Assessing the Genuineness of Different Brands of Filtered Groundnut Oil Available in Markets of India using Bellier Turbidity Temperature Test (BTTT)

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Abstract

BTT values prescribed for the certain vegetable oils comes under the mandatory food laws in some countries but due to development towards hybridization in oil seeds, reconsideration in laws is required. In this study an attempt has been made to investigate the applicability of BTTT to different brands of filtered groundnut oils obtained from different parts of India and thereby examine the influence of geographical variations on BTTT. In the present work, the filtered groundnut oils used for analysis, such as Filtered groundnut oil(40.2) (Fgn, Tirupati),Filtered groundnut oil(40.2) (Fgn1,Ankur), Filtered groundnut oil(40.2) (Fgn2,Kanak), Filtered groundnut oil(40.5)(Fgn3,Dhaara),Filtered groundnut oil (40.0) (Fgn4,Dammani), Filtered groundnut oil(40.0)(Fgn5, fortune),Filtered groundnut oil (40.1) (Fgn6,gemini) and Filtered groundnut oil(40.2) (Fgn7,Rani), Filtered groundnut oil(40.2) (Fgn8,postlite) and Pure groundnut oil(40.5) (Pgn, Ekta) exhibited BTT in the range of 40.0 40.5^{0}C. The result have demonstrated the reproducibility through the analyzed data. Hence It is observed that filtered groundnut oils fulfils BTTT values as per Regulation (Food Products and Standards) 2011 of Food Safety Standards and Act 2006. The standard mean error is in between 0.15-0.23 in case of BTT.

Keywords: Vegetable oil, filtered groundnut oil, BTTT

I. INTRODUCTION AND OBJECTIVE

The pea nut, often called as "The King of Oilseeds", is botanically known as *Arachis hypopgaea* and belongs to family Leguminosae, which is also called Fabacae. The pea nuts differ in the quantity as well the quality of oil. These differences in the pea nut oil may be due to several factors *i.e*. genotype, the level of maturity of the seed, season and geographical area of production[1].About 80% of the total fatty acid content of peanut oil constitutes unsaturated fatty acids mainly oleic acid and linoleic acid[2].Thus the chemistry and quality of pea nut oil mostly depend on the oleic to linoleic ratio. The studies observed that the oil containing high UFAs/SFAs ratios are thermodynamically more stable and may be heated to high temperatures[3]. The oil containing higher content of MUFAs fatty acids (oleic acid) are more stable to oxidative damage during refining and storage[4].On the other hand, other scientist suggested that the linoleic acid, a PUFA, having two double bonds is more susceptible to oxidative rancidity than oleic acid as well as the saturated fatty acids. But Linoleic acid, being an essential fatty acid, also plays a beneficial role in human health in lowering the total blood cholesterol and LDL levels. The long term stability of peanut oil may also be associated with the antioxidant substances (tocopherols and polyphenols) present in peanut oil as the minor components[5].

The quality of fats and oils is dictated by several physical such as texture, density, pacific gravity, colour, refractive index etc and chemical parameters such as acid value, iodine value, saponification value, unsaponifable matter BTT etc are dependent on the source of oil; geographic, climatic, and agronomic variables of growth. Thus one must assess quantitatively the influence of these variables on characteristics of oils and fats; in present case on characteristics of groundnut oil, Bellier Turbidity Temperature Test (BTTT) (acetic acid method), based on insolubility of Arachidic acid is used as a qualitative method for identification of pure groundnut oil. Sometimes it is observed that groundnut oil fulfils all specifications of refined oil but fails to pass BTTT. The imposition of BTT values to raise the issue pertaining to the discrepancy in BTT for the presence of other vegetable oils(admixture of oils) in groundnut oil. Moreover Groundnut from different geographical locations differs in oil content. The Bellier figure or the temperature at which turbidity appears in a specified and neutralised oil sample under specified conditions was first proposed by Bellier and modified by several workers including Franz and Adler. According to Ever in 1912, the addition of sufficient acetic acid used instated of 1% hydrochloric acid succeeding modifications in the BTT. This had been adopted by several workers and gives satisfactory results for sufficient to judge the purity of peanut oil and admixture of oils. In most cases the Bellier figure increases with the % of peanut oil in the mixture. The increase is not proportional and there is a steep rise for the % of peanut oil below 25 %[6].

