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Measurement of Viscosity of Gummy Fibre from Syzygium Cumini Seeds and Its Co- Relationship to the Mobility and Dialysability of Sugar Molecules by In Vitro Dialysis Studies

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Abstract:

Aim: *1. Measurement of Viscosity of Gummy Fibre from Syzygium Cumini Seeds and Its Co- relationship to the Mobility and Dialysability of sugar molecules by in Vitro Dialysis Studies.*

2. The effect of water soluble gummy fiber isolated from Syzygium Cumini seeds, Guargum and Gum Arabica on the mobility of glucose molecule across the dialysis bag was carried out.

3. Hydrolysis of water soluble gummy fiber isolated from Syzygium Cumini seeds was conducted to identify the monosaccharide present in the hydrolysates by thin layer chromatography.

Materials: *The method and material used for isolation of water soluble gummy fibre isolated from Syzygium cumini seeds have been described. Viscosity of the water soluble gummy fibre isolated from Syzygium cumini seeds was determined by Ostwald's Viscometer. Solution of 1% gummy fibre (w/v) isolated from Syzygium cumini seeds were prepared with distilled water at room temperature (250C). Viscosity was measured with the help of Ostwald's Viscometer with respect to the flowing time and the density of the solution and results obtained were expressed in centipoise unit.*

Results: *Increase in the hindrance of glucose mobility was observed with the increase in the amount of the gummy fibre as shown in the graph (Figure 1, 2, 3 & 4). The slow rate of dialysis of glucose in presence of guargum and gummy fibre from Syzygium cumini seeds may be attributed to viscosity of these fibers which in turn hinder the mobility and dialysability of glucose molecules. No hindrance in the mobility of the glucose molecule across the dialysis bag containing the gum arabica was observed as evident by the amount of glucose in dialysate which was almost equivalent to dialysate obtained from the dialysis bag containing glucose alone.*

Conclusion: *The reduced mobility of glucose molecules caused by their entrapment in viscous gummy fibre across the dialysis bag in our study may be considered to be a crude representation of reduced intestinal absorption of highly viscous gel forming gummy fibers as reported carlier.*

Keywords: ***Syzygium cumini seed fibre, viscosity, dialysis bag experiment.***

Introduction

Syzygium Cumini Skeels (Eugenia Jambolana or Syzygium jambolana) is a large evergreen tree up to 30 m high. It is widely distributed throughout India, Ceylon-Malaya and Australia. It is commonly known as Jamun, in Hindi, Jambado in Gujrati, Kala Jam in Bengali Jambu in Marathi Black plum in English have been valued in Ayurveda and Unani system of medication for possessing variety of therapeutic properties.[1] Most of the plant parts of Syzygium cumini are used in traditional system of medicine in India.

Syzygium cumini skeels of family Myrtaceae is one of the twenty most widely used traditional antidiabetic plant[2,4]

The quantitative determination showed that Syzygium cumini seeds contained 40% of water soluble gummy fibre and 15% of water insoluble neutral detergent fibre [NDF]. In one of our study it has been shown that hypoglycaemic

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Syzygium cumini is mainly due to water soluble gummy fibre. The water insoluble neutral detergent fibre [NDF] had no significant effect.[5]

The hypoglycaemic effects of water soluble mucilagenous fibres like guargum, pectin, methyl cellulose, gum tragacanth have been attributed to their viscosity.[6,11] The gummy fibres obtained from plant sources have also been reported to impair nutrient absorption, delay gastric emptying or decrease intestinal transit time. The impairment in glucose absorption has been attributed to the gel forming property of soluble fibres.

The hypoglycaemic effect of Syzygium cumini seeds has been shown to be mainly due to water soluble gummy fibre[5] and also that the hypoglycaemic effects of water soluble gummy fibers have been attributed to their viscosity, it was thought to determine the viscosity of the water soluble gummy fibre isolated from the Syzygium cumini seeds.

In addition to this, identification of monosaccharide in water soluble gummy fibre isolated from Syzygium cumini seeds was carried out by thin layer chromatography.

