EVALUATION OF SOME VARIETIES OF TEA *(THEA SINENSIS L)* RECENTLY CULTIVATED IN EGYPT

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Abstract

Eighteen tea samples were cultivated by the Horticultural Research Institute then treated at the Food Technology Research Institute. These samples are belonging to Hypride Charleston type and two species (Aassame and Sinensis) , Hypride Charleston type (variety E_{10}, E_{11} ,E_{13}, E_{16}, E_{20}, E_{21}, E_{23}, and E_{28}), Aassame species (variety E_8, E_9,E_{14},E_{17},and E_{27}) and Sinensis species (variety E_{12}, E_{19}, $E_{25}$and E_{29}). Moisture content , water soluble extract (WSE), colour , caffeine and tannin were evaluated in all samples. The corresponding chemical analysis average of these species were (3.55%- 4.66%-3.00%) for moisture, (11.33% - 13.16%- 8.60%) for WSE, (0.972- 0.829- 0.808) for colour as O.D. at wavelength 585 nm., (2.33%-1.88% - 2.85%) for caffeine and (4.58%- 5.10% -3.41 %) for tannin. On the other hand, low moisture content was found in variety E_{19} (1.60%) belonging to sinensis species, while maximum level of water soluble extract (WSE) and tannins were 22% and 8.14% respectively in variety E_{22} belonging to Aassame species. The highest colour degree was apparent in variety E_{21} (1.092) which belongs to Hypride Charleston type and the major content of caffeine was noticed in varieties E_{16} and E_{20} (4% for each)belonging to Hypride Charleston type. Tea manufacture depends on mixing of some varieties during processing. Therefore these values are closer to the Egyptian standards for tea (559/1991).

INTRODUCION

Tea plant, *Thea sinensis* L. is one of about 80 species of East Asian ever green shrubs and trees that belongs to tea family . Cultivation of tea began for the first time in CHINA since about 4000 years ago and it is known as its native country.

Japaneses did not discover the plant until the 8th century and its cultivation was established by 13th century. Europeans had finally introduced tea plants during the 17th century. By late 19th and early 20th centuries, tea growing had spread former into Former Russian Georgia, Sumatra, Iran and the non- Asian countries such as Natal, Uganda, Kenya, Congo and also to Argentina, Brazil and Peru and even to Queensland in Australia; Algood (1999). At the end of 1998, tea seedlings were imported from the United States of America (South Carolina State)and cultivated in Bahteem farm , Qaluobia Governorate, Egypt. Caffeine content of brewed tea includes a range of 8-91 mg/ cup as given by Gilbert *et al.* 1976. the mean daily/ caffeine intake for adults from tea ranges from 0.9-1.4mg/kg body weight (Roberts and Barone, 1983).Formation of different metabolites during various stages of tea fermentation may affect antimutagenic potencies against different types of chemical mutagens (Hour *et al.* 1999). The active phytochemicals in green and black teas improve glucose metabolism, being of the specific plant extracts that have positive effect on insulin metabolism activity, and which would have a possible role of these plants in improving glucose and insulin metabolism, (Broadhurst *et al.* 2000). Polyphenol fractions of tea are able to protect against nitric oxide toxicity in several ways. Both green tea and black tea scavenge nitric oxide and peroxynitrite , inhibit the excessive production of nitric oxide by the inducible form of nitric oxide synthase (Jos *et al.* 2000). Figure (1) show that the quantities and values of tea imports in the four last years.

The aim of this research is to produce and manufacture tea in Egypt, in order to decrease the import quantities of tea and to save some of the hard foreign currencies paid for importation .

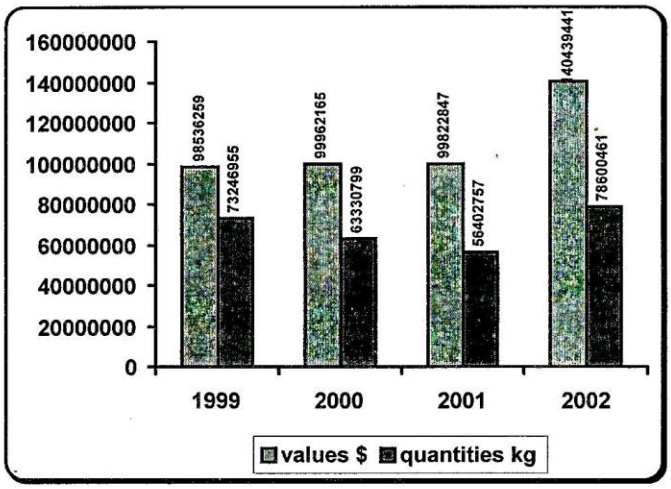

Figure 1. Quantities and values of tea imports (CAPMAC 2003).

