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The Relationship between Molecular Gastronomy
and Competitive Advantage of Egyptian
Restaurants from the Point Of View of Chefs by
Using the Five Forces Model

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المخلص

تبحث صناعة المطاعم باستمرار عن تقنيات جديدة للابتكار الغذائي والتي منها فن الطهي الجزيئي، لإنتاج أطعمة ذات جودة أفضل وإدخال أدوات ومنتجات وطرق جديدة للطهي. يستخدم فن الطهي الجزيئي الأساليب العلمية لفهم التغييرات الفيزيائية الكيميائية التي تحدث في الأطعمة والتحكم فيها بشكل أفضل أثناء تحضيرها واستهلاكها، مع التركيز على الاستمتاع بالطعام. يهدف هذا البحث إلى دراسة العلاقة بين فن الطهي الجزيئي والميزة التنافسية للمطاعم المصرية من وجهة نظر الطهاة باستخدام نموذج القوى الخمس. يعد نموذج القوى الخامسة أداة رائعة لتحليل المنافسة في صناعة المطاعم، ويمكن تحليل المنافسة من خلال تهديد الدخول الجديد، وتهديد الاستبدال، وقوة المورد، وقوة العميل، ودرجة التنافس. تم اختيار مدينة القاهرة كعينة ممثلة لمطاعم الخمس نجوم المصرية نظراً لشعبيتها وكثرة مطاعمها من فئة الخمس نجوم. لتحقيق هدف البحث، تم تصميم أسئلة مقابلة شخصية وتوزيعها على الطهاة التنفيذيين لمطاعم الخمس نجوم الذين يطبقون تقنيات فن الطهي الجزيئي في مطاعمهم، حيث أوصى أن يكون للمطعم قائمة طعام محددة ومنفصلة تعرض مجموعة من أطباق فن الطهي الجزيئي المتنوعة؛ حتى يمكن للعملاء الاختيار من بينها، لكي يخفف ضغط العمل على قائمة الطعام التقليدية.

الكلمات المفتاحية: فن الطهي الجزيئي، الميزة التنافسية، القوى الخامسة، الابتكارات الغذائية، المطاعم المصرية.

Abstract

The restaurant industry is constantly looking for new food innovation techniques, such as molecular gastronomy "MG," to produce higher-quality foods and introduce new tools, products, and cooking methods. With a focus on food enjoyment, molecular gastronomy employs scientific methods to better understand the molecular, physicochemical changes that occur in foods during preparation and consumption. Using the five forces model, this study aims to investigate the relationship between molecular gastronomy and competitive advantage in Egyptian restaurants from the perspective of chefs. Five Forces "5F" model is a fantastic tool for analyzing restaurant industry competition, and it can be used to analyze competition based on Threat of New Entry, Threat of Substitution, Supplier Power, Customer Power, and Competitive Rivalry. Because of its popularity and large number of five-star restaurants, Cairo was chosen as a representative sample of the Egyptian five-star restaurant society. To achieve the research aim, a personal interview was designed and distributed with executive chefs of five-star restaurants who implement molecular gastronomy techniques in their restaurants. It is recommended that the restaurant has a set menu offering a variety of molecular gastronomy dishes; where customers can choose from, in order to relieve the pressure of work on the traditional menu.

Key Words: Molecular Gastronomy, Competitive Advantage, Five Forces, Food Innovations, Egyptian Restaurants.

Introduction

With the increasing importance in food and cooking in recent years, the desire to understand the chemical and physical principles that determine the nature of what we eat (**Guiné *et al.*, 2016**). As a result of these developments, food and beverage companies have been on the lookout for new products, as well as different cooking and serving techniques, in order to maintain their competitiveness in the restaurant industry (**Ruiz *et al.*, 2013**). As a result, they have begun to incorporate molecular gastronomy into restaurant menus (**Caporaso and Formisano, 2016**). As a result of this situation, chefs and food companies have engaged in competitive efforts to constantly renew themselves and present their art more freely in restaurants in order to meet their customers' expectations to seek out different tastes (**Mărcuță *et al.*, 2014**). Furthermore, restaurants that use molecular gastronomy to surprise their guests with different flavours make more money than other restaurants (**Sivakumaran and Prabodhani, 2018**).

Research's Problem & Questions

Customers prefer restaurants that serve innovative dishes and avoid those that serve traditional dishes because they bore those (**Ruiz *et al.*, 2013**). Restaurants, on the other hand, place a high value on staying current with scientific developments, following modern trends, and striving to provide everything new by changing the menu

and offering innovative foods in order to increase the number of their customers and attract a new segment of customers (Mărcuță *et al.*, 2014). Although molecular gastronomy arrived in southern Mediterranean countries such as Lebanon, Jordan, Egypt, Tunisia, and Morocco much later than in northern countries such as "France, Spain, Portugal, Greece, and Cyprus" (This, 2014). Although Egyptian restaurants rarely apply molecular gastronomy techniques in order to achieve competitiveness, the problem of the study lies in identifying the extent to which Egyptian restaurants apply molecular gastronomy from the point of view of chefs by using the five forces model through some questions, which are as follows:

1. What are the techniques and food additives of molecular gastronomy currently implementing in restaurants?
2. What are equipments and tools used in molecular gastronomy techniques?
3. To what extent are restaurants seeing molecular gastronomy as a competitive advantage?
4. What is the five forces analysis (Threat of New Entrants "Molecular Gastronomy", Threat of New Substitutes Products "Food Additives", Bargaining Power of Suppliers "Supplier Power", Bargaining Power of Customers "Customer Power", and Competitive Rivalry "Degree of Competition") of applying molecular gastronomy in restaurants?

