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L. acidophilus La-5, fructo-oligosaccharides and inulin may improve sensory acceptance and texture profile of a synbiotic diet mousse

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ABSTRACT

We evaluated in this study the effects of *Lactobacillus acidophilus* La-5, fructo-oligosaccharides (FOS) and inulin supplementation as well as time of storage at −18 °C on sensory acceptance and instrumental texture profile of a synbiotic diet mousse (SDM) compared with a standard mousse without pro- and prebiotics. Formulations were compared in terms of chemical composition, total energy value, pH variation, instrumental texture profile (hardness, adhesiveness, elasticity, cohesiveness, and gumminess), and sensory acceptability. *L. acidophilus* La-5 counts in SDM remained above 7.8 log CFU g^{-1} during 112-day storage, with no significant differences ($p > 0.05$) in its viability. SDM pH throughout storage was slightly lower than that of standard mousse, and its total energy value about 20% lower. SDM gumminess and hardness increased, adhesiveness and springiness remained relatively stable, while cohesiveness decreased along storage. Standard mousse showed lower acceptability after storage than SDM, probably due to its higher content of powdered milk and absence of inulin and FOS. These results suggest that the presence of *L. acidophilus* La-5 and prebiotics may improve texture and sensory properties of diet mousses.

1. Introduction

Recent research efforts aim at modifying technological properties of food macromolecules so as to develop products able to enhance consumers' life quality.

The International Scientific Association for Probiotics and Prebiotics (ISAPP) defined 'probiotics' as "live micro-organisms that, when administered in adequate amounts, confer a health benefit on the host" (Hill et al., 2014). Probiotics have in fact attracted special attention because of their nutritional and functional properties, and several studies have been developed aiming to clarify the mechanisms of their action in the human body (Reid, 2016). As a result, a daily intake of viable probiotic cells per serving portion (10^9 CFU day^{-1}) is recommended by several health agencies.

Probiotic cultures have been incorporated into frozen desserts with the aim of diversifying probiotic foods on the market (Cruz, Antunes, Souza, Faria, & Saad, 2009). Dairy desserts are widely consumed worldwide by several groups of consumers, including children and elderly (Buriti & Saad, 2014), mainly because of their attractive nutritional and sensory characteristics (Ferraz et al., 2012; Tárrega & Costell, 2006).

Many species belonging to the *Lactobacillus* genus are used to develop dairy products (Gebara, Ribeiro, Chaves, Gandara, & Gigante, 2015). Among the main products containing *Lactobacillus acidophilus* La-5 are yoghurt (Savard et al., 2011), ice cream (Magariños, Selaive, Costa, Flores, & Pizarro, 2007), cheese (Alves et al., 2013) and dairy dessert (Xavier-Santos, Lima, Simão, Bedani, & Saad, 2018). This strain stands out for playing an important role in modulating the intestinal microbiota, suppression of harmful bacteria, hypocholesterolemic effects and immune tolerance, among other health effects (Zhao et al., 2015).

Prebiotics, which are currently defined as "substrates that are selectively used by the host microorganisms, conferring a health benefit" (Gibson et al., 2017), are also added to food formulations to develop products with functional properties (Hutkins et al., 2016) as well as to improve their sensory characteristics and structural stability during processing (Wang, 2009).

Inulin is being increasingly used in the food industry to substitute fat and increase the food fibre content (Barclay, Ginic-Markovic, Cooper, & Petrovsky, 2010). Fructo-oligosaccharide (FOS) is a fairly

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Table 1
Ingredients used to prepare the standard mousse and the synbiotic diet mousse.

Ingredients (g 100 g^{-1})	Standard mousse	Synbiotic diet mousse
Skimmed milk[a]	61.7	61.6
Skimmed milk powder[b]	14.0	4.0
Sucralose[c]	1.1	1.1
Fructooligosaccharides[d]	–	6.0
Inulin[e]	–	4.0
Pasteurized and frozen guava pulp[f]	20.0	20.0
Stabilizer/emulsifer[g]	2.8	2.8
Lactic acid[h]	0.4	0.4
Lactobacillus acidophilus La-5[i]	–	0.05
Total	100.0	100.0

[a] Paulista (Danone, Guaratinguetá, SP, Brazil).
[b] Molico (Nestlé, Araçatuba, SP, Brazil).
[c] Sucralose (Línea Sucralose, São Paulo, SP, Brazil).
[d] Beneo P95 (Orafti, Oreye, Belgium).
[e] Beneo HP (Orafti, Oreye, Belgium).
[f] Icefruit (Icefruit Comércio de Alimentos, Tatuí, SP, Brazil).
[g] Cremodan Mousse 30 (Danisco, Cotia, SP, Brazil).
[h] Purac (Purac Sínteses, Rio de Janeiro, RJ, Brazil; 85 g kg^{-1} food-grade solution).
[i] Freeze-Dried DVS La-5 culture (Christian Hansen, Hoersholm, Denmark).

soluble fibre, which is marketed either as viscous syrup (containing 75% of total solids) or powder (up to 95% purity). In its pure form, it has about one-third of sucrose sweetness, combining well with delicate flavour and reducing sweetener aftertaste (Franck, 2002).

