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Comparative study of physico-chemical property in different brands of jam, honey and jelly

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Abstract
The present investigation of physico-chemical properties (moisture, water activity, pH, acidity, ash, reducing sugar) using the chemical method and the values were found in average amount of Jam, Honey and Jelly. The mean value of moisture in Jam was found to be T_1 (46.78), T_2 (40.02) and T_3 (25.00) and the mean value indicate that sample T_1 has highest moisture value (46.78) followed by the sample T_2 (40.02) and the lowest value was obtained by sample T_3 (25.00). The mean value of water activity in Jam was found to be T_1 (0.69), T_2 (0.77) and T_3 (0.85) and the mean value indicate that sample T_3 has highest water activity value (0.85) followed by the sample T_2 (0.77) and the lowest value was obtained by sample T_1 (0.69). Similarly, the mean value of moisture in Honey was found to be T_1 (18.38), T_2 (16.25) and T_3 (15.12) and the mean value indicate that sample T_1 has highest moisture value (18.38) followed by the sample T_2 (16.25) and the lowest value was obtained by sample T_3 (15.12). The mean value of water activity in Honey was found to be T_1 (0.67), T_2 (0.73) and T_3 (0.66) and the mean value indicate that sample T_2 has highest water activity value (0.73) followed by the sample T_3 (0.66) and the lowest value was obtained by sample T_1 (0.65). In Jelly, the mean value of water activity indicate that sample T_3 has highest water activity value (0.78) followed by the sample T_1 (0.75) and the lowest value was obtained by sample T_2 (0.74). Moisture and water activity showed a strong coordination was observed in order to confirm the safety relative shelf life, survival of microorganism and overall quality of product. Moisture content alone did not sufficiently describe the quality of the sample.

Keywords: Jam, honey, jelly, acidity, reducing sugar

Introduction
Jam is a fruit. Jams are usually made from pulp and juice of one fruit or a combination of several fruits. Jams are thick, sweet spreads made by cooking crushed or chopped fruits with sugar (Barbara 2008) [3]. Jam is prepared from cooked fruit or vegetable pulps after removal of stones and seeds. Good jam has a soft even consistency without distinct pieces of fruit, bright colour, good fruit flavour and semi-jellied texture that is easy to spread but has no free liquid (Berolzheimer *et al.* 1959) [4]. Jam is a fruit preserve with a stable shelf-life and that depends on high sugar content combined with the fruit acidity and prevent microbial invasion and growth. A good jam is a complex product that requires precise balance between sugar level, acidity and pectin content of fruit boiled together to produce a gel on cooling (Egan *et al*., 1981) [9]. Jams are very sweet fruit made from whole fruit or fruit pulp and are consumed as accompaniments to other foods (UNIFEM, 1998) [15]. There are different types of jams which differ from each other in the raw material used, processing method and additives. Mango jam, orange jam and apple jam are favourite to the consumers of India. Fresh mango contains a variety of nutrients but only vitamin C and folate are in significant amounts of the daily values as 44% and 11% respectively (USDA 2010) [16]. Due to shorter shelf life of the mango, it must be converted into various processed products (Sakhale *et al.,* 2012) [14]. Jams were made with a high concentration of sugars mainly sucrose (WHO/FAO 2003) [17]. However, large sucrose consumption has been correlated with adverse effects on health such as obesity, cardiovascular diseases, diabetes, and hypertension (Mendonc 2005) [12].

Honey is the substance made when nectar and sweet deposits from plants are gathered, modified and stored in the honeycomb by honey bees. Honey was an important food. It has a great value in traditional medicine for centuries (Zumla and Lulat, 2009; Chowdhury, 2010) [18, 6]. But honey has a limited use in modern medicine due to lack of scientific support (Ali *et al.*, 2014) [1]. A medicine branch has developed in recent years are offering treatments for many diseases by honey and the other bee products (Crane 2013) [8]. The chemical composition of honey depends on the plant source, season and production methods (Hatice *et al.*, 2010) [10]. Several physicochemical and bioactive compounds found in different honey samples from various geographical areas including phenolic compounds, flavonoids and many other antioxidants (Liviu *et al.*, 2009) [11]. Besides pure honey contains alkaloids,

auterquinone glycosides, flavonoids, cardiac glycosides and reducing compounds (Rakhi *et al*., 2010) [13].

