Characterization of canola seed oil produced by small scale food processors in Mweiga, Nyeri County

Name: Everlyn N Wambugu
Reg. No: A90/23664/2008

Supervisors: Prof. E.G Karuri
Ms Jane Njenga

A report of the research project submitted in partial fulfillment of the awarding of a degree in Bsc. Food science, Nutrition & Dietetics
Declaration

It is my declaration that this project is my original work not and to my knowledge it has not been submitted to any other institution of higher learning.

Name: EVERLIN WAMBUROU

Sign: [Signature]

This report has been submitted to my supervisor

Prof E.G Karuri

Sign: [Signature]

Date: 5/6/2012
Dedication

This project is dedicated to my parents Mr. & Mrs. Wambugu for your struggle to give me the best in education as an essential for a better life.
Acknowledgements

I hereby express my gratitude to my supervisors Prof Karuri and Ms Jane Njenga for their useful suggestions and guidance in the course of preparing this project.

I acknowledge the financial support by the University of Nairobi during my study and research work.

I am indebted to Ms Pascaline, Mr. Kimondo and Mr. Macharia for their permission to conduct the research on their farms and the invaluable information they offered in the field.

I acknowledge the much needed technical advice and assistance offered by the laboratory assistance and data analyst, Mr. Mugo from the Food Sci., Nutrition & Technology department.

I also thank my family members for their support during the preparation of this project and to all my classmates, your companionship throughout this study will greatly be missed.
Abstract

There have been many cooking oils in the market today with nutritional claims on their labels. The oils claim to minimize the risks of all health-related problems for instance, hypertension, heart disease etc

Consumers also lack the knowledge to interpret and understand the nutritional information on these labels. As a result, consumers are uncertain on what cooking oil is good for them to consume.

This project therefore tried to find the most suitable way of processing the available data and disseminating the nutritional information to consumers. In order to realize this, characterization of canola oil was done for particular parameters and compared to the KEBS standards
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1.0 INTRODUCTION

1.1 Background Information

CANOLA-acronym for Canadian Oil Low Acid was developed in Canada in the 1970s and gradually became popular for the health benefits claimed by the company that produced and marketed it. The plant was originally developed by cross-breeding the rapeseed plant, mainly to produce edible oil from its seeds. www.canola-council.org

Canola is an engineered plant developed in Canada. The oil is derived from rapeseed plant. Rapeseed has been used in many parts of the world namely India, Japan, U.S.A and China. In the late 1970s, Canadian plant breeders were able to create a variety of rapeseed which produced monosaturated oil which was much lower in erucic acid. This "new" oil was originally called LEAR oil (Lower Erucid Acid Rapeseed) Neither "rape" nor "lear" created an appealing image; hence canola

Globally, the plant is the third largest in the vegetable market after soya beans and palm oil with cultivation mainly for edible oils, animal feeds and biodiesel. At present, Kenya’s domestic production of edible oil covers about a third of its annual demand estimated at around 380 000m³. The rest is imported at a cost of around $140M a year. In Kenya there are very few producers who face competition from imported products. www.canolainfo.com
1.2 Problem Statement

Canola oil being a new product in the Kenyan market is only produced by few farmers who feel that their product has not been received well by consumers according to one of the farmers who grow canola and process the oil

In many cases the product has a “poorer” appearance and a lower perceived quality and hence they are losing sales. The incomes of traditional processors are also failing as a result

Vegetable oil undergo several processes which help in the development of a better product in terms of appearance and purity [www.canolainfo.com](http://www.canolainfo.com)

In Nyeri, the seeds are grinded, oil is squeezed from them and the oil is boiled and allowed to cool (cold) then the oil is packed. However different farmers have varying products in terms of quality due to difference in the manner of handling of seeds, processing, packaging and storage

1.3 Justification

The oil producers would like to know the nutritional and chemical profile of the oil they produce, an objective that this project hopes to achieve

The products to be used on this project are locally available; this will ensure that this project will be a success

The information from this project will be used to encourage consumers to diversify their sources of cooking oil for a more nutritional and affordable product

1.4 Objectives

To analyze the quality of the canola seed oil produced by small scale food processors

Sub objectives

- To characterize three farmers in terms of the equipment they use to produce the oil, method and how they market the oil
- To characterize canola oil collected from selected processors
Hypothesis

It is expected that these oils hardly meet the results from these samples with KEBS standards of oil for various parameters;

Peroxide value, specific gravity, iodine number, free fatty acid

1.5 Benefits of this project

This project seeks to compare the results from these samples with KEBS standards of oil for various parameters and make recommendations of better refining methods and storage of the oil to the small scale food processors

The analysis will help in confirming chemical profile claims and document information in a scientific way
2.0 Literature Review

Canola is an oilseed crop that was developed from traditional rapeseed by Canadian plant breeders during the 1970's. It is grown widely across Canada, several European countries, and Australia, and to a lesser extent in the United States. Canola is distinguished from traditional rapeseed by the greatly reduced levels of the fatty acid, erucic acid and anti-nutritional compounds called glucosinolates.

