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Food technology neophobia and consumer attitudes toward foods produced by new and conventional technologies: A case study in Brazil

Márcia C.T.R. Vidigal*, Valéria P.R. Minim, Andréa A. Simiqueli, Pedro H.P. Souza, Douglas F. Balbino, Luis A. Minim

Department of Food Technology, Universidade Federal de Viçosa, Campus Universitário, CEP 36570-000, Viçosa, Minas Gerais, Brazil

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ABSTRACT

New food technologies are promoting innovations in the food sector. However, not all technologies are accepted and understood by consumers; some cause resistance. The present work sought to study the behavior of Brazilian consumers in relation to different food technologies. A questionnaire was administered to a representative sample of 389 respondents in Belo Horizonte-MG, Brazil. Questionnaire collected information on consumer perceptions regarding new technologies by means of the Food Technology Neophobia Scale (FTNS), translated and validated into Portuguese, in addition to familiarity and willingness to try yogurts labeled such as traditional, pasteurized, organic, genetically modified, enriched with bioactive proteins and nanotechnology. Results suggested that neophobia regarding food technology is important to explain consumer behavior in relation to new technologies, especially for nanotechnology. Participants were less familiar with foods labeled as GM and nanotechnology, and willingness to try these products was lower. Consumers are still wary of GM and nanotechnology, possibly due to lack of assurance that these foods are safe for human health and the environment. For new food technologies (such as nanotechnology) that are still recent, communication is very important, being decisive for the consolidation of consumer perceptions, and consequently for the acceptance of these innovations on the market.

1. Introduction

In recent years, new food technologies have been promoting innovations in the food sector and the number of new foods has increased considerably. In this context, much research has been devoted to new technologies used in food production and processing. One reason for this interest is the range of benefits that these new technologies can provide to the food industry and the consumer). Advantages include safer, healthier and more nutritious foods using less energy, water and chemicals and producing less waste (Rollin, Kennedy, & Wills, 2011). Some technologies could even enhance environmental sustainability (Matin et al., 2012), and increase food productivity.

In a globalized market, there are two major consumer trends: on one hand, there is a growing demand for modernity (functional foods, convenience foods, health foods such as low-calorie and low-sodium foods), and on the other hand there is a growing demand for natural foods (organic foods, natural foods, local products and typical foods). Although technologies have arisen in response to market needs and the more rigorous consumer demand, it is well documented that consumers are increasingly wary of new technologies due to the risks and lack of perceived benefits (Cox, Evans, & Lease, 2007; Frewer, Bergmann, et al., 2011). Currently, consumers are exposed to various applications of emerging technologies, including genetic modification (GM foods), food irradiation and nanotechnology (Rollin et al., 2011; Siegrist, 2008). However, caution and aversion by consumers has been found for a wide range of food technologies in different countries (Backstrom, Pirttila-Backman, & Tuorila, 2004; Cardello, 2003; Cardello, Schutz, & Lesher, 2007; Cox et al., 2007; Siegrist, 2008; Siegrist, Cousin, Kastenholz, & Wiek, 2007). The preservation technique, food irradiation, although considered safe and effective by the scientific community, was not accepted by consumers (Ronteltap, Van Trijp, Renes, & Frewer, 2007). Literature indicates that the acceptance

* Corresponding author. Tel.: +55 31 3899 3805; fax: +55 31 3899 2208.
E-mail address: marcia.vidigal@ufv.br (M.C.T.R. Vidigal).

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of new technologies applied to food production varies from country to country. Genetically modified foods tend to be more accepted by American consumers than by European and Japanese consumers (Gaskell et al., 2000; Lusk, Roosen, & Fox, 2003). According to Schnettler, Crisóstomo, et al. (2013), among developing countries there are groups of consumers who have a positive attitude towards genetically modified foods, as is the case of Brazil (Da Costa, Deliza, Rosenthal, Hedderley, & Frewer, 2000), China (De Steur et al., 2010) and Kenya (Kimenju & De Groote, 2008), but in other developing countries, perceptions are generally more negative than positive, as in Argentina (Mucci, Hough, & Ziliani, 2004) and Chile (Schnettler, Miranda, Sepúlveda, & Denegri, 2012).