MATERIALS AND METHODS

Sampling: Eighteen samples of tea cultivated and manufactured by the cooperation between Horticultural Research Institute (Aromatic and Medicinal plants Research Department) and Food Technology Research Institute (Horticultural Crops Processing Research Department). These samples are belong to Hypride Charleston type (variety E_{10}, E_{11},E_{13},E_{16}, E_{20}, E_{21}, E_{23}, and E_{28}), Aassame species (variety E_8 ,E_9, E_{14}, E_{17}, E_{22} and E_{28}) and Sinensis species (variety E_{12}, E_{19}, E_{25}, and E_{29}). Tea manufactured at three main steps: Cutting , fermentation and drying according to John, 1996. About 50 g of each tested sample was packaged in polyethylene bags tightly closed and stored in cold and dry place until analysis.

Methods of analysis : Moisture content, water soluble extract (WSE) and caffeine were determined as described by A.O.A.C.(1995). Colour of tea samples was measured after boiling in water for 0,1,2,3 and 4 minutes respectively at 585nm which was identified experimentally through scanning process using spectrophotometer by the standard method of the A. O.A. C. (1995). Tannin was determined as described by Ranganna (1979) as follows : An aliquot of the filtered extrat (10-20ml containing 0.01 of tannins) was poured in a porcelain dish followed by 20 ml of the indigo carmine solution and about 500-750ml of water were also added. 1ml of potassium permanganate solution was added using a burette, with vigorous stirring until the colour changes to light green. Addition of permanganate would continue dropwise until the colour changes to bright yellow or to a faint pink at the time. The milliliters of potassium permanganate used was recorded (A). Add 25 ml of gelatin solution to 50ml of clear filtered extract in a 250ml flask and make up to volum with acid sodium chlorid solution Add a little filter aid (Kieselguhr), shake for 15 minute and filter. Add 20 ml of the indigo carmine solution to 50 ml of the filtrate (= 10ml of extract), and about 500- 750 ml of water and titrate with potassium permanganate solution as before. Note the milliliters of potassium permanganate used (B).A-B = permanganate solution required to oxidize the tannins. One ml of O. lN KMn04 = 0.0042 g of tannin as gallotannic acid.

$$\%\ \text{tan nin} = \frac{\text{titre} \times 100 \times \text{g.of tan nin per ml of KMno 4 solution}}{\text{ml taken of filtered extract}}$$

Statistical analysis by using: statistical package for social sciences (SPSS)VER. 10.LSD test with significance level 0.05.

RESULTS AND DISCUSSION

Moisture content in tea samples:

Table (1) shows the moisture content of the different tea samples, from which, the average of moisture of Hypride Charleston type, Aassame and Sinensis species were 3.55, 4.66 and 3.00% respectively. The lowest moisture content was in

the variety E_{19} (1.60%) belonging to Sinensis species and the highest moisture content was in the variety E_{17} (6.20%) of the Aassame species.

Table I. Moisture content in the tested tea samples.

Hypride Charleston type			Aassame species			Sinensis species		
Variety	Mean	Standard deviation	Variety	Mean	Standard deviation	Variety	Mean	Standard deviation
E_{10}	3.90	0.20	E_8	4.80	0.06	E_2	3.95	0.05
E_{11}	3.50	0.10	E_9	5.10	0.10	E_{19}	1.60	0.04
E_{13}	2.90	0.05	E_{14}	4.00	0.00	E_{25}	2.85	0.03
E_{16}	6.00	0.05	E_{17}	6.20	0.06	E_{29}	3.60	0.01
E_{20}	2.00	0.10	E_{22}	3.80	0.02	Average :3.00%		
E_{21}	2.70	0.05	E_{27}	4.10	0.15	LSD: 0.02552		
E_{23}	3.40	0.02	Average :4.66%					
E_{28}	4.00	0.02	LSD:0.0578					
Average :3.55 %								
LSD:0.0653								

Variations in moisture content of the tea samples could be related to the level of fermentation, condition of drying and packaging materials. These results would be in accordance with the fact which ascertained that minimzing the moisture to a level of 3% , makes the product suitable for storage (wickremasinghe, 1978). The optimal condition for storage of black tea in to keep its moisture content in the range of 3 to 5 % at a temperature below 30°C (Stagg, 1974).

Water soluble extract in tea samples:

Table (2) shows the percentage of water soluble extract of the investigated different tea samples. The averages of water soluble extract of Hypride Charleston type, Aassame and Sinensis species were 11.33,13.16 and 8.60% respectively.