The objective of the present studies was to investigate the applicability of BTTT to different brands of filtered groundnut oils obtained from different parts of India and thereby examine the influence of geographical variations on BTTT as tool for

identification of groundnut oil.assessing the quality and compared the assessed value with existing standards of BTTT for the respective oils as per Food safety and standards (food products and additives) Regulation 2011.

II. LITERATURE REVIEW

India is the largest producer of groundnut in the world. About 88% of the groundnut area and production in India is concentrated in five states: Andhra Pradesh, Gujarat, Karnataka, Tamil Nadu, and Maharashtra. Nearly 83% of the total area is under rainy-season groundnut and the other 17% is cultivated during the post rainy season[7]. India possesses varying climatic conditions results in cultivation of a wide range oil bearing crops trees and nuts. Peanuts make an important contribution to the diet in many countries. Peanut seeds are a good source of protein, lipid and fatty acids for human nutrition[8]. The oil content of groundnut differs in quantity, the relative proportion of fatty acids, geographical location, seasons and growing conditions[9].The reported changes on the chemical composition as a result of processing. However, little information on the effect of traditional processing on peanuts quality was reported. The chemical and properties of oils are amongst the most important properties that determine the quality and help to describe the present condition of oils[10].

The solubility of oils in various solvents is a constant, depending on the nature of the glycerides composing the oil. Fryer and Weston found that a mixture of equal volume of 92% ethyl alcohol and pure amyl alcohol used as a solvent for turbidity. In Valenta test, acetic acid was used as a solvent, the results are affected by the presence of moisture in the oil and free fatty acid which lower the turbidity temperature, increasing the solubility of the oils, which raises the turbidity temperature[6].

The modified BTT test has been used by Ever for judging the purity of oils and has been found simple, rapid and fairly accurate for routine analysis as compared to the results obtained by Valenta test. Moreover, it can be conveniently used in the analysis of soap and commercial fatty acids and also for determining the % of two mixed oils. Others workers have also successfully used the same test for determining adulteration of groundnut oil in some edible oils and also suggested its analytical importance. Besides the turbidity temperatures obtained with fatty acids by the method of fryer and Weston are different from those for the respective oils, depending on the difference in the solubility of the glycerides of the oil and its fatty acids in the same solvent [11].

Krishnamurthy et al (1985) studied and investigated that BTT test is useful to check purity of groundnut oil. BTT values for arachis (groundnut) oil depend on the relative insolubility of arachidic acid (C20:0) in 70% ethyl alcohol (1:2). The high BTT values of groundnut oil compared with the other vegetable oils is due to the insolubility of arachidic acid but due to the lignoceric acid (C24:0) present in the groundnut oil. They concluded that there is no direct relationship between the added lignoceric acid in groundnut oil which is responsible for the high BTT value. However, higher concentrations of lignoceric acid present in oil improve the perception of turbidity[12].

BTT values prescribed for the certain vegetable oils comes under the mandatory food laws in some countries but due to development towards hybridization in oil seeds, reconsideration in laws is required.

Table – 1

Shows BTT standards/values for some edible vegetable oils under 2.2: Fats, oils and Fat emulsions as per FSSA 2006[13]

