SUMMARY

The research of this thesis has focused on the development of biscuits formulations with healthy fatty acid profile and reduced fat content by using a vegetable oil/hydrocolloid gel system as a replacement of shortening.

First, the effect of the replacement of butter with sunflower oil and different cellulose ethers and an important decrease in the biscuit fat content (from 18 to 10.6%) was evaluated. The effect of the degree of methoxyl and hydroxypropil methyl substitution on dough rheological properties and on baked biscuit texture and consumer acceptance was evaluated.

The rheological essays results showed that the structure of sunflower oil/gel systems presented a closer behaviour to a liquid structure and that the degree of methoxyl and hydroxypropil methyl substitution did not affect dough rheological properties. On the other hand, sunflower oil/gel systems doughs presented lower resistance to deformation than doughs prepared with butter, indicating that the sunflower oil/gel systems doughs were less elastic and that this elasticity was related with the dough spread after baking.

Regarding mechanical properties of baked biscuits, in general, there were hardly any differences among the different sunflower oil/ gel systems and butter biscuits regarding the values of maximum force at breaking and the maximum force values at penetration. The biscuits made with the sunflower oil/gel systems prepared with the different cellulose ethers showed differences in consumers acceptability compared to the biscuits made with butter; mainly in the overall acceptability and the texture and, to a lesser extent, in flavour.

Therefore, in the second part of this thesis, the sensory changes perceived by consumers when shortening (dairy or vegetable origin) is replaced by different oil/gel systems in biscuits were studied in depth. In this part, apart from sunflower oil and hydroxipropilmethylcellulose, olive oil, xanthan gum and different fat contents (18; 15.6 y 10.6%) were also considered. By using the free

choice profile method, the sensory changes in the biscuits sensory properties perceived by consumers were evaluated when fat type and content varied.

In order to study the texture and flavour differences of biscuits occurred during the whole eating process, a modification of the technique was proposed and, it was observed that the complexity of the differences perceived by consumers in the different samples increased as the eating process progressed. Results showed that in shortening biscuits, an important decrease in the fat content (from 18 to 10.6%) lead to biscuits that were perceived harder, drier and with less flavour. However, with a less drastic fat reduction (from 18 to 15.6%), the biscuits' sensory properties were similar at both fat contents.

The biscuits with xanthan gum systems (with both olive and sunflower oil) were those that presented the sensory characteristics more different from shortening biscuits. Nevertheless, biscuits made with hydroxipropilmethilcellulose systems (with both olive and sunflower oil) presented similar sensory characteristics to the shortening ones. Subsequently, the changes in mechanical and acoustical properties were evaluated as well as the relationship between these properties and the sensory texture perceived by consumers.

When reducing the fat content, biscuits presented higher values of the breaking strength and penetration and also a higher number of fractures during the penetration with a cylindrical probe, which explained the more intense sensation of hardness and crunchiness perceived in mouth. Moreover, in general, the fat content reduction or the oil/gel systems replacement, was traduced in a decrease in the number of force events during the biscuits penetration with the spherical probe and they were perceived less mealy and crumbly.

In general, the use of oil/hydroxipropilmethilcellulose systems conferred similar mechanical and acoustical properties compared to biscuits made with shortening, leading to obtain biscuits with similar textural properties perceived in mouth.

Finally, the last part of the research work included in this thesis, was the evaluation of consumers acceptability of biscuits made with the oil/gel systems prepared with hydroxipropilmethilcellulose and olive oil or sunflower oil.

The biscuits' acceptability varied among consumers and, by using cluster analysis, three groups of consumers with different preference patterns were identified. The study of the relationship between acceptability data and the sensory characteristics perceived by each individual by using the Check All That Apply method was able to identify the attributes responsible for the biscuits' liking or disliking for each group of consumers.

For the first group of consumers, the preferred biscuits were those prepared with olive oil and butter at a high fat content which were perceived easy to chew, easy to swallow, crispy and as having biscuit flavour.

The second group of consumers preferred butter biscuits which were perceived crispy, easy to chew and as having biscuit flavour.

For consumers of the third group, liking was related with butter flavour, roasted flavour and biscuit flavour which were perceived in olive oil and sunflower oil biscuits at high fat content. Thus, while for the first and second group of consumers the texture characteristics as well as the flavour ones affected liking, for the third group of consumers, the flavour was the characteristic that affected the liking to a higher extent.

The last step was to carry out an expectation study to evaluate the effect of the nutritional information displayed on biscuit label on consumers biscuits' liking and the consumers.perception of biscuit' healthiness.

The label claims "with olive oil" and "low saturated fat content" increased the hedonic expectation considerably and the consumers' perceived healthiness of biscuits. The actual liking of biscuits depended on both the sensory quality of the samples and the information provided. However, the perception of the biscuits' healthiness was based on the label information alone and the hedonic characteristics of the samples did not affect it.