



QUANTIFICATION OF CARBOHYDRATE IN *IN VITRO* PRODUCED MICRO AND MINI TUBER OF POTATO

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ABSTRACT

The analysis of carbohydrate was done in micro and minitubers produced by microtuber of Murashige and Skoog (MS) and Low Cost (LC) media using Mc Ready method. Yet, no earlier reports were found related to carbohydrates analysis in micro as well as in minituber of potato cultivar *K. Himalini*. It has been observed that higher carbohydrate content was found in the microtuber produced from LC media, than MS media. The minitubers produced by microtubers of LC media showed higher carbohydrate content.

KEYWORDS: carbohydrate, microtuber of Murashige and Skoog, potato cultivar, low cost.

INTRODUCTION

The annual diet of an average global citizen in the first decade of the twenty first century would include about 33 kilograms (or 73 lbs.) of potato. However, the local importance of the potato is extremely variable and rapidly changing. The potato remains an essential crop in Europe (especially eastern and central Europe), where per capita production is still the highest in the world, but the most rapid expansion of potato over the past few decades has occurred in southern and eastern Asia. China is now the world's largest potato producing country and nearly a third of the world's potato are harvested in China and India (Robert, 2001). Potato contains vitamins and minerals that have been identified as vital to human nutrition. Humans can subsist healthy on a diet of potato and milk; the latter supplies Vitamin A and Vitamin D (a b c, 2009). Nutritionally, potato is best known for their carbohydrate content (approximately 26 grams in a media potato). The predominant form of this carbohydrate is starch. A small but significant portion of this starch is resistant to digestion by enzymes in the stomach and small intestine, and so reaches the large intestine essentially intact. This resistant starch is considered to have similar physiological effects and health benefits as fiber: it provides bulk, offers protection against colon cancer, improves glucose tolerance and insulin sensitivity, lowers plasma cholesterol and triglyceride concentrations, increases satiety and possibly even reduces fat storage (Cummings *et al.*, 1996; Hylla *et al.*, 1998; Raban *et al.*, 1994). The nutrition of the potato seems to be fairly evenly distributed between the flesh and the skin. For a media potato, 156g without the skin, nutritiondada.com gives the following: 33% of the RDA for vitamin C, 11% of the thiamin, 11% of the niacin, 23% of the vitamin B6, 4% of the folate, 9% of the pantothenic acid, 3% of the iron,

10% of the magnesium, 17% of the potassium, 17% of the copper. For a similarly sized potato, 173g with the skin, the figures are, respectively, 28%, 7%, 12%, 27%, 12%, 10% 12%, 26% and 10% (www.nutritiondata.com/fact/vegetables-and-vegetableproducts/2554/2; www.nutritiondata.com/fact/vegetables-and-vegetableproducts/2770/2)

MATERIALS & METHODS

The present study was carried out with an aim to quantify the carbohydrate content of *in vitro* produced micro and mini tuber in various mediums. The micro tubers were produced in two different mediums i.e. MS (Murashige and Skoog, 1962) medium with 10 mg/l BAP (MSBAP) and LS (Low Cost) medium with five concentrations as 5, 8, 10, 12 and 15 mg/l of BAP (LCBAP₅, LCBAP₈, LCBAP₁₀, LCBAP₁₂ and LCBAP₁₅). Quantification of carbohydrate was done with the method as describe below:

Soluble Sugars

For the estimation of soluble sugars and starch, 50 mg of plant material was homogenized in 5 ml of 80% alcohol. Homogenates were then centrifuged at 3000 rpm for 10 minutes in REMI centrifuge. The supernatants were taken for the estimation of sugars by anthrone method as described by Mc Ready *et al.* (1950) and pellets were put open in the refrigerator for overnight for starch estimation.

Anthrone reagent was prepared by dissolving 200 mg of anthrone in 100 ml of 95% sulphuric acid, which was then kept in refrigerator and the cold reagent was used for the color development in sugar estimation. 4 ml of this anthrone reagent was gently poured through the wall of the test tube, which contains the dilutions of the supernatant made with the distilled water. The contents of the test tubes were put in the boiling water bath for 7 minutes. The solution was then

allowed to cool for about 20 – 30 minutes at room temperature. The absorbance of the solutions was measured at the wavelength 620 nm by using Systronics UV-VIS spectrophotometer (Model-117). The standard curve was prepared by taking sucrose as a standard.

Starch

Pellets left behind openly in the refrigerator during the estimation of sugars were used for the starch estimation. The pellet was then homogenized in the 52% (w/v) perchloric acid and centrifuged at 3000 rpm for 12 minutes in REMI centrifuge. After centrifugation, known volume of supernatant was taken and the dilution was made with distilled water. Then to this solution the anthrone reagent (4 ml) was poured through the wall of the test tube, which contains the dilutions of the supernatant made with the distilled water. The contents of the test tubes were mixed thoroughly in the cyclomixture for 1 – 2 minutes and then the test tubes were put in the boiling water bath for 7 minutes. Rest of the operations was same as applied in case of soluble sugars.