These alterations have led to the widespread use of canola oil in Canada and today it is the most popular all-purpose vegetable oil. Canola oil is sold as a salad and frying oil and is also used in margarines, shortenings and in prepared foods that contain vegetable oil (such as baked goods, potato chips, French fries, etc.). Canola oil accounted for approximately 78% of total Canadian production of edible oils in 1996 (Statistics Canada, 1996).

Canola meal is the by-product of canola oil processing. It is used as a high-protein feed ingredient in the rations of poultry, swine, cattle and fish.

These food and feed applications are possible through strict procedures used in the processing of canola seed into oil and meal. This document describes the processing methodologies that are used by the canola industry to produce high quality oil and meal products.

The production of edible vegetable oils including canola oil involves two overall processes, mechanical pressing and extraction, and further processing to remove impurities. The techniques used are similar for most vegetable oils produced from the seeds of plants. The crushing and extraction processes utilized by the canola industry today produce very little change to the fatty acid profile of the oil and the nutritional qualities of the meal.

The majority of canola seed is grown by Canadian farmers as a commodity crop, meaning that canola seed is commingled and not separated by variety or other specific traits. Following harvest, canola seed is purchased by Canadian and American processors on the basis of grading standards set by the Canadian Grain Commission and, in the U.S., by the National Institute of Oilseed Processors. A number of criteria are used to grade canola seed, including the requirement that the seed must meet the canola standard with respect to erucic acid and glucosinolate levels.

2.1 Canola Seed Cleaning

Graded seed is cleaned by a number of different methods including air aspiration, indent cylinder cleaning, sieve screening, or a combination of these. Cleaning ensures that the seed is free of extraneous plant and other foreign material which is referred to in the industry as "dockage". Seed generally contains less than 2.5% dockage following the cleaning process. Seed that has been cleaned is ready for subsequent export or for crushing into canola oil and meal.
Canola Seed Preconditioning

Seed which will be processed for oil and meal is preconditioned using mild heat treatment, and moisture is then adjusted to improve subsequent oil extraction.

2.2 Canola Seed Processing

Following preconditioning, canola seed is next crushed and flaked and then heated slightly. These processes help to maximize oil recovery. The canola flakes are then "prepressed" in screw presses or expellers to reduce the oil content from about 42% in the seed (on an 8% moisture basis) to between 16-20%. Screw pressing also compresses the flakes into more dense cakes (called "press cake") which facilitate oil extraction.

Canola Oil Extraction

Press cake which results from seed processing is next subjected to one of two types of oil extraction to remove much of the remaining oil. Oil may be extracted using either hexane ("solvent") extraction or by "cold-pressing" (also referred to as "expeller pressing"). The end-market into which the oil is sold generally dictates which form of extraction will be used. Hexane is the extraction medium used for the bulk of canola oil which is sold into the commodity grocery chain market as well as to the food industry. Cold-pressed canola oil represents a much smaller volume sold to consumers and is generally marketed in specialty food stores. Both extraction processes result in oil essentially bland in taste, light yellow in color, and with excellent nutritional and stability properties.

2.3 Hexane Extraction of Canola

Hexane extraction reduces the oil content of the press cake to very low levels. Oil recovery from canola seed is approximately 96% when this form of extraction is used. This is accomplished by maximizing contact of the hexane with the press cake through a series of soakings or washings. Residual hexane in the extracted press cake and oil is easily removed by evaporation at low temperature. Solvent residues in oils and meals, when produced in accordance with good manufacturing practice, can be said to be truly insignificant.

Canola Oil Refining

The oil which is produced during the extraction process is referred to as "crude oil" because it contains various compounds which must be removed to ensure a product with good stability and shelf-life. These impurities include phospholipids, mucilaginous gums, free fatty acids, color pigments and fine meal particles. Different methods are used to remove these by-products including water precipitation or organic acids in combination with water. Once removed, these by-products are added to the canola meal fraction in order to increase its feeding value (energy) and make it an even more nutritious product.

