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GLUTEN FREE CAKES AND COOKIES WITH PSEUDOCEREALS AND TEFF

Introduction

About 1% of the world population is diagnosed with celiac disease (gluten intolerance). A larger portion, however, does not eat gluten because of wheat allergy, gluten sensitivity, health beliefs etc. The pseudocereals quinoa (*Chenopodium quinoa*), amaranth (*Amaranthus* spp.) and buckwheat (*Fagopyrum esculentum* Moench) and the Ethiopian cereal teff (*Eragrostis tef* Zucc.) do not contain gluten and can be incorporated in a gluten free diet. In the research project Alterbake, the application possibilities of these gluten free (pseudo)cereals in bakery products, such as cakes and cookies, are being investigated. A sample set of amaranth, buckwheat, quinoa (white, red and mixed) and teff (white and brown) whole meals was purchased from local suppliers. The aim of this study was to compare technological and sensory parameters of the gluten free cakes and cookies with reference (wheat) cookies and cakes.



Methods

Cookies

Cookies were made of 100g whole meal flour, 66g butter, 55g sugar and 9g whole egg. The weight, spread ratio (diameter/height), and color (Spectrophotometer, CM700d Konica Minolta) of the cookies were assessed after cooling down. The hardness (3-point bending rig, Texture analyzer) was measured 2 days after baking. A reference cookie (whole meal and wheat flour) was included. Statistical differences were determined with 2-way ANOVA and post-hoc tests ($p < 0.05$). Sensory tests were performed on a selection (amaranth, buckwheat, teff brown and quinoa white). The parameters were scored relative to the whole meal wheat cookie by 27 participants.

Cakes

Cakes were pound cakes (300g) with 6g of baking soda. Before baking, the batter density was assessed. The weight, volume (Volscan Profiler 600) and color (Spectrophotometer, CM700d Konica Minolta) were evaluated after cooling down. Two and 9 days after baking, the hardness of the crumb was analyzed with a Texture analyzer (TPA test). A reference cake (whole meal and wheat flour) was included. Statistical differences were determined with 2-way ANOVA and post-hoc tests ($p < 0.05$). Sensory tests were performed on a selection (buckwheat, teff brown, teff white and quinoa red). The parameters were scored relative to the whole meal wheat cake by 22 participants.

