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Nutrient composition of avocado fruits of selected cultivars grown in Kerala

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Abstract
Avocado or butter fruit is a tropical ever green climacteric fruit scientifically known as *Persea americana*, which belongs to the family Lauraceae. Studies had shown that avocado is a fruit rich in monounsaturated fatty acids and phytochemicals. This property of the fruit enable the population to use it as therapeutic as well as healthy fruit. The nutrient compositions of four avocado cultivars which were grown in Wayanad districts of Kerala were studied. The cultivars selected for the study includes Purple hybrid, Fuerte, Kallar round and Pollock. The cultivar Pollock reported to have the highest fat content of 20.2g/100g of fresh fruit. Maximum acidity was noted in kallar round (5.76%). The cultivar Pollock exhibited highest carbohydrate content (7.40g/100g) and protein content of (1.32g/100g). Total mineral content of avocado cultivars were ranged between 1.02g- 1.22g/100g and cultivars such as Pollock (0.80 mg/100g) and Fuerte (525 mg/100g) exhibited highest content of Na and K respectively. The calcium content of the fruits were ranged from 9mg/100g to 9.8mg/100g.

Keywords: fat, acidity, total carbohydrate, protein, total minerals, sodium, potassium, calcium

1. Introduction
Avocado or butter fruit is a tropical ever green climacteric fruit scientifically known as *Persea americana*, which belongs to the family Lauraceae (Koller, 1992) [10]. Avocado is the only tree that produces edible fruits among the members of laurel family (Ikhuoria *et al*., 2007) [8]. This fruit is the native of Mexico and South Central America and is found distributed throughout the world (California Avocado Commission, 2011) [4]. The world avocado producers are Mexico, Chile, Sri Lanka etc.(FAO, 2013) [5]. In India avocados are cultivated in Kerala, Karnataka, Tamil Nadu, Maharashtra and Sikkim. In Kerala it is found grown in homesteads of Wayanad and Idukki Districts.

Avocado fruits stand out as the most nutritive among fruits and are regarded as the most important therapeutic fruit in human diet. Avocado is a low sugar fruit with high protein, fibre and vitamins A, B, C and E. It is an excellent source of potassium and phosphorus, and contains mono-unsaturated fatty acids which effectively reduces the levels of low density lipoproteins, in the blood helping in the prevention of coronary heart diseases. The avocado oil from flesh has a digestibility coefficient of 93.8%, which is mainly used as salad oil.

2. Materials and Methods
Four avocado cultivars which were grown in Wayanad District of Kerala State were selected for the study. The cultivars selected were Pollock, Kallar round, Purple hybrid and Fuerte. The mature fruits were collected from Regional Agricultural Research Station, Ambalavayal, and Wayanad District. Total carbohydrate, protein, total minerals, sodium, potassium, calcium, dietary fibre, moisture and iron were selected for determining nutritional composition of selected avocado cultivars**.** Ripe fruits were estimated for its nutrient content by following methods mentioned below:-

Estimation of moidture and total carbohydrate
The moisture and carbohydrate content of avocado samples were estimated by the method described by Sadasivam and Manickam (2008) [14].

Estimation of dietary fibre and Calcium
The dietary fiber and calcium avocado samples were estimated by the method described by Sadasivam and Manickam (2008) [14].

Estimation of protein
The nitrogen content of avocado samples was estimated by micro Kjeldahl's wet digestion method. The values of nitrogen contents were multiplied by the factors 6.25 to get crude protein content (AOAC, 2000).

Estimation of total minerals
Total mineral content was estimated as per the method described by Raghuramalu *et al.* (1983) [13].

Estimation of sodium and Potassium
Sodium and potassium were estimated by the method suggested by Jackson (1973) [9] using flame photometer.

Statistical Analysis
In order to obtain suitable interpretation the generated data was subjected to statistical analysis such as One-way Analysis of Variance (ANOVA) at 0.05%.

3. Results and Discussion

Carbohydrate

Carbohydrate is one of the major essential molecule found in all living organisms. The maximum carbohydrate content was reported in the cultivar Pollock and it was 7.40g/100g and in purple hybrid, kallar round and Fuerte the carbohydrate content found on par and it was significantly different from Pollock. According to the study conducted by Fulgoni (2010) [6] the carbohydrate content of avocados were found 8.64g per 100g.

Protein

Avocado with other foods boost the protein intake at each meal. The amount of protein was higher in the cultivar Pollock (1.32g/100g) and the least amount of protein was found in Furte (1.15g/100g) and amount of protein was on par in kallar round (1.27g/100g) and purple Hybrid (1.23g/100g).

Fat

The fat content of the four avocado cultivars were assessed and the cultivar Pollock reported the highest fat content of 20.20g/100g of fresh fruit and the cultivars fuerte and purple hybrid were on par in their fat content. The lipid content of avocado had 0% cholesterol level and it decreases the LDL level in the body by 22%, it also increases the HDL level by 11%. (Wardlaw & Kessel, 2002) [15].