Synbiotics are nutritional supplements composed of both probiotics and prebiotics (Moumita et al., 2017). According to Kolida and Gibson (2011), a synergistic activity occurs when the prebiotic improves probiotic survival and growth in the host, whereas a complementary action occurs when the prebiotic selectively increases the concentrations of microbiota beneficial components.

The objective of this study was to investigate the effects of *L. acidophilus* La-5, FOS and inulin supplementation as well as time of storage at −18 °C on the sensory acceptance and texture profile of the same synbiotic diet mousse compared with a non-synbiotic diet one.

2. Materials and methods

2.1. Production of diet mousses

Table 1 lists the proportions of ingredients used to prepare the synbiotic diet mousse (SDM) and the standard mousse without pro- and prebiotics. A lyophilized commercial direct-to-vat probiotic culture of *Lactobacillus acidophilus* La-5, stored at −18 ± 1 °C, was used for SDM preparation. Fructo-oligosaccharides (FOS) and skimmed milk powder were supplemented to ultra-high temperature skimmed milk one day before product preparation to make their dissolution easier. This pre-mixture was stored at 4 ± 1 °C until the other ingredients were added. After sterilization at 121 °C for 15 min, 40 mL of this pre-mixture were used, the next day, to activate the culture at 37 °C for 120 min (Komatsu et al., 2013).

After supplementation of the additional ingredients (Table 1), the solution was mixed in a 6-kg UMMSK-12 mixer (Geiger, Pinhais, PR, Brazil) until complete uniformity, pasteurized in the same equipment for 5 min at 85 °C, cooled to 40 °C and supplemented with milk inoculated with reactivated probiotic culture in the proportion of 10 mL kg^{-1} of mousse. Next, the suspension was maintained at 5 °C and aerated at 10–15 °C in a 20-L planetary electric mixer (Irmãos Amadio, São Paulo, SP, Brazil), leading to an 80–85% volume increase. The mousse was then brought to an IQ81-A manual filler (Intelimaq Máquinas Inteligentes, São Paulo, SP, Brazil), packed in 100-mL polypropylene food pots (Tries Aditivos Plásticos, São Paulo, SP, Brazil) and sealed with metallic covers (Delgo Metalúrgica, Cotia, SP, Brazil). Fig. 1 schematically illustrates the main steps of SDM manufacture. Mousse samples were drawn in triplicate and stored at −18 °C.

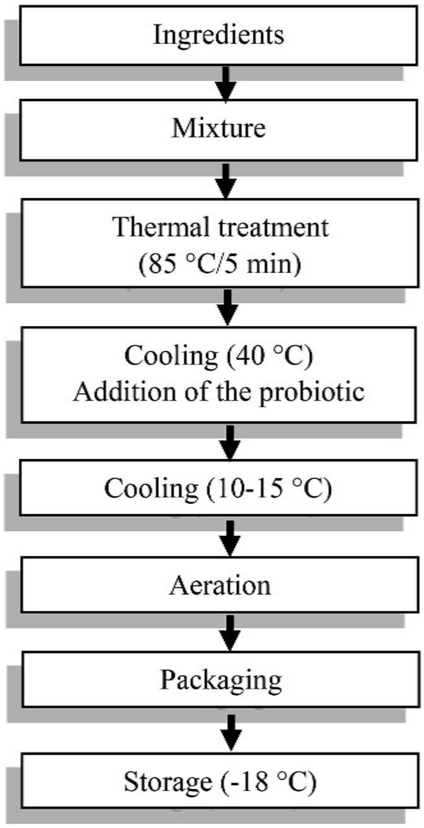

Fig. 1. Main steps in the production of synbiotic diet mousse.

Standard mousse was produced in the same way as SDM, but without *L. acidophilus* La-5, inulin and FOS addition.

2.2. Determination of pH and microbiological parameters

The pH was determined on quadruplicate samples using a pH meter Orion 3-Star (Thermofisher Scientific, Waltham, USA) equipped with a penetration electrode.