Following water precipitation and/or organic acid processing, the oil will still contain color compounds which, if not removed would make it unattractive to the consumer and also reduce its
stability. These compounds are extracted through a process called bleaching. In contrast to what may be implied by the term, bleaching does not involve the use of harsh chemicals. Instead, during the bleaching process, the oil is moved through natural, diatomaceous clay to remove color compounds and other by-products.

Deodorization is the final step in the refining of all vegetable oils, including canola. Deodorization involves the use of steam distillation with the objective being the removal of any residual compounds which, if retained, could impart an adverse odor and taste to the oil. The oil produced is referred to as "refined oil".

Further Processing of Canola Products

Refined canola oil is utilized in a large variety of edible oil products. Generally, no further processing is required for canola oil used as a liquid product for salads, dressings and home frying. The refined oil is sold under a number of brand names for both household and industrial purposes. A special process called hydrogenation is used in the production of margarine, shortening and other specialized products. Hydrogenation solidifies the oil and therefore greatly increases the range of products in which it can be used. As a rule, the more "solid" a product is, the greater has been the degree of hydrogenation.

Canola oil may also be processed into more solid products using a method called interesterification. Interesterification involves mixing canola oil with other oils that are more solid by nature, including palm kernel oil. Special processing parameters are utilized and result in a semi-solid product which does not need to be hydrogenated.

2.4 Cold Pressing of Canola

The production of cold pressed canola oil involves essentially the same steps as those used in hexane extraction. The most significant difference is that the hexane extraction step is omitted and the oil is removed primarily through mechanical pressing. In addition, the temperature of the cake during the mechanical pressing of the oil from the seed is controlled at 60 degrees C by water cooling. A drawback to cold pressing is that the recovery of oil is lower than from hexane extraction. This is because the mechanical pressing of the cake is less effective at low temperatures. Oil recovery when using cold-pressing techniques most often ranges between 75% to 85%. The price of cold pressed canola oil tends to be slightly higher because of the lower recovery of oil. Cold pressed canola oil is generally sold in bottled form directly to consumers and is usually not used in further food processing.

Canola Oil Health Claim

Consumers can take canola oil's new health claim to heart; FDA rules canola oil may help reduce the risk of cardiovascular disease.

October 6, 2006: The Food and Drug Administration (FDA) has ruled that canola oil is now eligible to bear a qualified health claim on its ability to reduce the risk of coronary heart disease due to its unsaturated fat content. Canola Council of Canada president Barb Isman says the
FDA's stamp of approval is proof positive that canola oil's unsaturated fats are really "Good for Every Body"!

"The FDA puts all health claim petitions through rigorous scientific review," Isman says. Here's what the FDA approved for display on containers of canola oil and eligible products* sold in the U.S.:

*Limited and not conclusive scientific evidence suggests that eating about one and a half tablespoons (19 grams) of canola oil daily may reduce the risk of coronary heart disease due to the unsaturated fat content in canola oil. To achieve this possible benefit, canola oil is to replace a similar amount of saturated fat and not increase the total number of calories you eat in a day.

Isman says the Council will be supporting the use of this new marketing tool to promote healthy eating because "it's now possible to point to this FDA approval to show very clearly that all fats are not created equal".

Canola oil is high in healthy unsaturated fats (93%), free of cholesterol and Trans fat, and the lowest in saturated fat (7%) of any common edible oil. In addition, canola oil is multi-functional with a high heat tolerance, neutral taste and light, smooth texture.

Criteria for foods eligible to bear the claim include containing at least 4.75 grams of canola oil per reference amount customarily consumed, no more than one gram of Trans fat and low levels of saturated fat and cholesterol.

According to Mr. Kimondo who grows canola seeds and who processes the oil, "Canola is a highly natural product just the way nature intended. Canola is grown organically. Canola is a graded quality oil product."

### 2.5 Crop Etiology

- Canola requires minimum rainfall
- It is planted by broadcasting
- One requires 1.5kgs to 2kgs of canola seeds
- The canola covers the soil with its wide leaves and deep roots and thus consumes other legume weed apart from grass family which could be sprayed using spraying chemicals
- Apply 30kg of DAP fertilizer where the soil is poor
- Control insecticide by spraying
- One acre yields 1500-2000kgs of canola seed
- 3kgs of canola oil seeds produce one litre of canola oil
3.0 Methodology

An exhaustive proximate composition was done on samples of canola oil for the different parameters.

