GELLED EMULSIONS (WITH CHIA AND HEMP OIL) AS ANIMAL FAT REPLACER IN GOAT BURGERS: EFFECT ON LIPID PROFILE, LIPID OXIDATION AND SENSORY QUALITY

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I. INTRODUCTION

Currently, the meat industry is exploring various approaches to reduce overall fat levels and introduce more nutritious lipids into processed meat products to meet the demands of modern consumers [1,2]. To create a healthier meat product that is suitable for a larger population and consumer market, an experimental study was conducted to evaluate the use of gelled emulsions as a substitute for animal fat in goat burgers [1]. The purpose of using gelled emulsions in meat products is to minimize the effects of the substitution of animal fats on the final product's physicochemical and sensory characteristics, while ensuring consumer acceptance and technological feasibility [1,3,4]. Various emulsifiers and gelling agents have been used to develop these gelled emulsions, which have successfully served as fat substitutes in healthier meat products [3,4]. This study aimed to determine the impact of substituting animal fat in goat burgers with gelled emulsions (with amaranth flour and chia or hemp oil) on lipid oxidation, lipid profile, nutritional indices, and sensory attributes of both raw and cooked burgers.

II. MATERIALS AND METHODS

In this study, a batch of goat burgers with 10% pork backfat was used as the control (BGC), which was then fully replaced with a gelled emulsion made from amaranth flour and chia oil (BGCh) and other gelled emulsion based on amaranth flour and hemp oil (BGH). The emulsions were made with a ratio of 40% water, 40% chia or hemp oil, 15% amaranth flour, and 5% gelatine as a gelling agent. The basic formulation of the burgers was 90% goat meat, 10% fat (only meat ingredients up to 100%, the other percentages are related to meat ingredients), 5% water, 1.5% salt and 0.05% pepper. The lipid profile was determined by gas chromatographic, and the lipid oxidation by the TBA method, in both raw and cooked burgers (in an oven preheated to 180ºC until de internal temperature of the burgers reached 70ºC). The sensory evaluation of cooked burgers was made using a trained taste panel [3,4]. Significant differences were determined by means of ANOVA and the Tukey test ($P<0.05$)

III. RESULTS AND DISCUSSION

The animal fat substitution by both gelled emulsions (BGCh and BGH) resulted in a decrease ($P<0.05$) in saturated fatty acids (SFA) of 32% in raw burgers and 36% in cooked burgers, compared to the corresponding controls. Both raw and cooked, reformulated burgers, showed a reduction in palmitic, stearic, and oleic fatty acids, accompanied by an increase in linoleic (in BGH) and α-linolenic (in BGCh) acids according to the emulsion used. In the raw BGCh sample the main fatty acid was the α-linolenic acid (38.0 g/100 g fat), and in the BGH sample the linoleic acid (36.6 g/100 g fat). After cooking, both fatty acids were again the predominant but with decreasing of 5% in BGCh and 2% in BGH samples.

The atherogenic and thrombogenic indices decreased (P<0.05) due to the substitution of animal fat with every gelled emulsion used. All raw burgers showed similar thiobarbituric acid reactive substances (TBARS) values, however, after cooking, BGCh samples showed three times more TBARs values (1.62 g MDA/kg) and BGH samples two times more than BGC (P<0.05). A trained panel rated the BGCh and BGH samples higher than BGC in flavour intensity and persistence (Table 1).

Table 1 Sensory attributes of reformulated goat burgers evaluated by a trained panel.

	BGC	BGCh	BGH	SEM	P-value
Colour	5.67^{a}	5.83^{a}	5.79^{a}	0.168	0.918
Brightness	5.29^{a}	4.71^{a}	4.75^{a}	0.168	0.288
Aroma	5.79^{a}	6.46^{a}	6.04^{a}	0.121	0.072
Hardness	3.13^{a}	2.75^{a}	3.04^{a}	0.119	0.405
Juiciness	5.58^{a}	5.75^{a}	6.08^{a}	0.129	0.277
Chewiness	3.08^{a}	2.79^{a}	2.92^{a}	0.105	0.532
Oiliness	3.29^{a}	3.92^{a}	3.79^{a}	0.187	0.356
Flavour intensity	5.50^{b}	6.54^{a}	6.13^{ab}	0.131	0.004
Flavour persistence	5.38^{b}	6.25^{a}	6.00^{ab}	0.125	0.011

BGC: control burger; BGCh: burger with chia oil-gelled emulsion; BGH: burger with hemp oil-gelled emulsion; SEM: standard error of the mean; For the same row, values followed by different letter (a-b) indicate signifcant differences according to Tukey's HSD post-hoc test (P<0.05)

IV. CONCLUSION

This study suggests that using gelled emulsion based on amaranth flour and chia or hemp oils as a total replacement for pork backfat in goat burgers could be a viable approach to produce healthier meat products with improved quality of dietary fats (increased PUFAs and decreased SFAs). These findings not only enable producers to meet the dietary fat requirements of food safety agencies but also enhance the competitiveness of the meat industry.

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