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Characterization of a Partially Purified Carom (*Trachyspermum ammi*) Extract and Its Influence on Starch Functionality and Digestibility

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ABSTRACT

The interactions between starches and the components in spices and herbs have been poorly studied so far. This study investigated the preliminary effects of thirty-six different spices and herbs on pasting properties of rice starch. It largely concentrated on the characterization of a partially purified carom extract (from the dried fruit of the *Trachyspermum ammi* plant) and its influence on the structural, thermal, pasting properties and digestibility of native rice starch. Rheology, differential scanning calorimetry, size exclusion chromatography coupled with a multi-angle laser light scattering, zeta potential, hot-stage optical microscopy, scanning electron microscopy (SEM), and in-vitro starch digestion analysis were carried out to characterise the carom extract and starch-carom system. The results showed that carom, cumin, fennel, mulberry leaf, perilla leaf, neem and coriander seed extracts showed peak and final viscosity-suppressing effect, while mesona, rosemary, green tea, thyme, and clove extracts showed peak viscosity-enhancing effect on rice starch during starch pasting. The water-soluble fraction of carom had the highest degree of viscosity-suppressing effect as compared to other spices and herbs. With increasing concentration of carom, the peak and final viscosities of rice starch decreased; the onset, peak, and end temperatures of rice starch increased; and granular swelling of potato starch was restricted and delayed. The viscosity-suppressing effect was not caused by pH or small molecular carom compounds such as mineral salts and phytochemicals. A protein polymer in carom extract with an M_w of $\sim 2.08 \pm 0.10 \times 10^5$ Da and isoelectric point of ~ 3.5 was found responsible for the suppression effect. The protein fraction completely denatured at $\sim 83^\circ\text{C}$. Micrographs of SEM showed that carom protein appeared as raisin-like clusters. The ability of carom protein to suppress the peak viscosity of starch was also observed in potato, tapioca, glutinous rice, waxy maize, waxy rice, rice, sweet potato, maize, wheat, and pea starches, suggesting that the effect was independent of the source and ratio of amylose to amylopectin. It was proposed that the protein molecules could be interacting with the starch granular surface and/or starch molecules. *In-vitro* starch digestion study showed that dialysed carom extract with rice starch caused an unusual increment in glucose release. The lower viscosity of the starch-carom gels and/or a carom enzyme stimulatory effect were proposed to be responsible for increasing the rapid breakdown of starch.

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TABLE OF CONTENTS

ABSTRACT	2
ACKNOWLEDGMENTS	3
TABLE OF CONTENTS	4
LIST OF FIGURES	8
LIST OF TABLES	10
CHAPTER 1: GENERAL INTRODUCTION	11
CHAPTER 2: LITERATURE REVIEW	14
2.1 Introduction.....	14
2.2 Spices and Herbs.....	14
2.3 Carom (<i>Trachyspermum ammi</i>).....	17
2.3.1 Classification and characteristics.....	17
2.3.2 Traditional medicine and culinary applications.....	18
2.3.3 Chemical constituent.....	19
2.3.4 Aqueous extract of carom.....	22
2.4 General Properties of Starches.....	23
2.4.1 Starch molecules.....	23
2.4.2 Minor components.....	24
2.4.3 Types of starches.....	25
2.4.4 Starch pasting properties.....	26
2.4.4.1 Starch pasting curve.....	26
2.4.4.2 Hydration.....	27
2.4.4.3 Gelatinization.....	27
2.4.4.4 Pasting.....	27
2.4.4.5 Breakdown.....	28
2.4.4.6 Retrogradation & gelation.....	28
2.4.5 Characterization techniques for starches.....	28
2.4.5.1 Rheological properties.....	28
2.4.5.2 Thermal properties.....	29
2.4.5.3 Structural properties.....	29
2.5 Starch-Spice/Herb Interactions and Complexes.....	30
2.6 Starch-Saccharide Interactions and Complexes.....	31
2.6.1 Effect of simple sugars.....	31
2.6.2 Effect of non-starch polysaccharides.....	33
2.7 Starch-Protein Interactions and Complexes.....	34
2.7.1 Proteins in spices and herbs.....	34
2.7.2 Increment in viscosity.....	35
2.7.3 Decrement in viscosity.....	35