Research Limitations

- Place limitations: Due to the difficulty of surveying chefs in all Egyptian restaurants, Cairo was chosen as a representative sample of the Egyptian five-star restaurant society, with (51) five-star restaurants, representing (44.3%) of Egypt's total number of five-star restaurants (115).
- Human limitations: represented in chefs of five-star restaurants who implementing molecular gastronomy techniques in their restaurants.
- Time limitations: represented in addressing personal interviews questions to the investigated chefs in the period from “November, 2021 to January, 2022”.

Literature Review:

1. Competitiveness in Five-star Restaurants

Five-star restaurants still have a competitive advantage in terms of food. In terms of applications healthy/nutritious food items, menu creativity, food innovation, and local food use in menu development as unique factors influencing restaurant selection (**Alonso et al., 2013**). To achieve a competitive advantage, FDRs must continuously meet the varying demands of prospective target customers (**Eliwa, 2014**). Dining at five-star restaurants is motivated by more than just basic needs; thus, luxury restaurants cater to their customers' desires and needs and delve deeply into them, in addition five-star restaurants can achieve a long-term competitive advantage

through innovative menus, customized services, and innovative activities (**Chin and Tsai, 2013**).

According to **Ruiz et al., (2013)**, one of the important significant predictors of competitive advantage is food innovation, which food has become one of the basic factors of the restaurant experience, and there is no doubt that the food has a major impact on customer satisfaction, thus achieving the restaurant's competitive advantage. Restaurant industries were facing a critical challenge in providing quality food innovations that not only entice customers but can also be more profitable for business competitors (**Hsu et al., 2018**).

The concept of molecular gastronomy, which has gained popularity in recent years in the world of gastronomy, it is believed that the world's most famous chefs are still working on molecular gastronomy techniques. Among the most successful chefs are those who use molecular gastronomy techniques (**Cömert and avuş, 2016**). Molecular gastronomy is currently popular because this new cooking method can create brand new and wonderful products that can satisfy customers' curiosity and the psychology of novelty (**Spence and Youssef, 2018**).

2. Molecular Gastronomy as a Driver for Competitiveness

Gastronomy was included as a word in the French language and defined as "the art of good food" (**Ruiz et al., 2013**). Gastronomy has become a driving force in increasing the competitiveness of restaurants in recent years (**Banjac et al., 2016**). Gastronomy is becoming a major

driver of food innovation, with the French branch of a food movement known as "molecular gastronomy" defining it as the use of experimental sciences and laboratory apparatuses to advance the culinary arts (**Slavich et al., 2020**).

Chefs play an important role in the development of new food products by actively participating in the generation of ideas, process development, and final applications (**Tragardh, 2018**). Chefs have used food innovation tools such as molecular gastronomy, liquid nitrogen, rotary steamers, ultrasonic mixers, and other laboratory type equipment to create radically different food items such as vodka mayonnaise and transparent pasta stuffed with caviar (**Slavich et al., 2020**). Molecular gastronomy techniques can be used to prepare a variety of items and are not limited to a single type. It can also be served in any type of restaurant where chefs are familiar with the application of these techniques; however, molecular gastronomy dishes may require special tools and equipment for serving, necessitating the addition of additional staff to serve those dishes (**Gdanskiy et al., 2019**).

Because all food additives are healthily safe, molecular gastronomy can be eaten by people of all ages and demographics, including children, adolescents, adults, the elderly, and those on diets. Furthermore, molecular gastronomy dishes can be served either inside or outside the restaurant, and these dishes have the ability to retain their properties in terms of shape or texture, which are important factors that customers consider (**Caporaso and Formisano, 2018**).

According to **Guiné *et al.*, (2016)**, gastronomic developments and new gastronomic trends have become an increasingly important factor in shaping unique tourist experiences. According to World Tourism Organization “**UNWTO**” (2017), molecular gastronomy dishes are healthy because most food additives are of natural origin and have been approved by the FDA "Food and Drug Association," which stated that food additives have no effect on health and are completely safe for the human body. **Klaysung (2019)** emphasized the importance of memorable food experiences, and thus molecular gastronomy as a driving force for increasing restaurant competitiveness, despite the fact that molecular gastronomy dishes require more time to prepare. The flavor of molecular gastronomy dishes is not different from the raw materials, and food additives do not change the flavor but work to change the texture and shape, which attracts and fascinates customers to try these dishes.

3. Molecular Gastronomy Techniques and Food Additives

The most significant element of molecular gastronomy techniques is playing with the molecular structure of food materials by utilizing the opportunities provided by technology while also presenting materials that are not thought to come together in order to create food innovation (**Ruiz *et al.*, 2013**). Spherification, Gelification, Emulsification, Thickening, Effervescence, Transformation, Liquid Nitrogen Technique, and Sous-Vide Technique are the most popular and widely used molecular gastronomy techniques (**This, 2013; Arons, 2015, and D'Angelo *et al.*, 2016**). These techniques have been enhanced with some

food additives to ensure their completeness, and in the modern era, it is simple to trade and import food additives, which are available from a variety of suppliers (**Gourmet Food World, 2021**). Food additives used in molecular gastronomy are substances with precisely known chemical compositions that cannot be consumed as food or as an ingredient of food; these are added to food to enhance their technological and sensory properties, much like in the technological process of production, during food preparation and processing (**Gomes *et al.*, 2020**).

