



Liking of soy flour muffins over time and the impact of a health claim on willingness to consume



Emily M.T. Padhi^{a,b}, D. Dan Ramdath^b, Stephanie J. Carson^a, Aileen Hawke^b, Heather J. Blewett^d, Thomas M.S. Wolever^e, Derek Vella^c, Koushik Seetharaman^{c,1}, Lisa M. Duizer^c, Alison M. Duncan^{a,*}

^a Department of Human Health and Nutritional Sciences, University of Guelph, Guelph, Ontario, N1G 2W1, Canada

^b Guelph Food Research Centre, Agriculture and Agri-Food Canada, Guelph, Ontario, N1G 5C9, Canada

^c Department of Food Science, University of Guelph, Guelph, Ontario, N1G 2W1, Canada

^d Canadian Centre for Agri-Food Research in Health and Medicine, Agriculture and Agri-Food Canada, Winnipeg, Manitoba, R2H 2A6, Canada

^e Glycemic Index Laboratories Inc., Toronto, Ontario, M5C 2N8, Canada

ARTICLE INFO

Article history:

Received 5 June 2015

Received in revised form 26 August 2015

Accepted 6 September 2015

Available online 11 September 2015

Keywords:

Soy muffin

Sensory evaluation

Consumer acceptability

Health claim

FACT scale

Functional foods

ABSTRACT

Increased dietary intake of soy is associated with improved health outcomes, making soy a suitable ingredient for functional foods. However, consumer acceptability of soy-based functional foods is not well understood. This study examined consumer liking of soy flour muffins during repeated exposure and evaluated the impact of a health claim on willingness to consume. Participants ($n = 116$) consumed two soy or wheat flour muffins daily for 6 weeks and completed weekly questionnaires on sensory liking qualities (overall liking and liking of appearance, aroma, flavor, taste, texture) using 9-point hedonic scales; feeling of fullness using a Visual Analog Scale (VAS); and, adverse symptoms using a checklist. A Food Action (FACT) rating scale was also administered with and without an approved health claim relating soy to a reduction in blood cholesterol, to evaluate its impact on willingness to consume the soy muffins. Results showed that overall liking, liking of appearance, aroma, flavor, taste, texture, and feeling of fullness were significantly higher in the soy muffin compared to wheat muffin group and did not significantly differ among weeks 1–6 within either group. Presence of a health claim significantly increased willingness to consume the soy muffins. This study demonstrates that muffins made from soy flour are acceptable to consumers and that a therapeutic health claim would enhance their acceptability.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

Market trends indicate a shift in consumer preferences toward foods that promote health but are also convenient (Kearney, 2010). Functional foods have the potential to meet this trend as they resemble conventional foods and also are considered to be able to reduce chronic disease risk (Health Canada, 1998). Soy has substantial potential as a functional food as it can be incorporated into a variety of food matrices and is associated with lower risk of cardiovascular disease (Messina, 2010). This has led to approval of a disease risk reduction health claim that relates 25 g soy protein to a reduced risk of coronary heart disease (CHD) in the United States (USFDA, 2014) and a therapeutic health claim in Canada that relates 25 g soy protein to the lowering of blood

cholesterol (Benkhedda et al., 2014; Health Canada, 2015). Health claims are increasingly being used in the marketplace; however, their influence on consumer acceptability is unclear (Pothoulaki & Chryssochoidis, 2009; Williams, 2005).

Soybeans contain many bioactive compounds that can be affected by processing (Reinwald, Akabas, & Weaver, 2010) making it unclear what form of a soy-based functional food would confer the most health benefits. It has been postulated that whole soy ingredients may be more beneficial than isolated soy constituents due to a synergistic effect of the protein, isoflavones, dietary fiber and/or other bioactives (Reinwald et al., 2010). Soy flour is a whole soy ingredient that is produced through the de-hulling, grinding, and de-fatting of soybean seeds, and is arguably minimally processed (Riaz, 2006). Soy flour is favored by the food industry for its emulsifying, binding, and texture properties (Enders, 2001) and therefore is a candidate ingredient for the development of soy-based functional foods. Further, baked products are a functional food matrix worth consideration despite their slower industry growth compared to, for example, the functional beverage industry (Siró, Káplona, Káplona, & Lugasi, 2008). Consumer acceptance of functional foods depends on liking of sensory qualities, such as taste (Siró et al., 2008; Urala & Lähteenmäki, 2003) and therefore, an evaluation

Abbreviations: CHD, Coronary heart disease; FACT, Food action rating scale; LDL, Low density lipoprotein; USFDA, United States Food and Drug Administration; VAS, Visual Analog Scale.