L. acidophilus La-5 counts were monitored during either the production process or storage by the pour plate method with incubation at 37 °C for 48 h (Buriti, Castro, & Saad, 2010b). For this purpose, 25-g portions of quadruplicate mousses samples were aseptically added to 225 mL of 0.85% NaCl solution, using a Bag Mixer 400 (Interscience, St. Nom, France). Samples were serially diluted in 0.1% (w/v) peptone solution and seeded in De Man–Rogosa–Sharpe (MRS) agar modified by the addition of 50% (w/v) maltose solution.

Aliquots of each sample dilution (1 mL) were transferred to Petrifilm EC Count Plates or Petrifilm YM Count Plates (3M Microbiology, St. Paul, MN, USA) for counting coliforms and *Escherichia coli* or molds and yeasts, respectively, according to the manufacturer instructions. Petrifilm EC plates were incubated at 35–37 °C for 24 h, while Petrifilm YM plates were incubated at 20–25 °C for 3–5 days.

2.3. Chemical composition and total energy value of mousses

Portions of stored SDM and standard mousse were analysed in triplicate for their chemical composition and total energy value (TEV). Briefly, the solid content of 5.0-g mousse samples was determined by drying at 70 °C in vacuum oven, model 440/A (Nova Ética, Vargem Grande Paulista, SP, Brazil), according to Instituto Adolfo Lutz (2005). Protein content was determined by measuring nitrogen content through the micro Kjeldahl method and multiplying by a conversion factor of 6.38, according to the method 690.52 of AOAC (2003). Lipid content was quantified by Soxhlet extraction and that of ash gravimetrically by incineration of 2.0-g samples at 550 °C (Instituto Adolfo Lutz, 2005). Finally, percentage of carbohydrates (excluding total dietary fibre) was calculated as the difference to obtain 100% of total composition.

Contents of these macronutrients were converted into TEV through the Atwater factors and energy for all components (Roberfroid, 1999):

$$\begin{aligned} TEV\,(kJ\ 100\,g^{-1}) = {} & 16.74\ kJ\ g^{-1}\,.\ x\ g\ proteins\ 100\,g^{-1} \\ & + 16.74\ kJ\ g^{-1}\,.\ y\ g\ carbohydrates\ 100\,g^{-1} \\ & + 6.28\ kJ\ g^{-1}\,.\ z\ g\ fructans\ 100\,g^{-1} \\ & + 37.66\ kJ\ g^{-1}.\ t\ g\ total\ lipids\ 100\,g^{-1} \end{aligned} \quad (1)$$

being x, y, z and t the percentages of proteins, carbohydrates, fructans and total lipids, respectively.

2.4. Instrumental texture profile

Texture profile of mousse samples collected throughout a 112-day storage period was analysed by double compression tests performed at room temperature with a TA-XT2 texture analyser (Stable Micro Systems, Haslemere, UK) using a 25-mm diameter aluminium cylindrical plunger (P25), a 10-mm distance and a 1-mm s^{-1} penetration speed. Before testing, frozen diet mousses were transferred and maintained for 6 h at 4 °C to avoid freezing interference with determination of texture parameters, namely hardness, adhesiveness, cohesiveness, springiness and gumminess. Collected data were analysed using the Texture Expert for Windows software, version 1.20 (Stable Micro Systems, Godalming, UK).

Frozen mousse samples were collected in quintuplicate, thawed at 4 °C and analysed for instrumental texture properties one day after preparation and after freeze storage for 7, 35, 56, 84, and 112 days.

2.5. Sensory evaluation

Sensory evaluation was performed according to the guidelines established in the Helsinki Declaration. The protocol was approved by the Research Ethics Committees of the School of Pharmaceutical Sciences of São Paulo University (CAAE 30539214.6.0000.0067) and University Hospital, São Paulo, SP, Brazil (Protocol Number 663.138). Sensory evaluation was carried out on samples of both mousses stored at −18 °C for different storage times (7–112 days) and thawed at 4 °C 2 h before starting sections. Samples were codified with 3 random digits and distributed among participants for their individual evaluation.

Tests of sensory acceptability were conducted by voluntary consumers, using for overall acceptability the 9-point hedonic scale, where 1 = extreme dislike and 9 = extreme liking (Lawless & Heymann, 2010), and allowing the panelist to indicate what was the sensory characteristics that he or she liked most or least.