Jellies are the products brought to semisolid gelled consistency and made from the juice or aqueous extracts of one or more fruits or vegetables and mix with foodstuffs with sweetening properties with or without the addition of water (CAC, 2009) [7]. It is made by cooking fruit juice with sugar. Jelly should have fresh taste and fruity (Ingham, 2008) [2, 3]. It should not be gummy, sticky, or syrupy or have crystallized sugar. The product should free from dullness with little syneresis and neither tough nor rubbery body. Water, pectin, acid and sugar (65%) are four essential ingredients of jelly. Pectic substances are present in the form of calcium pectate and are responsible for the firmness of fruits and vegetables. Generally, about 0.5-1.0 percent of pectin of good quality in the extract is sufficient to produce good jelly. Jelly was successfully developed by using 2% pectin, 0.5% citric acid and 61% sugar. Sensory evaluation of developed beet root jelly along with two variations in formulation was done (Chaudhari *et al.*, 2015) [5].

Material and Methods

This present study deals with the description of various materials and methods used to accomplish the research work done to attain the desired objectives of the study entitled "Comparative study of physico-chemical property in different Brands of Jam, Honey and jelly" have been described in this chapter under appropriate heading: All experimental studies were carried out at the Department of Food Technology, Warner School of Dairy Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad and Research Lab "FICCI Research and Analysis centre plot no.2A, Sector 8 Dwarka, New Delhi-110077.

Material required

Three samples of Honey, jam and jelly were collected from Reliance shopping mall located in Dwarka, New Delhi. All the samples were collected freshly in sterile containers (labelled with numbers, place and date of collection) and stored at ambient temperature until analyse. All chemicals and reagents were used of analytical grade AR and GR. Chemicals used in study were sodium hydroxide, phenolphthalein indicator, ammonia solution, acidic acid, Fehling solution A and B. All working solutions were also prepared in redistilled water. Glassware were used such as Test tube, Beaker, Measuring cylinder, Micro pipette. Equipment were used as Hot air oven, Centrifuge, Weight balance, Rotatory shaker, Centrifuge tube.

Treatment Combination

T_1- Jam, Honey and Jelly Brand A
T_2- Jam, Honey and Jelly Brand B
T_3- Jam, Honey and Jelly Brand C

Physico-chemical analysis

Acidity was determined as per method mentioned in A.O.A.C 17thedn, 2000, Official method 94.2.15. pH content was determined as per method mentioned in AOAC 1990. Moisture content was determined as per method mentioned in AOAC 1990. Ash content was determined as per method mentioned in AOAC 1975) ISO 6884:2008. Reducing sugar was determined as per method mentioned in Lane and Eyon method reported in AOAC (2000). Water activity was determined as per method mentioned in manual of FSSAI.

Statistical analysis- All data were analyzed by MS Excel, 2007.

Results and Discussion

The present study was undertaken to evolve "Comparative study of physio-chemical property in different brands of Jam, honey and jelly". The data collected on different aspects were tabulated and analysed statistically using the method of analysis of variance and critical difference. The significance and non-significance differences observed were analysed critically within and between combinations. The results obtained from the analysis are presented on the basis of average data of jam, honey and jelly in triplets of different parameters and physico-chemical analysis of Jam, honey and jelly.

