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Evaluation of Functional Properties of Roasted Lentil and Faba Bean Flours

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INTRODUCTION & AIM

With the increasing shift towards plant-based diets, legumes such as lentils and faba beans have become prominent due to their rich nutritional profile and potential as sustainable protein sources. These legumes are valued not only for their high protein content but also for their significant levels of dietary fiber, vitamins, minerals, and bioactive compounds. Processing methods like roasting can further enhance the nutritional and functional qualities of legume flours, making them more suitable for a wide range of food applications.

Roasting is known to improve the sensory characteristics of legumes, such as flavor and aroma, and can modify their chemical composition, influencing factors like phenolic content and antioxidant activity. Moreover, it can positively affect the functional properties of legume flours, such as water and oil absorption, emulsification, and gelation capabilities, which are crucial for their use in various food formulations. Understanding these functional properties is essential for optimizing the use of roasted legume flours in bakery, snack, and other food products.

This **study aims** to evaluate the functional properties of roasted lentil and faba bean flours, focusing on how roasting influences attributes such as water absorption capacity, oil holding capacity, and particle size distribution. By assessing these properties, we can gain insights into the potential applications of these flours in enhancing the nutritional and sensory qualities of plant-based foods.

METHOD

The study was conducted at the Faculty of Agriculture and Food Technology's scientific and microbiology laboratories at the Latvia University of Life Sciences and Technologies, located in Jelgava, Latvia. For this research, both raw and roasted flours of lentils (*L. culinaris*) and faba beans (*L. Vicia faba*) were sourced from the local supplier, Ltd "ZEKANTS" (Latvia). Four distinct samples were prepared: raw faba bean flour, raw lentil flour, roasted faba bean flour, and roasted lentil flour. These samples were manually sifted using a sieve to achieve particle sizes greater than 0.6 mm.

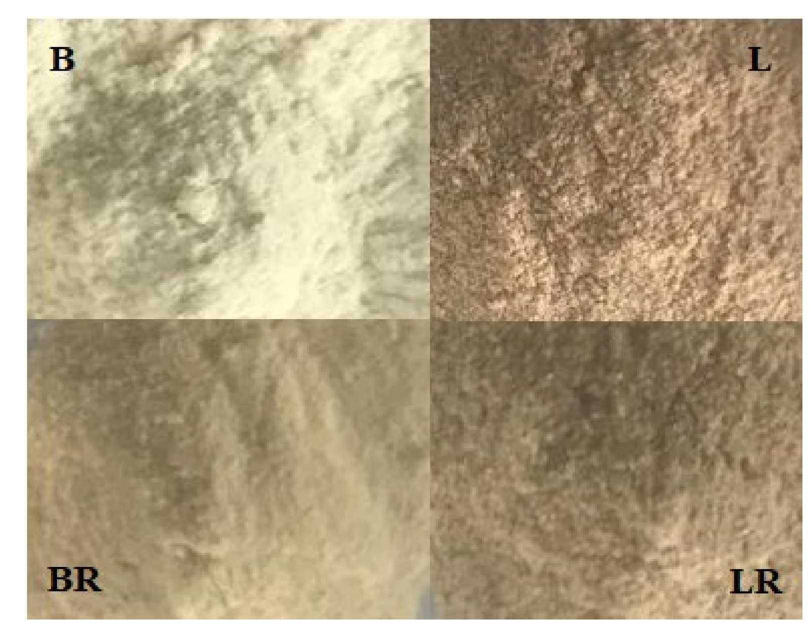
Water absorption capacity of the flours was determined using a standardized gravimetric method. A known weight of flour was mixed with a measured volume of water and allowed to hydrate for a specific duration. The mixture was then centrifuged, and the excess water was removed. The capacity was calculated as the weight of water absorbed per gram of flour, reflecting the flour's ability to retain water during processing.
The **oil absorption** capacity was measured using the same method as for water absorption, except that oil was used in place of water.
The **foam capacity** of flour was evaluated by dispersing a known weight of flour in a specified volume of distilled water and blending the mixture at high speed for a set duration. The resulting foam was then transferred into a graduated cylinder, and the initial volume of the foam was recorded. Foam capacity was expressed as the percentage increase in volume compared to the original liquid volume, reflecting the flour's ability to incorporate air and form stable foams. The foam volume was recorded immediately and at regular intervals (e.g., every 5, 10, 30 minutes) to assess the rate of foam collapse. **Foam stability** was calculated as the percentage of the initial foam volume remaining after a set time, indicating the ability of the foam to resist breakdown over time.
Moisture content was determined using the oven-drying method. A known weight of the flour sample was placed in a pre-weighed moisture dish and dried in a hot air oven at 105°C until a constant weight was achieved. After drying, the sample was cooled in a desiccator and weighed again. The moisture content was calculated as the percentage weight loss of the sample, representing the amount of water present in the flour.
Color analysis of the flour samples was performed using a colorimeter. The samples were placed in a standardized container, and measurements were taken in terms of L* (lightness),

