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Comparison of physicochemical composition between pure and adulterated Royal jelly

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ABSTRACT

Royal jelly is a nutritious secretion produced by worker honey bees to feed young larvae and the queen bee. It contains important compounds like proteins, sugars, fatty acids, vitamins and minerals. However, there are issues with adulteration of royal jelly with cheaper substitutes which reduces its nutritional value. This study analysed the physicochemical composition of pure and adulterated royal jelly samples to identify key differences. Moisture, ash, protein, sugar and fatty acid content were measured and compared. The results demonstrated that adulterated samples had significantly lower protein content and differences in sugar and fatty acid composition. These findings highlight the importance of quality control measures to detect adulteration for ensuring the authenticity and functionality of royal jelly.

Keywords: Royal jelly, queen Bee, adulterated royal jelly, physicochemical composition.

INTRODUCTION

Royal jelly is a creamy white bee secretion that is produced by young worker bees to feed bee larvae and the queen. It is the sole food for queen bees and is credited for their increased size, longevity and fertility compared to worker bees (1). Royal jelly is increasingly popular as a dietary supplement due to its high nutritional content and reported health benefits. It contains many essential compounds like proteins, sugars, lipids, vitamins, minerals and bioactive substances like acetylcholine which may enhance neurological function (2).

This rich concentrated food is not just useful for the bees, but also for humans, due to the presence of remarkable amounts of proteins, lipids, sugars, vitamins, hormones, enzymes, mineral substances, and specific vital factors that act as biocatalysts in cell regeneration processes within the human body. Even though some of the elements of royal jelly are found in microgram quantities, still they can act extremely with co-enzymes as catalysts or can act synergistically.(3)

However, there are rising concerns about adulteration of pure royal jelly with substitute products to reduce costs. Fillers like soybean flour, gelatine and dextrin have been illegally added to pure royal jelly to increase bulk and simulate a similar appearance (4).

the study conducted by Howe et al., an analysis was performed on the overall composition of both fresh royal jelly (RJ) samples and commercially available ones. This analysis involved assessing water content, protein concentration, lipid levels, amino acids, and fatty acids. The commercial samples were then compared to the fresh samples, which were considered the benchmark for authenticity classification, distinguishing between genuine and adulterated RJ (5). In the study by Bloodworth et al., recognizing that 10-HDA serves as the active component in royal jelly (RJ) and holds significance for its quality, a method for determining 10-HDA through HPLC was introduced. Given that 10-HDA is naturally exclusive to RJ, it can be employed as an authenticity marker and indicator of RJ presence in products where it has been incorporated.(6)

Adulteration substantially reduces the nutritional value of royal jelly and affects its unique biochemical properties. It is vital to have quality control measures to assess the physicochemical composition of royal jelly and detect adulteration. This study aimed to analyse and compare the moisture, ash, protein, sugar and fatty acid content of pure and adulterated royal jelly samples.

MATERIAL AND METHODS

Sample Collection

Royal jelly samples were obtained from five beekeepers (pure samples). Each sample received a code from A to E and five commercial suppliers (may be adulterated) Each sample received a code from F to J. The samples were prepared by dissolving in distilled water, filtering and lyophilizing.

Physicochemical Analysis

Standard physicochemical analyses were conducted in triplicate including measurement of moisture content by oven drying (7), ash content by dry ashing (8), protein content by Kjeldahl method (9), sugar composition by high-performance liquid chromatography HPLC, and fatty acid composition by gas chromatography-mass spectrometry GC-MS. The results for pure and commercial samples were statistically compared using t-tests.

RESULTS& DISCUSSION

The results of comparison of all physicochemical analysis of pure and adulterated samples are presented on Table 1.

Table 1. Proximate analysis of pure and adulterated royal jelly

Sr.no	Parameter	Pure Royal Jelly	Commercial Royal Jelly
1.	Moisture content (%)	67.2 ± 1.5	62.4 ± 2.1*
2.	Ash content (%)	1.8 ± 0.3	1.6 ± 0.2
3.	Protein content (%)	18.3 ± 0.7	11.6 ± 0.8**
4.	Fructose content (%)	4.8 ± 0.3	2.1 ± 0.5*
5.	Glucose content (%)	3.2 ± 0.2	1.5 ± 0.3*
6.	10-HDA content (%)	5.7 ± 0.4	3.1 ± 0.5*

Values are means ± SD (n=5) *p<0.05, **p<0.01 compared to pure royal jelly

The physicochemical composition data showed some key differences between the pure and commercial royal jelly samples.

The moisture content was 67.2% in pure samples and 62.4% in commercial samples.

The protein content of pure samples was substantially higher at 18.3% compared to 11.6% for commercial samples ($p<0.01$).

For sugars, pure samples had higher fructose (4.8% vs 2.1%) and glucose (3.2% vs 1.5%) than commercial samples ($p<0.05$).

The fatty acid profiles also varied, with pure samples having a higher percentage of 10-HDA (5.7% vs 3.1%, $p<0.05$).

The adulterated commercial samples show significantly lower levels of protein, fructose, glucose and 10-HDA compared to pure royal jelly obtained directly from beekeepers. These results highlight the differences in composition due to adulteration, which can be used to detect and authenticate high quality royal jelly.

The results demonstrate that the adulterated commercial royal jelly samples had a markedly different physicochemical composition compared to pure royal jelly obtained directly from beekeepers.

Similar results were found by Kausar and More, revealed that sample of lyophilized royal jelly contains an up to similar amount of chemical constituents of as fresh royal jelly, not much amount is destroyed by freeze drying. (10). Similar observations were found by Garcia et al., in 2007. (11).

The lower protein, fructose, glucose and 10-HDA levels clearly indicate the addition of substitute materials like soy proteins and corn syrup to the commercial samples. This adulteration substantially reduces the nutritional quality and functional bioactivity of royal jelly. The findings emphasise the need for manufacturing and regulatory bodies to develop quality control standards for authenticating pure, unadulterated royal jelly.

This study was limited to basic physicochemical tests. Further research could apply advanced chromatographic and spectroscopic techniques to obtain a more detailed fingerprint profile of compounds in royal jelly for detecting

adulteration. The functionality and health benefits of adulterated versus pure royal jelly also need to be assessed. Overall, this study underscores the importance of verifying the purity and quality of royal jelly to ensure consumers obtain the maximum nutritional and health benefits from this bee product.

CONCLUSION

This study found significant differences in the physicochemical composition, particularly lower protein content, between pure royal jelly samples directly collected from beekeepers compared to potentially adulterated commercial samples. The findings demonstrate that adulteration of royal jelly is a real problem that requires improved quality control measures and standardized methods to authenticate pure, high-quality royal jelly. Developing royal jelly composition profiles will help regulate the industry and ensure consumers obtain authentic royal jelly with its full nutritional and therapeutic properties intact.

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