using nowadays. Few properties of (25%) were suggested by friends and relatives while (9%) by shopkeepers and left (1%) by advertisements. From the data obtained, it can be concluded that the majority of people rely on themselves to choose a better oil brand for their kitchen.

Figure 7

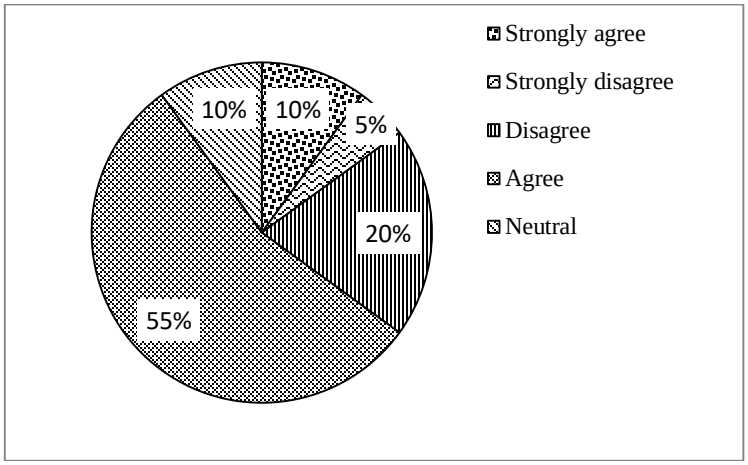
Pie- chart of consumers' View



The figure 6 elucidates that 50% of the people agreed the statement "Refined oil is superior to unrefined oil for health" while 10% of them disagreed the statement. Likewise, 20% strongly agreed and 10% strongly disagreed, the remaining 10% of them neither agreed nor disagreed the statement.

Figure 6

Pie-chart representing the consumers' views on price and quality of oil



The analysis of data from Figure 7 reveals that 55% of people agreed the statement, "Expensive oils are better than cheap oils" whereas 10% of the people were neutral and the same, that is, 10% of the people strongly agreed on the statement. The attribute 'strongly disagree' got a margin of 5% followed by 20% margin for disagree.

Previous users of mustard oil have noted that it is expensive, unpleasant-smelling, smelly, and irritating. Because mustard oil is more viscous and fatty than other cooking oils, they also found it more laborious and difficult to wipe away the cookware that utilized it. Mustard oil is not recommended for those who have hypertension (high blood pressure), according to some people who believe it might create difficulties with the stomach. People who had previously used sunflower oil also cited its drawbacks as being covered with, which is why it holds on tightly and leaves deposits on dishes and kitchenware. Some people also believe that this oil may cause chest discomfort, obesity, and gastritis. Additionally, individuals who use mustard oil now think that meals prepared with it taste well. They also said that mustard oil is readily accessible in local markets, non-sticky on meals, and good for those with diabetes and chronic high blood pressure. Additionally, users of sunflower oil noted its affordability and safety. They also mentioned how its less viscous nature offered non-stickiness and made dishes easier to wipe away. They said that sunflower oil is healthier, better for people with high blood pressure and arthritis, and does not easily deteriorate during lengthy storage.

According to the report, oil is used most frequently for frying and cooking by the residents of Baglung Bazaar.

Mustard oil was preferred by residents of Baglung bazaar for cooking meat and other dishes high in protein. In addition to this, they use mustard oil in particular for pickling and body massage. Some individuals use mustard oil as a hair conditioner. 'Diyo' and 'Aarati' are lit with the help of mustard and sunflower oils.

In the study, we explored user opinions on how to recognize and choose a quality oil brand. Most individuals use the color and smell of the oil as references in this respect. Some of them believe that food prepared with high-quality oil tastes better. However, it has also been observed that some individuals refer to the oil's viscosity and transparency, the oil's viscosity and expiry dates that are printed on the packaging

Conclusion

Several important conclusions were drawn from the analysis of sunflower and mustard oils. Both sunflower oil at 0.38% and mustard oil at 0.24% showed moisture content higher than the recommended level of 0.20%. For sunflower oil, the saponification values were 164.37 mg KOH/g and 157.64 mg KOH/g for mustard oil. Sunflower oil had the highest acid values while mustard oil had the lowest, with a range of 2.24 to 3.36 mg KOH/g. Compared to mustard oil (107.95 g/100 g), sunflower oil has a greater iodine value (125.60 g/100 g). In conclusion, the peroxide values for sunflower oil and mustard oil were 6 meq/kg and 4 meq/kg, respectively. These findings highlight important information about the characteristics and quality of sunflower and mustard oils. To compare various oil sources, significant factors like moisture content, saponification value, free fatty acid value and acid value, peroxide value and iodine value. The study's findings support the assertion that the oil samples are of acceptable quality and safe for ingestion by people. The oils' much-increased moisture content makes them more susceptible to oxidations that are beyond DFTQC standards, which lowers their stability and quality. The poll revealed that Baglung bazaar residents are slightly worried about choosing decent and healthy oil for their kitchens. Nevertheless, they only have a limited understanding of the factors that affect or contribute to oil quality. Therefore, research oil is required in Baglung bazaar so that customers may learn about the mysteries surrounding the standards and quality of oils sold in the market.

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