Sr.no	*Item no*	*Vegetable oil*	*BTT limits*
1	*2.2.1.2*	*Cotton seed oil*	*19.0 -21.0^{0}C*
2	*2.2.1.3*	*Groundnut oil*	*39.0-41.0^{0}C*
3	*2.2.1.6*	*Rape seed oil/Mustard oil (toria oil)*	*23.0-27.5 ^{0}C*
4	*2.2.1.7*	*Rape seed oil or Mustard oil-Low erucic acid*	*Not more than 19.0^{0}C*
5	*2.2.1.8*	*Virgin olive oil*	*17.0^{0}C Max*
		Refined olive oil	*17.0^{0}C Max*
6	*2.2.1.10*	*Safflower seed oil (barrey ka tel)*	*Not more than 16.0^{0}C*
7	*2.2.1.12*	*Til oil (Gingelly/sesame oil)*	*Not more than 22.0^{0}C*
8	*2.2.1.13*	*Niger seed oil (sargiya ka tel)*	*25.0-29.0^{0}C*
9	*2.2.1.17*	*Almond oil*	*Not more than 60.0^{0}C*

Source FSSA2006

Table – 2

shows that the imposition of BTT values to raise the issue pertaining to the discrepancy in BTT for the presence of other vegetable oils (Admixtures of oils) in groundnut oil[14]

Sr. no	*Name of Oil*	*Prosecution name*	*Year*	*Under PFA/FSSA Parameter to fail*	*BTT*
1	*Filtered Groundnut oil*	*Puneriya kishore kumar verses state of Andhra Pradesh*	*2001*	*BTT and others*	*Below the minimum requirement*
2	*Groundnut oil*	*Rakesh Gupta verses F.I, New Delhi*	*2002*	*BTT and others*	*Below the minimum requirement*
3	*Groundnut oil*	*Jeevan singh, New Delhi verses Govt. of New Delhi*	*2003*	*BTT and others*	*Below the minimum requirement*
4	*Groundnut oil*	*J.shravan kumar verses State of A.P.*	*2006*	*BTT and others*	*Below the minimum requirement*
5	*Groundnut oil*	*Sh.venaram Puraram sirvi M/S suresh provision stores verses state of Gujarat*	*2012*	*BTT and others*	*Below the minimum requirement*

All the above groundnut oil sample did not conform to the standards laid down for the groundnut oil under Prevention of food Adulteration Act 1954 and rules and Food safety standards Act2006 and rules and regulations, thereof, in that BTT values falls below the minimum requirement of 39^0C.

III. MATERIAL AND EXPERIMENTAL PROCEDURES

A. Materials

All the chemicals and reagents were analytical grade and used as received. Nine groundnut oils of different brands such as Filtered groundnut oil (Fgn, Tirupati), Filtered groundnut oil (Fgn1,Ankur),Filtered groundnut oil (Fgn2,Kanak),Filtered groundnut oil (Fgn3,Dhaara),Filtered groundnut oil (Fgn4,Dammani premium)), Filtered groundnut oil(Fgn5,fortune),Filtered groundnut oil(Fgn6,gemini)and Filtered groundnut oil (Fgn7,Rani) Filtered groundnut oil (Fgn8,postlite) and Pure groundnut oil (Pgn, Ekta, gold) were gathered from super market of different places of India and all these brands were in different forms of packaging while some were in poly packs and tetra pack. Since these nine groundnut oils were easily available for procurement. These different groundnut oils are used in the investigations on BTTT in this research study as per the Food product Standard and food additives Regulation 2011.

B. Experimental procedures

1) Determination of Bellier Turbidity Temperature Acetic Acid Method

Pipette out one ml of the filtered sample of oil in a flat-bottom 100 ml round flask, add 5ml of 1.5 N alcoholic potash heating over a boiling water bath using an air condenser After complete saponification cooling, neutralised by adding carefully dilute acetic acid and then add an extra amount of 0.4 ml of accurately measured dilute acetic acid using phenolphthalein indicator. Add 50 ml of 70% alcohol and mixed well. Heat and allow the flask to cool in air with frequent shaking. Note the temperature by using digital calibrated thermometer at which the first distinct turbidity appears which is the turbidity temperature. This turbidity temperature is confirmed by a little further cooling which results in deposition of the precipitate. Dissolve the precipitate by heating the contents to 50°C over water bath, again cool as desiccated above and make a triplicate determination of the turbidity temperature[15,16].