Table 2. Water soluble extract in the tested tea samples (on dry weight basis).

Hypride Charleston type			Aassame species			Sinensis species		
Variety	Mean	Standard deviation	Variety	Mean	Standard deviation	Variety	Mean	Standard deviation
E_{10}	12.00	0.00	E_8	14.00	0.01	E_{12}	10.00	0.00
E_{11}	12.16	0.04	E_9	15.00	0.02	E_{19}	6.50	0.02
E_{13}	11.00	0.02	E_{11}	10.50	0.00	E_{25}	8.40	0.03
E_{16}	8.50	0.04	E_{17}	9.50	0.04	E_{29}	9.50	0.01
E_{20}	14.00	0.05	E_{22}	22.00	0.03	Average :8.60%		
E_{21}	12.50	0.01	E_{27}	8.00	0.00	LSD: 0.0132		
E_{23}	10.00	0.00	Average :13.16%					
E_{28}	10.50	0.03	LSD:0.0158					
Average: 11.33%								
LSD: 0.0211								

The lowest water soluble extract that associated with the variety E_{19} (6.50%) was belonging to Sinensis species while the highest water soluble extract was found in the variety E_{22} (22.00%) belonging to Aassame species. Variation in water soluble extract could be attributed to the level of the dissolved amounts of total minerals, pigments, tannins and caffeine of tea leaves and any other dissolved ingredients in the extractable medium.

Colour level of tea samples

The colour intensity of the different tea samples is given in table(3) and represented as optical density values. The colour average of Hypride Charleston type , Aassame and Sinensis species were 0.972, 0.829 and 0.808 respectively on which wavelength 585nm. The lowest value of optical density was in the variety E_{22} (0.728) belonging to Aassame species and the highest optical density was in the variety E_{21} (1.092) of the Hypride Charleston type.

Table 3. Colour level of the tested tea samples (Given as optical density values) at wavelength 585nm.

Hypride Charleston type			Aassame species			Sinensis species		
Variety	Mean	Standard deviation	Variety	Mean	Standard deviation	Variety	Mean	Standard deviation
E_{10}	1.045	0.00	E_8	0.845	0.00	E_{12}	0.730	0.00
E_{11}	0.980	0.00	E_9	0.784	0.00	E_{19}	0.849	0.00
E_{13}	0.952	0.00	E_{14}	0.865	0.00	E_{25}	0.813	0.00
E_{16}	0.971	0.00	E_{17}	0.932	0.00	E_{29}	0.840	0.00
E_{20}	0.950	0.01	E_{22}	0.728	0.00	Average :0.80		
E_{21}	1.092	0.00	E_{27}	0.820	0.00	LSD: 0.0020		
E_{23}	0.960	0.00	Average :0.829					
E_{28}	0.830	0.00	LSD:0.0041					
Average: 0.972								
LSD: 0.0177								

Variation in the colour intensity of the tested tea samples could be related to the level and degree of fermentation as well as to the extracts retained from the non enzymatic browning reactions during the withering stage of black tea processing. Some of the reactions occurred during fermentation are also related to the catalaze enzyme and to the oxidations of tea flavanols by polyphenol oxidase, which leads to colour development. Conversion of chlorophyll into pheophytin during processing of tea participates in gaining the black tea it's desired black appearance and raising the pH value of the fermented leaf yields a brown product which is not acceptable to the tea trade.

Caffeine content in tea samples:

Caffeine concentration in tea amples is given in table (4). The average of caffeine percentage in Hypride Charleston type, Aassame and Sinensis species were 2.33, 1.88 and 2.85 g./l00g dry matter respectively. The lowest caffeine percentage was noticed in the variety E_{23} (0.00) belonging to the Hypride Charleston type and

variety E_{17} (0.50) of the Aassame species while the highest level of caffeine was in the variety E_{16} and variety E_{20} (4.00 for each), belonging to the Hypride Charleston type. These results are in agreement with Gilbert et al ., (1976), and Robert and Barone(1983).

Table 4. Caffeine content in the tested tea samples (on dry weight basis).

