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Short Communication
Nutritional assessment in tasting menu from molecular gastronomy restaurant

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Abstract: In recent years, the demand for molecular gastronomy restaurants has increased worldwide. In these establishments, chefs are cooking with new techniques in order to create new sensory properties. Energy and nutrient have not been evaluated in tasting menus before. However, for the first time, we show that in some of these menus, the energy, fat, cholesterol and sodium values are excessive, i.e. niacin, vitamin A and sodium are higher than the tolerable upper intake levels. Although people visit these restaurants only sporadically, advice for customers with cardiovascular diseases must be specified in the menu and a dietitian should join the multi-disciplinary cooking team.

Keywords: Nutrition, tasting menu, molecular gastronomy

Introduction

In 1988, Hervé This and Nicholas Kurti coined the term "molecular gastronomy", which is defined as the chemistry and physics behind the preparation of any dish (This, 2005a, 2005b, 2006; This and Kurti, 1994). This discipline is a crossover of food science and cooking. Outstanding restaurants around the world are serving unusual dishes using for example agar and nitrous oxide to stabilize warm beef gelatine and sauces, respectively (Yek and Struwe, 2008). Several names of chefs and/or restaurants, some with Michelin stars, have gained worldwide recognition and fame, especially Heston Blumenthal (*Fat Duck*; Bray, England), Grant Achatz (*Alinea*; Chicago, USA), Pierre Gagnaire (*Pierre Gagnaire's*; Paris, France), Gualtiero Marchesi (*Gualtiero Marchesi's*; Milan, Italy), Alvin Leung Bo (*Bo Innovation*; Hong Kong, China), Ferràn Adrià (*El Bulli*; Girona, Spain). Adrià, also called the "Salvador Dali of the Kitchen", has popularized molecular gastronomy (even though he uses the term *haute cuisine*) with his foams and faux caviar (Hoffman, 2009).

A molecular gastronomy restaurant is an atypical establishment where people eat sporadically - compared to fast-food and chain restaurants. It is the least demanded foodservice because there consumers spend an important part of their total food budget, whereas in fast-food restaurants they can choose from a variety of less expensive menus. Food in chain restaurants tends to be less nutritious and higher in calories than food prepared at home (Lichtenstein, 2006; Dumanovsky *et al*., 2009), but what is the situation for molecular gastronomy restaurants? Adrià (2005) suggested that "*...until now we've hardly tackled the topic of dietetics and nutrition in our cooking. Nevertheless, it's just not right to forget this important debate in our society, a debate from which high gastronomy still seems to remain aside. Should dietetics and nutrition have an important part in gastronomy? Would it be necessary, in such an isolated fact as the visit to a gastronomic restaurant, to care about such important parameters on lifestyle? It must be considered that the fact of visiting a gastronomic restaurant rarely takes place more than once a month, and people just do it six times a year, or even less. In collaboration with the main food companies, we have always paid attention to dietetic and nutritional aspects. Even so, owing to the vast amount of meals and the variety of ingredients, it seems really difficult to perceive any precept related to dietetics in a tasting menu. Regarding cooking and health, we usually resort to an illustrative example: Chinese cuisine. As they argued themselves, the gastronomic proposals of this country are always related to health, but this is not an obstacle for it to be a complete gastronomic experience. Without any kind of doubt, this area must be researched upon in the future*...". In our opinion, the future is now.

Nowadays, people sporadically visit molecular gastronomy restaurants searching new organoleptical sensations but there is not any study focussed in nutritional viewpoint of menus served in these establishments. The objectives were to evaluate the tasting menu from molecular gastronomy restaurant according to contained energy and nutrient.

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Methods

This study is the first one evaluating the energy and nutrient values from portions served in a tasting menu, relying on a food composition database network (Rosa *et al*., 2009). The portions evaluated include dishes, petit-fours ("small ovens", which are small cakes generally eaten at the end of a meal or served as part of a large buffet), desserts and tapas (a wide variety of appetizers in Spanish cuisine which may be cold or warm), and they have been taken from a molecular gastronomy restaurant (Adrià *et al*., 2004) and compared with Dietary Reference Intakes (DRIs) (IOM, 1997, 1998, 2000, 2001, 2004, 20005). The statistical analysis of energy/nutrient and year was carried out with a two-tailed paired t test (P-value). Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 12.0 (SPSS Inc., Chicago, Ill., USA). A P value <0.05 was considered significant for all statistical tests conducted.

