Analyse the Carbohydrate Content in the Muskmelon (Cucumis Melo) using Tray Dried Method and compare it with Oven Dry Method

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ABSTRACT

Aim: To examine the effect of oven and tray dryer towards drying of *(Cucumis Melo)*, muskmelon fruit, to compare the Carbohydrate obtained. **Materials and methods:** The muskmelon fruit was studied at different parameters such as dimension, temperature and time. In the present study the tray drying method is taken as group 1 (N=20) and the oven drying method is taken as group 2 (N=20). 20 samples per group and totally 40 samples were studied by using the selected parameters for determining the carbohydrate content. **Results:**The overall findings shows that the combination of various parameter showed best values (T8 - 50°C for 5 hrs) in the tray dryer with a value of (8.36 g/100g) carbohydrate content as compared to oven drying (8.00 g/100g) in muskmelon. The G power calculation at 80% and the significance differences were observed among the oven drying and tray drying method at the level of P=<0.001 (P<0.05). And it is believed to have a faster rate of drying and is more efficient for carbohydrate content. **Conclusion:**Within the scope of this study, the results show that the novel tray drying method is more effective than the oven drying method due to the higher carbohydrate content and better product appearance.

Keywords: Drying, Carbohydrate, Novel Tray drying, Oven drying, Muskmelon, *Cucumis melo*.

INTRODUCTION

Muskmelon is a spherical fruit with a firm peel and yellowish pulp. Muskmelon *(Cucumis melo L.)*, sometimes known as cantaloupe, is a Cucurbitaceae family member. Muskmelon is a large sweet fruit. Muskmelon *(Cucumis melo)* ranks 4th in the fresh fruit market and is an excellent nutrient source, with a variety of kinds (Raji et al. 2018; Mabaleha, Mitei, and Yeboah 2007). In the year 2017-2018 the production of muskmelon in India was Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Punjab and Haryana. Muskmelon contains 8.36 g of carbohydrate content per 100 g of an edible portion (Silva et al. 2020). Carbohydrates are the necessary food elements that your body converts to glucose in order to provide you with energy. Carbohydrates, along with sucrose, glucose, fructose, and other soluble sugars, are the major important biochemical ingredients in assessing the muskmelon fruit quality (Gross and Pharr 1982; Lalonde et al. 2003). Carbohydrates are polyhydroxy aldehydes, polyhydroxy ketone, or compounds that can be hydrolysed to them (Petrucci and Wismer 1983). The application of this study is novel drying methods of the muskmelon sample, Drying is one of the major significant procedures in processing of fruits because it extends the shelf life of the fruits by limiting microbe development

while preserving nutrient content, physiologically active chemicals, and antioxidants (Sogi, Siddiq, and Dolan 2015). Drying is a way to increase the shelf life of food while also making storage and distribution easier by eliminating the need for expensive cooling systems. Oven drying is the easiest method for drying food on a small scale which results in both safe and tasty. Tray dryers, another form of batch dryer, are used in small-scale food drying operations. When it comes to drying muskmelon, tray drying is the ideal option because it saves time when compared to oven drying. (Shankar, Thirupathi, and Venugopal 2017) mentioned that the decrease of moisture content is due to the increase in temperature.

A large amount of research has been carried out in recent years. Numerous research publications have been published in the last 5 years, 173 articles of study published in Google Scholar and 165 research articles published in Science Direct. Previous research indicates that freeze-drying is superior to oven-drying because it preserves the nutrient and phytochemical quality of bitter melon leaves(Zhang et al. 2009). In this study the author determined that the dried samples in the cabinet dryer were superior to other dryers and it had more nutrients than the sun drying, shadow and the oven dried samples in drumstick leaves (Satwase, Pandhre, and Sirsat 2013). The comparative study of drying performance in tomatoes by covered sun dried method, Oven dried method, Sun dried method has shown significant carbohydrate content in oven drying when compared with other types (Bello and Amubieya, n.d.). Previous study was conducted in unripe plantain banana with similar results (Arinola and Ogunbusola 2016). The best cited paper related to this paper is: This work addressed a comparative study on the nutritional characteristics of novel tray and oven dried leafy and non-leafy vegetables (Sanwiriya 2019; Mondal, Rangan, and Uppaluri 2019).(Parakh et al. 2020; Pham et al. 2021; Perumal, Antony, and Muthuramalingam 2021; Sathiyamoorthi et al. 2021; Devarajan et al. 2021; Dhanraj and Rajeshkumar 2021; Uganya, Radhika, and Vijayaraj 2021; Tesfaye Jule et al. 2021; Nandhini, Ezhilarasan, and Rajeshkumar 2020; Kamath et al. 2020)