Thirty untrained, healthy, adult volunteers took part in each of the five sections of sensory analysis, giving a total of 150 consumers, of whom 50.0% were women and 50.0% men, aged 18–60 years (average age 24.4 ± 7.4 years). They were mainly graduate and undergraduate students as well as employees of São Paulo University. Exclusion criteria included people with a history of allergic manifestations, food intolerance or chronic diseases like hypothyroidism, diabetes, hypertension, hyperthyroidism or others, people suffering from indisposition, having flue or a cold, under medical treatment, or who had been in contact with highly odorous materials, cosmetics or foods less than 1 h before sensory section.

Texture, appearance, odour and taste were selected as sensory attributes (Afoakwa, Paterson, Fowler, & Viera, 2009). Based on the study performed by Bedani, Campos, Castro, Rossi, and Saad (2014), in order to obtain more information on the sensorial characteristics of the mousses, the consumers were instructed to report on the sensorial attributes that they liked or disliked most in the samples, and they were free to mention none or more than one attribute.

2.6. Statistical analyses

Homogeneity of variance for each data set was checked using the Hartley, Cochran and Bartlett tests. Student *t*-test was used to determine statistically significant differences ($p < 0.05$) between two means when a homogeneous variance was observed. Results were compared by the analysis of variance (ANOVA) using the Tukey's test and assuming a significance level of 5% ($p < 0.05$). In the absence of normal distribution, we employed the nonparametric Kruskal-Wallis test followed by the Dunn's post-hoc test. Statistical analyses were carried out using the Statistica version 12.0 software (Statsoft Inc., Tulsa, OK, USA).

3. Results and discussion

3.1. Microbiological parameters

Some studies emphasized the importance of previously testing the compatibility between probiotic and prebiotic to provide a positive interaction able to increase microbial viability throughout storage (Peredo, Beristain, Pascual, Azuara, & Jimenez, 2016). *Lactobacillus acidophilus* La-5 population in the synbiotic diet mousse (SDM) kept in the range 7.63–7.85 log CFU g^{-1} during 112-day storage at −18 °C, with no significant differences ($p > 0.05$) in its viability. Such a viability was higher than that previously observed in a sucrose-based synbiotic mousse either after 14-day refrigerated storage (6 log CFU g^{-1}) or 112-day frozen storage (> 7 log CFU g^{-1}) (Buriti, Castro, & Saad, 2010a). Settachaimongkon et al. (2016) suggested that post-acidification, ascribable to probiotic fermentation under refrigeration, may have reduced the pH due to release of organic acids, thereby impairing viability. Since some lactobacilli have β-fructofuranosidase activity (Makras, Van Acker, & De Vuyst, 2005), the higher counts of the same probiotic (8.62–8.92 log CFU g^{-1}) observed in a sucrose-based dairy dessert after 15-day refrigerated storage (Moura et al., 2016) may be ascribed to the absence of inulin.

No microbial contaminants were detected in frozen mousses during storage, confirming the good manufacturing practices.

3.2. pH evaluation

SDM pH was significantly lower ($p < 0.05$) than that of standard mousse throughout the whole storage period (Table 2). Possibly, these differences can be attributed to the presence of 10% more solids of non-lipid origin (skimmed milk powder) in the standard mousse compared with the synbiotic diet mousse (Table 1). Besides, the addition of

Table 2
Mean pH values (± standard deviations) of standard mousse and synbiotic diet mousse stored at −18 °C for up to 112 days.

Storage time (days)	Standard mousse	Synbiotic diet mousse
1	6.40 ± 0.01 ^{Aa}	5.85 ± 0.02 ^{Ba}
7	6.37 ± 0.02 ^{Aab}	5.82 ± 0.01 ^{Bab}
35	6.28 ± 0.03 ^{Abc}	5.80 ± 0.03 ^{Babc}
56	6.26 ± 0.01 ^{Acd}	5.71 ± 0.03 ^{Bbcd}
84	6.22 ± 0.02 ^{Acd}	5.68 ± 0.09 ^{Bcd}
112	6.18 ± 0.02 ^{Ad}	5.66 ± 0.02 ^{Bd}

^{A,B} Different uppercase letters in the same line indicate statistically significant differences ($p < 0.05$) between the two diet mousse formulations after the same storage period.
$^{a\text{-}d}$ Different lowercase letters in the same column indicate statistically significant differences ($p < 0.05$) among different storage periods.

Table 3
Chemical composition, energy contribution of macronutrients, and total energy values of standard mousse and synbiotic diet mousse referred to 100 g of mousses (dry weight).

