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Author Affiliation:
[1]AIPH University, EAST Campus Prachi Vihar, Anantapur Phulnakhara - 754001 Cuttack, Odisha, India
[2]Regional Institute of Education (RIE), Sachivalaya Marg, Bhubaneswar-751022, India

[*]**Corresponding Author**
Regional Institute of Education (RIE), Sachivalaya Marg, Bhubaneswar-751022,
India
Email: anjugk9@gmail.com

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Quantitative analysis of vanaspati in desi ghee from the samples of Odisha

Manika M[1], Anjana M[2*]

ABSTRACT

The present study was aimed to detect the adulteration of ghee with vanaspati using the spectrophotometry analysis method. Spectral wavelength of 348 nm to 570 nm were used to determine and make a comparison of the absorbance values of pure ghee and ghee adulterated with partially hydrogenated vegetable oil that were obtained from the local market in Baripada. The study clearly showed that the market ghee adulterated with partially hydrogenated vegetable oil had lower absorbance difference value than the pure ghee (control). Market ghee (sample 6) with deviation value -0.06 was found to be least adulterated. The experiment and its results are suggesting that the samples of ghee from the local markets are adulterated with partially hydrogenated vegetable oils otherwise known as Vanaspati because the samples are showing negative deviation value from the control. The variation in absorbance may be due to the lengths of carbon chains and the ester bonds present in the samples.

Keywords: Vanaspati, desi ghee, adulteration, spectrophotometry

1. INTRODUCTION

Food is the basic source of energy for any organisms including human beings. Consuming healthy diet throughout life course helps to prevent malnutrition in all its forms as well as a range of non-communicable disease (WHO, 2020). Among the first to draw public attention to food adulteration was Frederick (Accum, 1820). He published an exposé, Adulterations of Food and Culinary Poisons, which was a seminal event in the history of adulteration and reform. The book itself features a small skull and cross-bones motif on the cover with the underlying words, “There is death in the pot”, summarizing Accum's conclusion. Accum exposed numerous examples of dangerous food adulteration (Wilson, 2008).

Jirankalgikar and De, (2014) conducted a study of tallow adulteration in Ghee and its detection by spectrophotometry. Antony et al., (2018) conducted a comparative analysis of Ghee and common vegetable oil using FT-MIR reflectance spectroscopy. A study was conducted by Saleem, (2020) for the detection of

adulteration present in desi ghee using fluorescent spectroscopy. Adulteration is nowadays a lot serious public health concern and in India have been quite common and a matter of concern. As the dairy products are prone to adulteration, this study is based on the identification of vanaspati adulteration with different ghee samples. Ghee otherwise known as clarified butter is a dairy product is used since the ancient time for cooking purpose.

Ghee is obtained from the milk of cows and buffaloes using different methods. Desi ghee is enriched with Vit-A, Vit-E, beta carotene and high concentration of conjugated linoleic acid (CLA). Due to the rich flavour and fragrance ghee is one of the dairy products to be high market demand. Due to this high demand and cost price, the issue of adulteration with inferior vanaspati ghee is quite common. Vanaspati is hydrogenated vegetable cooking oil and gas a cheaper substitute of desi ghee. Most of the time palm oil is used in purpose as adulterant as it is cheap and contains very high range of trans fats. The detection of adulterant in ghee products could be reported by performing fluorescence spectroscopy, U.V. visible spectrophotometry methods.

2. MATERIALS AND METHODS

Materials

LT- 291 single beam UV visible spectrophotometer (UV/NIR), 8 ghee samples and 3 vegetable oil samples. Test tubes, Test tube stand, pipette, Tissue paper, rotor.

Methods

Sample collection

Ghee samples were bought from a local market of Baripada. Two samples of homemade desi ghee, three partially hydrogenated vegetable oil samples and six different samples of market ghee were taken for the study. The total of eleven products was taken in different test tubes. Each test tube after labeling was put inside rotor and was rotated for the uniform sample preparation. The ghee samples were kept under 31^{o}C to avoid the solidification of the samples.