Table 1: Average data of Jam in triplets of different parameters

Parameter	Treatment (Mean) value			
	T_1	T_2	T_3	S/NS
Physico-Chemical analysis				
Moisture %	46.78±0.04	40.02±0.01	25.00±0.03	S
Ash %	0.34±0.00	0.32±0.01	0.34±0.01	NS
Acidity %	0.36±0.00	0.36±0.01	0.34±0.00	NS
pH	3.67±0.12	3.53±0.09	3.43±0.04	NS
Reducing sugar %	4.62±0.01	4.84±0.03	4.26±0.06	S
Water Activity	0.69±0.06	0.77±0.00	0.85±0.03	S

Table 2: Average data of honey in triplets of different parameters

Parameter	Treatment (Mean) value			
	T_1	T_2	T_3	S/NS
Physico-Chemical analysis				
Moisture %	18.38±0.01	16.25±0.03	15.12±0.02	S
Ash %	0.25±0.00	0.21±0.01	0.26±0.01	S
Acidity %	0.41±0.00	0.16±0.01	0.34±0.01	S
pH	3.63±0.12	3.70±0.16	3.43±0.04	NS
Reducing sugar %	65.24±0.08	72.25±0.03	67.23±0.05	S
Water Activity	0.67±0.00	0.73±0.01	0.66±0.01	S

Table 3: Average data of jelly in triplets of different parameters

Parameter	Treatment (Mean) value			
	T_1	T_2	T_3	S/NS
Physico-Chemical analysis				
Moisture %	39.04±0.27	35.82±0.28	28.27±0.06	S
Ash %	0.34±0.02	0.33±0.03	0.36±0.01	NS
Acidity %	0.42±0.01	0.36±0.01	0.34±0.01	S
pH	3.33±0.12	3.57±0.04	3.60±0.08	NS
Reducing sugar %	6.24±0.03	6.15±0.00	6.52±0.04	S
Water Activity	0.75±0.01	0.74±0.07	0.78±0.00	NS

Physico-Chemical Analysis

The samples of Jam, Honey and Jelly were further subjected to physico - chemical analysis for parameters and the results are presented here in.

JAM

Moisture%

Moisture in different sample of jam, in triplicate, the mean value of Moisture percentage was found to be 25.00 to 46.78 for different sample. The mean value indicate that sample T_1 has highest Moisture value (46.78) followed by the sample T_2 (40.02) and the lowest value was obtained by sample T_3 (25.00). C.D. value at 5% level was found to be 2.28 and S.ED. value 0.82.

The result of ANOVA shows that F calculated value (369.0959) is more than the F tabulated value (6.944) at 5%

level of significant. Therefore, the difference was significant between different jam samples. It was further analysed that difference between the mean value of T_1-T_2 (6.76), T_1-T_3 (21.77) and T_2-T_3 (15.01) was more than the CD. Value (2.28). Therefore, the difference was significant.

Ash %

Ash in different sample of jam, in triplicate, the mean value of Ash percentage was found to be 0.32 to 0.34 for different sample. The mean value of ash indicate that sample T_1 has highest Ash value (0.340) followed by the sample T3 (0.34) and the lowest value was obtained by sample T2 (0.32). C.D. value at 5% level was found to be 0.04 and S.ED. value 0.02.

The result of ANOVA Shows that F calculated value (0.636364) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non-significant between different jam samples. The difference between the mean value of T_1-T_2 (0.02), T_1-T_3 (0.00) and T_2-T_3 (0.01) was less than the CD. Value (0.04). Therefore, the difference was non-significant.

Acidity (%)

It was statistically analysed that the acidity in different sample of jam, in triplicate, the mean value of Acidity was found to be 0.34 to 0.36 for different sample. The mean value indicate that sample T_1 has highest Acidity value (0.36) followed by the sample T_2 (0.36) and the lowest value was obtained by sample T_3 (0.34). C.D. value at 5% level was found to be 0.03 and S.ED. value 0.01.