Table – 3
BTTT of different groundnut oils with accuracy on BTT

Sr.no	*Name of oil*	*Brand name*	*Code*	*BTTT**	*SD*	*CV%*	*SEM*
1	*Filtered groundnut oil*	*Tirupati*	*Fgn*	*40.2*	*0.36*	*0.86*	*0.2*
2	*Filtered groundnut oil*	*Ankur*	*Fgn1*	*40.2*	*0.35*	*0.86*	*0.2*
3	*Filtered groundnut oil*	*Kanak*	*Fgn2*	*40.2*	*0.35*	*0.86*	*0.2*
4	*Filtered groundnut oil*	*Dhaara*	*Fgn3*	*40.5*	*0.4*	*0.98*	*0.23*
5	*Filtered groundnut oil*	*Dammani*	*Fgn4*	*40*	*0.26*	*0.66*	*0.15*
6	*Filtered groundnut oil*	*Fortune*	*Fgn5*	*40*	*0.35*	*0.87*	*0.2*
7	*Filtered groundnut oil*	*Gemini*	*Fgn6*	*40.1*	*0.36*	*0.89*	*0.2*
8	*Filtered groundnut oil*	*Rani*	*Fgn7*	*40.2*	*0.26*	*0.66*	*0.15*
9	*Filtered groundnut oil*	*Postlite*	*Fgn8*	*40.2*	*0.35*	*0.86*	*0.2*
10	*Pure groundnut oil*	*Ekta*	*Pgn*	*40.5*	*0.35*	*0.86*	*0.2*

All the above brands tested having shelf life of oil between 6months and 12 months * Each value is averages of three measurements, SD-standard deviation, CV-coefficient of variance, SEM-standard mean error.

Descriptive Statistics of different brands of filtered groundnut oils from different parts of India as shown in figure1and 2.