RESULTS

Soluble Sugar

The observations as recorded in Table – 1 were shown the soluble sugar in microtuber, produced by MS and LS media with various concentration of BAP. In the microtuber produced by MS media, sugar content was found 2.03 mg/gm. LCBAP₅ media showed least mean (0.50 mg/ gm) of sugar content. The sugar content in LCBAP₈ and LCBAP₁₀ reported 3.03 and 2.03 mg/gm respectively. The maximum sugar content (3.03 mg/gm) was found in the microtuber produced from LCBAP₈ media. In the minituber produced from the microtuber of MS media, sugar content was found 98.07 mg/gm and from LC media it was observed 103.05 mg/gm (Table – 2)

Starch content

The starch content of microtuber in MS media was reported 12.43 mg/gm. LCBAP₈ media have show maximum starch content (14.52) followed by LCBAP₁₀ (11.33 mg/gm) and LCBAP₅ (2.01 mg/gm) (Table – 1). The starch content of minituber of MS media was reported 106.15 mg/gm and from LC media 112.20 mg/gm (Table – 2).

TABLE 1: Carbohydrate content in microtubers produced from MS and LC media

Media Used	Soluble Sugar (mg/gm) in Microtuber	Starch content (mg/gm) in Microtuber
MSBAP	2.03	12.43
LCBAP ₅	0.50	2.01
LCBAP ₈	3.03	14.52
LCBAP ₁₀	2.03	11.33
LCBAP ₁₂	-	-
LCBAP ₁₅	-	-

TABLE 2: Carbohydrate content in minitubers produced from microtubers of MS and LC media

Media Used	Soluble Sugar (mg/gm) in Minituber	Starch content (mg/gm) in Minituber
MS	98.07	106.15
LC	103.05	112.20

DISCUSSION

Quantitatively the main nutrient in potatoes, as in cereals, is the storage carbohydrate starch. The potato is also a source of good quality protein and energy. It contains vitamins and minerals such as calcium, potassium and phosphorus, and its value within the human diet is often underestimated or ignored, particularly as a source of ascorbic acid (vitamin C). Starch is produced during photosynthesis and stored as partially crystalline granules in specific locations, such as tubers, grains and kernels. The shape and size of the granules and their physical characteristics, notably the temperature at which starch gelatinizes, are dependent on the relative amount of amylase and amylopectin present. The potato tuber contains approximately 20% dry matter (DM). Starch is the main component and comprises about 70 – 80% on DM basis (Camp, 2008). No earlier works were found related to the analysis of carbohydrate in micro and minitubers produced in MS and LC media. It was observed that higher carbohydrate content was found in the microtuber produced from LC media, then MS media (Table

– 1). The minitubers produced by microtubers of LC media showed higher carbohydrate content (Table – 2).

REFERENCES

Robert Hijmans (2001) Global distribution of the potato crop. American Jour. of Potato Research 78 (6): 403 – 412.

a, b, c. (2009) Columbus’s contribution to world population and utilization: A Natural Experiment Examining the Introduction of Potatoes. Harvard University, <http://www.economics.harvard.edu/faculty/nunn/files/potatoes>.

Cummings, J.H., Beatty ER, Kingman S.A., Bingham S.A., Englyst H.N. (1996) Digestion and physiological properties of resistant starch in the human large bowel. Br. Jour. Nutr. 75: 733 – 747

Hylla S., Gostner A., Dusel G., Anger H., Bartram H.P., Christl, S.U., Kasper H., Scheppach W. (1998) Effects of resistant starch on the colon in healthy volunteers: possible

implications for cancer prevention. *Am. Jour. Cli. Nutr.* 67: 136 – 142.

Raban, A., Tagliabue A., Christensen N.J., Madsen J., Host J.J., Astrup A. (1994) Resistant starch: the effect on postprandial glycemia, hormonal response, and satiety. *Am. Jour. Cli. Nutri.* 60: 544 – 551.

Murashige, T. and Skoog, F. (1962) A revised media for rapid growth and bioassay with tobacco culture. *Physiol. Plant.* 15: 473 – 497.

Mc. Ready, R.N., Guggolz, J., Silveira, V., and Owen, H.S. (1950) Determination of starch and amylase in vegetables. *Ann. Che.* 22: 1156 – 1158.

Camp, John Van (2008) Potatoes compared to other carbohydrate sources like rice and pasta. Published by, Ghent University Dept. Food Safety and Food Quality Research group Food Chemistry and Human Nutrition, pp: 2 – 18.