The result of ANOVA Shows that F calculated value (1.6) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non- significant between different jam samples. It was further analysed the difference between the mean value of T_1-T_2 (0.06) was more than the CD. Value (0.03). Therefore, the difference was significant. The difference between the mean value of T_1-T_3 (0.02) and T_2-T_3 (0.01) was less than the CD. Value (0.03). Therefore, the difference was non-significant.

pH

The pH in different sample of jam, in triplicate, the mean value of pH was found to be 3.43 to 3.67 for different sample. The mean value of pH indicate that sample T_1 has highest pH value (3.67) followed by the sample T_2 (3.53) and the lowest value was obtained by sample T_3 (3.43). C.D. value at 5% level was found to be 0.24 and S.ED. value 0.086.

The ANOVA results shows that F calculated value (3.7) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non- significant between different jam samples. It was further analysed that difference between the mean value of T_1-T_2 (0.13), T_1-T_3 (0.23) and T_2-T_3 (0.10) was less than the CD. Value (0.24). Therefore, the difference was non- significant.

Reducing Sugar %

Reducing sugar in different sample of jam, in triplicate, the mean value of reducing sugar was found to be 4.263 to 4.838 for different sample. The mean value of reducing sugar in jam indicate that sample T_2 has highest Reducing sugar value (4.84) followed by the sample T_1 (4.62) and the lowest value was obtained by sample T_3 (4.26). C.D. value at 5% level was found to be 0.09 and S.ED. value 0.031.

The result of ANOVA Shows that F calculated value (170.691) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different jam samples. It was further analysed that the difference between the mean value of T_1-T_2 (0.22), T_1-T_3 (0.36) and T_2-T_3 (0.57) was more than the CD. Value (0.09). Therefore, the difference was significant.

Water Activity

The data pertaining to Water activity in different sample of jam, in triplicate, the mean value of water activity was found to be 0.69 to 0.85 for different sample. The mean value indicate that sample T_3 has highest water activity value (0.85) followed by the sample T_2 (0.77) and the lowest value was obtained by sample T_1 (0.69). C.D. value at 5% level was found to be 0.11 and S.ED. value 0.04.

The result of ANOVA Shows that F calculated value (8.121622) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different jam samples. The difference between the mean value of T_1-T_3 (0.16) was more than the CD. Value (0.11). Therefore, the difference was significant and the difference between the mean value of T_1-T_2 (0.09) and T_2-T_3 (0.08) was less than the CD. Value (0.11). Therefore, the difference was non-significant.

