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Quantitative Determination of Protein and Carbohydrate Contents in Fruits of different Mulberry Varieties

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ABSTRACT: Mulberry fruits which are widely consumed dry as well as fresh, processed into juices, jams, jellies etc., are good sources of carbohydrates, lipids, proteins, vitamins, minerals and fibers. They contain considerable amounts of biologically active ingredients that are beneficial for human health. Present study was aimed to investigate the proximate composition of proteins and carbohydrates in the fresh and dry mulberry fruits of popular mulberry varieties viz., Goshoerami (*Morus multicaulis*), Botatul (*Morus indica*) and Ichinose (*Morus alba*). The ethanol stirrer extraction method was used for the preparation of mulberry fruit extracts. Fresh and dry mulberry fruit extracts of Botatul recorded highest protein content to the tone of 3.17% & 12.47% and highest carbohydrate content to the tone of 13.48% and 26.03% respectively.

Keywords: Mulberry fruit, Human health, Proteins and Carbohydrates.

INTRODUCTION

Mulberry (*Morus* sp.) can grow in a wide range of climatic, topographical, and soil conditions, ranging from tropical to temperate which can affect the chemical composition and nutritional status of plants. Mulberry fruits are widely consumed dry as well as fresh, processed into juices, jams, ice cream, marmalade, wine etc. It's fruits are juicy and rich in minerals, amino acids, fatty acids, sugars, flavonoids, vitamins etc (Wang *et al*., 2013). Conventionally, it is believed that fruits of mulberry, particularly black and red varieties are advantageous to the human body (Ercisli and Orhan, 2007). Mulberry fruits can serve as a remedy for dysentery and laxative, odontalgic, anthelmintic, expectorant, hypoglycemic, and emetic (Ercisli and Orhan, 2007). Fruits of *M. nigra* are among the important constituents of Unani medicine known as *Tutiaswad*, which is believed to have anti-cancerous activities (Nursalam, 2016). In traditional Chinese herbal medicine, mulberry fruits have been used in folk medicine to treat diabetes, hypertension, anemia, and arthritis (Ozgen *et al*., 2009). Anthocyanins are the most important constituent of mulberry fruits, which are a group of naturally occurring phenolic compounds that are responsible for the colour attribute and biological activities such as antioxidant, antimicrobial, and neuro-protective, anti-inflammatory properties (Kang *et al*., 2006; Chen *et al*., 2006). In our study, a compositional comparison of proteins and carbohydrates between different mulberry varieties was undertaken aiming to explore the nutrient profiles of mulberry fruits and promote the further development of the rich mulberry resources.

MATERIAL AND METHODS

The present study was carried out at the College of Temperate Sericulture, SKUAST-K, Mirgund. Fruit samples of three mulberry varieties viz., Goshoerami (*Morus multicaulis*), Botatul (*Morus indica)* and Ichinose (*Morus alba)* after collection were first washed with running tap water to decontaminate them from dust and other foreign materials followed by washing with distilled water. Samples were crushed in stainless steel blender and stored for subsequent analysis. For dry fruit sampling, the fruits were air dried on filter papers and then oven dried at 60-65^{o}C till constant weight was obtained. Dried samples were finally crushed with the help of mortar pestle and stored in labelled paper envelops for subsequent analysis.

A. Estimation of total protein content

Total protein content was measured by colorimetric method described by Lowry *et al.* (1951). 50mg of dry and fresh fruit samples were homogenized in 80% ethanol using mortar pestle. Homogenates were centrifuged at 5000rpm for 20 minutes. Supernatant were discarded and residues suspended in 10ml of 10% TCA (Trichloroacetic acid) for 30 minutes. The mixtures were centrifuged at 5000rpm for 10 min and the supernatant discarded. Pellets were washed with 5% TCA and protein precipitates (pellets) were dissolved in 1N NaOH and kept in hot water bath for 30 minutes. The samples were diluted 10 times with distilled water. From each tube, 1ml was taken, 5ml of alkaline copper reagent was added and were allowed to stand for 10 minutes. After 10 minutes, 0.5ml of 50% FCR reagent was added and mixed. Mixture was allowed to stand for 30 minutes at room temperature and absorbance was measured at 750nm.