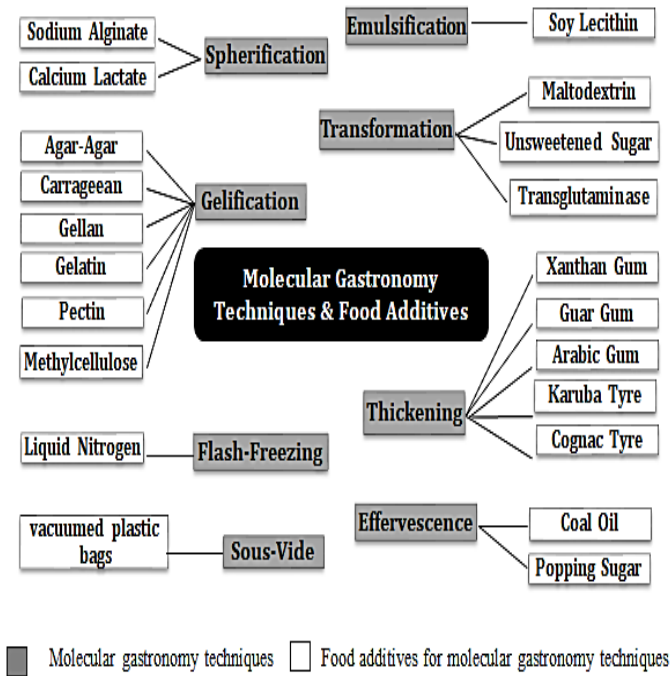


Figure (4): Molecular Gastronomy Techniques & Food Additives

Source: Developed by the researchers

3.1 Spherification Technique

Spherification has been defined as the "culinary process of shaping a liquid into spheres held together by a thin gel membrane that visually and texturally resembles caviar" (Lee and Rogers, 2012). It is a novel method of transforming food without the use of heat. Two food additives that can be used with technique are sodium alginate and calcium lactate, both of which are derived from natural sources (Halford, 2014).

3.2 Gelification Technique

Gelification is the process of converting a liquid into a gel with firmness ranging from soft or weak to hard or tough, with the help of a special gelling agent, this technique is extremely versatile and can be formed into any shape (**Ruiz et al., 2013**). According to **Caporaso and Formisano (2018)**, there are six different food additives that can be used with technique, all of which are derived from natural sources, including agar-agar, gelatin, carrageenan, gellan, pectin, and methylcellulose. It can also be used to make mousses and jellies, as well as to flavour cocktails, pastries, puddings, custards, and confections (**William Reed Business Media Ltd, 2020**). According to **Sivakumaran and Prabodhani (2018)**, the quality of food additives used in molecular gastronomy dishes is heavily influenced by the credibility of the supplier with whom the restaurant works.

3.3 Emulsification Technique

The emulsification technique is used to turn any liquid into light and tasty foam (**Caporaso and Formisano, 2016**). Soy Lecithin is the food additive used in this technique; it is a protein found in soy that has the unique property of stabilizing foams (**Molecule-R., 2020b**). The emulsifier can be used to achieve an unusual equilibrium between air and liquid, allowing air bubbles to be incorporated and retained in any watery solution (**Sivakumaran and Prabodhani, 2018**). The emulsification process necessitates the use of specialised equipment such as shakers, hand blenders, or whippers (**Molecule-R 2020a**).

3.4 Thickening Technique

The thickening technique increases a substance's viscosity without affecting its other properties (**Gomes et al., 2020**). This technique can thicken solutions with five different food additives: xanthan gum, Arabic gum, Gur gum, Karuba tyre, and Cognac tyre (**Molecule-R., 2020d**).

3.5 Effervescence Technique

When one of the food additives causing this technique is added, effervescence is the process of escaping gas that causes smoke (**This, 2013**). In this technique, two additives are used, Coal oil and granulated sugar (**Razvozova, 2017**). Popping sugar is a sugar that contains carbon dioxide, which causes the fizzing (**Mărcuță et al., 2014**). Coal oil is an oil that has been infused with wood-derived substances to give it the smell, flavor, and taste of charcoal (**This, 2014**).

3.6 Transformation Technique

Transformation is a molecular gastronomy technique that alters the composition of a food item (**Graham, 2016**). Maltodextrin, unsweetened sugar, and transglutaminase are the food additives used in this technique (**Caporaso and Formisano, 2016**). Maltodextrin and unsweetened sugar have the ability to turn fatty oil into powder (**Molecule-R., 2020b**). Transglutaminase, also known as "meat glue," is an enzyme that can be used to bind proteins to create uniform portions of fish, meat, and chicken, among other things, that cook evenly (**Erdem et al., 2020**).