Dialysis bag experiments were also designed to test the possibility whether there was an- impairment in the dialysis of glucose in presence of water soluble gummy fibre due to gel forming property of this fibre.[12]

The slowing down of glucose absorption blunts the rise in blood glucose. The water soluble gel forming or gummy fibers bring about this effect probably by disbursing the incoming food into various parts of gel structure which slows down the movement of nutrients toward the gut wall to be absorbed.

Materials and Methods:

A) Measurement of Viscosity:

The method and material used for isolation of water soluble gummy fibre isolated from Syzygium cumini seeds have been described.[5]

Viscosity of the water soluble gummy fibre isolated from Syzygium cumini seeds was determined by Ostwald's Viscometer.[10,12]

Solution of 1% gummy fibre (w/v) isolated from Syzygium cumini seeds were prepared with distilled water at room temperature (250C). Viscosity was measured with the help of Ostwald's Viscometer with respect to the flowing time and the density of the solution and results obtained were expressed in centipoise unit.

B) Dialysis Studies:

Guar Gum, Gum Arabica and Dialysis bag (240A), were purchased from the Sigma chemical Co. St. Louis, U.S.A.

D-Glucose of AR grade was procured from Qualigen's fine chemicals, Bombay.

The effect of water soluble gummy fibres isolated from Syzygium cumini seeds, guar gum and gum arabica on the glucose diffusion out of dialysis bag was carried out as follows:

Different amount of guar gum, gum arabica and gummy fibers isolated from Syzygium cumini seeds were added as indicated in the table below to 9 different dialysis bags each containing 8ml of 50g/dl of glucose solution. The dialysis bag no.10 contained 8ml of 50 g/dL glucose solution alone.

Table I: Different Dialysis bags containing different amounts of water soluble gummy fiber

No. of Dialysis Bags	Quantity Used	Guar Gum	Gummy Fiber From S. Cumini Seed	Gum Arabica	Glucose Solution
1	1.0g	Guar Gum	-	-	-
2	2.4g	Guar Gum	-	-	-
3	3.5g	Guar Gum	-	-	-
4	1.0g	-	Gummy Fiber From S. Cumini Seed	-	-
5	2.4g	-	Gummy Fiber From S. Cumini Seed	-	-
6	3.5g	-	Gummy Fiber From S. Cumini Seed	-	-
7	1.0g	-	-	Gum Arabica	-
8	2.4g	-	-	Gum Arabica	-
9	3.5g	-	-	Gum Arabica	-
10	8.0ml of 50g/ dL	-	-		Glucose Solution

All the 10 dialysis bags were placed in 10 separate beakers each containing 100ml of water and dialysis was carried out separately. The glucose contents of water in all the beakers were analysed every15 minutes up to 120 minutes by enzymatic method i.e. glucose oxidase-peroxidase method.[13,14] The glucose content is expressed as mg of glucose/ 100 ml of dialysate and were represented graphically. (Figure 1, 2, 3 & 4)

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A study was conducted to identify the monosaccharide in the hydrolysates obtained from the hydrolysis of water soluble gummy fibre isolated from Syzygium cumini seeds with dilute mineral acid i.e. hydrochloric acid followed by separation of liberated monosaccharide using thin layer chromatography technique.[15]

Silica gel G, Standard sugars like ribose, rhamnose, xylulose, galactose, mannose, glucose, fructose & glucuronic acids were purchased from Qualigens fine chemicals, Bombay.

Ethyl acetate, isopropanol, hydrochloric acid, pyridine, diphenylaniline, acetone and 85% phosphoric acid were procured from S/D fine chemical Bombay.

Standard sugars and hydrolysis of water soluble gummy fibre isolated from Syzygium cumini seeds with dilute mineral acid i.e. hydrochloric acid were spotted on previously activated thin layer plates (20cm X 20cm) of silica gel and chromatography was carried out by placing the plates in saturated chamber containing solvents so that 0.5cm of the plates immersed in the solvents. When the solvent front reached 15cm from the origin of the plate, line was drawn across the plate and plates were dried in a stream of cold air and sugar were located by spraying the plates with freshly prepared aniline diphenylamine fuming chamber and heating briefly at 100˚C in an oven. Colour of each sugar and Rf value were used for the identification of sugars.