Hypride Charleston type			Aassame species			Sinensis species		
Variety	Mean	Standard deviation	Variety	Mean	Standard deviation	Variety	Mean	Standard deviation
E_{10}	2.90	0.05	E_8	1.30	0.01	E_{12}	3.00	0.02
E_{11}	2.10	0.00	E_9	2.60	0.31	E_{19}	3.50	0.03
E_{13}	1.70	0.04	E_{14}	1.90	0.02	E_{25}	2.90	0.01
E_{16}	4.00	0.02	E_{17}	0.50	0.00	E_{29}	2.00	0.01
E_{20}	4.00	0.00	E_{22}	2.00	0.03	Average :2.85 %		
E_{21}	1.50	0.01	E_{27}	3.00	0.02	LSD: 0.0137		
E_{23}	0.00	0.00	Average: 1.88%					
E_{28}	2.50	0.02	LSD:0.0912					
Average :2.33 %								
LSD: 0.0177								

Tannins in tea samples:

Table (5) shows the percentage of tannins as gallotannic acid in the tested tea samples. The average of tannins content in the samples of Hypride Charleston type, Aassame and Sinensis species were 4.58,5.10 and 3.41 g/100 g dry matter respectively. The lowest content of tannin was in the variety E_{19} (2.66) belonging to the Sinensis species while the highest was relative to the variety E_{22} (8.14) of the Aassame species. The important components of tea from the medical view points are the polyphenols which constitute 48.5% of the total solids (Sanderson *et al.* 1976).These data explain that the variety E_{22} in Aassame species contained the highest level of water soluble extract, in the same time contained the highest level of tannins.

Table 5. Concentration of tannins as gallotannic acid in the investigated tea samples (on dry weight basis).

Hypride Charleston type			Aassame species			Sinensis species		
Variety	mean	Standard deviation	Variety	Mean	Standard deviation	Variety	Mean	Standard deviation
E_{10}	4.50	0.01	E8	6.00	0.00	E_{12}	3.90	0.00
E_{11}	4.95	0.02	E_9	5.90	0.01	E_{19}	2.66	0.02
E_{13}	4.60	0.03	E_{14}	3.50	0.02	E_{25}	3.33	0.03
E_{16}	3.40	0.01	E_{17}	3.70	0.01	E_{29}	3.75	0.00
E_{20}	5.32	0.02	E_{22}	8.14	0.02	Average :3.41%		
E_{21}	5.63	0.03	E_{27}	3.36	0.01	LSD: 0.0127		
E_{23}	4.10	0.00	Average :5.10 %					
E_{28}	4.14	0.02	LSD:0.0096					
Average: 4.58 %								
LSD: 0.0141								

Libert *et al.*1999 reported that brewing time steering and chopping operations caused an increase in total phenolics content of green and black tea. Changes in tannin may be due to the effect of fermentation and oxidation on the tannin as quality of tea is dependent on the content of tannin (El-Shanawany, 1981).

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تقييم بعض أصناف الشاي المزروعة حديثاً في مصر

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بالتعاون بين معهد بحوث البساتين قسم النباتات الطبية والعطرية ومعهد بحوث تكنولوجيا الأغذية قسم بحوث الحاصلات البستانية تم زراعة وتصنيع ١٨ سلالة شاي تنتمي إلي النوع المختلط والصنف الهندي والصنف الصيني وتم تقدير النسبة المئوية للرطوبة والنسبة المئوية للمستخلص الزائب في الماء واللون والنسبة المئوية للكافيين والنسبة المئوية للتانينات في جميع العينات وكان متوسط النتائج للنوع المختلط والصنفين الهندي والصيني (٣,٥٥ – ٤,٦٦– ٣,٠) ، (١١,٣٣– ١٣,١٦– ٨,٦) ، (٠,٩٧٢– ٠,٨٢٩ – ٠,٨٠٨) ، (٢,٣٣– ١,٨٨– ٢,٨٥) ، (٤,٥٨– ٥,١– ٣,٤) علي الترتيب . حيث كانت العينة رقم E_{19} والتي تنتمي إلي الصنف الصيني تحتوي علي أقل محتوي رطوبي(١,٦%) وكانت العينة رقم E_{22} والتي تنتمي إلي الصنف الهندي تحتوي علي أعلي نسبة من المستخلص الزائب في الماء والتانينات (٢٢% ، ٨,١٤%) وكانت العينة رقم E_{21} والتي تنتمي إلي الصنف المختلط تحتوي علي أعلي درجة من اللون(١,٠٩٢) وكانت العينة رقم E_{16} والعينة رقم E_{20} تحتويان علي أعلي نسبة للكافيين حيث بلغت ٤% لكل منهما وحيث أن صناعة الشاي تعتمد بدرجة كبيرة علي عملية الخلط وعلي أساس هذه النتائج فإنه يمكن الحصول علي منتج مطابق لدرجة كبيرة للمواصفات القياسية المصرية رقم ٥٥٩ لسنة ١٩٩١.