As a result from the previous studies, the problem identified is transporting mature fruit to distant markets increases the danger of quantity and quality loss, resulting in massive waste. To improve the quality, Muskmelon can be dried to extend shelf life, and prevent microbial growth. Hence the study's aim is to compare and evaluate the performance of novel tray and oven drying methods in muskmelon to increase carbohydrate content. Now the developing trend in this sector has encouraged me to undertake this project.

MATERIALS AND METHODS

The research was executed in the Department of Agricultural Engineering, Saveetha School of Engineering (SSE), Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, Tamil Nadu. This study is about comparison of two drying methods in muskmelon to acquire carbohydrate content. Fully ripe Muskmelons were bought from a local market in Tamil Nadu. The pre-test analysis has been performed using an online clinical sample calculator by keeping 80 percent of G-power , 0.05% of threshold, and confidence interval at

95% (Venkata Ramana and Kumar 2018). Experimental group and Control group are the 2 total number of groups involved in this project. The sample size per group involved in this project was 20 and the total sample size was 40. The fruits were washed with water. Before dehydration the sample must undergo blanching. The blanching pretreatment was done by immersing the fruit in warm water at 60˚C held in a water bath to maintain the temperature and steam generated from boiling water for 5 and 3 min, respectively at atmospheric pressure. The blanching was done by immersing the muskmelon in sodium chloride solution (NaCl). And then muskmelon fruits were peeled, seeds were manually removed, and sliced into three different sizes. The AOAC standard method was used to determine the first level of moisture content of the fresh fruit samples (Association of Official Analysts and Chemists). The sample was kept at 105˚C for 3 hours and the sample weight was measured at the interval of every 15 minutes, till it reached the constant weight.

The muskmelon *(Cucumis Melo)* sample was dried in a novel tray drying method (Group 1) was carried out at different temperatures of 40˚C, 50˚C and 60˚C, with the dimensions of 1 cm^3 (1cm x 1cm x 1cm), 8 cm^3 (2cm x 2cm x 2cm) and 27 cm^3 (3 cm x 3cm x 3cm) with different timing of 5, 6 and 7 hours was shown in Fig. 1 respectively. Each sample from the tray drying method is taken for determining the carbohydrate content. The drying air velocity in the tray drier was measured using an Anemometer (Extech AN300). The novel tray drying method was conducted in the food engineering laboratory (Bains, Ramaswamy, and Lo 1989)

Drying of muskmelon *(Cucumis Melo)* in an oven drying method (Group 2) was conducted in the Highway and Concrete laboratory. The muskmelon samples were dried using the oven dryer (Lawrence & Mayo STXL095) at various temperatures of 40˚C, 50˚C and 60˚C for 5, 6 and 7 hours with the dimensions of 1 cm^3 (1cm x 1cm x 1cm), 8 cm^3 (2cm x 2cm x 2cm) and 27 cm^3 (3 cm x 3cm x 3cm)was shown in Fig. 2 respectively. The samples from each treatment are taken for determining the carbohydrate content (Soe, Toungoo, and Myint, n.d.).

The test setup requires the tray dryer from the food engineering laboratory and oven dryer from highway and concrete laboratory for drying the muskmelon samples. An analytical balance was used to determine the sample's weight loss (WENSAR).The dimensions of the samples were determined by the vernier calliper. The drying process was recorded by using a stopwatch. This moisture content was recorded for every sample to determine the effect of drying time and also the carbohydrate content (g/100g).