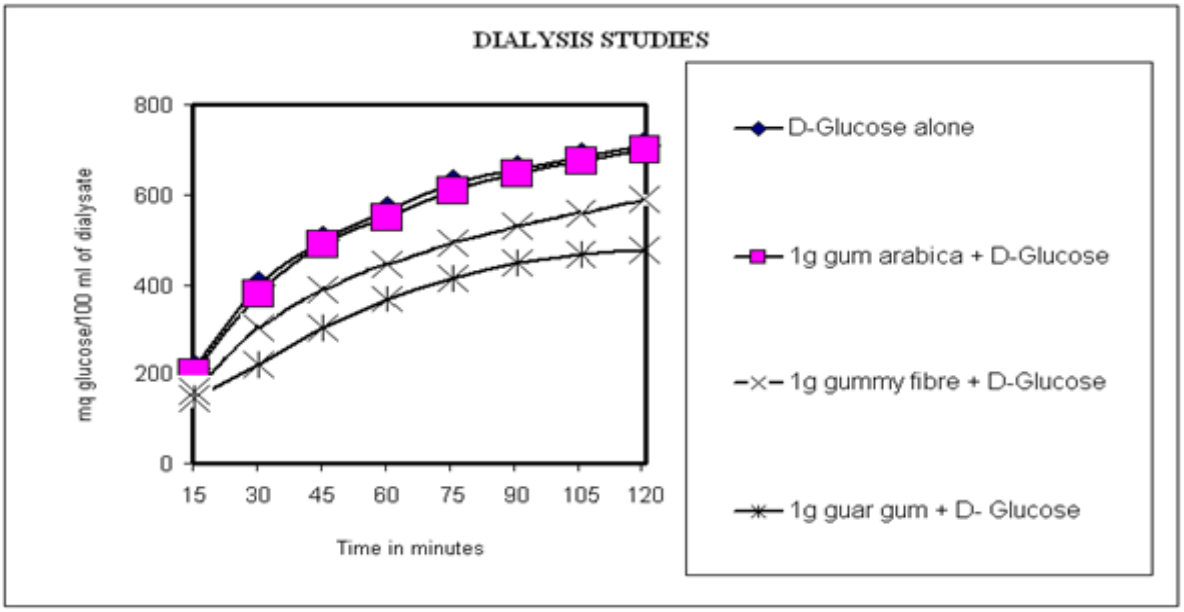

Fig.1: Comparative effects of 1g guar gum, 1g gum arabica and 1g water soluble gummy fibre isolated from Syzygium cumini seeds on the dialysis of D-Glucose.