* Corresponding author at: Department of Human Health and Nutritional Sciences, University of Guelph, Guelph, Ontario, Canada N1G 2W1.

E-mail address: amduncan@uoguelph.ca (A.M. Duncan).

¹ Deceased.

of the sensory qualities of a soy-based functional food is necessary in order to ascertain its potential for success in the marketplace.

Exploring consumer acceptability of functional foods made from soy flour is particularly important since its incorporation into traditional wheat flour baked food products can adversely affect sensory characteristics, as has been seen in the crust, shape and flavor of soy bread (Olaoye, Onilude, & Idowu, 2006; Mashayekh, Mahmoodi, & Entezari, 2008). This may be related to the formation of undesirable flavor compounds during soybean processing which can result in a beany flavor (Boge, Boylston, Wilson, 2009), and the increased water-holding capacity (WHC) of soy relative to wheat flour (Traynham, Myers, Carriquiry, & Johnson, 2007), which has been shown to reduce loaf volume in breads (Mashayekh, Mahmoodi, & Entezari, 2008). Previous studies have examined sensory acceptability of soy flour in baked goods such as pretzels (Alpaslan & Hayta, 2006), graham crackers (Romanchik-Cerpovicz, Abbott, & Dent, 2011) and biscuits (Ugwuona, 2009; Zaker, Genitha, & Hashmi, 2012), and have reported lower (yet still acceptable) sensory scores than their wheat-based controls, although none of the studies included repeated exposure.

Muffins are familiar baked products that are consumed widely in Canada (Euromonitor International, 2013) and the United States (Euromonitor International, 2014), which make them a candidate food matrix for a functional food product. The acceptability of muffins made from soy flour has not been evaluated and the role of a soy health claim in the Canadian context has also not yet been explored. Therefore, the aim of this study was to examine the acceptability of muffins made from soy flour through consumer-perceived liking scores during a 6-week period of repeated daily consumption and to evaluate the influence of a government-approved health claim on willingness to consume.

2. Materials and methods

2.1. Study design and centres

Data for the current study were collected from a multi-centre 6-week clinical trial that examined CHD risk factors using a randomized, double-blinded parallel arm design. Participants were randomly assigned to consume: (1) two soy muffins; (2) one soy and one wheat muffin; or, (3) two wheat muffins. Participating clinical trial centres were in Canada and included the Human Nutraceutical Research Unit (HNRU, University of Guelph, Guelph, ON, Canada), the Canadian Centre for Agriculture Research in Health and Medicine (CCARM, Winnipeg, MB, Canada) and Glycemic Index Laboratories Incorporated (GI Labs Inc., Toronto, ON, Canada).

2.2. Study participants

Participants were recruited using flyers, newspaper advertisements, and radio announcements. Participants were eligible if they were healthy adults between 30 and 70 years of age, had a BMI between 18.5 and 40.0 kg/m², and had elevated fasting plasma LDL cholesterol (3.0–5.0 mmol/L). Exclusion criteria included: the use of any prescribed or non-prescribed medications, herbal, or nutritional supplements known to affect blood lipids; pregnancy or lactation; smoking (≥ 1 cigarette per day); alcohol intake > 2 drinks/day; consumption of ≥ 5 servings of soy products per week; unstable body weight (defined as body weight change ≥ 3 kg within 3 months prior to enrolling in the study); presence of diabetes mellitus; presence of a gastrointestinal disorder or medication that alters the digestion and absorption of nutrients; any food allergy; concurrent participation in other scientific studies; consumption of $\geq 15\%$ total energy intake from saturated fat; and, unwillingness to consume a soy or wheat baked product. Participant self-reported ethnicity was captured in the screening questionnaire.