Spectrophotometric Analysis

Samples were taken in cuvette to take the readings of absorbance. The wavelength range was set to be in between 348 nm to 570 nm. The readings were noted respectively as per the sample numbers.

3. RESULTS AND DISCUSSION

Results

The mean value of absorbance of two homemade pure ghee samples, A (control) and the mean absorbance of three partially hydrogenated vegetable oil samples, B at different wave length of spectra (348 nm and 570 nm) were taken and were compared (Figure 1) with the absorbance at same wavelengths of different market ghee products.

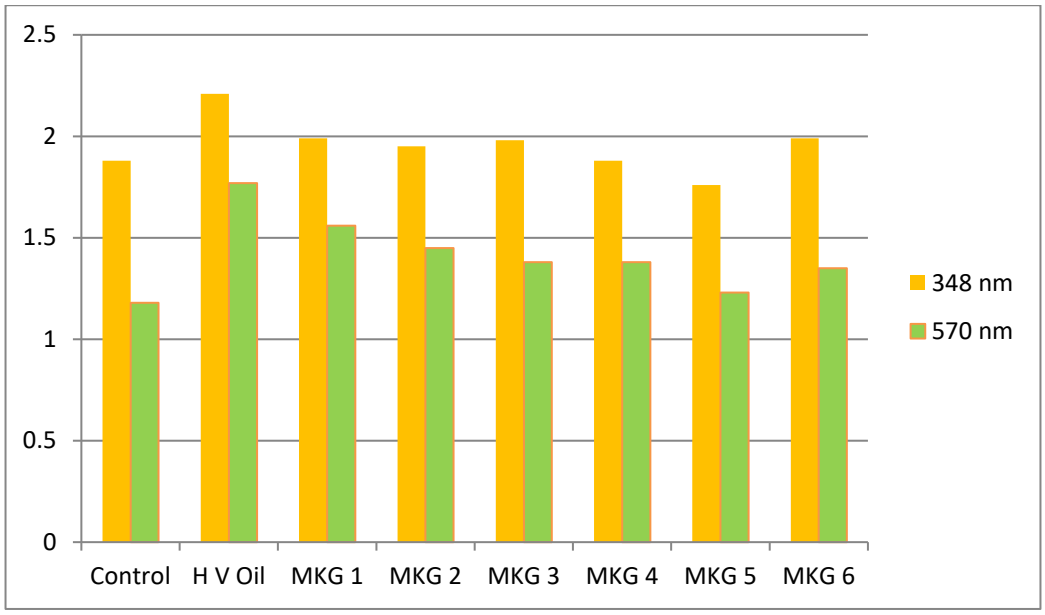

Figure 1 Absorbance values of ghee samples at 348 nm and 570 nm spectra

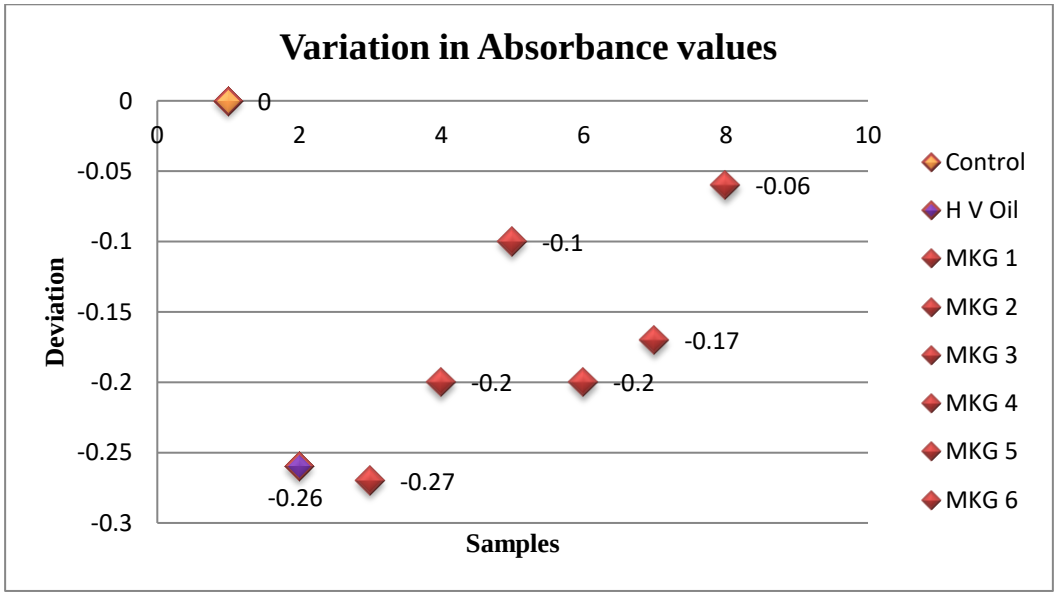

Figure 2 Deviation of MKGs and hydrogenated vegetable oil from control

From the above graphical information, the absorbance deviation (Figure 2) of ghee samples and vegetable oil samples were noted. The observed parameters are plotted in Table 1 and using these values quantitative analysis was done.

Table 1 Absorbances at 348 nm and 570 nm spectra of different samples and the deviation from pure ghee (A. Control; B. H V oil (partially hydrogenated vegetable oil) & C 1-6 MKG (Market ghee)

Sample		Absorbance			
No	**Type**	**348 nm**	**570 nm**	**Difference**	**Deviation(d) from pure ghee**
A	Control	1.88	1.18	0.70	0.00
B	H V Oil	2.21	1.77	0.44	-0.26
C	Market Ghee				
1	MKG	1.99	1.56	0.43	-0.27
2	MKG	1.95	1.45	0.50	-0.20
3	MKG	1.98	1.38	0.60	-0.10
4	MKG	1.88	1.38	0.50	-0.20
5	MKG	1.76	1.23	0.53	-0.17
6	MKG	1.99	1.35	0.64	-0.06

From the examination of absorbance of ghee and partially hydrogenated vegetable oil at 348 nm and 570 nm, it was observed that the difference did exist in their absorbance values. The deviation values can be a great clue to find out the adulterated products.

Discussion

