PE4.113 Using Different Types Of Legume Flours In The Coating Of Beef Meatballs 418.00

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Abstract- In this study, using precooked lentil, chickpea, pea and rusk in batter formulation for coating of meatballs was investigated. Legumes were prepared as powder and used as different amounts in batter formulations. Incorporation of legume flours to the batter formulations did not change moisture, protein, fat and pH values of meatball samples. Usage of legume flours resulted better performance in some of the functional properties according to rusk group. Batters with chickpea flour had the highest batter pick up property. The cooking yield and fat retention values of lentil and chickpea containing groups were found significantly higher than the other sample groups. Incorporation of legume flours into the batter formulation resulted softer texture and affected the colour and sensory scores of meatball samples. All the samples were evaluated as acceptable by the sensory panel.

Index Terms: Coated beef meatball, lentil, pea, chickpea, rusk

I. INTRODUCTION

Consumption of battered foods especially fish, seafood, poultry, cheese and vegetables has become very popular within the last few years. Frying batters are used to improve product quality. The basic quality factors in fried foods are texture, moisture and oil contents, porosity, color, taste and nutrition [1,2]. Crust brittleness or crispness is a critical element in a consumer's evaluation of a particular fried battered food product. To achieve the desirable texture of crust in fried battered products, design of appropriate ingredients with wide-ranging functionalities is available [3]. Battered foods are very complex systems from a structural viewpoint; they tend to contain a wide range of components of very different natures and both the coating and the food substrate undergo substantial changes as a result of frying [4]. Typically a simple mixture of flour and water, batter can be defined as liquid dough into which a product is dipped prior to cooking, normally by frying. Batter coatings enhance food flavor, texture and appearance and act as a barrier against loss of moisture by protecting the natural juices of foods from the effects of freezing or reheating, thereby ensuring a final product that is tender and juicy on the inside and crisp on the outside [3]. Wheat flour is the most common flour used in batter systems. However, rice, corn, and soy flours have also been used. [5]. Shih and Daigle (1999) [6] observed a 69% reduction in oil absorption by using rice flour batter on shrimp products, compared to using wheat flour. Research on battered products in the past few decades has focused on researching a formula to control the quality of fried products, particularly studying ways to reduce the amount of fat absorbed during frying. The proteins in batter provide structure and increase the coating pick-up values and final yield in the fried products [4, 3]. In recent years legumes have been investigated regarding their potential use in developing functional foods. Legumes provide energy, dietary fibre, proteins, minerals and vitamins required for human health [7]. The main objective of this study was to evaluate of some quality characteristics of meatballs coated with different batter formulations which added legume flours.

II. MATERIALS AND METHODS

Meatball Preparation Lean meat and fat were ground through a 3 mm plate grinder. Meatball samples were produced according to following recipe. The minced lean beef was mixed with 7% beef fat, 0.3% onion powder, 1.5% salt, 0.3% black pepper and 0.3 % red pepper. The mix was kneaded and obtained meatball dough was divided into four equal portions. Treatment groups were as following; R: Meatballs coated with batter including rusk P: Meatballs coated with batter including pea L: Meatballs coated with batter including lentil C:Meatballs coated with batter including chickpea Legume Flours Preparation Rusk was purchased as dried flour and pea was purchased as boiled and canned. Lentil and chickpea were prepared as follow parameters. Lentil: Boiled for 45 min., drained, ground with mixer and dried for 10 hour at 100ºC. Chickpea: Boiled for 1 hour and 45 min., drained ground with mixer and dried for 5 hours at 100ºC. Pea: Boiled peas were ground with mixer and dried for 6 hours at 100ºC. Dried lentil, chickpea and pea were ground with a mill (Brook Cromton Series, 2000) to obtain flour. Batter preparation The batters were prepared by mixing dry ingredients (legume flours and salt) with water and egg at room temperature

in a mixer by using following formulations. Different types of legume flours have different water holding capacity so ratios of water were used according to flour types. Solid to water ratio Lentil: 1: 3 Chickpea: 1-3.5 Pea: 1-5.6 Rusk: 1-3.33 Solid Content 99% Legume Flour 1% Salt Water content Water: 1.67 unit Egg : 1 unit Sample coating and Frying Meatball samples were pre-dusted with wheat flour and then immersed individually into the batter suspensions for 30 s. All the samples were deep fat fried at 180ºC in fryer (Moulinex) with containing 2.5 l sunflower oil. Analyses Moisture content of samples was determined according to [8]. Fat content was determined by chloroform- methanol extraction according to, Flynn and Bramblett [9] and protein content was determined according to [10]. pH was measured directly by using probe type electrode according to [11]. Cooking yield [12], fat retention [13] and batter pickup [14]of samples were also determined. Objective measurement of colour (L*, a*, b*) was performed at the surface of meatballs using a HunterLab Colorflex model Colorimetre (Management Company, USA). A Sommer Runge-Model, KG PNR- 6 penetrometer equipped with a total 100 g load weight was used to evaluate cooked meatballs for hardness. Coated Meatballs were served warm after frying to a semi-trained panellist for sensory attributes of appearance, colour, hardness, flavour, juiciness and overall acceptability. A seven point scale was used for where, 7=extremely desirable, 1= extremely undesirable. The data obtained from two replications were analyzed by one way ANOVA using the MINITAB statistical package program [15].