B. Estimation of total carbohydrate content

Total carbohydrate was estimated by Anthrone reagent method outlined by Thimmaiah (1999) with slight modification. 0.1g of dry and fresh fruit samples were taken in test tubes. 5ml of 2.5N HCL was added to each tube. The tubes were kept in water bath for 3 hours for hydrolysis and cooled at room temperature. Samples were neutralized with dry sodium carbonate until the effervescence ended and volume was made upto 10ml with distilled water. 0.05ml of the samples was used for analysis. Volume was made up to 1 ml in all the tubes with distilled water and 4 ml of anthrone reagent was added. The samples were kept in boiling water for 8 minutes, cooled rapidly and the green to dark green colour was read at 630nm.

RESULT AND DISCUSSION

A. Total Protein content

The results with respect to total protein content are presented in Table 1-2 and Fig. 1-2. Dry mulberry fruit extract of Botatul recorded highest (12.47%) total protein content followed by Goshoerami (11.23%) and Ichinose (6.58%). Similar trend was found in fresh fruit extracts, where Botatul and Ichinose recorded protein contents to the tone of 3.17% and 2.12% respectively. The experimental results of Ghosh *et al*. (2006) are in accordance with the results obtained in present study. They reported total protein content of 3 to 3.9% in fresh fruits of different mulberry varieties. Kim *et al.*, (2021) recorded total protein content of 6.14%, 6.23%, 7.03% & 7.49% in different varieties of mulberry fruit. Imran *et al.*, (2010) reported protein content of 0.96, 1.55, 1.57 and 1.73g/100g DW in *Morus nigra*, *Morus alba*, *Morus laevigata* (large white fruit) and *Morus laevigata* (large black fruit)respectively. The quantity of protein in fresh mulberry fruit (*M. alba*) is greater than that of raspberries (Rao and Snyder, 2010) and strawberries (Giampieri *et al*., 2012) and comparable to blackberries, (Kaume *et al*., 2012).

B. Total carbohydrate content

Carbohydrate content of different mulberry varieties is shown in Table 1 & 2 and Fig. 1 & 2. In case of dry mulberry fruit, highest carbohydrate content was observed in Botatul (26.03%) followed by Goshoerami (23.11%) and Ichinose (20.01%). Similarly in fresh fruit extracts, Botatul recorded highest carbohydrate content to the tone of 13.48%, whereas, lowest carbohydrate content was recorded in Ichinose (9.18%). Imran *et al*. (2010) reported total carbohydrate content of 13.83, 14.21, 15.21 and 17.96g/100g DW in *Morus nigra*, *Morus alba*, *Morus laevigata* (large white fruit) and *Morus laevigata* (large black fruit) respectively. Dimitrova *et al*. (2015) recorded carbohydrate content in the range of 3.4, 6.2, 9.8g/100 g FW in white (*Morus alba*), black (*Morus nigra*) and red (*Morus rubra*) mulberry fruits respectively. Total carbohydrate content of 69.47, 74.09 and 75.58g/100g DW was recorded by Sadia *et al*. (2014) in *Morus alba*, *Morus laevigata* and *Morus nigra* mulberry varieties respectively. Kumar and Chauhan (2011), reported the carbohydrate content in the range of 0.3733mg/g in BR-2 to 0.6548mg/g in S-36 variety. Sharif, *et al*. (2016) found carbohydrate content in the range of 18.12 – 32.80 g/100g in fresh mulberry juice. Mulberry fruits are rich source of carbohydrates and sugars. The principal carbohydrates are found in the form of monosaccharide and polysaccharides (Mahmood *et al.*, 2012; Gundogdu *et al*., 2011). The monosaccharide of mulberry fruits comprises of glucose, arabinose, galacturonic acid, and galactose (Chen *et al*., 2015). While the immense majority of the polysaccharide reported from mulberry fruits are acid heteropolysaccharides, which are the primary source of α, β-glycosidic linked glucans, these mulberry fruit polysaccharides (MFPs) exert remarkable medicinal effects on human health (He *et al*., 2018).

Table 1: Protein and carbohydrate content (%) of dried fruits of different mulberry varieties.