Table 1: Proximate Composition of Different Avocado Cultivars

Cultivars	Carbohydrate(g)	Protein (g)	Total Fat(g)	Dietary Fibre(g)	Moisture (%)
Pollock	7.40a	1.32a	20.20a	1.43a	86.25b
Kallar Round	6.66b	1.27ab	19.52b	1.35a	86.75a
Purple Hybrid	6.50b	1.23b	19.40c	1.28ab	77.25c
Fuerte	6.40b	1.15c	18.90c	1.16b	74.50d
CD (0.05)	0.443	0.069	0.458	0.156	0.029

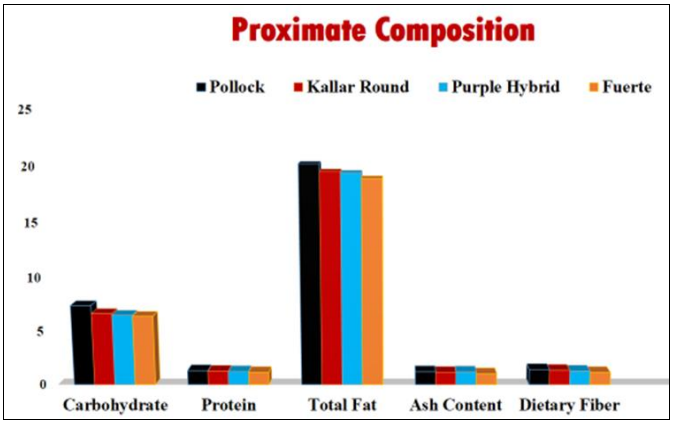

Fig 1: Proximate Composition of Different avocado Cultivars

Dietary Fibre

The dietary fibre content of avocado ranges from 1.16g/100g to 1.43g/100g. The highest amount of dietary fibre was noted in the cultivars Pollock (1.43g/100g) and Kallar round (1.35g/100g) and the lowest amount of Dietary fibre found in the cultivars Fuerte (1.16g/100g) and purple hybrid. The analysis found non-significant at 5% level.

Moisture

Moisture content of a fruit determines the shelf life quality of the fruit. The highest moisture content was reported in the cultivar Kallar round with a moisture of 86.75% and least amount of moisture content was reported in the cultivar Fuerte (74.50%). Brown and Ferruzzi (2004) opined that the moisture content of hass avocado rages from 72.3% to 88.6%.

Table 2: Comparison of Mineral Composition of Different Avocado Cultivars

Cultivars	Total Minerals(g)	Calcium (mg)	Sodium (mg)	Potassium (mg)	Iron(mg)
Pollock	1.22a	9	0.80a	300d	0.50c
Kallar Round	1.16b	9.5	0.30c	400c	0.58b
Purple Hybrid	1.20a	9.8	0.20d	500b	0.60a
Fuerte	1.02d	9.2	0.40b	525a	0.40d
CD (0.05)	0.027	-	0.388	54.359	0.274

Total Minerals

In the case of avocado cultivars grown in Kerala the highest amount of ash was observed in the cultivar Pollock (1.22g/100g).The least amount of ash was noted in the cultivar Fuerte (1.02g/100g). Olaeta and Espinosa (2007) [11] opined that the total ash content of the avocado cultivars ranges from (1.66g/100g).

Calcium

The calcium content of the four avocado cultivars were ranged from 9mg/100g to 9.8mg/100g. The calcium content of the four avocado cultivars were found non-significant at 5% level. Zieliski, H. and Kozowska (2000) [16] reported that the calcium content of Indian avocados were ranged from 12mg to 13 mg/100g of fresh pulp.

Sodium

The sodium content of the four avocado cultivars were analysed and the highest amount of sodium was present in the cultivar Pollock (0.80mg/100g) and least amount of sodium was found in the cultivar Purple hybrid (0.20mg/100g). There

was significant difference in the sodium content of the four cultivars and the values found significant at 5% level

According to the study conducted by Akpabio (2011) [1] the sodium content of Nigerian avocados 0.230 mg/100g and he also opined that avocado is a fruit with low sodium content, this property of the fruit aid in prevention of cardio vascular diseases in individuals.

Potassium

The potassium content of the four avocado cultivars ranges from 300mg/100g to 525mg/100g.The highest amount of potassium content was noted in the cultivar Fuerte (525mg/100g) and the lowest content of Potassium content was recorded in the cultivar Pollock (300mg/100g).

Iron

The iron content of the four avocado cultivars were ranges from 0.40 mg to 0.60 mg/ 100g. The highest amount of iron content was observed in the cultivar Purple Hybrid (0.60mg/100g)). Pandey and Rizvi (2009) [12] reported that the iron content of the Guatemalan race of avocados ranged from 0.69 mg to 1.2mg/100g of pulp.

4. Conclusion

The present study reveals that avocado is a fruit with high nutrient and therapeutic value. The high fat content in the fruit was responsible for the smoothening recipes and the fat present in avocados were mostly mono unsaturated and poly unsaturated so this fruit can be recommended for patients with cardiac ailments. The estimation of sodium and potassium content of avocados revealed the fact that avocado is a fruit with low sodium and high potassium content so this fruit can be recommended for hypertensive patients.

5. Acknowledgement

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