The Clegg anthrone method was used for the determination of carbohydrate content of various samples of muskmelon (Okonwu and Enyinnaya 2016). Initially, 1g of the sample of muskmelon was thoroughly combined with distilled water of 10 mL. Following that, perchloric acid 13 mL of 62 % was introduced into the mixture, which was constantly stirred for 20 minutes. The samples were filtered using glass filter paper after being further diluted to 250 mL. Finally, With distilled water, 10 mL of filtrate was diluted to 100 mL and 1 mL of the diluted filtrate was

combined with 5 mL of anthrone reagent. By mixing 5 mL of anthrone reagent with 1 mL of distilled water blank samples were prepared . And after that, each sample was placed in a 100 C water bath for 12 minutes. At last, the absorbance's samples (both blank/standard and fruit-based) were determined. The carbohydrate content of the muskmelon fruit sample was obtained by using the Equation (1).

$$Carbohydrate\ content\ \% = \frac{As}{Astd} * 25 \quad (1)$$

Where

A_s - the diluted sample's absorbance

A_{std} - the absorbance of the standard (blank)

Statistical Analysis

SPSS v.26 was used to determine the standard deviation, mean, and significance difference of drying results. In total, 27 samples were collected and analysed for each group, letting confidence level at 95 % with a P value of 0.05. Dimension, Temperature, and Time are independent variables in this research work, whereas carbohydrates is a dependent variable. The research work is analysed by Independent Paired t-test, which is used to compare the carbohydrate content in tray and oven drying of Muskmelon(Siva Shankar and Pandiarajan 2019).

RESULTS

Experiments were conducted to study the carbohydrate content in the oven and novel tray drying characteristics of muskmelon slices at different power. The drying techniques of muskmelon to compare the values of carbohydrate content obtained, have been represented in a pictorial form with samples in Table 1 with various factors. For both methods, the carbohydrate content increased significantly with temperature. The highest values of carbohydrate were (8.36 g/100g) using the tray drying method at 50°C of 27 cm^3 dimensions within 5 hrs while comparing oven drying method (8.00 g/100g). For determining the statistical analysis, the sample data were taken from the optimised treatment.

The experimental details carried out with the parameters of which the muskmelon attains the highest carbohydrate content when it is in the treatment 8 (T8) which has been taken for statistical analysis was shown in Table 2. Table 3 shows that the novel tray drying provides a higher carbohydrate value as compared with the oven drying method. The tray drying of 20 samples obtained a 8.3650 of mean value and 0.14321 of standard deviation. The standard error mean value for tray drying is 0.03202, while the value for oven drying is 0.08575. Table 4 shows the results of the independent sample T test. According to the table, there is a significant variation between the control and experimental groups, which is P=<0.001 (P < 0.05). The dried muskmelon samples at different parameters of both tray and oven drying method was depicted in Fig. 3. The comparison of oven drying and tray drying in terms of mean accuracy and standard deviation for carbohydrate content is shown in Fig. 4. The novel tray drying method has a greater mean accuracy than oven drying and a somewhat better standard deviation than oven drying method.

DISCUSSION

According to the results obtained, tray drying performs significantly better than oven drying when the following

parameters are used. The fischer value achieved for this research is 20.871, with a significance value of <0.001 that is < 0.05, showing a significant variation between the two drying processes. Fig. 4, illustrates the amount of carbohydrate content in dried muskmelon in the particular combination is shown by plotting the graph with both drying methods. Fig. 4, illustrates the comparison of oven drying and tray drying in terms of overall accuracy for the carbohydrate content. The mean accuracy of Tray drying is higher than oven drying and the standard deviation of Tray drying is slightly superior than oven drying. From the bar chart Fig. 4, it is clearly observed that greater carbohydrate content (g/100g) is obtained when the sample is dried by tray method and carbohydrate content (g/100g) is lower when the sample is dried by oven method.