III. RESULTS AND DISCUSSIONS

Mean values for the proximate composition are given in Table 1. No differences (p0.05) were found in moisture, fat and protein content between the treatments. Ash content of P and R groups were found significantly higher than L group. Batters that prepared by using different kinds of legume flours showed significantly different pick up properties ($p<0.05$). Batters with chickpea flour had the highest batter pick up property and significantly different from batters with rusk and pea flours. Dogan et al. (2005) [2] determined that coating pick up value of soy flour was found significantly higher than rice flour and coating pick-up was found to be directly proportional to batter viscosity The cooking yield values of sample groups L and C were found significantly higher from P group ($p<0.05$) (Table 2). Deliza et al., 2002 [16] determined that despite textured soy protein addition up to 20%, the cooking yield was similar or higher than that of control due to more water binding during cooking. L and C groups significantly had higher fat retention values when compared with P and R groups. Shih and Daigle (1999) [6]., compared rice flour and wheat flour added batters and found that rice flour resisted oil absorption better but was less effective as a thickening agent than wheat flour. The pH values of meatballs ranged between 6.02 and 6.12. Coating with different types of legume flours did not alter the pH of meatball samples significantly (p0.05). Usage of pea and lentil flour in the formulation of batter caused significantly softer texture (lower penetration values) according to usage of rusk ($p<0.05$). Legume flours have different colour characteristics so the colours of batters were different. Treatment with lentil and chickpea of batters significantly increased the lightness (L* values) of samples. The lowest redness (a* value) was determined in pea samples and the highest in chickpea samples. L and C sample groups had the highest yellowness values according to rusk and pea samples ($p<0.05$). Dogan et al. (2005) [2] determined that soy flour added batter was found to provide the darkest and have the reddest colored nuggets. Sensory evaluation results are given in Table 4. The use of pea flour in the formulation of meatball batter caused significantly lower colour and appearance scores. Chickpea usage in the formulation improved the texture of patties so, C group had higher hardness scores than R and C groups. No differences in flavour were found among treatments ($p>0.05$). But the usage of lentil flour in batter formulation decreased juiciness scores significantly. All of the treatment groups had acceptable scores but R group had significantly higher overall acceptability score ($p<0.05$).

IV. CONCLUSION

Using different kinds of legume flours (lentil, pea and chickpea) in the batter formulation improved some functional properties of meatballs. But some of these flours caused changes in colour, texture and sensory properties of samples. Investigations can be focused on the appropriate amounts and cooking parameters of this new kind of products.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge for the supports to Melek Aydin , Berrin Avdancý and Saliha Yýlmaz……

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Table1. Proximate Composition and pH of Coated Meatballs

Sample	Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Sample pH
R	53.93^{a}±2.08	12.84^{a}±1.24	21.54^{a}±2.39	2.65^{a}±0.15	6.02^{a}±0.17
P	53.47^{a}±2.03	13.09^{a}±0.70	22.63^{a}±1.75	2.62^{a}±0.18	6.04^{a}±0.17
L	56.46^{a}±3.51	13.95^{a}±0.62	18.34^{a}±0.91	2.27^{b}±0.13	6.11^{a}±0.21
C	54.06^{a}±2.35	13.88^{a}±1.23	20.69^{a}±0.92	2.41^{ab}±0.04	6.12^{a}±0.19

a-c Different supercripts in the same column indicate significant differences

Table 2. Functional Properties Coated Meatballs

Sample	Batter Pick Up	Cooking Yield	Fat Retention
R	26.19^{b}±2.05	68.68^{ab}±1.03	120.13^{b}±3.37
P	32.19^{b}±4.11	67.72^{b}±3.66	114.90^{b}±8.30
L	33.10^{ab}±2.63	75.34^{a}±1.63	149.78^{a}±5.48
C	39.51^{a}±4.33	74.83^{a}±4.23	138.62^{a}±6.33

a-c Different supercripts in the same column indicate significant differences

Table 3. Colour Parameters and Penetrometer Values of Samples

Sample	*L**	*a**	*b**	Penetrometer value (mm)
R	40.60^{c}±0.59	15.02^{ab}±0.14	27.00^{b}±1.35	1.42^{a}±5.32
P	45.00^{b}±0.20	10.21^{c}±0.05	28.66^{b}±1.08	1.23^{b}±4.24
L	56.26^{a}±2.90	13.86^{b}±1.49	38.30^{a}±1.78	1.23^{b}±5.19
C	55.78^{a}±0.16	16.44^{a}±0.32	39.89^{a}±0.03	1.30^{ab}±11.81

a-c Different supercripts in the same column indicate significant differences

Table 4. Sensory Scores of Coated Meatballs

Sample	Colour	Hardness	Juiciness	Flavour	Appearance	Overall Acceptability
R	6.44^{a}±0.33	5.61^{b}±0.26	6.20^{a}±0.16	6.01^{a}±0.08	6.35^{a}±0.19	6.31^{a}±0.01
P	5.41^{b}±0.36	5.83^{ab}±0.05	6.05^{a}±0.04	6.32^{a}±0.19	5.45^{b}±0.36	5.74^{b}±0.03
L	6.56^{a}±0.25	5.68^{b}±0.07	5.32^{b}±0.53	5.35^{a}±1.01	6.09^{a}±0.55	5.93^{ab}±0.42
C	6.51^{a}±0.20	6.05^{a}±0.04	6.16^{a}±0.13	5.82^{a}±0.31	6.16^{a}±0.22	6.16^{ab}±0.13

a-c Different supercripts in the same column indicate significant differences