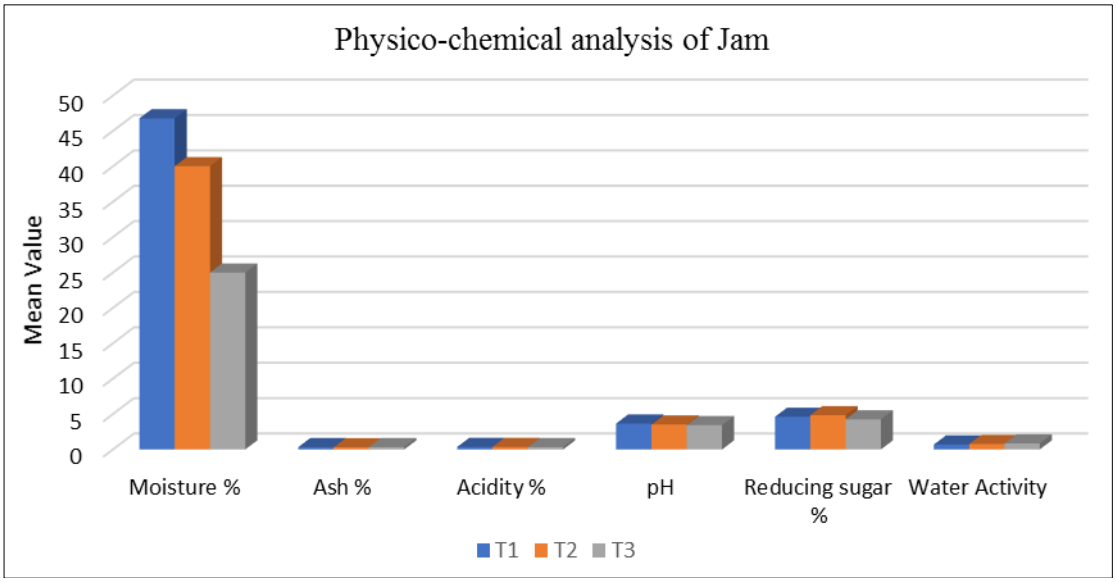

Fig 1: Graph depicting the mean value of physico-chemical analysis of Jam

Honey

Moisture %

Moisture in different sample of honey, in triplicate, the mean value of Moisture was found to be 15.12 to 18.38 for different sample. The mean value indicate that sample T_1 has highest moisture value (18.38) followed by the sample T_2 (16.25) and the lowest value was obtained by sample T_3 (15.12). C.D. value at 5% level was found to be 0.075 and S.ED. value 0.27 and F-test was found significant.

The result of ANOVA shows that F calculated value (7497.939) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different honey samples. It was further analysed that difference between the mean value of T_1-T_2 (2.13), T_1-T_3 (3.26) and T_2-T_3 (1.13) was more than the CD. Value (0.07). Therefore, the difference was significant.

Ash %

Ash in different sample of honey, in triplicate, the mean value of ash was found to be 0.21 to 0.26 for different sample. The mean value indicate that sample T_3 has highest ash value (0.26) followed by the sample T_1 (0.25) and the lowest value was obtained by sample T_2 (0.21). C.D. value at 5% level was found to be 0.04 and S.ED. value 0.01 and F-test was found significant.

As evident from the result of ANOVA Shows that F calculated value (8.32) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different honey samples. It was further analysed that difference between the mean value of T_2-T_3 (0.05) was more than the CD. Value (0.037783). Therefore, the difference was significant**.** The difference between the mean value of T_1-T_2 (0.04) and T_1-T_3 (0.01) was less than the CD. Value (0.037783). Therefore, the difference was non-significant.

Acidity %

Acidity in different sample of honey, in triplicate, the mean value of acidity was found to be 0.16 to 0.41 for different sample. The mean value indicate that sample T_1 has highest acidity value (0.41) followed by the sample T_3 (0.34) and the lowest value was obtained by sample T_2 (0.16). C.D. value at 5% level was found to be 0.11 and S.ED. value 0.04 and F-test was found significant.

ANOVA results shows that F calculated value (325.9231) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different honey samples. It was further analysed that difference between the mean value of T_1-T_2 (0.24), T_1-T_3 (0.07) and T_2-T_3 (0.17) was more than the CD. Value (0.03). Therefore, the difference was significant.

pH

pH in different sample of honey, in triplicate, the mean value of pH was found to be 3.43 to 3.70 for different sample. The mean value indicate that sample T_2 has highest pH value (3.70) followed by the sample T_2 (3.63) and the lowest value was obtained by sample T_3 (3.43). C.D. value at 5% level was found to be 0.29 and S.ED. value 0.10 and F-test was found non-significant.

The result of ANOVA shows that F calculated value (3.586207) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non-significant between different honey samples. It was further analysed that difference between the mean value of T_2-T_3 (0.27) was less than the C.D. Value (0.29). Therefore, the difference was significant and difference between the mean value of T_1-T_2 (0.07) and T_1-T_3 (0.20) was less than the CD. Value (0.29). Therefore, the difference was non- significant.

Reducing Sugar %

Reducing sugar in different sample of honey, in triplicate, the mean value of reducing sugar was found to be 65.23 to 72.25 for different sample. The mean value indicate that sample T_2 has highest reducing sugar value (72.25) followed by the sample T_3 (67.23) and the lowest value was obtained by sample T_1 (65.24). C.D. value at 5% level was found to be 0.20 and S.ED. value 0.07 and F-test was found significant.