Figure. 4 clearly observed that as the temperature rises, the sample's moisture content decreases, while the sample's carbohydrate content rises with the 36 % of the retended value. The sample's moisture evaporates or diffuses to the drying medium in the dryers over a period of time, causing the samples to dry. This author's result is consistent with previous research, which stated that increasing the temperature in samples decreased the moisture content of the used sample (Link, Tribuzi, and Laurindo 2017). The findings of this author (Sanwiriya 2019) contradict the findings of this work. The cause for this discrepancy could be due to the relationship between oven drying and foam mat drying of watermelon rinds, the energy value is significantly higher in foam mat drying than oven drying of watermelon is because of the drying method's effect. The similar content of carbohydrate is high in dehydrated banana powder in tray dry method compared to oven dry method (Chauhan and Jethva 2016). The previous study is not in line (Aremu, Akintola, and Others 2014), the carbohydrate content of the dehydrated moringa seeds was maximum in the oven drying method when compared to the tray drying method.

In the comparison of muskmelon characteristics, the tray dryer effectively dried the muskmelon samples without changes in size, colour, or fragrance, but in the oven dryer the sample was somewhat burned, as seen by a dark colour surrounding the sample and significant shrinkage in size. It was suggested that the product's appearance and quality be maintained even after the drying process was done. The results show that the tray dryer performs much better than the oven dryer. This might be due to the type of heat transfer medium utilised or the heat transfer rate efficiency of the tray dryer, which is supposed to be equal across all trays.

The limitation of this experiment is when the temperature has exceeded 50℃ there will be changes in colour and texture. As the samples were not efficient of drying time and it is not edible and decreases the quality and nutritional parameters in oven drying. Due to these reasons tray dryer is the replacement method for oven dryer since it provides better performance when provided with the same input temperature. Various drying methods are studied to retain the nutrient and the product quality. In order to avoid the loss of product quality the similar study of comparing carbohydrate content in any other fruits like papaya can be dried by using tray and

oven drying methods can be implemented in future studies.

CONCLUSION

The nutritional qualities of muskmelon of tray and oven drying methods were compared in this study, taking into account all significant criteria. As drying temperature decreases carbohydrate content increases significantly ($P<0.05$), When compared to oven drying, a tray drier is believed to have a faster rate of drying and is more efficient for carbohydrate content. The final outcome shows that the combination of various additives contributed best values (T8) in the tray dryer with a value of (08.36 g/100g) carbohydrate content as compared to oven drying (08.00 g/100g) in muskmelon.

DECLARATIONS

Conflict of Interests

The authors of this paper declare no conflict of interest.

Author Contribution

Author MS was involved in data collection, data analysis, manuscript writing. Author SS was involved in conceptualization, guidance and critical review of manuscript.

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TABLES AND FIGURES

Table 1. Taguchi method was used to minimize the experimental trials by optimal experimental design, L9 Orthogonal array for thecarbohydrate content (g/100g) present after tray and oven drying of muskmelon at various treatments.

Treatment	Dimension (cm^3)	Temperature (°C)	Time (hour)	Carbohydrate Content (g/100g) in Tray Drying Method	Carbohydrate Content (g/100g) in Oven Drying Method
T1	1 cm^3	40	5	7.53	7.45
T2	1 cm^3	50	6	7.47	7.31
T3	1 cm^3	60	7	7.22	7.18
T4	8 cm^3	40	6	8.11	7.62
T5	8 cm^3	50	7	7.88	7.44

T6	8 cm^3	60	5	7.67	7.13
T7	27 cm^3	40	7	8.31	8.01
T8	27 cm^3	50	5	8.36	8.00
T9	27 cm^3	60	6	8.29	7.81

Table 2. The table below contains the data onexperimental details for the calculated tray and oven drying method of muskmelon sample of carbohydrate content at T4.

Trial no	**Carbohydrate Content (g/100g) in Tray Drying Method**	**Carbohydrate Content (g/100g) in Oven Drying Method**
1.	8.36	8.55
2	8.40	7.95
3	8.10	7.50
4	8.25	7.69
5	8.45	7.80
6	8.20	8.00
7	8.38	8.28
8	8.60	7.45
9	8.41	8.35
10	8.50	8.45
11	8.36	8.55
12	8.40	7.95
13	8.10	7.50
14	8.25	7.69
15	8.45	7.80
16	8.20	8.00
17	8.38	8.28
18	8.60	7.45
19	8.41	8.35

20	8.50	8.45

Table 3. T testcomparison of carbohydrate content of tray drying method and oven drying method by varying the different parameters. There is a statistically significant difference in carbohydrate content of muskmelon samples from the tray drying method and oven drying method. Carbohydrate content of the tray drying method has the highest mean (8.3650) over the oven drying method (8.0020).