3.7 Flash Freezing Technique

Flash freezing is a common technique used by molecular gastronomists and involves the use of liquid nitrogen,

which has a temperature of about -196°C . (**Berrizbeitia et al., 2010**). Because of this feature and innovative chefs, it was used to immediately freeze food and drinks, create steam, fog, and an impressive cloud when exposed to air (**Ruiz et al., 2013**). This method is commonly used in quick ice cream production and various visual presentations (**Comfort Zone, 2014**). Because of the short time it takes to freeze ice cream with liquid nitrogen, the crystals are very small, and the ice cream has a very creamy and smooth texture, when quickly freezing food, it sometimes leaves a liquid center, but this is due to the use of a bowl of liquid nitrogen dubbed TeppanNitro (**De Solier, 2010**). Chefs later began using an appliance called Nitral, which has a metal surface that freezes rather than cooks (**Ruiz et al., 2013**).

3.8 Sous-Vide Technique

Sous Vide is a French term for cooking food in heat-proof vacuumed plastic bags at low temperature for an extended period of time by applying the desired level of temperature " $65-96^{\circ}\text{C}$ " (**Baldwin, 2012**), after vacuuming in the package of the food which is formed alone or with other auxiliary products (sauce-spices) and stored under cold conditions ($1-4^{\circ}\text{C}$) to block the effect provided by oxidative and aerobic bacteria development (**Del Pulgar et al., 2012**). Sous Vide, also known as vacuum cooking technology, is now widely used in restaurants and the food industry, particularly in the preparation of meat, fish, and their derivatives (**Espinosa et al., 2015**). According to **Jeong et al. (2018)**, the sous-vide technique is the most well-known molecular culinary technique used in many restaurants because many customers want and prefer to eat their dishes this way.

4. Porter's Five Model as a Tool of Competitive Advantage Analysis

Competition is frequently viewed narrowly, identifying threats only from today's direct competitors. Michael Porter's five forces model of competitive advantage proposes a compelling view on how a firm can achieve competitive advantage in a specific industry by leveraging the industry's five imperative forces (Anton, 2015).

Five Forces Analysis (Porter)

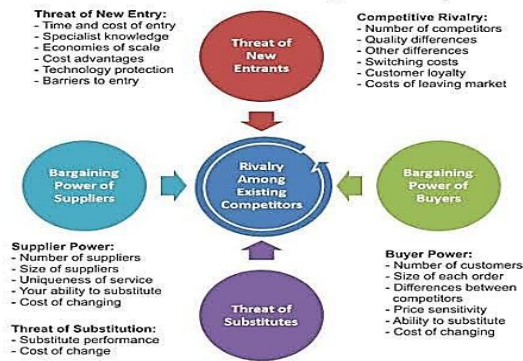


Figure (2): Porter's Five Forces

Source: Designed by the researchers based on Porter, (2008).

The Porter five forces model is a fantastic tool for analyzing industry competition; it also studied industry elements to present the degree of competition, and it can be applied to virtually any industry segment (Mehjabeen, 2018). The Five Forces model has been widely used in many industries to depict a complete market landscape in

order to identify what could be done to benefit from the five forces (Anastasiu, *et al.*, 2020).

1. Threat of New Entrant: The ease with which new competitors can enter the market (and potentially drive down prices).
2. Threat of Substitution: The degree to which different products and services can be substituted for one's own.
3. Supplier Power: The ability of suppliers to raise input or raw material prices.
4. Customer Power: The ability of customers to influence price reductions.
5. Competitive Rivalry: The industry's level of competition.

Research Methodology:

The study focused on Egypt's five-star restaurants. Egypt has (115) five-star restaurants, according to Chamber of Tourism Establishments "CTE", (2021). However, due to time, cost, and data constraints, it was extremely difficult to study all five-star restaurants. As a result, the study was conducted in (23) five-star restaurants in Cairo, which represents (44.3%) of Egypt's total number of five-star restaurants. This is due to two factors:

- Cairo was chosen as a representative sample of the Egyptian five-star restaurant society due to its popularity, and it has the most number of five star restaurants (51) compared to other cities in Egypt "for

example, Alexandria (10), Louxor (2), Giza (42), Port Said (1), Red Sea (6), South Sinai (3), (Chamber of Tourism Establishments "*CTE*", (2021).

- Five-star restaurants were chosen as a symbol of maturity, a desire for improvement, innovation, and increased competition in order to achieve a high level of customer satisfaction. As a result, it must adopt a new strategy in order to focus on new food innovations and stay current on industry developments. Furthermore, focusing on all restaurant grades in a single study is impractical.

The research tool consisted of interview questions with (23) executive chefs from five-star restaurants who use molecular gastronomy techniques in their establishments. Executive chefs were chosen based on their previous work experiences and professional knowledge. This interview included twenty (20) questions in the form of a "Porter's Five Forces Analysis."

Results and Discussion

The researchers asked the chefs a series of questions focusing on their demographic data, the percentage of molecular gastronomy dishes on the menu, the percentage popularity of these dishes, the techniques and food additives used to apply molecular gastronomy dishes in a restaurant, the extent to which chefs see molecular gastronomy as a competitive advantage, the molecular gastronomy concept from a chef's perspective, and a variety of questions related to five forces analysis (Threat of New

Entrants "Molecular Gastronomy", Threat of New Substitutes Products "Food Additives", Bargaining Power of Suppliers "Supplier Power", Bargaining Power of Customers "Customer Power", and Competitive Rivalry "Degree of Competition").