2.8 Starch-Phytochemical Interactions and Complexes	37
2.8.1 Classification of phytochemicals	37
2.8.2 Starch-tea phytochemical interactions	38
2.8.3 Starch-sorghum phytochemical interactions	39
2.8.4 Starch-botanical extract interactions	40
2.8.5 Starch-pure phenolic compound interactions.....	40
2.8.6 Starch-pure monoterpenoids interaction	42
2.9 Effect of Mineral Salts on Starch Pasting Properties	43
2.10 Effect of pH on Starch Pasting Properties	44
2.11 Influence of Spices and Herbs on Carbohydrate Digestion	45
2.11.1 Anti-enzymatic properties.....	45
2.11.2 Digestion stimulating action	46
2.11.3 Naturally-occurring amylases	48
CHAPTER 3: GENERAL MATERIALS AND METHODS	49
3.1 Introduction.....	49
3.2 Materials	49
3.3 Rheological Measurements.....	50
3.4 Hot-Stage Optical Microscopy (HSOM) Analysis	51
CHAPTER 4: SCREENING THE EFFECTS OF SPICE AND HERB AQUEOUS EXTRACTS ON PASTING PROPERTIES OF RICE STARCH	52
4.1 Introduction.....	52
4.2 Materials and Methods	53
4.2.1 Materials	53
4.2.2 Spice / herb extraction process	54
4.2.3 Sample preparation for rheological measurement	54
4.3 Results and Discussion	56
4.3.1 Influence on starch pasting properties	56
4.3.2 Classification of spices and herbs	59
4.3.3 Effect of macromolecules	59
4.3.4 Effect of phytochemicals	60
4.3.5 Effect of naturally-occurring amylases	61
4.3.6 Effect of pH.....	62
4.4 Conclusion.....	62
CHAPTER 5: THE EFFECT OF CAROM EXTRACT ON THE PASTING, THERMAL AND STRUCTURAL PROPERTIES OF RICE STARCH.....	63
5.1 Introduction.....	63
5.2 Materials and Methods	63
5.2.1 Material.....	63
5.2.2 Carom extraction process	63
5.2.3 Determination of the fraction responsible for viscosity suppression of starch	65

5.2.4	Chemical composition of freeze dried carom extract	65
5.2.5	Determination of the effect of carom concentration on pasting properties of rice starch.....	66
5.2.6	Determination of the effect of carom concentration on thermal properties of rice starch	67
5.2.7	Determination of the effect of carom concentration on structural properties of rice starch	67
5.3	Results and Discussion	68
5.3.1	Effect of different carom fractions on starch	68
5.3.2	Chemical composition of carom extract	69
5.3.3	Effect of carom extract concentration.....	70
5.3.3.1	Rheological properties	70
5.3.3.2	Thermal properties	71
5.3.3.3	Structural properties	74
5.4	Conclusion.....	76
CHAPTER 6: THE EFFECT OF SMALL MOLECULAR COMPOUNDS ON THE PASTING PROPERTIES OF RICE STARCH		77
6.1	Introduction.....	77
6.2	Materials and Methods	77
6.2.1	Materials	77
6.2.2	Determination of the effect of pH on rice starch.....	78
6.2.3	Determination of the effect of mineral salts on rice starch	78
6.2.4	Determination of the effect of phytochemicals on rice starch	79
6.3	Results and Discussion	80
6.3.1	Effect of acids and bases	80
6.3.2	Effect of mineral salts	81
6.3.3	Effect of phytochemicals	83
6.4	Conclusion.....	86
CHAPTER 7: CHARACTERISTICS OF CAROM POLYMER AND ITS INTERACTION WITH DIFFERENT STARCHES		87
7.1	Introduction.....	87
7.2	Materials and Methods	87
7.2.1	Materials	87
7.2.2	Dialysis (dialysed carom extract)	88
7.2.3	Protein hydrolysis (protease-treated carom extract)	88
7.2.4	Determination of the effect of pH on carom extract	90
7.2.4.1	Visual observation	90
7.2.4.2	Isoelectric point of carom protein	90
7.2.4.3	Pasting properties using “pH-treated carom extract”	90
7.2.5	Determination of the effect of heat on carom extract	91
7.2.5.1	Structural characteristics of heated carom protein.....	91
7.2.5.2	Pasting properties using heat-treated carom extract	91
7.2.6	Determination of the effect of carom extract on different starches	92