Results and Discussion

Table 1 shows the mean values and standard deviations of the daily energy and nutrients of a tasting menu from a molecular gastronomy restaurant during four years. Mean energy intake in the tasting menu was from 18.2 to 29.7 MJ in 1992 and 1990, respectively, these values appeared to be higher than DRI (IOM, 2005). The highest values of the carbohydrate and fat intakes were in 1990 and 1993, respectively, but the highest value of protein intake was in 1991. The DRIs (IOM, 2005) recommended 10-35% of daily energy intake for protein, since this value had been obtained in all studied years. However, our values of carbohydrate and lipids are lower (21.0-23.9%) and higher (44.7-57.4.6%) than DRIs (IOM, 2005), with 45-65% and 25-35% of daily energy intake, respectively. The highest value of cholesterol intake in a tasting menu was obtained in 1993 (2546.5 mg). For the cholesterol, the DRIs (IOM, 2005) suggest 256 mg, as a mean value for usual daily intake, but our values are higher for every examined year (Table 1). In our study, the PUFA/SFA ratio is lower than 0.5 and the (PUFA+MUFA)/SFA values are <2, as obtained in 1993. On the other hand, dietary fibre intakes in tasting menus ranged from 27.1 to 43.5 g in 1992 and 1990, respectively, and these values are higher than the Adequate Intakes (AIs) (IOM, 2005), except for men in 1992 and 1993. All studied vitamins were higher than Recommended Dietary Allowances (RDAs) and AIs (IOM, 1997, 1998, 2000, 2001) being niacin higher than 100 mg/day in 1991, and vitamin A intakes higher than 3000 µg/day in 1993. Our values for these vitamins are higher than the tolerable upper intake levels (ULs) (IOM, 1997, 2001, 2004). The demonstrated mineral intakes were higher than RDAs and AIs (IOM, 1997, 2001, 2004) except for calcium in 1992. However, all values of sodium in the examined years were higher than ULs (IOM, 2004).

Nevertheless, the values of energy and nutrient intakes are very high taking into account that a tasting menu is the main meal of a day.

Table 1. Mean values and standard deviations of the daily energy and nutrients from tasting menu in the studied molecular gastronomy restaurant

	1990	1991	1992	1993	Dietary Reference Intakes (DRIs)
Energy(MJ)	29.7±2.9[b]	29.1±3.4[d]	18.2±2.9[b,d,f]	28.9±3.2[f]	9.2♀[g]/12.2♂[g]
Protein (g)	211.4±26.1[b,c]	235.5±15.7[d,e]	180.5±10.7[b,d]	177.2±18.4[c,e]	46♀[h]/56♂[h]
Carbohydrate(g)	418.8±26.9[b]	364.5±40.9[d]	248.2±34.6[b,d,f]	411.2±71.6[f]	130[h]
Fat(g)	404.7±56.0[b]	392.2±50.1[d]	215.3±40.6[b,d,f]	438.6±70.9[f]	74.7[i]
Dietary fibre (g)	43.5±3.4[b,c]	42.2±3.2[d,e]	27.1±5.0[b,d,f]	34.8±3.1[c,e,f]	21♀[j]/38♂[j]
Cholesterol (mg)	1272.7±188.3[a,c]	1455.7±287.8[a,d,e]	1929.2±235.5[c,d]	2546.5±411.2[e]	256[k]
SFA (g)	108.2±36.5[b]	107.2±30.0[d]	50±14.0[b,d,f]	131.5±42.1[f]	25.6[l]
MUFA (g)	173±16.2[b]	158±15.0[d,e]	81.5±19.9[b,d,f]	190.5±20.7[e,f]	28.7[m]
PUFA (g)	51.3±5.6	62.4±3.0[e]	42.4±4.4[e]	48.3±2.8	-
PUFA/SFA	0.5±0.1	0.6±0.2	0.8±0.2[f]	0.4±0.1[f]	-
(PUFA+MUFA)/SFA	2.1±0.9	2.0±0.9	2.5±0.8	1.8±0.7	-
Thiamin (mg)	2.8±0.2[b]	2.5±0.1[d]	1.7±0.3[b,d,f]	2.0±0.1[f]	1.1♀[h]/1.2♂[h]
Riboflavin (mg)	3.3±0.2[b]	3.8±0.3[d]	2.5±0.2 [b,d,f]	3.3±0.3[f]	1.1♀[h]/1.3♂[h]
Niacin (mg)	83.5±1.5[a,b,c]	101.8±1.5[a,d,e]	62.6±2.6[b,d]	62.4±2.1[c,e]	14♀[h]/16♂[h]/100[n]
Vitamin B6 (mg)	4.8±0.5[b]	4.0±0.7	3.2±0.8[b]	3.8±0.9	1.3-1.5♀[h]/1.3-1.7♂[h]/35[n]
Vitamin B12 (µg)	15.3±0.3[a,b,c]	19.7±1.0[a,d]	21.3±0.5[b,f]	17.1±0.6[c,d,f]	2.4[h]
Folate (µg)	827.9±47.3[b,c]	717.3±23.3[d]	466.2±50.6[b,d,f]	644±34.8[c,f]	400[h]/1000[n]
Vitamin C (mg)	183.9±13.5	178.4±58.2	182.1±18.2	191.7±20.3	75♀[h]/90♂[h]/2000[n]
Vitamin A (µg)	2923.1±505.7[c]	2891.5±493.1[e]	2777.5±279.7[f]	4206.9±712.0[c,e,f]	700♀[h]/900♂[h]/3000[n]
Vitamin D (µg)	4.9±0.9[b,c]	3.9±1.8[d,e]	10.1 ±1.5[b,d]	10.3±1.9[c,e]	5-15[j]/50[n]
Vitamin E (mg)	61.2±2.7	63.9±2.1[e]	56.1±3.3	42.7±3.0[e]	15[j]/1000[n]
Vitamin K (µg)	447.8±17.9[b,c]	409.1±22.2[d,e]	281.9±27.8[b,d]	348±34.2[c,e]	90♀[4]/120♂[4]
Panthotenic acid (mg)	14.5±0.5[b]	15.4±1.2[d]	10.2±0.9[b,d,f]	16.2±1.2[f]	5[j]
Biotin (µg)	50.2±5.0	59.8±14.2[d]	34.5±9.6[d]	44.2±12.7	30[j]
Calcium (mg)	1201.3±87.9[a,b]	1590.6±162.2[a,d,e]	1064.3±98.2[b,d,f]	1240.4±112.0[e,f]	1000-1200[j]/2500[n]
Phosphorus (mg)	3149.4±145.8[b,c]	3641.1±229.5[d,e]	2592.3±253.7[b,d]	2714.7±181.2[c,e]	700[h]/4000[n]
Iron (mg)	39.2±2.8[b]	41.1±1.5[d]	29.3±3.6[b,d,f]	41.6±2.1[f]	8-18♀[h]/8♂[h]/45[n]
Iodine (µg)	325.8±45.2[b,c]	383.9±25.0[d,e]	240.9±33.7[b,d]	212.5±28.6[c,e]	150[h]/1100[n]
Magnesium (mg)	787.2±65.1[b,c]	763.7±31.8[d,e]	611.3±59.6[b,d]	607.5±18.1[c,e]	310-320♀[h]/400-420♂[h]
Zinc (mg)	21.7±2.4[b]	25.6±1.4[d]	16.4±1.2[b,d,f]	28.5±1.0[f]	8♀[h]/11♂[h]/40[n]
Sodium (mg)	13400.5±795.5[b]	11136.7±790.2	10854.7±147.9[b]	11584.3±743.2	1200-1500[j]/2300[n]
Potassium (mg)	7851.4±623.8[b]	7499.7±232.6	5850.2±437.1[b]	6872.4±239.9	4700[j]

