QUALITY EVALUATION OF NEW VEGETARIAN BEAN SPREADS

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Abstract

Vegetarianism is a growing trend in Latvia but there is a lack of spread like products for vegetarians. Common beans (*Phaseolus vulgaris* L.) which are popular among Latvian consumers and rich in important macro- and micronutrients could be a good raw material for vegetarian spread-like products but are not represented in foreign or Latvian food company products yet. The aim of this research is to develop new vegetarian spreads using commercially available beans in Latvia and to subject the newly developed bean spreads to physicochemical and nutritional evaluation. Four bean spreads were developed using white beans: classic, with basil, with curry, and with sun-dried tomatoes. The results show that bean spreads contain 7.74 g protein, 7.30 g fat, 9.48 g total dietary fiber, 8.92 g carbohydrates per serving (100 g) on average. Energy value of new vegetarian bean spreads ranges from 153.27 kcal 100 g^{-1} (641.28 kJ) to 166.27 kcal 100 g^{-1} (695.67 kJ). A serving of bean spreads provides 13 % of protein, 33-35 % of total dietary fiber, 13-15 % of fat, 3 % of carbohydrates and 8% of energy value of one's recommended daily nutrient intake. Common white beans are an optimal raw material for new vegetarian bean spread production.

Keywords: Beans, vegetarian spreads, nutritional evaluation

Introduction

According to the latest estimates about 3 to 5% of Latvian population identify themselves as vegetarian. Vegetarianism is the practice of abstaining from the consumption of meat – red meat, poultry, seafood and the flesh of any other animal; it may also include abstention from by-products of animal slaughter (Craig, 2010). Vegans are the most strict vegetarians abstaining from any kind of animal flesh, dairy products, eggs, or any other products which are derived from animals. Lacto-ovo-vegetarians allow both dairy products and eggs in their diet, lacto- vegetarians consume dairy products but avoid eggs, and ovo-vegetarians eat eggs but abstain from dairy products in return (Marsh et al., 2012). A properly planned vegetarian diet is healthful, nutritionally adequate, and provides health benefits in the prevention and treatment for such diseases as diabetes, cancer and coronary heart disease (McEvoy et al., 2012; Rizzo et al., 2011).

For diversification of vegetarian diet there is a variety of plant-derived protein products available in the world: tofu, soy-based vegetarian meat substitutes, peanut butter, seitan, tempeh and hummus. Meat alternative ingredients are nutritious with some offering specific health benefits. As well as increasing consumer choice, such products therefore have the potential to contribute to overall public health (Van Roost, 2003). The main plant protein spread-like product is hummus which is very popular in the Middle East and Mediterranean countries (Zubaida, 2011). There are about 10 plant protein spreads commercially available in Latvia that differ very much in nutritional value and ingredients.

As common beans (*Phaseolus vulgaris* L.) are the most important source of protein for vegetarians; furthermore they are a rich and fairly inexpensive source of carbohydrates, dietary fibre, minerals and vitamins (Fageria et al., 2010; Gepts et al., 2008), common beans could be a good raw material for vegetarian spread-like products as they are not represented in foreign or Latvian food company products yet.

The aim of this study is to develop new vegetarian plant spreads using commercially available beans in Latvia and to subject the newly developed bean spreads to physicochemical and nutritional evaluation.

Materials and methods

For bean spread production the following materials were used: white beans (*Phaseolus vulgaris* L.) (harvested in 2012), *Extra virgin* canola oil, 5% citric acid solution, drinking water, and salt, as well as additional additives – frozen fresh basil, curry powder, and sun-dried tomatoes.

Dry white beans were soaked in water at 18±2 ºC for 15 h, then rinsed and boiled until tender (about 110±5 minutes). Cooked beans were then grinded in a food processor and the homogeneous bean paste cooled to 60±5 ºC. Other ingredients were added to the bean paste; oil and salt were added at the end of mixing in the food processor. Vegetarian bean spreads were packed in 200±5 g polypropylene cups and stored at 3±1°C for 12 h prior to physicochemical evaluation (Kirse, Karklina, 2013).

Vegetarian bean spreads were made using common white beans (75.0-89.0 %), water (5.0-7.0 %), unsaturated canola oil (4.0-7.0 %), 5% citric acid solution (2.0-2.5 %), basil (0.8-1.5 %), curry powder (0.5-1.1 %), sun-dried tomatoes (5.5-8.5 %), and salt (0.03-0.08 %).

Four different kinds of bean spreads were developed: classic bean spread, bean spread with basil, bean spread with curry, and bean spread with sun-dried tomatoes.