The data from the analysis of oil from three farms was compared with the KEBS standards to confirm whether the oil actually meet the required standards.

This was to be determined using AOAC method (1994).

4.0 Experimental Design

Sample collection

2 wks old samples

2 months

Proximate & chemical analysis

proximate & chemical analysis

Data analysis

Data analysis

Data analysis was done using the ANOVA and one T-test methods.
5.0 RESULTS AND DISCUSSION

1.0 Table showing the values of different parameters for oil processed after two weeks

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Farm A</th>
<th>Farm B</th>
<th>Farm C</th>
<th>KEBS stds</th>
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<tr>
<td>Peroxide value</td>
<td>6.6</td>
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<td>9</td>
<td>10</td>
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<tr>
<td>Iodine value</td>
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<tr>
<td>Acid value</td>
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<tr>
<td>Specific gravity</td>
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<td>0.923</td>
<td>0.916</td>
<td>0.915-0.918</td>
</tr>
</tbody>
</table>

1.1 Table showing the values of different parameters for oil processed after two months

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Farm A</th>
<th>Farm B</th>
<th>Farm C</th>
<th>KEBS stds</th>
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<td>Peroxide value</td>
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<td>75-95</td>
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<tr>
<td>Acid value</td>
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<td>Specific gravity</td>
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<td>0.920</td>
<td>0.915-0.918</td>
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</table>
Peroxide value

This is a measure of peroxides contained in the oil. All the samples were stored at a standard temperature of 25°C.

The 2 months oil for all the samples expressed a higher peroxide value compared to 2 weeks oil.

During storage, peroxide formation is slow at first after processing and may vary from a few weeks to several months according to the oil.

After comparison with the KEBS standards, it was found out farms A & C met the standard, which is a maximum of 10, farms A & B had a peroxide value of 6.6 and 10 respectively for their 2 weeks oil. Farm B had a value of 12 which is slightly higher, this difference could have been caused by poor storage whereby the oil was stored in a poorly ventilated room after processing, this scenario was confirmed during the farm visit.

Iodine value

The iodine value of an oil or fat is defined as the weight of iodine absorbed by 100 parts by weight of the sample. The glycerides of the unsaturated fatty acids present unite with a definite amount of halogen and the iodine values are therefore a measure of the degree of unsaturation. Iodine value is determined using wijs method.

The iodine values among the sample are relatively higher in comparison with the KEBS standard which is 75-95. The higher the iodine value the higher the unsaturation.

Acid value

The acid value is a measure of the extent to which the glycerides in the oil have been decomposed by the lipase action. The determination is often used as a general indication of the condition and edibility of oils.

The acid values of farms A&C at 1.309 and 2.7 respectively which were lower than KEBS standard which is 4. The acid value of the oil from farm B is 5.1. These oil were 2 weeks old. The values of all the oils in the group of 2 months were higher. The decomposition was accelerated by heat and light and was a general indication of the condition and edibility of these oils.
Specific gravity

This is the ratio of the mass in air of a given volume of the oil at 20°c to that of the same volume of air. The specific gravity according to the KEBS should have a range of 0.915-0.932

The specific gravity does not vary much with the KEBS values. The differences among the samples is not much, the values of the two months oil is slightly higher

Discussion according to the processing method

The processors in farm B&C use cold-processing method to produce their oil. The processors use grinders which are operated manually. The cooking oil is sold to the local community and packaging is done using plastic bottles

The processor in farm A used hexane extraction. Oil is pre-pressed using screw presses which is mechanized then soaks the press cake in hexane for further oil extraction. The farmer exports the oil and sells the by-products to BIDCO for the production of biofuel
6.0 Conclusion

The hypothesis was justified because none among the sample samples met the stipulated standards according to KEBS for the given parameters.

Storage conditions and the methods of processing affected the quality of the oil. The quality of oil deteriorated with time. The method used for processing the oil guarantees the quality of the oil.

7.0 Recommendations

- Further analysis to determine the shelf life of the final product should be done
- There is need for commercialization to provide more options of cooking oil in the market
- It's important for the local processors to come together in order to purchase the necessary equipment for processing cooking oil of high quality
References

http://www.canolainfo.org/quadrant/media (Accessed 17/2/2012)


## APPENDICES

### ANOVA

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