The emulsion activity and stability, density, gelatinization temperature, concentration, and swelling capacity were measured using the methods described by Chandra et al. (2015)*.

Chandra S, Singh S, Kumari D (2015) Evaluation of functional properties of composite flours and sensorial attributes of composite flour biscuits. J Food Sci Technol 52: 3681-3688

RESULTS & DISCUSSION

The research investigated faba bean and lentil flour with a particle size of 0.6 mm. Sample B – Raw faba bean, L- Raw lentil, BR – Roasted faba bean; LR – Roasted lentil.



Visual appearance of flour sample

In the visual appearance of the flour, you can notice that the roasted flour samples (BR and LR) comparing to raw flour samples (R and L) are in darker shades

Functional and Physicochemical Properties of flour Samples

	B	BR	L	LR
Water absorption capacity, %	215.5 ± 4.1	331.0 ± 1.8	289.2 ± 0.5	328.8 ± 1.3
oil absorption capacit, %	140.0 ± 0.3	198.8 ± 0.9	142.4 ± 0.9	185.9 ± 0.8
foam capacity, %	48.2 ± 0.7	19.4 ± 0.5	54.3 ± 0.7	21.5 ± 0.3
Foam stability, %	70.5 ± 0.6	65.7 ± 0.9	93.8 ± 0.6	57.1 ± 0.8
Density, $g\ cc^{-1}$	0.58 ± 0.1	0.56 ± 0.1	0.73 ± 0.1	0.72± 0.1
Swelling capacity, ml	13.0 ± 1.0	18.0 ± 1.0	21.0 ± 1.0	31.0 ± 1.0
Moisture content, %	6.4 ± 0.1	3.2 ± 0.1	8.3 ± 0.3	5.8 ± 0.3
Color analysis, L*	86 ± 1	73 ± 1	77 ± 1	58 ± 1
Emulsion activity, %	42 ± 2	48 ± 3	42 ± 3	42 ± 3
Emulsion stability, %	16 ± 3	96 ± 1	21 ± 1	97 ± 1
Gelatinization temperature, ° C	38.7 ± 0.1	48.1 ± 0.1	36.0 ± 0.1	43.2 ± 0.1
Least gelation concentration, %	15	12	12	7

Overall, roasting generally increased water absorption capacity and emulsion stability but decreased foam capacity, while lentil flours demonstrated higher gelatinization temperatures compared to faba bean flours.

CONCLUSION

Based on the results of this study, it can be concluded that the use of roasted flour in food production is more desirable than raw flour. This study showed that roasting improves the functional properties of legume flour, such as water and oil absorption capacity, swelling capacity, emulsion stability, and gelation. Roasted legumes showed an obviously darker colour, indicating the effect of roasting on the constituents of the sample. The study showed that roasted legume flour is significantly more beneficial for improving functional properties than raw flour. Further research comparing the effect of roasting on the reduction of anti-nutritional factors is necessary.