Dried mulberry fruit	Protein content (%)	Carbohydrate content (%)
Botatul	12.47	26.03
Goshoerami	11.23	23.11
Ichinose	6.58	20.01
C.D (p≤0.05)	0.061	0.030
SE (d)	0.024	0.012
SE (m)	0.017	0.008
C.V	0.297	0.063

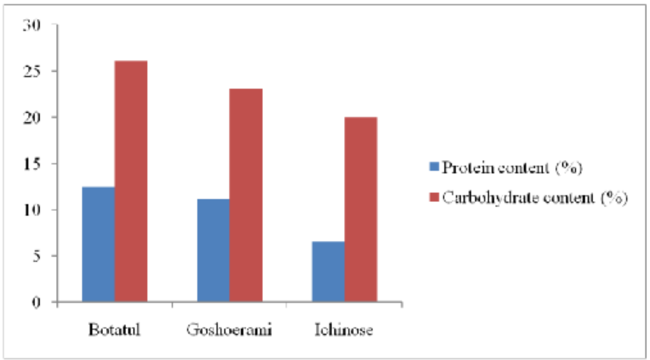

Fig. 1. Graphical representation of protein and carbohydrate content in dried fruits of different mulberry varieties.

Table 2: Protein and carbohydrate content (%) of fresh fruits of different mulberry varieties.

Fresh mulberry fruit	Protein content (%)	Carbohydrate content (%)
Botatul	3.17	13.48
Goshoerami	2.51	10.99
Ichinose	2.12	09.18
C.D ($p \leq 0.05$)	0.061	0.095
SE (d)	0.024	0.038
SE (m)	0.017	0.027
C.V	1.154	0.415

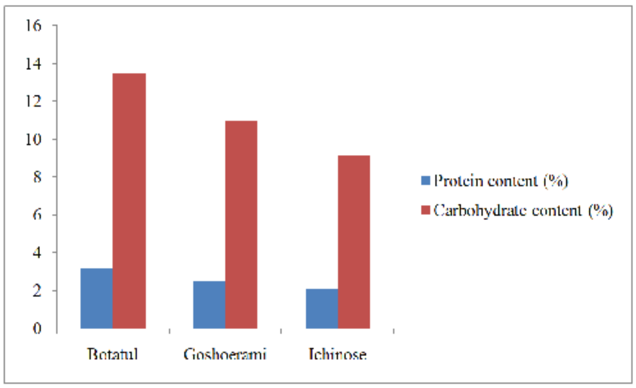

Fig. 2. Graphical representation of protein and carbohydrate content in fresh fruits of different mulberry varieties.

CONCLUSION

There were significant variations in theprotein and carbohydrate contents in fruits of three mulberry varieties, highest being in fresh and dry mulberry fruit extracts of Botatul. Hence, purification of these compounds will prove to be one of the important sources for pharmaceutical and nutraceutical applications and would thereby add value to sericulture industry.

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Conflict of Interest. None.

REFERENCES

Chen, C., You, L. J., Abbasi, A. M., Fu, X. and Liu, R. H. (2015). Optimization for ultrasound extraction of polysaccharides from mulberry fruits with antioxidant and hyperglycaemic activity in vitro. *Carbohydrate polymers*, *130*: 122-132.

Chen, P. N., Chu, S. C., Chiou, H. L., Kuo, W. H., Chiang, C. L. and Hsieh, Y. S. (2006). Mulberry anthocyanins, cyanidin 3-rutinoside and cyaniding 3-glucoside, exhibited an inhibitory effect on the migration and invasion of a human lung cancer cell line. *Cancer letters*, *235*: 248-259.

Dimitrova, M. R., Petkova, N. T., Denev, P. P. and Aleksieva, I. N. (2015). Carbohydrate Composition and Antioxidant Activity of Certain Morus Species. *International Journal of Pharmacognosy and Phytochemical Research*, *7*(3): 621-627.

Ercisli, S. and Orhan, E. (2007). Chemical composition of white (*Morus alba*), red (*Morus rubra*) and black (*Morus nigra*) mulberry fruits. *Food Chemistry, 103*: 1380-1384.

Ghosh, M.K., Das B.K., Misra A.K., Das, C., Mukherjee, P.K. and Urs, S.R. (2006). *Indian journal of plant physiology*, *11*(3): 246-252.