7.2.6.1 Rheological measurement	92
7.2.6.2 Hot-Stage Optical Microscopy (HSOM) Analysis	92
7.2.7 Determination of structural characteristics of starch-carom system during pasting	92
7.3 Results and Discussion	94
7.3.1 Effect of dialysed carom extract	94
7.3.2 Effect of protease-treated carom extract.....	95
7.3.3 Structural characteristics of carom protein.....	97
7.3.4 Effect of pH on carom extract.....	98
7.3.4.1 Isoelectric point of carom protein	98
7.3.4.2 Effect of pH-treated carom extract on starch pasting.....	99
7.3.5 Effect of heat on carom protein	101
7.3.5.1 Effect of heat treatment on the structure of carom extract.....	101
7.3.5.2 Effect of heat-treated carom extract on starch pasting	101
7.3.6 Effect of carom extract on different starches	102
7.3.6.1 Rheological properties	102
7.3.6.2 Morphology of different starch granules using light microscopy	106
7.3.7 Morphology and microstructure of rice starch-carom mixtures examined by SEM	110
7.4 Proposed Mechanism	113
7.5 Conclusion.....	115
CHAPTER 8: EFFECT OF CAROM ON STARCH DIGESTION.....	116
8.1 Introduction.....	116
8.2 Materials and Methods	116
8.3 Results and discussion	120
8.3.1 In-vitro starch digestion	120
8.3.2 Potential nutritional applications.....	123
8.4 Conclusion.....	123
CHAPTER 9: CONCLUSION & RECOMMENDATIONS	124
9.1 Conclusion.....	124
9.2 Recommendation	126
REFERENCES.....	128
APPENDICES	138