Applications of nanotechnology in the food sector are recent and have been growing rapidly in recent years. However, public perception and attitude towards nanotechnology is not yet clear (Gruère, 2012). Although nanotechnology has great potential to generate new products and processes and is increasingly used in food processing and packaging (Sanguansri & Augustin, 2006), little is known regarding its acceptance by consumers. Studies have shown that currently the population is not familiar with and has little knowledge of nanotechnology (Chaudhry et al., 2008; Matin et al., 2012; Siegrist, Stampfli, Kastenholz, & Keller, 2008). Nevertheless, food and packaging involving nanotechnology are already being marketed, although the number of products is still small (Frewer, Bergmann, et al., 2011). In the near future, nanotechnology may become increasingly important in the food sector, mainly due to investments from government agencies and industry in its development and implementation (Frewer, Fischer, Norde, & Kampers, 2011). Recent studies conducted in European countries indicate that consumers are still skeptical about buying food produced using nanotechnology (Bieberstein, Roosen, Marette, Blanchemanche, & Vandermoere, 2013; Siegrist et al., 2007; Stampfli, Siegrist, & Kastenholz, 2010). No data was found in literature on the perception of Brazilian consumers regarding nanotechnology.

Consumer attitude of new technologies will determine its success or failure in the marketplace. Thus, evaluating the acceptance of new technologies rather than risk a negative reaction from the public is sensible (Frewer, Bergmann, et al., 2011; van Kleef, van Trijp, & Luning, 2005). The food industry and research institutions that develop new technologies, and consequently new food concepts, should promote more interdisciplinary research,

Table 1
English and Portuguese version of the Food Technology Neophobia Scale (FTNS): loadings, item means and standard errors (se).

Item	English	Portuguese	Loadings			Means (SE)
			1 PC (27.6%)	2 PC (15.5%)	3 PC (11.9%)	
1	New food technologies are something I am *uncertain* about.	Eu não estou totalmente familiarizado com novas tecnologias empregadas na produção e/ou processamento de alimentos.	−0.001	−0.026	0.903	4.4 (1.9)
2	New foods are *not healthier* than traditional foods.	Novos alimentos não são mais saudáveis do que os alimentos tradicionais.	0.601	0.114	−0.067	3.7 (2.0)
3	The benefits of new food technologies are often grossly *overstated*.	As afirmações sobre os benefícios de novas tecnologias empregadas na produção e/ou processamento de alimentos são frequentemente muito exageradas.	0.424	0.246	−0.066	3.9 (1.9)
4	There are plenty of tasty foods around so we *do not* need to use new food technologies to produce more.	Já existem inúmeros alimentos saborosos no mercado, então nós não precisamos de novas tecnologias para produzir mais alimentos.	0.622	0.104	0.025	2.1 (1.7)
5	New food technologies *decrease* the natural quality of food.	Novas tecnologias empregadas na produção e/ou processamento de alimentos reduzem a qualidade natural dos alimentos.	0.750	0.057	0.067	3.4 (2.0)
6	New food technologies are *unlikely* to have long term *negative* health effects.[a]	Novas tecnologias empregadas na produção e/ou processamento de alimentos provavelmente não trarão, a longo prazo, efeitos negativos à saúde.[a]	0.407	0.265	0.215	4.3 (1.9)
7	New food technologies give people *more* control over their food choices.[a]	Novas tecnologias empregadas na produção e/ou processamento de alimentos proporcionam às pessoas um maior controle sobre as suas escolhas alimentares.[a]	0.267	0.798	−0.048	3.3 (2.0)
8	New products using new food technologies can help people have a balanced diet.[a]	Novos produtos que utilizam novas tecnologias de alimentos podem ajudar as pessoas a terem uma dieta equilibrada.[a]	0.350	0.688	−0.035	2.9 (1.8)
9	New food technologies may have long term *negative* environmental effects.	Novas tecnologias empregadas na produção e/ou processamento de alimentos podem causar, a longo prazo, efeitos negativos ao meio ambiente.	0.641	0.196	−0.055	3.8 (1.9)
10	It can be risky to switch to new food technologies too quickly.	Pode ser arriscado mudar rapidamente para novas tecnologias empregadas na produção e/ou processamento de alimentos.	0.577	0.278	0.260	4.2 (1.9)
11	Society should *not depend* heavily on technologies to solve its food problems.	A sociedade não deve depender demais de tecnologias para resolver os seus problemas alimentares.	0.523	0.074	0.301	4.1 (2.1)
12	There is no sense trying out high-tech food products because the ones I eat are already good enough.	Não faz sentido experimentar alimentos produzidos a partir de alta tecnologia, porque os que eu consumo já são bons o suficiente.	0.709	0.196	0.219	2.5 (1.8)
13	The media usually provides a *balanced* and *unbiased* view of new food technologies.[a]	A mídia geralmente fornece uma visão equilibrada e imparcial das novas tecnologias empregadas na produção e/ou processamento de alimentos.[a]	0.047	0.590	0.047	4.4 (2.0)
						47.0 (12.0)

[a] Indicates reverse scored items.