Giampieri, F., Tulipani, S., Alvarez-Suarez, J. M., Quiles, J. L., Mezzetti, B. and Battino, M. (2012). The strawberry: composition, nutritional quality, and impact on human health. *Nutrition*, *28*(1): 9-19.

Gundogdu, M., Muradoglu, F., Sensoy, R. I. G. and Yilmaz, H. J. S. H. (2011). Determination of fruit chemical properties of *Morus nigra* L., *Morus alba* L. and *Morus rubra* L. by HPLC. *Scientia Horticulturae, 132*: 37- 41.

He, X., Fang, J., Ruan, Y., Wang, X., Sun, Y., Wu, N., Zhao, Z., Chang, Y., Ning, N., Guo, H., and Huang, L. (2018). Structures, bioactivities and future prospective of polysaccharides from *Morus alba* (white mulberry): A review. *Food Chemistry, 245*: 899-910.

Imran, M., Khan, H., Shah, M., Khan, R. and Khan, F. (2010). Chemical composition and antioxidant activity of certain Morus species. *Journal of Zhejiang University. Science. B, 11*(12): 973–980.

Kang, T. H., Hur, J. Y., Kim, H. B., Ryu, J. H, and Kim, S. Y. (2006). Neuroprotective effects of the cyanidin-3-O-[beta]-d-glucopyranoside isolated from mulberry fruit against cerebral ischemia. *Neuroscience letters, 391*: 122-126.

Kaume, L., Howard, L. R. and Devareddy, L. (2012). The blackberry fruit: a review on its composition and chemistry, metabolism and bioavailability, and health benefits. *Journal of Agricultural and Food Chemistry.*

Kim, H. B., Kweon, H. Y., Ju, W. T., Jo, Y. Y. and Kim, Y. S. (2021). Nutrient compositions of Korean mulberry fruits (Morus sp.) dried with low temperature vacuum dryer using microwave. *International Journal of Industrial Entomology, 42*(1): 14-20.

Kumar, V., and Chauhan, S. (2011). Biochemical constituents of different parts of mulberry genotypes. *International Journal of Agriculture Sciences, 3*(2): 90-96.

Lowry, O. H., Rosebrough, N. F., Farr, A. L., and Randall, R. J. (1951). Protein measurement with folin phenol reagent. *Journal of Biological Chemistry, 193*: 267-275.

Mahmood, T., Anwar, F., Abbas, M., Boyce, M. C. and Saari, N. (2012). Compositional variation in sugars and organic acids at different maturity stages in selected small fruits from Pakistan. *International Journal of Molecular Sciences, 13*(2): 1380–1392.

Nursalam (2016). metode penelitian. Pertumbuhan Ekonomi Berpengaruh Positif Terhadap Kesempatan Kerja. *Journal of Chemical Information and Modeling, 53*(9): 1689-1699.

Ozgen, M., Serçe, S. and Kaya, C. (2009). Phytochemical and antioxidant properties of anthocyanin-rich *Morus nigra*and *Morus rubra* fruits. *Scientia horticulturae (Amsterdam), 119*: 275-279.

Rao, A. V. and Snyder, D. M. (2010). Raspberries and human health: a review. *Journal of Agricultural and Food Chemistry*.

Sadia, H., Ahmadi, M., Sultana, S., Abdullah, A. Z., Teong, L. K., Zafar, M., and Bano, A. (2014). Nutrient and mineral assessment of edible wild fig and mulberry fruits. *Fruits, 69*(2): 159-166.

Sharif, Z. M., Othman, M. S., and Jalil, N. J. (2016). A stability study on shelf life of mulberry juice in Malaysian SMEs' (small medium enterprise). AIP Conference Proceedings, 020082 (2018).

Thimmaiah, S. R. (1999). Standard Methods of Biochemical Analysis. Kalyani publishers, New Delhi, India, pp. 58-59.

Wang, Y., Xiang, L., Wang, C., Tang, C., and He, X. (2013). Antidiabetic and antioxidant effects and phytochemicals of mulberry fruit (*Morus alba* L.) polyphenol enhanced extract. *PLoS ONE 8*(7): e71144.

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