LIST OF FIGURES

Figure 1a: The <i>Trachyspermum ammi</i> plant and flower.....	17
Figure 1b: Carom, the schizocarp (dry fruit) of the <i>Trachyspermum ammi</i> plant, used as a spice.....	17
Figure 1c: Omum water, a home remedy concoction made solely from carom aqueous extract.....	17
Figure 1d: An Indian traditional medicine, Gasex Syrup, containing carom.....	17
Figure 2a: Mirch Ajwain Paratha, an Indian pan-fried bread made from wheat flour and carom. A common staple in North India.....	19
Figure 2b: Omumpodi Muruku, an Indian deep-fried snack made from chickpea flour, rice flour and carom.....	19
Figure 2c: Ajwain Samosa, an Indian deep-fried stuffed pastry made from flour and carom. A common snack in India.....	19
Figure 2d: Ethiopian Berberé stew, made from carom and other spices. Berberé is a key ingredient in Ethiopian cuisines.....	19
Figure 3: Schematic representation of the different structural levels of the starch granule and the occurrence of amylose and amylopectin.....	23
Figure 4: A typical starch pasting curve of native rice starch.....	26
Figure 5a: Fresh Mesona (<i>Platostoma palustre</i>) leaves.....	30
Figure 5b: Mesona herb (dried <i>Platostoma palustre</i> leaves and stems).....	30
Figure 5c: Hard grass jelly, a dessert made from Mesona and starch mixture.....	30
Figure 6: A highly schematic presentation of the structure of starch-Mesona gel.....	31
Figure 7: Parameters and settings for the rheological measurement of starch systems using a Paar Physica Rheometer with a starch cell.....	50
Figure 8: Extraction process to obtain filtered aqueous extract of the spices and herbs.....	54
Figure 9: Sample preparation procedure for rheological measurement.....	55
Figure 10: The viscosity-suppressing effect of 80% (w/w) filtered liquid (aqueous) extracts of different spices and herbs on the pasting properties of 10% (w/w) native rice starch.....	57
Figure 11: The viscosity enhancing effect of 80% (w/w) filtered liquid extracts of different spices and herbs on the pasting properties of 10% (w/w) native rice starch.....	58
Figure 12: Extraction process of carom to produce filtered liquid carom extract (LCE) and freeze-dried carom extract (FDCE).....	64
Figure 13: The four different fractions obtained after the centrifugation of 15% (w/w) carom mixture at 14,000 g for 1 hour at 15°C.....	64
Figure 14: The effect of Fractions A, B and C of carom extraction process on the pasting properties of 10% (w/w) native rice starch.....	68
Figure 15a: The effect of FDCE concentration on the pasting properties of 10% (w/w) native rice starch.....	70
Figure 15b: The effect of FDCE concentration on the peak viscosity of 10% (w/w) native rice starch.....	70
Figure 16: Thermal properties of 10% (w/w) native rice starch at varying liquid carom extract concentration (0%, 1.6%, 8%, 16%, 32%, 80% and 90%) (w/w) using the DSC.....	71
Figure 17: Hot stage micrographs of 1.5% (w/w) potato starch with 0.0, 1.7, 3.5, 7.0 and 14.0% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19°C/min.....	72
Figure 18: The effect of acidic pH (3 – 6) on 10% (w/w) rice starch in comparison to 10% (w/w) native rice starch with 80% (w/w) Liquid Carom Extract (LCE) at pH 5.89.....	80
Figure 19: The effect of neutral and alkaline pH (7 – 9) on 10% (w/w) rice starch in comparison to 10% (w/w) native rice starch with 80% (w/w) Liquid Carom Extract (LCE) at pH 5.89.....	80
Figure 20: The effect of 0.0% (0M), 5.6% (0.5M) and 11.1% (1.0M) calcium chloride on 10% (w/w) rice starch (RS).....	82
Figure 21: The effect of 0.0% (0M), 2.9% (0.5M) and 5.8% (1.0M) sodium chloride on 10% (w/w) rice starch (RS).....	82
Figure 22: The effect of 0.0% (0M), 7.1% (0.5M) and 14.2% (1.0M) sodium phosphate on 10% (w/w) rice starch (RS).....	82
Figure 23: The effect of 0.0% (0M), 0.9% (0.1M) and 4.8% (0.5M) magnesium chloride on 10% (w/w) rice starch (RS).....	82
Figure 24: The effect of 0.0% (0M) and 4.8% (0.1M) ferrous gluconate on 10% (w/w) rice starch (RS).....	82
Figure 25: The effect of 0.0% (0M), 3.7% (0.5M) and 7.5% (1.0M) potassium chloride on 10% (w/w) rice starch (RS).....	82