The following physicochemical parameters of new bean spreads were determined according to standard methods: moisture content (AOAC 925.098), protein content (AACC 46-20), fat content (AOAC 2003.06), total dietary fiber content (AOAC 994.13); carbohydrates were determined by difference.

Nutritional value was calculated according to Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers and EU CIAA *The GDA Labelling Initiative*.

The obtained data processing was performed using mathematical and statistical methods with IBM SPSS Statistics 20.0. All data is expressed as the mean value ± standard deviation of triplicate determinations. The data was analysed using analysis of variance (ANOVA) and Tukey's test; differences among results are considered significant if p-value $<\alpha_{0.05}$. For interpretation of results it is assumed that $\alpha=0.05$ with 95% confidence (Næs et al., 2011).

Results and discussion

The best known plant protein spread-like products in Latvia are hummus (contains chickpeas, sesame oil, canola oil, salt and food additives) and vegetarian gourmet pate (contains plant oil, water, plant protein, starch, salt and food additives) both of which contain 2-6.5 % protein, 4-12 % carbohydrates and 29-30 % fat with energy value of 294-335 kcal 100 g^{-1} (1230-1400 kJ 100 g^{-1}). Most plant spread-like products contain 2-7 % protein, 4-12 % carbohydrates and 10-33 % fat per 100 g portion. Chemical parameters of newly developed vegetarian bean spreads are given in Table 1.

Table 1. Chemical parameters of vegetarian bean spreads.

BEAN SPREADS	Classic bean spread	Bean spread with basil	Bean spread with curry	Bean spread with sun-dried tomatoes
Moisture, %	$66.95 \pm 0.10^{A*}$	66.81 ± 0.12^{A}	66.47 ± 0.15^{A}	66.50 ± 0.20^{A}
Protein, g 100 g^{-1}	7.91 ± 0.06^{A}	7.69 ± 0.17^{A}	7.74 ± 0.15^{A}	7.62 ± 0.09^{A}
Fat, g 100 g^{-1}	7.06 ± 0.09^{A}	7.02 ± 0.01^{A}	7.04 ± 0.08^{A}	8.60 ± 0.10^{B}
Total dietary fiber, g 100 g^{-1}	9.48 ± 0.08^{A}	9.26 ± 0.08^{A}	9.35 ± 0.08^{A}	9.83 ± 0.10^{A}
Carbohydrates, g 100 g^{-1}	8.60 ± 0.05^{A}	9.06 ± 0.09^{A}	9.56 ± 0.09^{A}	8.45 ± 0.07^{A}

* – mean values within a row not sharing a superscript letter are significantly different ($p < 0.05$)

Moisture content in new vegetarian bean spreads ranges from 66.47 to 66.95 %; there are no significant differences among the moisture content in bean spreads ($p = 0.310$) and the moisture content between bean spreads and cooked beans (Deshpande, Cheryan, 1986) ($p = 0.201$).

Classic bean spread has the highest content of protein (7.91 ± 0.06 g 100 g^{-1}) and protein content in bean spreads is not significantly different or dependent on additives used, i.e., basil, curry or sun-dried tomatoes ($p = 0.078$). Commercially available vegetarian spread-like products contain less protein than new bean spreads ($p = 0.030$). Since the amino acid imbalance of beans limits bean protein biological value (Priman et al, 2001), further studies would be useful to analyse protein fractions and amino acid composition in bean spreads.

Fat content in vegetarian bean spreads is significantly higher comparing with dry and cooked beans ($p < 0.001$) because of the oil added for creamy texture. The average fat content in bean spreads is 7.48 ± 0.72 g 100 g^{-1}; bean spread with sun-dried tomatoes contains significantly more fat ($p = 0.002$) than other bean spreads because sun-dried tomatoes in oil are used as an ingredient resulting in higher total fat content. When compared to commercially available vegetarian spread-like products, bean spreads are low in fat ($p = 0.001$).

New vegetarian bean spreads contain 9.48 ± 0.25 g 100 g^{-1} total dietary fiber on average. Added ingredients do not influence total dietary fiber content ($p = 0.910$). Commercially available vegetarian spread-like products are not labelled as containing fiber even if they contain fiber. Carbohydrates available for digestion by human enzymes account to less than 10 g 100 g^{-1} of new bean spreads; bean spreads are low in carbohydrates.

Products can be labelled as a *source of protein* (Commission Directive 2008/100/EC; Regulation No 1924/2006) if at least 12 % of the energy value of the food is provided by protein. A claim that a food is a *source of fibre* can be made if the product contains ≥ 3.0 g fiber 100 g^{-1}, and *high in fiber* if the product contains ≥ 6.0 g fiber 100 g^{-1}; also a food is *energy-reduced* if the energy value of the product is reduced by at least 30%.