The result of ANOVA Shows that F calculated value (5065.116) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different honey samples. It was further analysed that the difference between the mean value of T_1-T_2 (7.01), T_1-T_3 (2.00) and T_2-T_3 (5.02) was more than the CD. Value (0.20). Therefore, the difference was significant.

Water Activity

Water activity in different sample of honey, in triplicate, the mean value of water activity was found to be 0.65 to 0.73 for different sample. The mean value indicate that sample T_2 has highest water activity value (0.73) followed by the sample T_3 (0.66) and the lowest value was obtained by sample T_1 (0.65). C.D. value at 5% level was found to be 0.04 and S.ED. value 0.01 and F-test was found significant.

The result of ANOVA Shows that F calculated value (8.121622) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different jam samples. The difference between the mean value of T_1-T_2 (7.01), T_1-T_3 (2.00) and T_2-T_3 (5.02) was more than the CD. Value (0.20). Therefore, the difference was significant.

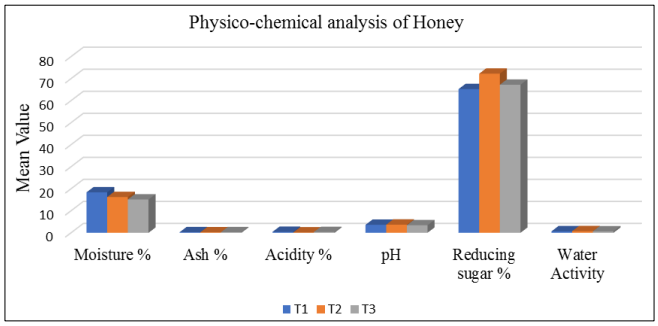

Fig 2: Graph depicting the mean value of physico-chemical analysis of Honey

Jelly

Moisture%

Moisture in different sample of Jelly, in triplicate, the mean value of moisture was found to be 28.27 to 39.04 for different sample. The mean value indicate that sample T_1 has highest moisture value (39.04) followed by the sample T_2 (35.82) and the lowest value was obtained by sample T_3 (28.27). C.D. value at 5% level was found to be 0.58 and S.ED. value 0.21 and F-test was found significant.

The result of ANOVA Shows that F calculated value (1404.77) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different jelly samples. The difference between the mean value of T_1-T_2 (3.22), T_1-T_3 (10.76) and T_2-T_3 (7.54)

was more than the CD. Value (0.58). Therefore, the difference was significant.

Ash %

Ash in different sample of Jelly, in triplicate, the mean value of ash was found to be 0.33 to 0.36 for different sample. The mean value indicate that sample T_3 has highest ash value (0.363) followed by the sample T_1 (0.34) and the lowest value was obtained by sample T_2 (0.33). C.D. value at 5% level was found to be 0.03 and S.ED. value 0.01 and F-test was found non-significant.

As evident from the result of ANOVA Shows that F calculated value (3.454545) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non- significant between different jelly samples. It was further analysed that the difference between the mean value of T_1-T_2 (0.01), T_1-T_3 (0.02) and T_2-T_3 (0.03) was less than the C.D. Value (0.03). Therefore, the difference was non-significant.

Acidity%

The data pertaining to Acidity in different sample of Jelly, in triplicate the mean value of acidity was found to be 0.36 to 0.42 for different sample. The mean value indicate that sample T_1 has highest acidity value (0.42) followed by the sample T_2 (0.36) and the lowest value was obtain by sample T_3 (0.34). C.D. value at 5% level was found to be 0.04 and S.ED. value 0.01 and F-test was found significant.

As evident from the result of ANOVA Shows that F calculated value (15.64706) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different jelly samples. It was further analysed that difference between the mean value of T_1-T_2 (0.06), T_1-T_3 (0.07) and T_2-T_3 (0.02) was more than the CD. Value (0.04). Therefore, the difference was significant.

pH

The data pertaining to pH in different sample of Jelly, in triplicate, the mean value of pH was found to be 3.33 to 3.60 for different sample. The mean value indicate that sample T_3 has highest pH value (3.60) followed by the sample T_2 (3.57) and the lowest value was obtain by sample T_1 (3.33). C.D. value at 5% level was found to be 0.24 and S.ED. value 0.09 and F-test was found non-significant.