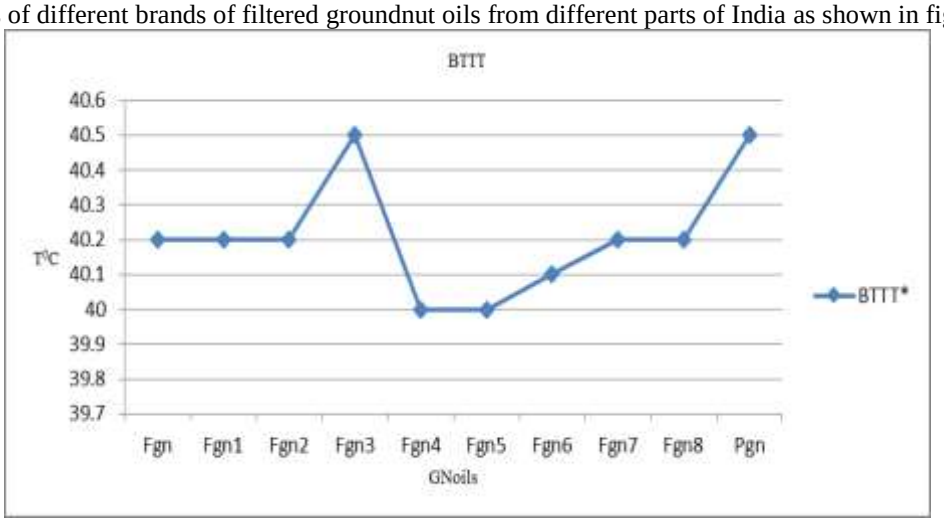

Fig. 1: shows the BTTT values for different filtered groundnut oil

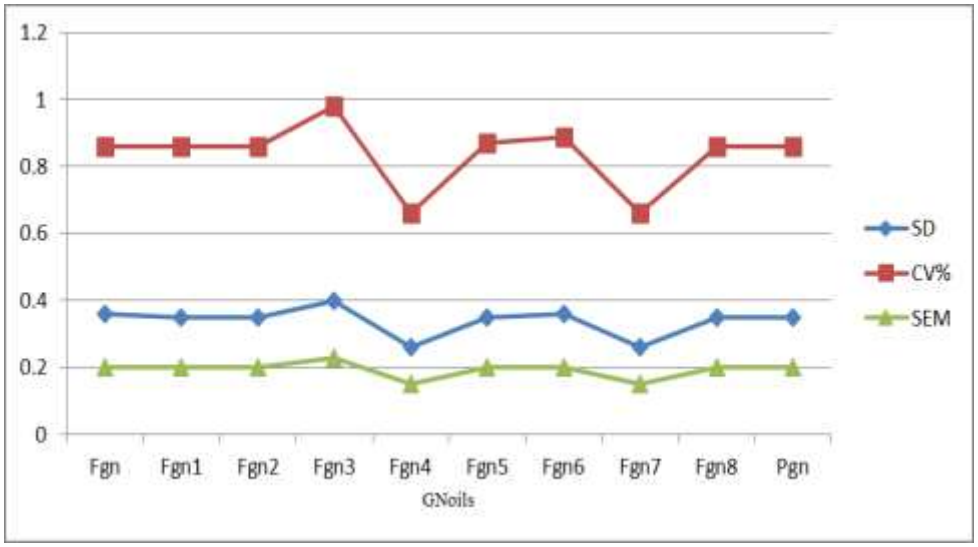

Fig. 2: shows the statistical parameters for different filtered groundnut oil

IV. STATISTICAL ANALYSIS

The data obtained from the experimental measurements and accuracy of BTTT for different brands of filtered Groundnut oils have been analyzed and the Statistical parameter like standard deviation, coefficient of variance and standard mean error were calculated for both the parameters. All the experiment was carried out in triplicate and the results are presented as the mean SD, CV and SEM. Descriptive Statistics of different groundnut varieties from different parts of India as shown in figure1 and 2.

V. RESULT AND DISCUSSION

BTT standards/values for some edible vegetable oils under 2.2: Fats, oils and Fat emulsions as per Food Safety and Standard Act 2006 and food product standards and food additives Regulation 2011 as shown in table1[13].The prescription of the BTT test created some example of prosecution under prevention of food adulteration act 1954 and food safety act, rules and regulations 2011 and shows that the imposition of BTT values to raise the issue pertaining to the discrepancy in BTT for the presence of other vegetable oils (Admixtures of oils) in groundnut oil[11] The results obtained for BTTT for the groundnut oils from ten different brands of groundnut oil from different places of India are shown in Table3. Fgn(40.2), Fgn1(40.2), Fgn2(40.2), Fgn3(40.5), Fgn4(40.0), Fgn5(40.0), Fgn6(40.1), Fgn7(40.2), Fgn8(40.2) and Pgn(40.5) displayed BTT in the range of 40.0 to 40.5°C.As all the reported BTTT values are average of three readings, the results have demonstrated the reproducibility of the analysis data. Thus the present investigations prove with due certainty the applicability of BTTT to all nine filtered groundnut oils. Table 3 shows the accuracy, In case of the standard deviation and variation coefficient is in the range of 0.26-0.4 and 0.66-0.98.

VI. FUTURE PROSPECTS/AHEAD

Quantitative test should be essential because BTTT depends on the presence of arachidic acid and other higher acids in groundnut oil. Further investigations may be required to analyses the influence of seasonal variations on BTTT. Wherever required, BTTT analysis can be easily supplemented with GC and HPLC analysis, which provide the quantitative data on presence of high molecular weight fatty acids in groundnut oils.

VII. CONCLUSION

The BTTT method is cheaper, easier, requires little laboratory infrastructure and recognised as a convenient qualitative tool for identification of different variety of oils. In this study BTTT is applied on groundnut oils and found that BTTT can be easily used as qualitative tool for identification of purity of groundnut oil from different places of India. The present investigations prove with due certainty about applicability of BTTT to all nine groundnut oils. This study also confirms prove reliability, reproducibility and diverse applicability of BTTT.

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