1. Demographic Data Analysis of the Chef Questions

The following table represents the demographic data of interviewees.

Table (1): Demographic Data of Chefs.

Attribute	Chefs of Five Star Restaurants in Cairo (N = 23)	
	No.	%
Age		
Less than 30 years	8	34.8
30 – 50 years	12	52.2

Continue

Continued

More than 50 years	3	13
Education Level	23	100%
Intermediate " <i>Vocational - Secondary Degree</i> "	7	30.5
Above Intermediate " <i>Hotel Secondary School</i> "	10	43.5
University " <i>Bachelor's Degree</i> "	4	17.4
Postgraduate Studies " <i>Diploma - Masters - Ph.D.</i> "	2	8.6
Years of Experience	23	100%
Less than 5 Years	6	26.1
5 – 10 Years	13	56.5

More than 10 Years	4	17.4
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According to table (1), the majority of the interviewees (52.2 %) were between the ages of 30 and 50; (34.8 %) were under the age of 30, and (13 %) were over 50. This finding indicates that the majority of chefs who use molecular gastronomy are young.

Regarding the previous table, among the (23) interviewees, a high proportion of the tested sample (30.5 %) has an above Intermediate educational "Hotel Secondary School," and (43.5 %) has an intermediate educational "vocational - secondary degree," followed by chefs who have a university educational "bachelor's degree" with a bachelor's degree (17.4 %). Chefs with postgraduate degrees "Diploma-Master-Ph.D." made up the smallest group and was represented by (8.6 %). This finding indicates that the majority of chefs who use molecular gastronomy have a secondary hotel education, which allows them to gain more knowledge and skill about new food developments and innovations.

Concerning years of experience, a large proportion of the tested sample (56.5%) had 5-10 years of experience, while 26.1 % had less than 5 years. Chefs with more than ten years of experience constituted the smallest group and were represented by (17.4%). This result indicates that the application of molecular gastronomy is not a difficult or complicated technique that requires many years of experience, as most chefs who use this modern trend have an average of years of experience. This finding contradicts the findings of **William Reed Business Media Ltd (2020)**,

who demonstrated that the application of molecular gastronomy is dependent on the chef's knowledge, skill, and more experience in the extent of optimal use of food additives and knowledge of implementing the finest and best dishes in molecular gastronomy.

2. Objective Data Analysis of the Chef Questions

Six questions are included in this section. These questions are designed to elicit objective data relevant to the study's objectives. The objective data of interviewees are represented in the table below.

Table (2): Objective Data of Chefs.

Question	(N = 23)	
	Freq.	%
1) Does the restaurant apply molecular gastronomy dishes?		
Yes	23	100
No, "Thank you for your cooperation."	0	0
2) What percentage of molecular gastronomy dishes are on the menu?		
10% - less than 25%	20	87
25% - less than 50%	3	13
50% - less than 75%	0	0
More than 75%	0	0
3) What percentage popularity of molecular gastronomy dishes?		
10% - less than 25%	11	48
25% - less than 50%	7	30.3
50% - less than 75%	5	21.7

More than 75%	0	0
4) What techniques and food additives are used to apply molecular gastronomy dishes in a restaurant?		
Gelification " <i>Agar-Agar, Gelatin, Carrageenan, Pectin</i> "	3	13
Thickening " <i>Xanthan Gum, Gum Arabic, Guar Gum</i> "	1	4.3
Spherification " <i>Sodium Alginate & Calcium Lactate</i> "	3	13
Sous-Vide " <i>Vacuum Bags / low temperature / long time</i> "	6	26
Flash-Freezing " <i>Liquid Nitrogen / 196 ° C</i> "	2	8.7
Emulsification " <i>Soy Lecithin</i> "	1	4.3
Transformation " <i>Meat Glue (Transglutaminase)</i> "	3	13
Effervescence & Smoking " <i>Smoking Gun, Coal Oil</i> "	4	17.4
5) To what extent do you see molecular gastronomy as a competitive advantage?		
Prices & Cost of Dishes	4	17.4
Quality of Dishes	3	13
Flexibility & Variety of Dishes	4	17.4

Continue

Continued

Delivery & Time of Dishes	2	8.7
Innovation & Technology of Dishes	10	43.5

The results of the objective data questions for the chef interviews are illustrated as follows:

- Q1:** According to the results of the personal interviews, the majority of chefs have sufficient awareness and vision to implement molecular gastronomy dishes in their restaurants. This finding is consistent with the findings of **This (2014)**, who stated that molecular gastronomy chefs must have awareness, sufficient knowledge, and skills to apply molecular gastronomy techniques.
- Q2:** Through the previous table, the percentage of molecular gastronomy dishes on the menu, the majority of the interviewees (87 %) were in the category of 10% less than 25%; (13% of the interviewees) were in the category of 25% less than 50%. While none of the chefs chose an answer in the 50 % less than 75 % or more than 75 % categories. This finding indicates a low prevalence of molecular gastronomy dishes and techniques on five-star restaurant menus. This result also contradicts **Gomes et al., (2020)**, who stated that molecular gastronomy has grown in recent years as a result of increased customer awareness and desire to try innovative new dishes.
- Q3:** Following the previous question and following the same steps, the percentage popularity of molecular gastronomy dishes was discovered that the majority of the interviewees (48%) were in the category of 10% less than 25%; (30.3%) of the interviewees were in the category of 25% less than 50%; and (21.7%) of the interviewees were in the category of 50% less than 75 %. While none of the chefs chose a response in the category older than 75 years. This result contrasted with **Slavich et al., (2020)**, who stated that molecular

gastronomy techniques have recently begun to attract a large number of customers who want to experiment with and eat these innovative dishes.

