**Obtaining fermented beverages from vegetables and seeds using a commercial lactic culture**

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**Highlights**

* Probiotics sources for common people are expensive in Latin America
* Vegetables consumption in Latin America is low
* Seeds and grains can be useful to prepare fermented beverages
* Blends of vegetable purees and seeds extracts can be a cheaper source of probiotics

**1. Introduction**

Nowadays there is an increasing interest of people to replace consumption of dairy products, not only for health reasons, like lactose intolerance, but also for ethical reasons, as vegans. Vegetable beverages are now a reality, and their studies are focused on beverages from soybean. In case of other legumes, cereals and vegetables, there is not enough information about their products or how the process to obtain them is performed. That is why the use of this engineering is proposed, to obtain fermented beverages through lactic fermentation of vegetable beverages of quinoa and canary seed, considering the addition of carrot and pumpkin puree.

**2. Methods**

Quinoa (*Chenopodium quinoa*), canary seed (*Phalaris canariensis*), carrots (*Daucus carota*) and pumpkins (*Cucurbita maxima)* were purchased at the local market in Valparaiso, Chile. A Commercial culture Choozit® MY 800 LYO (Dupont), which contains three types of microorganisms: *Streptococcus thermophilus, Lactobacillus delbueckii subsp. lactis* and *Lactobacillus delbueckii subsp. bulgaricus*, was used as fermenting agent. All fermentation tests were done in triplicate, and the culture was added directly to the mixtures according to the manufacturer's dosage instructions.

*Preparation of quinoa and canary seed beverages and vegetables purees*

It was performed according to methodologies reported by Cuenca and Benavides to obtain soymilk [1,2]

*Lactic fermentation of beverages, purees and blends*

Lactic culture was added for all cases according to the manufacturer's dosage instructions (0.016 g/kg). 1 kg of beverage, puree or blend was fermented at 42ºC in triplicate using three home yogurt makers (Blanik, model BYM019, 220V, 50-60 Hz, 20W, China) for 5 hours.

*Analytical analysis*

pH and total acidity measurements, expressed as percentage of lactic acid (% w/v) (methods 981.12 and method 950.15, AOAC, 1998) [3]

*Total reducing sugars*

Initial and final total reducing sugars were measured by the 3,5 Dinitrosalicyclic Acid Method (DNS) [4]

**3. Results and discussion**

Table 1 presents different blends evaluated during lactic fermentation, and Figure 1 presents variation of blends F1, F2, F3 and F4 during 5 fermentation hours for pH (a) and Total Acidity (b).

**Table 1**. Different blends used for evaluating lactic fermentation (% w/w)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Beverages blend** | **Quinoa beverage** | **Canary seed beverage** | **Purees blend** | **Carrot puree** | **Pumpkin puree** | **Formulation** | **Quinoa beverage** | **Canary seed beverage** | **Carrot puree** | **Pumpkin puree** |
| B1 | 100% | 0% | P1 | 100% | 0% | F1 | 16% | 64% | 8% | 12% |
| B2 | 80% | 20% | P2 | 80% | 20% | F2 | 12% | 48% | 16% | 24% |
| B3 | 60% | 40% | P3 | 60% | 40% | F3 | 8% | 32% | 24% | 36% |
| B4 | 40% | 60% | P4 | 40% | 60% | F4 | 4% | 16% | 32% | 48% |
| B5 | 20% | 80% | P5 | 20% | 80% |  |  |  |  |  |
| B6 | 0% | 100% | P6 | 0% | 100% |  |  |  |  |  |

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**Figure 1.** pH (a) and Total Acidity (b) Variation of different blends with quinoa, canary seed, carrot and pumpkin

Through these studies it was determined that despite not being a process as productive as the lactic fermentation of cow's milk, it is possible to carry out the fermentation of the different substrates studied. It was selected F4, which contains an 80% of purees and 20% of vegetable bevereages, presenting values ​​consistently better than other blends, achieving a productivity of 0.563 g\*l-1\*h-1. Final product 1.1 x 105 CFU\*ml-1 of lactic acid bacteria, which is one order of magnitude less than what is required to be named a probiotic, if it has characteristics that would make it an adequate food for consumption.

**4. Conclusions**

It is possible to obtain vegetable fermented blends that can be a potential source of lactic acid bacteria to people that cannot access to cheap probiotic sources. It remains to study specific parameters of the process, such as its viscosity, and the effect that temperature has on the process. A greater dosage of lactic acid bacteria culture can improve microorganism’s count in the final product to be consider a good source of probiotics.

**References**

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