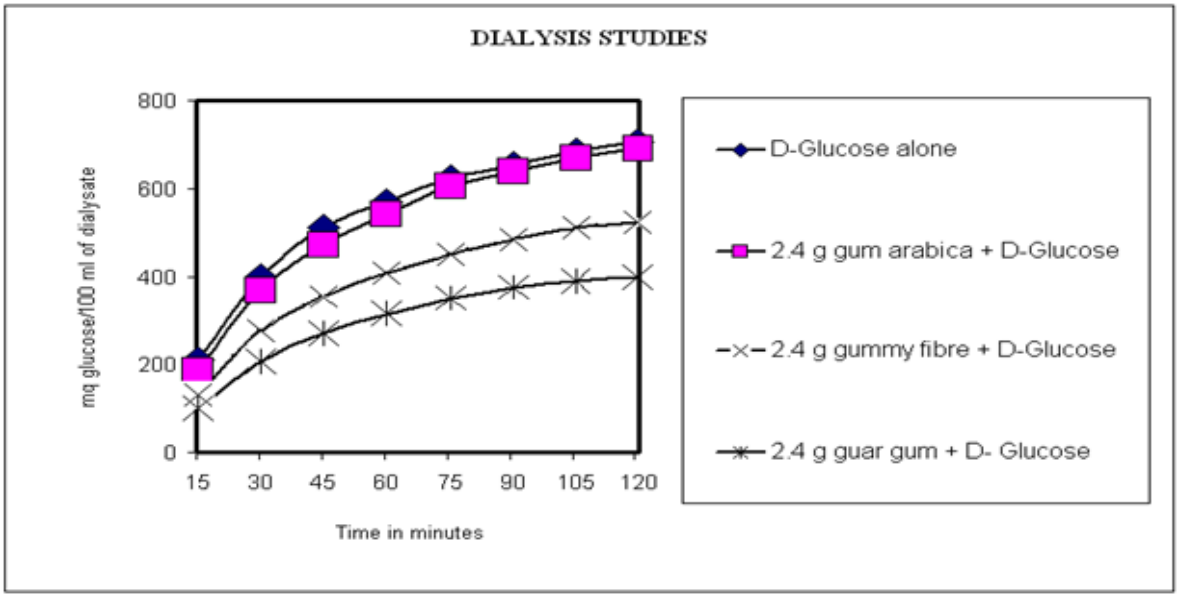

Fig.2: Comparative effects of 2.4g guar gum, 2.4g gum arabica and 2.4g water soluble gummy fibre isolated from Syzygium cumini seeds on the dialysis of D-Glucose.

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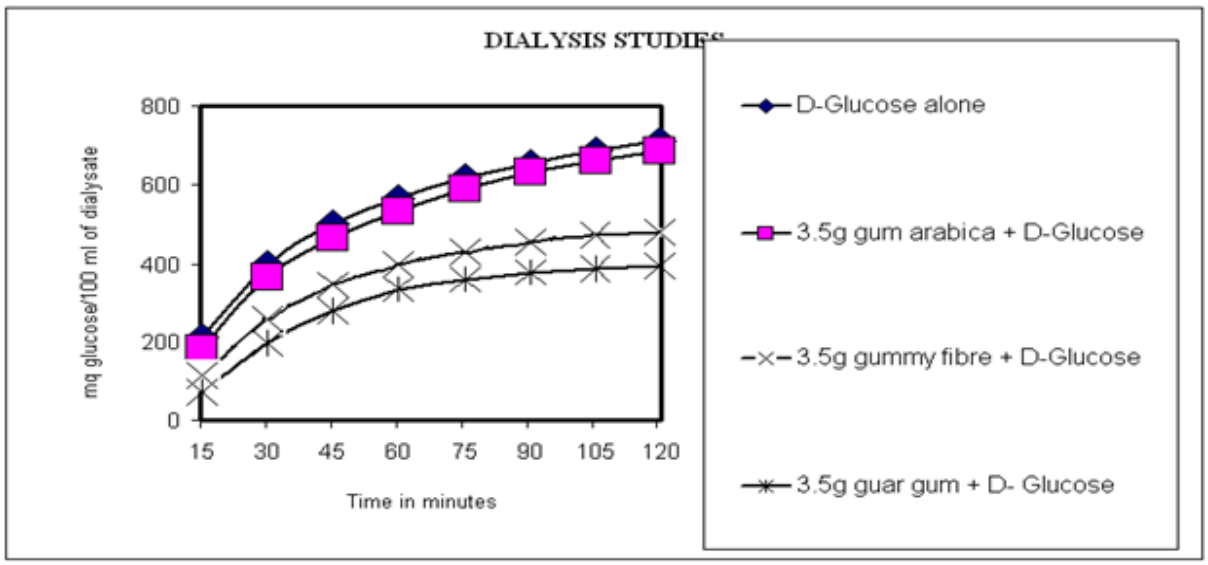

Fig.3: Comparative effects of 3.5g guar gum, 3.5g gum arabica and 3.5g water soluble gummy fibre isolated from Syzygium cumini seeds on the dialysis of D-Glucose.