- Q4:** The results of this question's analysis show that the majority of chefs agreed to use these molecular gastronomy techniques (Gelification, Spherification, Sous-Vide, Transformation, and Smoking) in their restaurants, with the majority of chefs (48 %) selecting the Sous-Vide technique. This result agrees with **Jeong *et al.*, (2018)**, who stated that the sous-vide technique is the most well-known molecular culinary technique used in many restaurants because many customers want and prefer to eat their dishes cooked in this manner.
- Q5:** The results of this question's analysis show that the majority of chefs agreed to use these molecular gastronomy techniques (Gelification, Spherification, Sous-Vide, Transformation, and Smoking) in their restaurants, with the majority of chefs (48 %) selecting the Sous-Vide technique. This result agrees with **Jeong *et al.*, (2018)**, who stated that the sous-vide technique is the most well-known molecular culinary technique used in many restaurants because many customers want and prefer to eat their dishes cooked in this manner.
- Q6:** According to the majority of chefs, the concept of molecular gastronomy is the use of natural and artificial food powders to create new dishes with an appealing shape, texture, and color that fascinate customers and break their boredom, thereby

increasing the restaurant's profitability. This result agrees with **This (2013)** who defined molecular gastronomy as "the use of food powders and chemical composition to produce the most delicious dishes and interesting effect to customers."

3. Five Forces Analysis of the Chef Questions

This section contains total of (20) questions. These inquiries were about the five forces analysis. (Threat of New Entrants "Molecular Gastronomy", Threat of New Substitutes Products "Food Additives", Bargaining Power of Suppliers "Supplier Power", Bargaining Power of Customers "Customer Power", and Competitive Rivalry "Degree of Competition"). The following are the results of the five forces analysis questions for the chef interviews:

3.1: Threat of New Entrants (Molecular Gastronomy)

1. What is the growth and spread rate of molecular gastronomy dishes? According to the chef's responses, this is a low rate, representing 10% of the total dishes on the restaurant's menu, and this percentage is due to the menu containing molecular gastronomy dishes using the sous-vide technique and the smoking technique, and the reason for the low rate is the long time and duration of preparing these dishes. This result agrees with **Jeong et al., (2018)**, who stated that the sous-vide technique is the most well-known molecular culinary technique used

in many restaurants because many customers want and prefer to eat their dishes cooked in this manner.

2. To what extent does the restaurant protect its market share of molecular gastronomy dishes? The restaurant helps to protect the molecular gastronomy dishes by not displaying the method of preparation and not listing the ingredients on the menu. The executive chef maintains the standard recipe for these dishes because he regards it as the secret to the restaurant's success. This finding is consistent with **Arons (2015)** who observed that several factors contribute to the restaurant's market share of molecular gastronomy dishes, including the standard recipe, the chef's experience and skill, the quality of food additives, and the credibility of the supplier with whom the restaurant works.
3. What are the restaurant's obstacles of applying all molecular gastronomy techniques? These obstacles can be identified in the following points based on the chefs' responses: Preparing molecular gastronomy dishes requires more time and effort, and the prices and costs of food additives used to prepare molecular gastronomy dishes are high and expensive. One of the issues that restaurants face when receiving food additives from suppliers is the continuous withdrawal process. If a large number of food additives are requested by restaurants and the demand for them rises, suppliers will raise the price of those food additives. This result also

contradicts **Gomes et al., (2020)**, who stated that food additive prices have decreased in recent years due to the expansion, spread, and increased desire to experiment with molecular gastronomy dishes.

4. *Does the restaurant have skilled chefs and knowledge of applying molecular gastronomy techniques?* Through the answers of the chefs, it was discovered that there are chefs with sufficient knowledge, skill, and awareness of the application of the art of molecular cooking, by assisting the general chef when preparing these dishes and training them to apply these techniques through restaurant management, in addition to their participation in culinary competitions that are characterized by creativity and innovation and keeping abreast of everything that is new in the world. This result is consistent with the results of **This (2014)**, who stated that molecular gastronomy chefs must have awareness, sufficient knowledge, and skills to apply molecular gastronomy techniques.
5. *How does restaurant management promote molecular gastronomy dishes?* According to the chef's responses, the restaurant management promotes molecular gastronomy dishes in a variety of ways, including photographing those dishes during a so-called (photo session) and downloading those images through the marketing social networking pages Facebook and on their website, and the executive chef himself promotes

these dishes. Using the up-selling method, particularly in (life cooking) restaurants, as well as restaurant management electronic mobile applications such as Menus & Madelia, and using vouchers that customers can use to try molecular gastronomy dishes. This result is agreement with the predictions of **Slavich *et al.* (2020)**, who stated that the majority of restaurants promote and market their innovative molecular gastronomy dishes through social media, which has become the most popular and acceptable marketing method today.