The result of ANOVA shows that F calculated value (5.428571) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non-significant between different jelly samples. It was further analysed that difference between the mean value of T_1-T_3 (0.27) was more than the CD. Value (0.24). Therefore, the difference was significant. The difference between the mean value of T_1-T_2 (0.23) and T_2-T_3 (0.03) was less than the CD. Value (0.24). Therefore, the difference was non- significant.

Reducing Sugar %

Reducing sugar in different sample of Jelly, in triplicate, the mean value of reducing sugar was found to be 5.52 to 6.24 for different sample. The mean value indicate that sample T_1 has highest reducing sugar value (6.24) followed by the sample T_2 (6.15) and the lowest value was obtained by sample T_3 (5.52). C.D. value at 5% level was found to be 0.09 and S.ED. value 0.03 and F-test was found significant.

As evident from the result of ANOVA Shows that F calculated value (281.36) is more than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was significant between different jelly sample. It was further analysed that the difference between the mean value of T_1-T_2 (0.093), T_1-T_3 (0.73) and T_2-T_3 (0.63) was more than the CD. Value (0.09). Therefore. The difference was significant.

Water Activity

The data pertaining to water Activity in different sample of Jelly, in triplicate, the mean value of water activity was found to be 0.74to 0.78 for different sample. The mean value indicate that sample T_3 has highest water activity value (0.78) followed by the sample T_1 (0.75) and the lowest value was obtained by sample T_2 (0.74). C.D. value at 5% level was found to be 0.04 and S.ED. value 0.01 and F-test was found non-significant.

As evident from the result of ANOVA Shows that F calculated value (3.7) is less than the F tabulated value (6.944) at 5% level of significant. Therefore, the difference was non-significant between different jelly sample. The difference between the mean value of T_1-T_2 (0.003), T_1-T_3 (0.03) and T_2-T_3 (0.04) was less than the CD. Value (0.04). Therefore, the difference was non- significant.

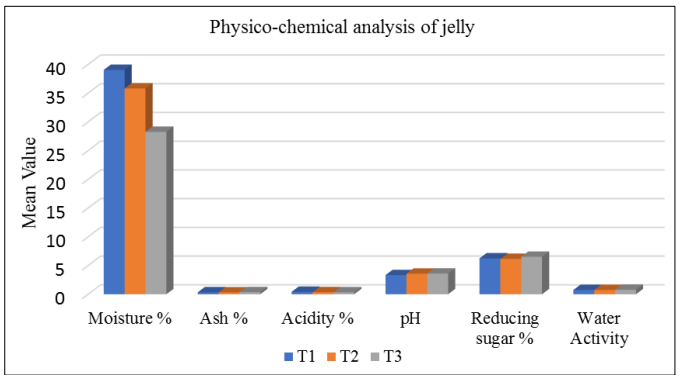

Fig 3: Graph depicting the mean value of physico-chemical analysis of Jelly

Conclusion

In this study, Physico-chemical properties of three different treatments of jam, honey and jelly were investigated. Honey and jam are rich conventional natural resources of sweetness and energy for human beings. Jellies are made by cooking fruit juice with sugar. In this investigation, the mean value of pH was found to be 3.43 to 3.67 for different sample in jam. The mean value of pH was found to be 3.43 to 3.70 for different sample in honey. The mean value of pH was found to be 3.33 to 3.60 for different sample in jelly. In jam, honey and jelly highest moisture value was obtained by the sample T_1 as compared to the samples T_2 and T_3. Similarly, Highest water activity value in jam was obtained by the sample T_3 as compared to T_1 and T_2 but in the case of honey and jelly was obtained differ from jam. So, it was concluded that the moisture content alone did not sufficiently describe the quality of the sample.

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