GROUP STATISTICS					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Carbohydrate	Tray Drying Method	20	8.3650	0.14321	0.03202
	Oven Drying Method	20	8.0020	0.38347	0.08575

Table 4. The Mean, standard deviation and significance difference of carbohydrate content for tray drying method and oven drying method. Outputs of independent sample T test. A significant difference between the experimental group and control group is observed significance value P=<0.001 (P < 0.05). (t value is -3.966 & -3.966; and the df is 38 and 24.199)

INDEPENDENT SAMPLES TEST											
		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Carbohydrate	Equal variances assumed	20.871	<.001	-3.966	38	<.001	<.001	0.36300	0.09153	0.17770	0.54830
	Equal variances assumed			-3.966	24.199	<.001	<.001	0.36300	0.09153	0.17417	0.55183

Fig. 1. Fresh muskmelon samples are kept for drying in the tray drying method at 40°C, 50°C and 60°C for 4, 5 and 6 hours.

Fig. 2. Fresh muskmelon samples are kept for drying in an oven drying method at 40°C, 50°C and 60°C for 4, 5 and 6 hours

Fig. 3. Represents the dried muskmelon with different parameters. (a).Oven dried samples. (b). Tray dried samples.

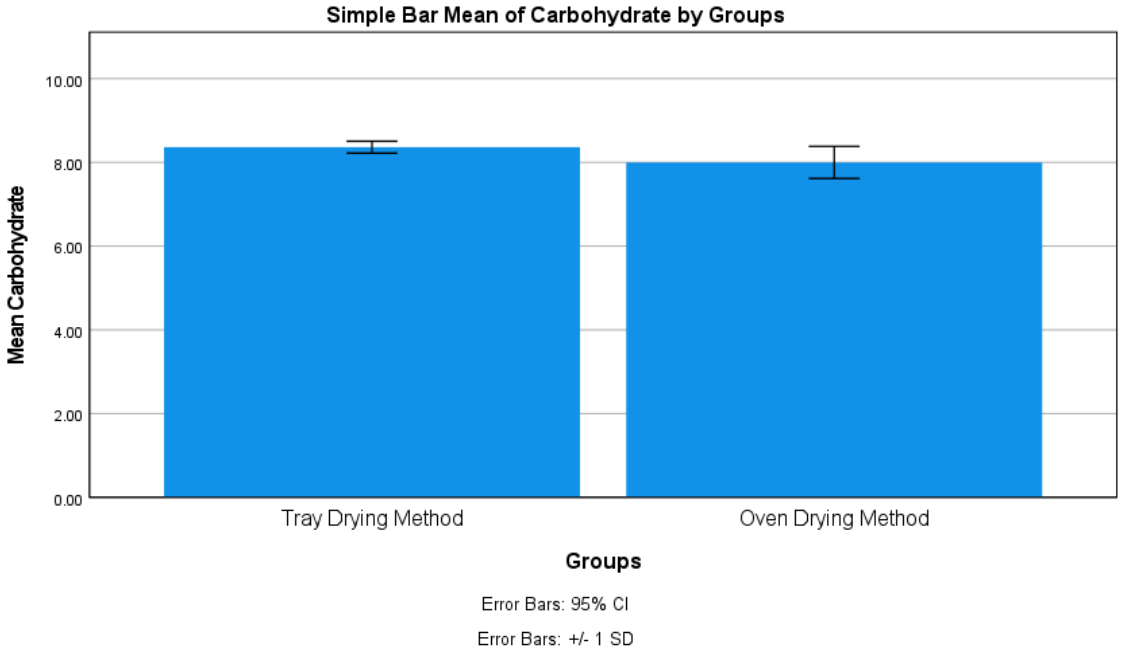

Fig. 4. Comparison of tray drying and oven drying in terms of mean accuracy. The mean accuracy of tray drying is better than oven drying and the standard deviation of tray drying is slightly better than oven drying. X Axis: Tray dry vs Oven dry. Y axis: Mean accuracy of carbohydrate detection (+/-1 SD).