Figure 26: The effect of 0.6% and 6.0% (w/w) thymol on 10% (w/w) rice starch (RS).....	84
Figure 27: The effect of 0.6% and 6.0% (w/w) tannic acid on 10% (w/w) rice starch (RS).....	84
Figure 28: The effect of 0.6% and 6.0% (w/w) p-cymene on 10% (w/w) rice starch (RS).....	85
Figure 29: The effect of 0.6% and 6.0% (w/w) S-limonene on 10% (w/w) rice starch (RS).....	85
Figure 30: The effect of 0.6% and 6.0% (w/w) γ -terpinene on 10% (w/w) rice starch (RS).....	85
Figure 31: The effect of 0.6% and 6.0% (w/w) saponins on 10% (w/w) rice starch (RS).....	85
Figure 32: The effect of 80% (w/w) dialysed liquid carom extract (LCE) (0 hours, 48 hours, 72 hours and 1 week) on the pasting properties of 10% (w/w) rice starch (RS).....	94
Figure 33(a-f): Effect of protease treatment of liquid carom extract for 0 hours (33a and 33b), 1 hour (33c and 33d) and 24 hours (33e and 33f) on the changes in molecular mass distribution (33a, 33c and 33e) and its corresponding changes in rice starch pasting properties (33c, 33d and 33f).....	96
Figure 34: Scanning electron microscope images (5 μ m and 10 μ m) of polymers identified in dialysed (24 hours) 10% (w/w) carom extract solution.....	97
Figure 35a: SEM image of coagulated whole milk. The matrix was casein "sponge" (white) with milkfat globules (yellow).....	97
Figure 35b: SEM image of soy cheese spread sample SCS-B, which was made by lactic acid bacteria fermentation method and modified by papain.....	97
Figure 36: Zeta potential (mV) measurement at 20 °C of diluted liquid carom extract samples with pH adjusted between 2 and 10.....	98
Figure 37: Visual appearance of liquid carom extract with changing pH from pH 2.0 to pH 9.....	99
Figure 38: The effect of pH-treated (pH 2-5) liquid carom extract (LCE) on pasting properties of rice starch (RS).....	100
Figure 39: The effect of pH-treated (pH 6-9) liquid carom extract (LCE) on pasting properties of rice starch (RS).....	100
Figure 40: SEM images (10, 20 and 40 μ m) of dialysed (24 hours) 10% (w/w) freeze-dried carom extract solution with and without heat treatment (90°C for 5 mins).....	101
Figure 41: The effect of preheated (20, 40, 60, 70°C) liquid carom extract (LCE) on pasting properties of rice starch (RS).....	102
Figure 42: The effect of heat preheated (20, 80, 83, 85, 100°C) liquid carom extract (LCE) on pasting properties of rice starch (RS).....	102
Figure 43(a-j): The effect of liquid carom extract (LCE) on different starches (potato, tapioca, glutinous rice, waxy maize, waxy rice, rice, sweet potato, maize, wheat, and pea) with varying amylose content.....	103
Figure 44: The viscosity difference in the peak and final viscosities of rice starch and rice starch-carom system for different starches (potato, tapioca, glutinous rice, waxy maize, waxy rice, rice, sweet potato, maize, wheat, and pea).....	105
Figure 45: Hot stage micrographs of 1.5% (w/w) tapioca starch with and without 3.5% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19 °C/min.....	107
Figure 46: Hot stage micrographs of 1.5% (w/w) sweet potato starch with and without 3.5% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19 °C/min.....	107
Figure 47: Hot stage micrographs of 1.5% (w/w) potato starch with and without 3.5% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19 °C/min.....	108
Figure 48: Hot stage micrographs of 1.5% (w/w) wheat starch with and without 3.5% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19 °C/min.....	108
Figure 49: Hot stage micrographs of 1.5% (w/w) maize starch with and without 3.5% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19 °C/min.....	109
Figure 50: Hot stage micrographs of 1.5% (w/w) pea starch with and without 3.5% (w/w) freeze-dried carom extract dispersed in water was heated from 50°C to 90°C at the rate of 19 °C/min.....	109
Figure 51: The pasting curve of 10% (w/w) rice starch (RS) with and without 80% (w/w) liquid carom extract (LCE), with six temperature points (50, 72, 85, 95, 25°C and 5°C) at which aliquots were sampled for SEM analysis.....	110
Figure 52: SEM images (10 μ m and 20 μ m) of 10% (w/w) rice starch with and without 80% (w/w) liquid carom extract dispersed in water.....	111
Figure 53: A schematic diagram of the proposed mechanism of the starch-carom system.....	113
Figure 54: In-vitro gastrointestinal digestion model.....	117
Figure 55: The rate of glucose released (average of duplicates) during in-vitro starch digestion of rice starch samples and rice starch-carom samples prepared at two different temperature settings.....	120

LIST OF TABLES

Table 1: Major chemical components and health properties of 36 different spices and herbs.	15
Table 2: Composition of whole carom	20
Table 3: Quantitative (%) phytochemical evaluation of carom	20
Table 4: Major chemical composition (%) of carom's essential oil	21
Table 5: Classification and solubility of main phytochemicals in carom essential oil	21
Table 6: Characteristics and properties of common starches	25
Table 7: Polyphenol content of common foods	38
Table 8: Effect of eleven phenolic compounds on wheat starch pasting properties	41
Table 9: Examples of monoterpenoids that form complexes with amylose	42
Table 10: Amylase activity found in various spices	48
Table 11: The types of spices and herbs used and their sources.	53
Table 12: Viscosity-suppressing and enhancing effects of 36 spice and herbal extracts on rice starch	56
Table 13: Methodology used for the chemical composition analysis	66
Table 14: Chemical composition of freeze-dried carom extract	69
Table 15: pH value of different samples	80
Table 16: The types of starches used and their sources.....	87