The study (Table 1) clearly shows that the hydrogenated vegetable oil sample has lower absorbance difference value compared to pure ghee (control). The negative deviation of hydrogenated vegetable oil (-0.27) is possibly due to the trans fats which are unsaturated fats having trans structure with hydrogenated C=C bond. The six marketed ghee samples were following trend of deviation from the pure ghee indicating adulteration. The experiment and its results suggested that the samples of ghee from the local markets were adulterated with vegetable oils, otherwise known as Vanaspati. Vanaspati is a trans-fat having no benefits regarding health. It is highly toxic and sometimes act as carcinogen. Rich in saturated fatty acid content, vanaspati can accumulate in vascular system and deposit cholesterol and may lead to heart attack and stroke like serious problems.

4. CONCLUSIONS

UV/NIR spectrophotometer was utilized to characterize vanaspati adulteration in desi ghee by spectral analysis. The result was found that the vegetable oil samples were having lower deviation value of absorbances with the 348 nm and 570 nm spectra. The ghee products except homemade desi ghee, all others were showing lower deviation than desi ghee. These ghee products are probably having vanaspati adulteration to some extent. There are many health-related issues associated with ghee having vanaspati adulteration. Since Vanaspati has trans fatty acids having various health risks such as cardiovascular diseases, cancers, allergic reactions etc. This paper will spread awareness about the ghee adulteration and marketing of adulterated products in locality especially in urbans. Awareness should be made on this social issue so that certain control shall be enforced in the addition of such harmful substances beyond a certain limit.

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Informed consent

Not applicable.

Funding

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Ethical approval

Ghee samples were bought from a local market of Baripada, India; meantime, ethically the "brand name" of the product not mentioned in content and "brand image" not displayed as image in the article. The product ethical guidelines are followed in the study for observation, identification & experimentation.

Conflict of Interest

The author declares that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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