	Standard mousse	Synbiotic diet mousse
Composition (g 100 g^{-1})		
Ash	1.42 ± 0.17 ^{A}	0.90 ± 0.06 ^{B}
Proteins	8.55 ± 0.33 ^{A}	6.77 ± 0.37 ^{B}
Simple carbohydrates	17.53 ± 1.01 ^{A}	10.24 ± 0.97 ^{B}
Fructans	0.00 ^{A}	9.63 ^{B,*}
Lipids	0.12 ± 0.06 ^{A}	0.22 ± 0.05 ^{A}
Moisture	72.38 ± 1.84 ^{A}	72.24 ± 1.59 ^{A}
Total	100.00	100.00
Energetic value (kJ 100 g^{-1})		
Proteins	143.09 ± 5.52 ^{A}	113.30 ± 6.67 ^{B}
Lipids	4.52 ± 2.26 ^{A}	8.28 ± 2.07 ^{A}
Simple carbohydrates	293.24 ± 16.90 ^{A}	171.38 ± 31.07 ^{B}
Fructans	0.00 ^{A}	60.46 ^{B}
Total Energy Value	440.85 ± 11.42 ^{A}	353.42 ± 27.91 ^{B}

Values expressed as means ± standard deviations.
*Estimated based on information given by the supplier (Orafti) of the prebiotic ingredients (Beneo P95 and Beneo HP).
A,B Different uppercase letters in the same line indicate statistically significant differences ($p < 0.05$) between the two diet formulations.

skimmed milk powder in both formulations may have contributed to the buffering capacity due to the presence of proteins and phosphates (Buriti et al., 2010a).

3.3. Chemical composition and total energy value

Chemical composition, energy contribution of macronutrients and total energy values of both diet mousses are listed in Table 3. There were no significant differences ($p > 0.05$) only for the lipid energy value. TEVs of standard mousse (440.85 kJ 100 g^{-1}) and SDM (353.42 kJ 100 g^{-1}) were 10.8 and 28.5% lower, respectively, than that of the non-diet mousse prepared by Komatsu et al. (2013) (494.0 kJ 100 g^{-1}), due to the high sucrose content (11%) in this product. Furthermore, SDM had a total energy value about 20% lower than the standard mousse.

There were no significant differences ($p > 0.05$) between lipid and moisture contents of the two formulations, while those of ash, carbohydrates and proteins were significantly higher ($p < 0.05$) in standard mousse, possibly due to its higher percentage (14.0% w/w) of skimmed milk powder (Table 1). Morais, Lima, Morais, and Bolini (2015) observed protein levels between 6.7 and 7.1% for milk chocolate desserts containing different sweeteners (sucrose, sucralose, aspartame, neotame or stevia), but higher ash contents (from 1.7 to 2.1%), while Komatsu et al. (2013) reported protein and ash contents in the ranges 4.4–8.0% and 0.8–1.0%, respectively, for milk guava mousses using inulin as fat replacer and/or whey as food supplement.

3.4. Texture profile analysis

Texture profiles of SDM and standard mousse stored at −18 °C are illustrated in Fig. 2. SDM gumminess and hardness increased and cohesiveness significantly decreased along storage ($p < 0.05$), while springiness and adhesiveness remained constant ($p > 0.05$) until 112 and 84 days, respectively. Conversely, standard mousse hardness did not undergo significant changes during storage ($p > 0.05$), while cohesiveness, springiness, adhesiveness and gumminess decreased gradually along the time ($p < 0.05$).

Borreani, Llorca, Quiles, and Hernando (2017) reported a decrease in hardness of non-diet dairy desserts containing skimmed milk powder enriched with liquid cream. Indeed, a relatively constant hardness along storage, like that observed for standard mousse, is a desirable feature of any food product, because it suggests that the stored product preserved its main original features (Maruyama, Cardarelli, Buriti, & Saad, 2006).

According to Cardarelli, Aragon-Alegro, Alegro, Castro, and Saad (2008), mousse particles take long to achieve stability at low temperature owing to the low mobility of air bubbles in the intrinsic structure. It has been suggested that hardness of inulin-containing foods is promoted by the ability of this prebiotic to interact with water molecules and milk protein fraction (Gokavi, Zhang, Huang, Zhao, & Guo, 2005), thus forming larger aggregates (Tárrega & Costell, 2006). Improvement of hardness induced by prebiotic incorporation has already been reported for different food products (Oliveira, Perego, Oliveira, & Converti, 2011). Thus, the higher hardness of standard mousse, compared with SDM, may be ascribed to its significantly higher content of skimmed milk powder (Table 1).