All participants provided voluntary written consent after receiving verbal and written information about the study. The clinical trial was

approved by the governing Research Ethics Board of each clinical trial centre and was registered at clinicaltrials.gov (ID NCT01547585).

2.3. Study muffins

De-fatted soy flour (Cargill Limited, Winnipeg, MB, Canada) was provided by Soy 20/20 (Guelph, ON, Canada) and commercial soft wheat flour was donated by Kraft Canada Inc. (Don Mills, ON, Canada). Whey isolate INPRO 90 protein powder was purchased from Vitalus Nutrition Inc. (Abbotsford, BC, Canada), and double-acting baking powder, salt, extra-fine granulated white sugar, canola oil, citric acid, and 5-dextrose equivalent (5DE) maltodextrin were purchased from Caldic Canada Inc., formerly Nealanders International Inc. (Mississauga, ON, Canada). Cold water swelling Novation®4600 native corn starch was purchased from Embassy Flavors Ltd. (Brampton, ON, Canada), WC150 wheat fiber was purchased from CreaFill Fibers Corp. (Chestertown, MD, USA), and artificial banana bread, lemon and vanilla flavoring were purchased from David Michael & Co. (Philadelphia, PA, USA).

Study muffins made from soy or wheat flour were developed by the Department of Food Science at the University of Guelph (Guelph, ON, Canada). The soy muffins were formulated to contain 12.5 g soy protein per muffin in order to match the US FDA health claim relating soy protein to CHD risk reduction (25 g/day) with the consumption of two study muffins (US FDA, 2014). Recipe formulations were modified after in-house palatability assessments to produce a soy muffin that contained approximately 12.5 g soy protein (~ 27 g de-fatted soy flour) and a wheat muffin containing similar amounts of whey protein. The study muffins were comparable in energy and macronutrient content. Insoluble fiber was initially added to the wheat muffin to equalize fiber content; however, since this adversely affected muffin palatability, the equalization of fiber content was abandoned.

Study muffins were prepared with two artificial flavors including lemon or banana bread, with base notes of vanilla flavoring in each. Muffins were prepared in batches of 48 and baked in aluminum non-stick muffin pans coated with PAM® Original non-stick canola oil cooking spray and dusted with flour. Muffin batter was transferred using depositors to ensure reproducible muffin weight and baked at 168 °C in a commercial baking oven until an internal temperature of 95 °C was reached. Following this, muffins were allowed to cool in pans and then were transferred to a wire pan grate purchased from s.t.o.p. Restaurant Supply Ltd. (Kitchener, ON, Canada) for additional cooling. Once at room temperature, muffins were wrapped in heavy duty food-grade plastic bags and frozen at -22 °C until packaged for long-term storage. Frozen muffins were packaged in food-grade 6" \times 12" \times 3 mm packaging sleeves purchased from Crawford Provincial (Mississauga, ON, Canada) and sealed using a ULINE 16" Impulse Sealer with Cutter (Brampton, ON, Canada). Two muffins were packaged in each sleeve and stored in cardboard boxes at -22 °C until distributed to participants for use in the human clinical trial. Table 1 summarizes the recipe formulations and nutritional composition of the study muffins. A photograph of the soy and wheat study muffins is presented in Fig. 1.

Participants were provided with a supply of frozen study muffins at weeks 0–5 with instructions to consume according to their preference (e.g. "cold", defrosted and consumed at room temperature; "warm", heated in the microwave or toaster oven; and with or without any type of spread). Muffin flavors were alternated weekly to provide variety, but participants could request to consume one flavor for the duration if preferred. Participants were provided with the energy and nutrient content of the muffins and counseled to replace a comparable breakfast item and daily snack with a study muffin.

2.4. Sensory questionnaires

Sensory questionnaires were completed by participants at weeks 1–6 in all 3 treatment arms; however, only participants assigned to

Download English Version:

<https://daneshyari.com/en/article/4561369>

Download Persian Version:

<https://daneshyari.com/article/4561369>

[Daneshyari.com](https://daneshyari.com)