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*Islands and peripheral territories:
challenges in a moving geography and
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16 DIVERSIFICATION STRATEGY FOR THE MITIGATION OF CLIMATE CHANGES IMPACT IN THE BEEKEEPING SECTOR: DEVELOPMENT AND CHARACTERIZATION OF ENERGY BARS WITH BEE BREAD AND BEE POLLEN

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ABSTRACT

In Trás-os-Montes region, which is peripherally located in the northeast of Portugal, the apiculture sector is almost exclusively dedicated to the production of honey. According to the most recent data, 9817 tons of honey were produced in 2020 in Portugal, contributing for an income over 23 Million € for the beekeepers. This high dependence on honey production, combined with the increasingly frequent and extreme climate change phenomena, might be considered a problem that can negatively influence the profitability of apicultural activities. In fact, climate changes constitute an additional stress factor, which might affect honeybees, reducing their production potential. Diversification and innovation in the apiculture sector can be an important strategy in order to mitigate the negative impact of climate change in the apiculture sector profitability. Therefore, this work aimed to evaluate the chemical composition, rheological properties, and global consumer acceptability of energy bars formulated with other hive products besides honey, such as bee bread and bee pollen, which could provide an additional source of income for beekeepers. Eighteen formulations of energy bars, containing a combination of beehive products (bee pollen and bee bread), nuts, and cereal/pseudocereal/seed, were developed. The energy bars that included white quinoa grains contained total carbohydrate, fat, protein, moisture, and ash percentages of 56.0 ± 0.3 – 61.1 ± 1.2 , 13.5 ± 0.5 – 44.5 ± 0.1 , 11.3 ± 0.1 – 20.0 ± 0.1 , 7.3 ± 0.1 – 11.9 ± 0.3 , and 2.0 ± 0.1 – 3.9 ± 0.1 , respectively, corresponding to energetic values between $414,2\pm 4.6$ and $438,5\pm 3,3$ kcal/100 grams. These values are comparable to those reported by a renowned company specialized in the sports nutrition that has on the market a variety of energy bars with energetic values ranging from 403 to 472 kcal/100 grams. The substitution of the white quinoa grains by sesame seeds yielded energy bars with higher proportion of fat in its composition, which yield an even higher energetic value (535.6 ± 6.5 – 570.9 ± 7.3 kcal/100 grams), which can make them an interesting alternative for sports activities that require higher energy expenditure. The results from the global acceptability sensory analysis evidenced that the type of beehive product present in the formulation played an important role in the panel global acceptability: the incorporation of bee bread in the energy bars formulation, instead of bee pollen, increased the sensory panel global acceptance, evidenced by higher scores (6.0–6.9/9.0 vs 5.6–6.3/9.0). Overall, the energy bars mostly appreciated by the sensory analysis panel contained quinoa grains, bee bread, and almonds in their formulation, exhibiting a global acceptability score of 6.9/9.0. The rheological analysis of these energy bars yielded hardness, adhesiveness, elasticity, cohesiveness, chewiness, and resilience values of 10982 ± 1278 g, 46.83 ± 8.65 g/s, 0.52 ± 0.08 %, 0.47 ± 0.05 %, 4838 ± 594 , and 0.23 ± 0.01 %, respectively. The analysis of the rheological properties did not evidence a clear relation between the parameters evaluated and the results from the sensory analysis, evidencing that besides the texture characteristics of the energy bars, other properties, such as global visual aspect and flavor, were also valued by the sensory panel. This study showed that the energy bars developed with the incorporation of added-value beehive products, such as bee bread and bee pollen, have a chemical composition and energy value comparable with those currently on the market, besides getting a good overall consumer acceptability. Therefore, the production of bee pollen and bee bread can constitute an additional source of income for the beekeepers, reducing the dependency on the production of honey, and minimizing the impact of climate change on the beekeeper's profitability.



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