[a] Result is statistically significant (p<0.05) between 1990 and 1991. [b] Result is statistically significant (p<0.05) between 1990 and 1992. [c] Result is statistically significant (p<0.05) between 1990 and 1993. [d] Result is statistically significant (p<0.05) between 1991 and 1992. [e] Result is statistically significant (p<0.05) between 1991 and 1993. [f] Result is statistically significant (p<0.05) between 1992 and 1993. [g] Recommended median energy intake for men and women 24 through 50 years of age (IOM, 2005). [h] Recommended Dietary Allowance (RDA) [i] Mean for usual daily intake of total fat (iom,2005). [j] Adequate Intake (AI). [k] Mean for usual daily intake of cholesterol (IOM, 2005). [l] Mean for usual daily intake of SFA (IOM, 2005). [m] Mean for usual daily intake of MUFA (IOM, 2005). [n] Tolerable Upper Intake Levels (UL)

According to Adrià *et al*. (2005), we suggested that customers visit this kind of restaurant once or twice every six months or even less. Furthermore, there is no study concerning the relationship between high energy and nutrient intakes and the development of a disease. But on the other hand, could these sporadic meal values really interfere on health? We think that people with cardiovascular diseases must be warned that several nutrients as cholesterol, fat, SFA and sodium are present in high concentrations (Soriano *et al*., 2002). What is more, it is very important to make nutritional information available to customers in restaurants, according to the Surgeon General recommendation (U.S. Department of Health and Human Services, 2011), and also to reduce energy and nutrient intakes in tasting menus because the dietary imbalances in the diet of an adult may damage their health and create cardiovascular risk factors, including hypertension, dyslipidaemia, glucose intolerance and insulin resistance. From our point of view for future research, a tasting menu must be evaluated by a dietitian; this professional being a key part of this multi-disciplinary cooking team. Furthermore, the chef would receive nutritional counseling in favor of their customers' health, without diminishing sensorial properties of molecular gastronomy.

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