SDM adhesiveness was significantly higher ($p < 0.05$) than that of standard mousse, likely due to the presence of FOS, which is more hygroscopic than inulin (Franck, 2002). For the same reason, while standard mousse adhesiveness significantly decreased after storage, that of SDM remained almost unchanged ($p > 0.05$) (Fig. 2). Such a stability of SDM adhesiveness is consistent with the one observed for a FOS-containing synbiotic guava mousse stored in the same way (Buriti et al., 2010a). Contrariwise, a progressive increase in this parameter was observed either in synbiotic chocolate mousses stored at 4 ± 1 °C for 28 days (Cardarelli et al., 2008) or in different formulations of probiotic dessert after 28-day storage at 5 ± 1 °C (Frederico et al., 2016).

Springiness and cohesiveness along storage were similar in both mousses ($p > 0.05$), and their values at the end of storage were significantly lower than at the start ($p < 0.05$). These results suggest that neither FOS nor inulin significantly contributed to these properties.

The known aggregation effect of inulin and FOS is highlighted by gumminess behaviour along storage that decreased in standard mousse but increased in SDM ($p < 0.05$) that contained both. Finally, the significantly higher gumminess of standard mousse compared with SDM can be ascribed to its higher content of skimmed milk powder.

3.5. Sensory analysis

The results of sensory analysis listed in Table 4 show statistically significant differences between the two mousses ($p < 0.05$) up to 56-day storage. SDM received higher scores (mean values between 6.7 and 7.0) than standard mousse (mean values between 5.9 and 6.5). These differences were detected again in the last period of storage (112 days).

The low content of skimmed milk powder (4%) and simultaneous presence of a probiotic and two prebiotics (inulin and FOS) in SDM could have been the reasons of its low hardness and gumminess as well as of its high adhesiveness (Fig. 2), resulting in better acceptability ($p < 0.05$) than standard mousse (Table 4) during the whole storage period. Some ingredients such as inulin and protein concentrates are often used to prepare milk desserts not only to substitute fat, but also to provide special functional and nutritional properties to products (Morais et al., 2016). In this regard, the simultaneous addition of *L. paracasei* subsp. *paracasei* LBC 82 and inulin improved texture, colour and flavour of chocolate mousses (Cardarelli et al., 2008).

Average scores for SDM (6.7–7.0) were lower than those (7.6–8.0) reported for the same guava mousse stored in the same way but having sugar instead of sucralose and lower contents of inulin (2.0%) and guava pulp (12.5%) (Buriti, Castro, Saad, & 2010a), hence suggesting a possible dependence of taste on these contents.

Texture was the most appreciated attribute among consumers for both standard mousse and SDM, while flavour was the one that most differed between them (data not shown); in addition, as previously shown, SDM and standard mousse exhibited different instrumental texture profiles ($p < 0.05$) (Fig. 2). Thus, the presence of 14.0% (w/w) skimmed milk powder and the absence of inulin and FOS may have