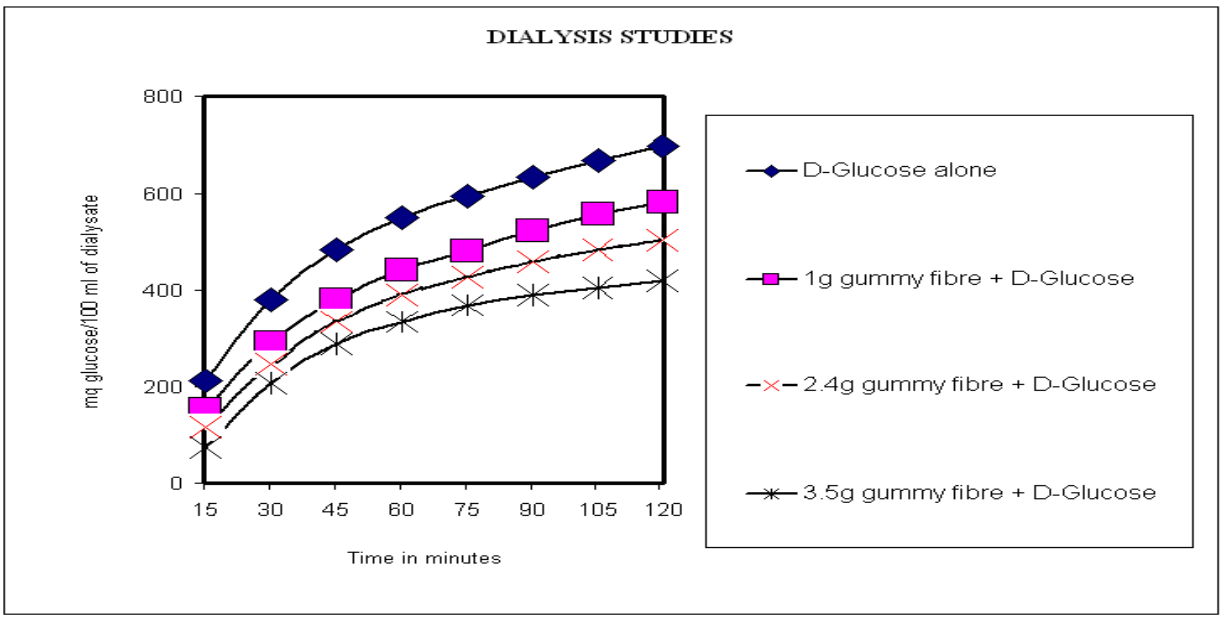

Fig.4: Comparative effects of 1g, 2.4g, 3.5g water soluble gummy fibre isolated from Syzygium cumini seeds on the dialysis of D-Glucose.

Result and Discussion

The study indicated that viscosity of the water soluble gummy fibre isolated from Syzygium cumini seeds was found to be 14 centipoise which is very near to that of guargum (16-20 centipoise)[16,17] while the viscosity of gum arabica has been shown to be 1% of the viscosity of guargum.[17]

There was a pronounced hinderance in the mobility of glucose molecules across the dialysis bag containing guargum and water soluble gummy fibre isolated from Syzygium cumini seeds as evident by the lower amount of glucose in the dialysates obtained from dialysis bags containing a glucose plus gummy material than in the dialysates obtained from the dialysis bag containing glucose alone.

Increase in the hinderance of glucose mobility was observed with the increase in the amount of the gummy fibre as shown in the graph (Figure 1, 2, 3 & 4).

The slow rate of dialysis of glucose in presence of guargum and gummy fibre from Syzygium cumini seeds may be attributed to viscosity of these fibers which in turn hinder the mobility and dialysability of glucose molecules.

No hinderance in the mobility of the glucose molecule across the dialysis bag containing the gum arabica was observed as evident by the amount of glucose in dialysate which was almost equivalent to dialysate obtained from the

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dialysis bag containing glucose alone. The very low viscous gummy fibre, gum arabica did not hinder the mobility of glucose across the dialysis bag.

The decrease in the dialysis of glucose in presence of guar gum has been attributed to its viscosity.[12] The reduced mobility of glucose molecules caused by their entrapment in viscous gummy fibre across the dialysis bag in our study may be considered to be a crude representation of reduced intestinal absorption of glucose in presence of highly viscous gel forming gummy fibers as reported earlier.[9,12,16,17]

The thin layer chromatography of the hydrolysates obtained upon acid hydrolysis of gummy fibre isolated from Syzygium cumini seeds showed that the gummy fibre contained mannose, galactose and xylulose as the monosaccharide units.

Conclusion

The reduced mobility of glucose molecules caused by their entrapment in viscous gummy fibre across the dialysis bag in our study may be considered to be a crude representation of reduced intestinal absorption of highly viscous gel forming gummy fibers as reported carlier.

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