3.2: Threat of New Substitutes Products (Food Additives)

6. How many food additives are used to apply molecular gastronomy dishes, and what is their conformity with the standard specifications? The number of food additives ranges from 2% to 10%, according to the molecular gastronomy techniques used inside the restaurant and their conformity with the standard specifications is due to the supplier, its credibility, and the quality of the food additives, according to the chef's answers. This finding is consistent with **Sivakumaran and Prabodhani (2018)**, who stated that the quality of food additives used in molecular gastronomy dishes is heavily influenced by the credibility of the supplier with whom the restaurant works.

7. What is the quality of the food additives needed to apply molecular gastronomy dishes? The quality of imported food additives differs from that of local food additives, according to the chef's answers, because imported food additives are of higher quality and effectiveness in the implementation of molecular gastronomy dishes. The quality of food additives can vary depending on the chef's skill and awareness of the proper use of these food additives, their components, and the method of application. This result is consistent with the findings of **William Reed Business Media Ltd (2020)**, who demonstrated that the quality of food additives is dependent on the chef's knowledge and skill in the extent of optimal use of food additives and knowledge of implementing the finest and best dishes in molecular gastronomy.
8. What are the costs of transferring and receiving the food additives needed to apply molecular gastronomy dishes in the restaurant? According to the chef's responses, the costs were previously exorbitant. Food additives for molecular gastronomy dishes became less expensive as time passed and the restaurant industry in Egypt expanded. These costs are summarized based on the restaurant's strength, management, and target segment, where these costs are placed on the dishes where they are added to the customer's check when they order molecular gastronomy dishes. This result is consistent

with **Gomes *et al.*, (2020)**, who stated that the prices of food additives have decreased in recent years as a result of the expansion, spread, and increased desire to experiment with molecular gastronomy.

9. *Does the restaurant face obstacles when receiving food additives?* According to the chef's responses, when receiving imported food additives from outside Egypt, the restaurant faces challenges such as customs, shipping costs, and health control, because the shape of some food additives resembles the shape of drugs. This result agrees with **Gaikwad *et al.*, (2019)**, who noted that there are some obstacles that restaurants face, particularly when receiving food additives, such as strict customs inspection, control, shelf life, and health inspection, which impedes the receipt of food additives and causes them to expire quickly.

3.3: Bargaining Power of Suppliers (Supplier Power)

10. *What are food additives does the restaurant import from suppliers?* It was discovered from the chef's responses that the molecular gastronomy food additives that the restaurant imports from suppliers are in accordance with the molecular gastronomy dishes and techniques that are applied and used inside the restaurant, including "***Agar-Agar, Pectin, Xanthan Gum, Soy Lecithin, Smoking Oil, Sodium Alginate, and Calcium Lactate.***"

11. How many suppliers does the restaurant deal with in purchasing food additives for molecular gastronomy dishes? According to the chef's responses, the number of suppliers ranges between two and three, and there are many local companies that supply food additives used in the application of molecular gastronomy dishes, such as "*Glaze Hotel Service, Seafood Factory, Zumra, Food Staff, and Almera Company.*" In the absence of certain food additives, restaurants will be imported via well-known commercial sites for the supply of food additives used to apply molecular gastronomy dishes, such as "*Amazon.com, Alberty Ferran Adria.com, and Ali Baba.com.*"
12. Does the restaurant require some food additives from suppliers outside Egypt, and what is the cost of these food additives? The chefs responded that the restaurant occasionally requests food additives from suppliers outside Egypt, but they are expensive, whereas most of the time the restaurant requests food additives from a supplier within Egypt, and if some food additives are not available in Egypt, the supplier imports them and sends them to the restaurant, provided that the restaurant management bears the cost inclusive of 14 % (Customs + VAT). This result contradicts the findings of **Razvozova (2017)**, who stated that restaurants must deal with local suppliers in order to receive food additives quickly and without delay.

13. Is it possible to dispense with suppliers of food additives by replacing them with another food item? It was observed through the chef's responses that some food additives can be omitted and replaced. Agar-agar, for example, can be replaced with gelatin, but the nutritional quality is not the same. Because agar-agar is of vegetable origin, but gelatin is of animal origin, this is considered a commercial fraud. This finding contradicts the research results of **Tragardh (2018)**, who stated that food additives have structural and nutritional properties, that the method of implementation is different, and that one food additive cannot be replaced with another.
14. Is there a difference and disparity in food additives for molecular gastronomy dishes from one supplier to another? It was discovered through the chef's responses that there is a difference because there are several types of food additives (first sort, second sort, third sort), and this is due to the credibility of the supplier that the restaurant deals with, and these differences are represented in (color, presentation, quantity, effort in using it, validity period) as some food additives are not pure. This finding is consistent with the results of **Spence and Youssef (2018)**, who stated that there are many different types of food additives whose degree varies depending on the country of origin, the percentage of extraction, and the materials added to

them, as purely natural food additives are among the best food additives that can be used in the application of molecular gastronomy dishes.

3.4: Bargaining Power of Customers (Customer Power)

15. *Is there a high demand for molecular gastronomy dishes, and to what extent do you see their response?*

According to the chefs' responses, there is a high demand, as customers dislike new dishes and prefer to eat dishes that are impressive in shape and taste. However, some molecular culinary dishes are distinguished by shape over taste, and to avoid this, distillation technology is used to extract a food product with a strong smell, color, and taste, and then use it again in the implementation of molecular gastronomy techniques. This result agrees with **Slavich et al., (2020)**, who stated that molecular gastronomy techniques have recently begun to attract a large number of customers who want to experiment with and eat these innovative dishes.

