

Gastrophysics: An Emerging Scientific Discipline.**Sangita S Meshram^a, and Anita S Goswami-Giri^{b*}.**

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Review Article

Received: 22/07/2014

Revised: 13/08/2014

Accepted: 27/08/2014

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Keywords: Gastrophysics,
food quality; cooking system;
heat; sensory specific satiety

ABSTRACT

The interdisciplinary science procures the technological, conjectural and creative thinking. Hence confinement of emerging sciences paid more attention of scientist towards the benefits of society. This present paper discussed the application of gastrophysics in noble cooking system along with proper combination of heat and time to improve the recipes without degrading nutrient values. Significances of article are interface of biophysics, biochemistry, food chemistry, technology and health.

INTRODUCTION

The interdisciplinary science procures the technological, conjectural and creative thinking. Hence confinement of emerging sciences paid more attention of scientist for the benefits of society. The term 'gastrophysics' an emerging scientific discipline that employs physical sciences, Chemical Sciences and biological sciences and technology. Especially, gastrophysics forwarding its recent advances in the physical sciences to agricultural field for raw materials, in processing food, food quality, flavor, appreciation, and absorption in the human body. (Ole G Mouritsen¹ et al. Flavour 2013, 2:9) Communities may think this term belongs to gastric problems – the echo of gastroenteritis. Gastrophysics should be to gastronomy as astrophysics is to astronomy. Astronomers observe the planets and stars, they note how they move and even predict future movements; but astrophysicists explain why the stars are where they are and how they got there, and they also supply the sound scientific basis for the whole subject. (Peter Barham: Flavour 2013 2:5)

Noble cooking system required the proper combination of heat and time. An enhancement in food is only after the scientific cooking, practices, discussions and uses it to draw preliminary findings on how to improve the recipe. The empirical world of cooking mostly uses materials of biological origin. The methods used in cooking involve some kind of chemical and physical processing. (Myhrvold N, Young C, Bilet M: 2011, Barham P. et al 2010, Barham P. et al 2001, McGee H: 2004, Vilgis T. et al 2011) Hence in the present paper discussed the sensations of food and non-scientific community improve their cooking process based on mechanisms obeying principles from physics and chemistry. Effect of culture, food habits and geographical area is worth the attention of serious biophysicists and biochemist.

Procedure

Sources : Green vegetables , Potato

Heat and thermo dynamics

The basic kitchen operation is heat that affects food texture, chemical constituent's flavours and its taste. The only easy way is to use a phase transition that occurs at a fixed temperature .The simplest and most accessible of these is to use boiling water. Place cooking vegetables in boiling water for a fixed time at variable temperature. It preserves the nutritive values of vegetables because boiling point of water depends on the pressure. Most of the people do not cook with pure distilled water, but rather with the local tap or spring water. The concentration and types of salts present in the water also affect the boiling point. Salts can have quite different effects on the food that is being cooked. If divalent salts such as Mg^{++} or Ca^{++} are present, it affect the colour of green vegetables – making them appear a brighter green after cooking (Myhrvold N, Young C, Bilet M: 2011, Barham P.et al 2010,Barham P.et al 2001, McGee H: 2004, Vilgis T. et al 2011) as they interact with chlorophyll molecules to change their shape and hence their vibrational spectra .(Haisman D R:et al 1975) After establishing a precise control over the water quality and the pressure, investigate how food immersed in hot water cooks.

The potato is rich in carbohydrate, vitamins, and minerals, phytochemicals, and trace amounts of thiamin, riboflavin, folate, niacin, magnesium,phosphorus, iron, and zinc. The fibre content of a potato with skin (2 g) is equivalent to that of many whole grain breads, pastas, and cereals.

Predominantly , carbohydrate/ starch a small but significant portion of this starch is resistant to digestion by enzymes while health benefits of fiber; provides bulk, offers protection against colon cancer, improves glucosetolerance and insulin sensitivity, lowers plasma cholesterol and triglyceride concentrations, increases satiety, and possibly even reduces fat storage.(Hylla S, Gostner A, Dusel G, et al. (January 1998), Raben A, et al. 1994, Englyst HN, Kingman SM, Cummings JH 1992) The amount of resistant starch in potatoes depends much on preparation methods. Cooking and then cooling potatoes significantly increases resistant starch. Cooked potato starch contains about 7% resistant starch, which increases to about 13% upon cooling(.Fernandes G, Velangi A, Wolever TMS :2005). The starch granules gelatinise at 60°C by visibly changes in texture from a wet milky creamy colour to a translucent gel-like sticky texture. Customization of gel transition to investigate heat transfer through a cooking potato(Barham P: The Science of Cooking. Berlin: Springer; 2000) is very important to express the gastrophysics.