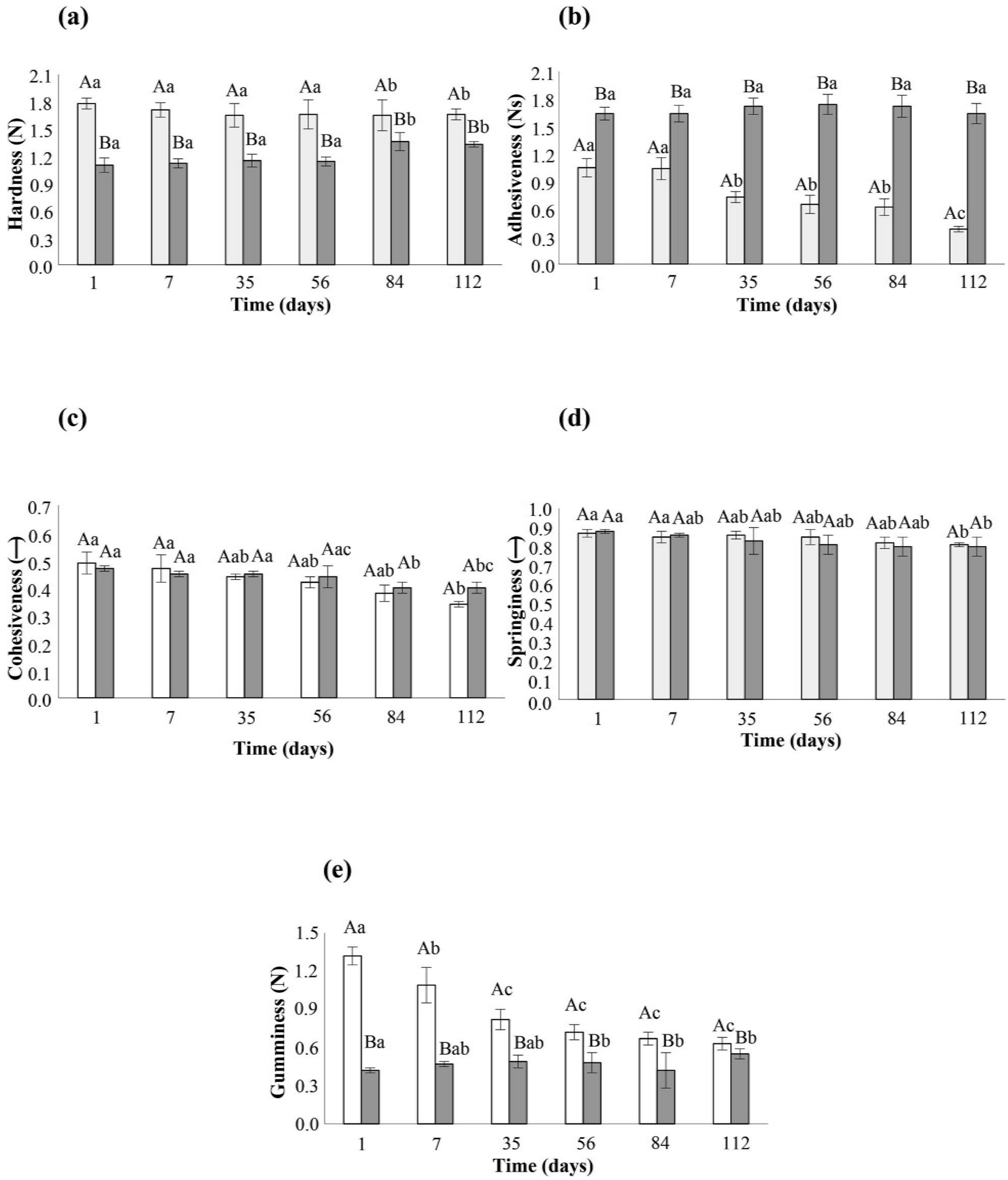

Fig. 2. Instrumental texture profiles of mousse formulations: (□) Standard mousse; (■) Synbiotic diet mousse. (a) Hardness, (b) Adhesiveness (absolute values), (c) Cohesiveness, (d) Springiness, (e) Gumminess. [A,B] Different uppercase letters indicate statistically significant differences ($p < 0.05$) between the two diet mousse formulations for the same storage time. [a-c] Different lowercase letters indicate statistically significant differences ($p < 0.05$) among different storage times for the same mousse formulation.

contributed to the lower acceptability of standard mousse compared to SDM (Table 4) during 112-day storage. Finally, odour was the least rated attribute for both (data not shown).

Relative frequencies of scores awarded to mouses after all storage times are illustrated in Fig. 3. Standard mousse received scores between 4 and 9 after all storage times, being 7 the most frequent (around 45%) and 4, 5 and 9 the less frequent (around 5%) ones. SDM received scores between 5 and 9 after 7- and 56-day storages, but 8 was by far the most frequent score (around 35%) after all storage periods. On average, SDM received better scores throughout the whole storage (Table 4).

4. Conclusions

Incorporation of *L. acidophilus* La-5, inulin and FOS as well as cold

Table 4
Mean scores of sensory acceptability (± standard deviations) attributed by consumers to standard mousse and synbiotic diet mousse.

Storage time (days)	Standard mousse	Synbiotic diet mousse
7	5.9 ± 1.4^{Ba}	6.9 ± 1.1^{Aa}
35	6.0 ± 1.5^{Ba}	7.0 ± 1.4^{Aa}
56	6.4 ± 1.5^{Ba}	6.8 ± 1.6^{Aa}
84	6.5 ± 1.3^{Aa}	6.7 ± 1.3^{Aa}
112	6.4 ± 1.8^{Aa}	6.7 ± 1.5^{Aa}

[A,B] Different uppercase letters indicate statistically significant differences ($p < 0.05$) between the two diet mousse formulations for the same storage time.
[a] The same lowercase letter indicates non-statistically significant differences ($p > 0.05$) among different storage times for the same mousse formulation.

storage time influenced the pH and instrumental texture profile of a synbiotic diet mousse (SDM) compared to a standard mousse without those ingredients. SDM exhibited lower pH than standard mousse, increased hardness and gumminess and decreased cohesiveness throughout storage, while springiness and adhesiveness remained almost stable. Standard mousse hardness did not vary significantly, while the other texture parameters gradually decreased along storage. Moreover, SDM showed higher sensory acceptability and higher probiotic viability during storage. The lower content of skimmed milk powder and the simultaneous presence of a probiotic and two prebiotics in SDM could have been the reasons of its better acceptability. The simultaneous presence of probiotic and prebiotic ingredients in synbiotic diet mousses may be useful to improve their texture and sensory properties.