16. *Is there a threat if restaurant customers back away from trying molecular gastronomy dishes?*

It was discovered through the chef's responses that the restaurant will face a threat if customers decline to try these dishes, as the restaurant will reduce its sales due to failure to follow modern developments and technologies and not to attract new customers. In the

event of this threat, restaurants can refer to the customer comment card to find out why customers' demand for those dishes has declined. This result agrees with **Banjac (2016)**, who explained that customers are the nucleus and main forces to move any restaurant, in order to choose any preferred technologies for customers, in order to satisfy the needs and desires of permanent and recurring customers, and thus will return to the restaurant with financial gains and benefit, as it becomes at the forefront of competitive restaurants for its same specialty.

17. *Do customers require a variety of dishes of molecular gastronomy techniques?* Customers demand multiple molecular gastronomy dishes, according to the chef's responses, and this is due to the variety of tastes, desires, and needs of customers to try new non-traditional dishes to break their boredom barrier. This finding is consistent with the result of **Spence and Youssef, 2018 (2018)**, who demonstrated that customer needs and desires are constantly changing and that in order for the restaurant to keep up with these changes, molecular gastronomy dishes must be varied within the menus it serves.

3.5: Competitive Rivalry (Degree of Competition)

18. How many competitors (competing restaurants)?

According to the chef's responses, competitive restaurants vary depending on their location and the services they provide, and their number averages **between 2 and 3 restaurants**, especially direct competitors that provide the same services, food, and beverages.

19. What is the size and strength of the competitors surrounding your restaurant?

According to the chef's responses, the level of competition will be high due to the customers' demand for the concept restaurant that offers all of the newest food innovations, as well as the best and the new together. This result is consistent with **Klaysia (2019)** who observed that restaurant competition is always in the context of innovation, as restaurants strive to provide the best services and products, such as innovative dishes, in order to achieve customer acceptance and continue to innovate everything new in the world of food innovations.

20. Are there many differentiations in molecular gastronomy dishes between competitors?

It was discovered through the chef's responses that it does differ from one competitor to the next. These distinctions are reflected in the creation of dishes, their shape, the manner in which they are prepared, cooked, presented, and the manner in which they are served. The competition must take place within the same

framework, allowing restaurant management to present their new ideas and innovations related to molecular gastronomy. This result contradicts **Caporaso and Formisano (2016)**, who argued that there is no significant difference in the presentation of a technology from one restaurant to another, but the degree of difference is represented in the quality of the food additives and the chef's ingenuity, and thus the restaurant can attract new customers and convert existing customers into permanent customers in restaurant.

Conclusion

This paper has presented an investigation into determining the relationship between molecular gastronomy and competitive advantage of Egyptian restaurants from the point of view of chefs by using the five forces model. To summarize the research results, the majority of chefs who use molecular gastronomy are young; additionally, most chefs who use molecular gastronomy have average years of experience and secondary hotel education, which allows them to gain more knowledge and skill about new food developments and innovations.

According to the research results, there is a low prevalence of molecular gastronomy dishes and techniques on the menus of five-star restaurants. Furthermore, the majority of chefs have enough awareness and vision to implement molecular gastronomy dishes in their restaurants, as well as these molecular gastronomy techniques (Gelification, Spherification, Sous-Vide, Transformation, and Smoking).

Based on the results of the question, to what extent chefs see molecular gastronomy as a competitive advantage, the majority of chefs agreed on dish innovation and technology. Furthermore, the majority of chefs agreed that the concept of molecular gastronomy is the use of natural and artificial food powders to create new dishes with an appealing shape, texture, and color, which fascinates customers and breaks their boredom, increasing the restaurant's profitability.

Finally, this paper confirms that the competition must take place within the same framework in order for restaurant management to present its new ideas and innovations related to molecular gastronomy.

Recommendations

1. The restaurant should design a set menu to offer a variety of molecular gastronomy dishes; where customers can choose from, in order to relieve the pressure of work on the traditional menu.
2. Contracting with reputable and credible suppliers, as food additives are easy to deceive commercially, which affects their quality and the health of customers later.
3. Introducing molecular gastronomy techniques with other traditional dishes in all corners of the menu; in order to dazzle customers in terms of shape, color and texture, which most customers are attracted to at the present time.

4. Chefs exploit the properties of various food additives in creating different and attractive molecular gastronomy dishes in terms of shape, texture and color, in order to break the boredom of customers and satisfy their different and constantly changing needs and desires.
5. Restaurants tend to use modern tools and equipment that reduce the time of preparation of molecular gastronomy dishes in order to approach the standard time for serving dishes.
6. In light of the digital transformation, restaurants must use modern and innovative methods such as mobile applications "menu application", through which images of molecular gastronomy dishes are displayed within the menu, and the most important adequate information about those dishes.
7. The executive chef should use the method of up selling, by presenting samples of molecular gastronomy dishes to regular and repeat customers in the restaurant, in order to motivate customers to try molecular gastronomy dishes, especially in the open kitchen system of restaurants.
8. Participating chefs' restaurant in the culinary competitions that are held annually, to witness and benefit from all the modern culinary ideas in the field of food innovations, including molecular gastronomy.

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