A serving of bean spreads (100 g) provides 13 % of daily protein needs (2000 kcal diet) and bean spreads are a *source of protein* accounting to 18% of the energy value provided by protein. Fiber content in new vegetarian bean spreads is high and they can be labelled as *high in fiber*. Soluble and insoluble fiber ratio in cooked beans is about 1 : 3.2 (Wang et al., 2010) that corresponds to European Guidelines on cardiovascular disease prevention in clinical practice (Perk et al., 2012); the ratio is maintained in the new vegetarian bean spreads.

Classic bean spread contains 153.27 ± 0.10 kcal 100 g^{-1} (641.28 ± 0.42 kJ). Nutritional value of bean spread with basil, curry, and sun-dried tomatoes is 153.92 ± 0.35 kcal 100 g^{-1} (644.00 ± 1.46 kJ), 155.31 ± 0.51 kcal 100 g^{-1} (649.82 ± 2.13 kJ) and 166.27 ± 0.92 kcal 100 g^{-1} (695.67 ± 3.85 kJ) respectively. There are commercially available vegetarian spread-like products containing as much as twice the amount of calories per 100 g serving as shown in Figure 1; most of the calories come from fat.

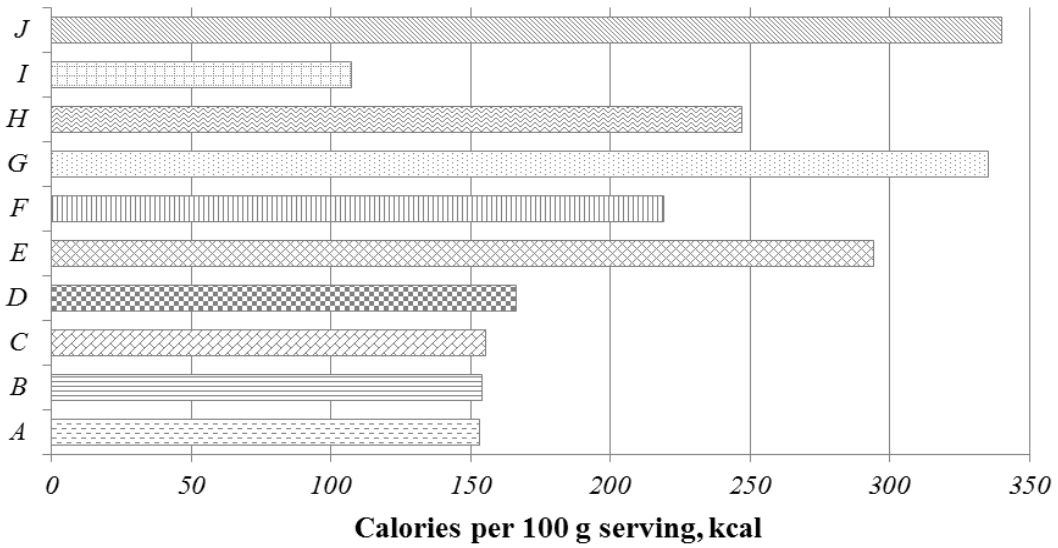

Figure 1: Nutritional information in calories of different plant protein spread-like products available in Latvia and new vegetarian bean spreads:
A – classic bean spread, B – bean spread with curry, C – bean spread with basil, D – bean spread with sun-dried tomatoes, E – *HUM-HUM* hummus, F – *WDfit* Pasztet sojowy, G – *Naturkost* Curry-Ananas Brotaufstrick, H – *Zwergenwiese* Basilikum Streich, I – *Allos* Gourmet Pastete, J – *Marno* Vegetarian Gourmet Pastete.

New bean spreads are *energy-reduced* products as their energy value is reduced by at least 43% of commercially available vegetarian spread-like products' energy value.
The results of this study suggest that bean spreads are a good source of protein and dietary fiber with reduced energy value. A serving of bean spreads provides 13 % of protein, 33-35 % of total dietary fiber, 13-15 % of fat, 3 % of carbohydrates and 8% of energy value of one's recommended daily nutrient intake.

Conclusion

Newly developed vegetarian bean spreads show higher protein and lower fat content when compared to commercially available vegetarian spread-like products. The results support the assumption that using beans commercially available in Latvia and the developed technology for bean spread preparation it is possible to obtain products with high quality. Physicochemical parameters and nutritional evaluation positions common white beans (*Phaseolus vulgaris* L.) as an optimal raw material for new vegetarian bean spread production.

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