Place a potato in a temperature-controlled bath for a fixed time and then cut it, open and measure the width of the cooked region. The measurement of the width of the cooked region possesses *thermal diffusion*. Hence observations shall be noted for the width of the cooked region. It shows increases as the square root of the cooking time and the rate at which this width increases depends on the temperature difference between the potato before immersion and the temperature of the heat bath.

Not all in the brain

The sensory specific satiety (SSS), describes that 'liking' of a food drops as intake, plays a role in satisfactions, wellbeing (Damasio AR: 2000) and also in controlling the variety of food intake.(Rolls BJ, Rolls ET,et al :1981,Rolls BJ,et al :1982, Sørensen L,et al:2003) The sensory specific desire (SSD), which describes the non-random desire for other foods the eating of a given food, induces.(Olsen A, Ritz C, Hartvig D, Møller P: 2011) But the dynamics in it is cooking processes that produce neural and hormonal channelized systems in the brain and body. SSD depends entirely on the food culture in which a measurement takes place. Different foods in different cultures with similar sensory profiles will induce the same desires in different cultures. Any precise theory for prediction of 'transfer effects' or for the number of sensory dimensions necessary to capture the effects has still to be formulated.

Why gastrophysics?

Foods are composed mainly of water, fat, protein, and carbohydrates. Cooking is the process of changing the chemistry of food usually by transferring energy in the form of heat to the food long enough so that it is safe and digestible, and achieves the desired flavour, texture, tenderness, juiciness, appearance, and nutrition. Cooking is all about physics and chemistry, with a little magic mixed in to be healthy body and mind one needs to understand how macroscopic physical food properties relate to

molecular properties and interactions of the ingredients. Function of the ingredient concentration and its type, energy input, temperature and time and its values are reflected by the food's microstructure. This structure allows an understanding of how macroscopic and molecular properties are related. Changing the preparation conditions will change the position of the the structure.(van der Linden Flavour 2013, 2:11)

The survival and sustainability concerns implies dramatically changes in the foods. The understanding of the neurobiological mechanisms responsible for preference formation and change could facilitate this necessary change of food habits.

Integration of physics with gastronomy can yield innovations in an efficient manner. An important element of this integration is the structure of food. The creation of food recipes often deals with designing new structures and a clear understanding of how food structure influences food properties is necessary.

Forthcoming perspectives

Gastrophysics is an emerging scientific discipline having goal to demonstrate the fundamental principles of physics, in particular soft-matter physics, biophysical chemistry, and molecular biophysics, can be brought together to work within the sciences dealing with food. Gastrophysics may provide impetus for less phenomenology and more explanation and prediction in the psychological and neuro-scientific areas that deal with food behaviour. Hence, to replace quantity with quality, gastrophysical / neurogastronomic/molecular gastronomic studies of delicious foods, might have a major impact on how to tackle problems of overeating. This view has indeed surfaced in certain scientific circles.(Epstein LH, Carr KA, et al 2011, Moller P, Köster EP :2012, Epstein LH, Bouton ME:2012).To solve this problem, Gastrophysics provides a route to encourage people of all ages to engage with science. The potential benefits of this stream is to society, are incalculable – improving diet to reduce obesity and improve health, bettering social cohesion though combined family activities, and creating a more scientific literate society. Erik van der Linden proposed that gastrophysics is not just finding some piece of 'physics' to apply, not just 'physics to go', but new physics, in the broadest understanding of the phrase, needs to be developed.

There are numerous areas where researching the physics in the kitchen can lead to new techniques that can be applied to more conventional branches of physics .The most important aspect of using the kitchen as an experimental laboratory is that is provides a route to encourage people of all ages to engage with science in a way that is not otherwise possible and creating a more scientific literate society.

The integration of physics and gastronomy should be incorporated in BSc and MSc programme. The questions raised here are the key challenges facing by the physicist and would be incomplete without addressing link between physics and gastronomy. Gastrophysics can make important contribution in this regard.

CONCLUSION

Current era is of emerging trends of various scientific discipline including interdisciplinary sciences. Gastrophysics includes broadly physics, chemistry, food sciences, environment, behaviour of human beings and their health. Hence this interfacing of substrate is needed to address for the society benefits and belief. This paper illustrated the term Gastrophysics and it's need for today ,tomorrow and future.

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