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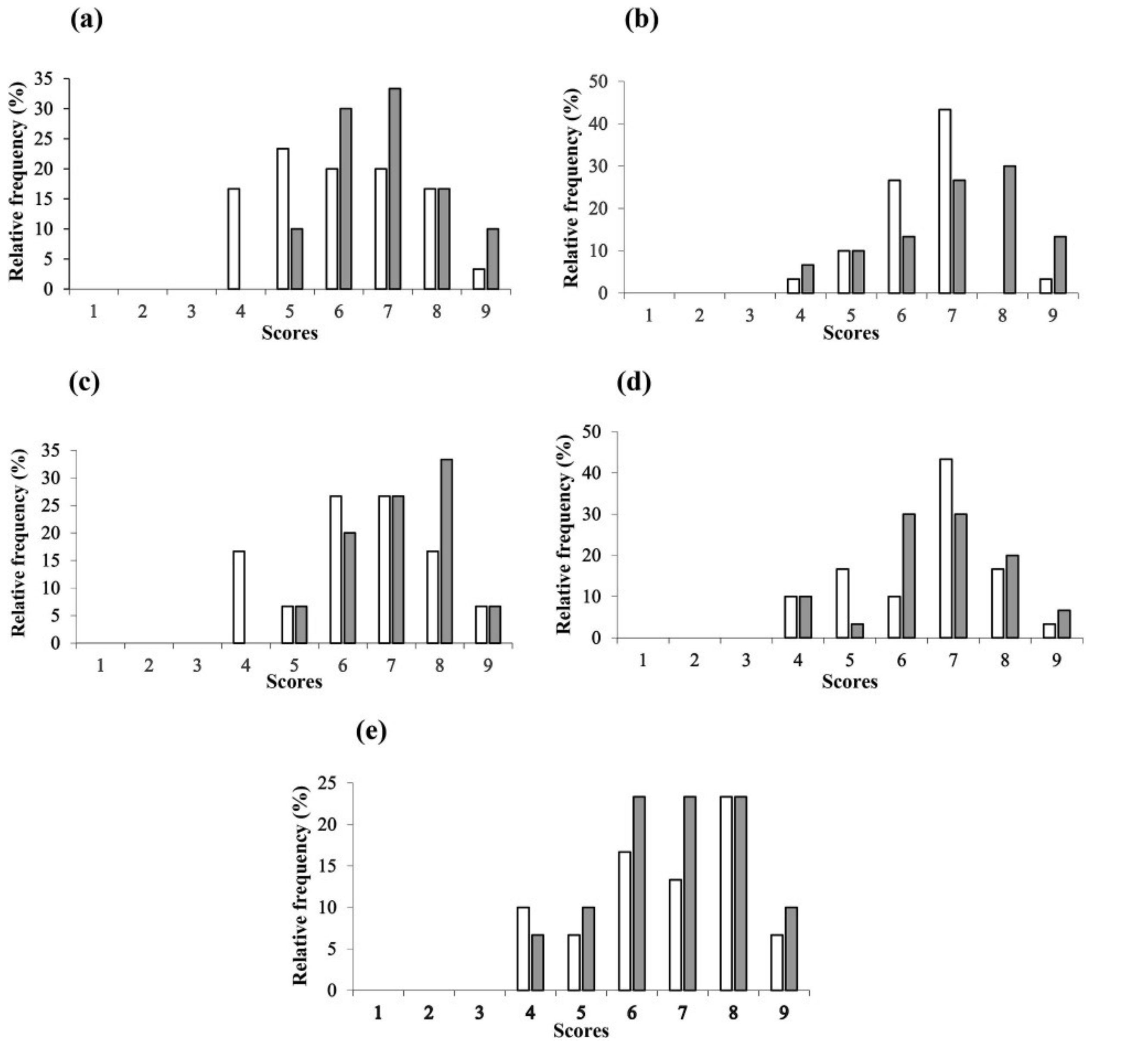

Fig. 3. Relative frequencies of scores awarded to mousses in all storage times. Time of storage (days): (a) 7, (b) 35, (c) 56, (d) 84, (e) 112. Scores: 1, dislike extremely; 2, dislike very much; 3, dislike moderately; 4, dislike slightly; 5, neither like or dislike; 6, like slightly; 7, like moderately; 8, like very much; 9, like extremely. (□) Standard mousse, and (■) Synbiotic diet mousse.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.lwt.2019.02.011.

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