Results

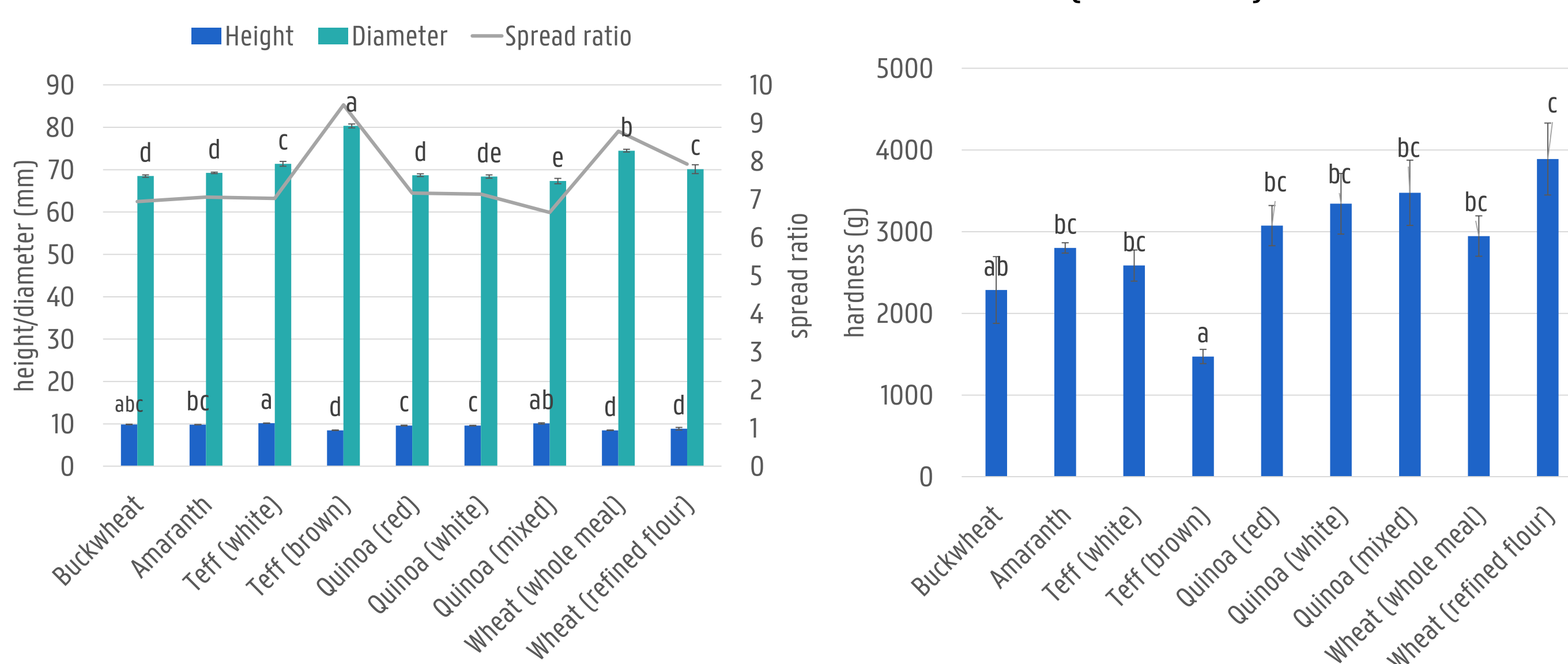
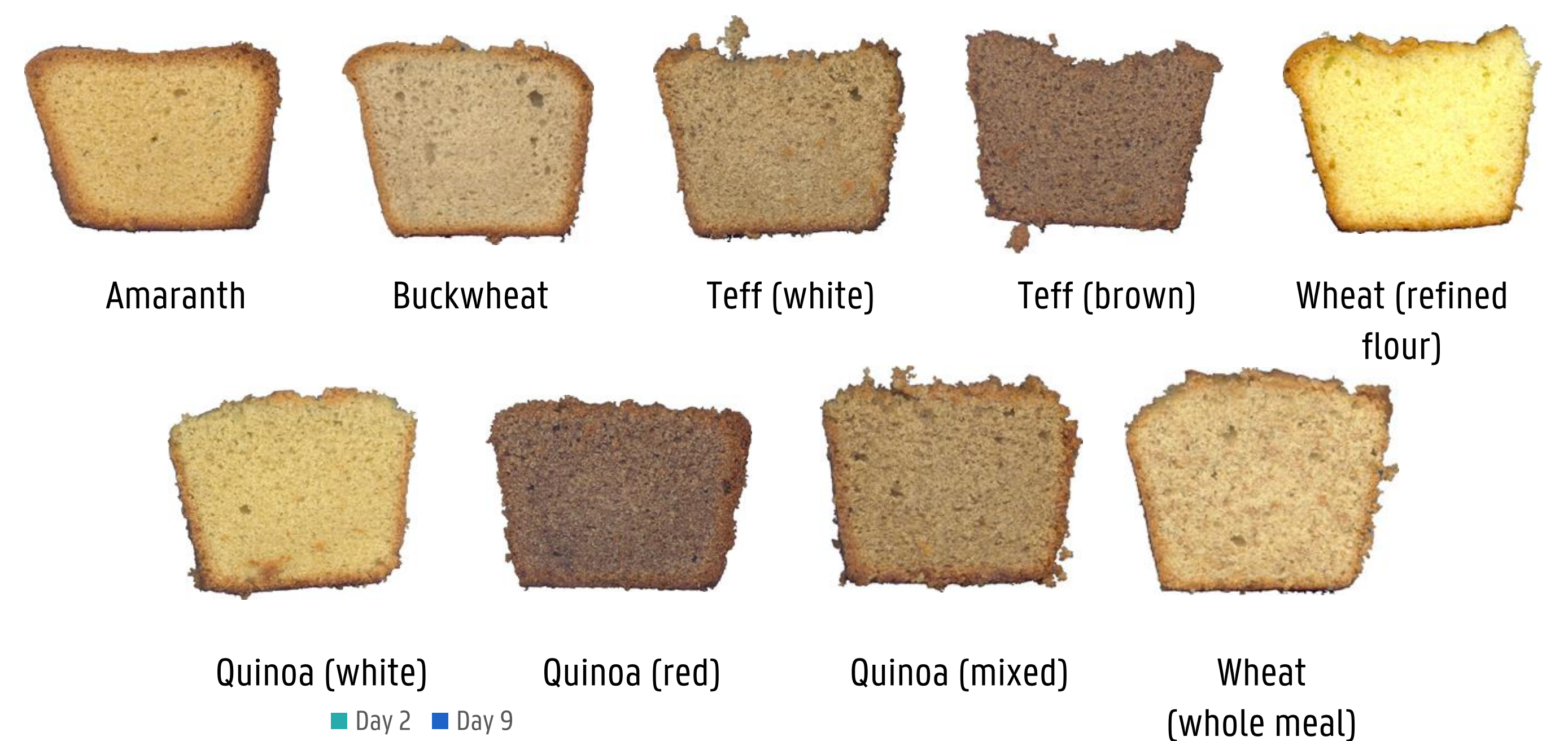
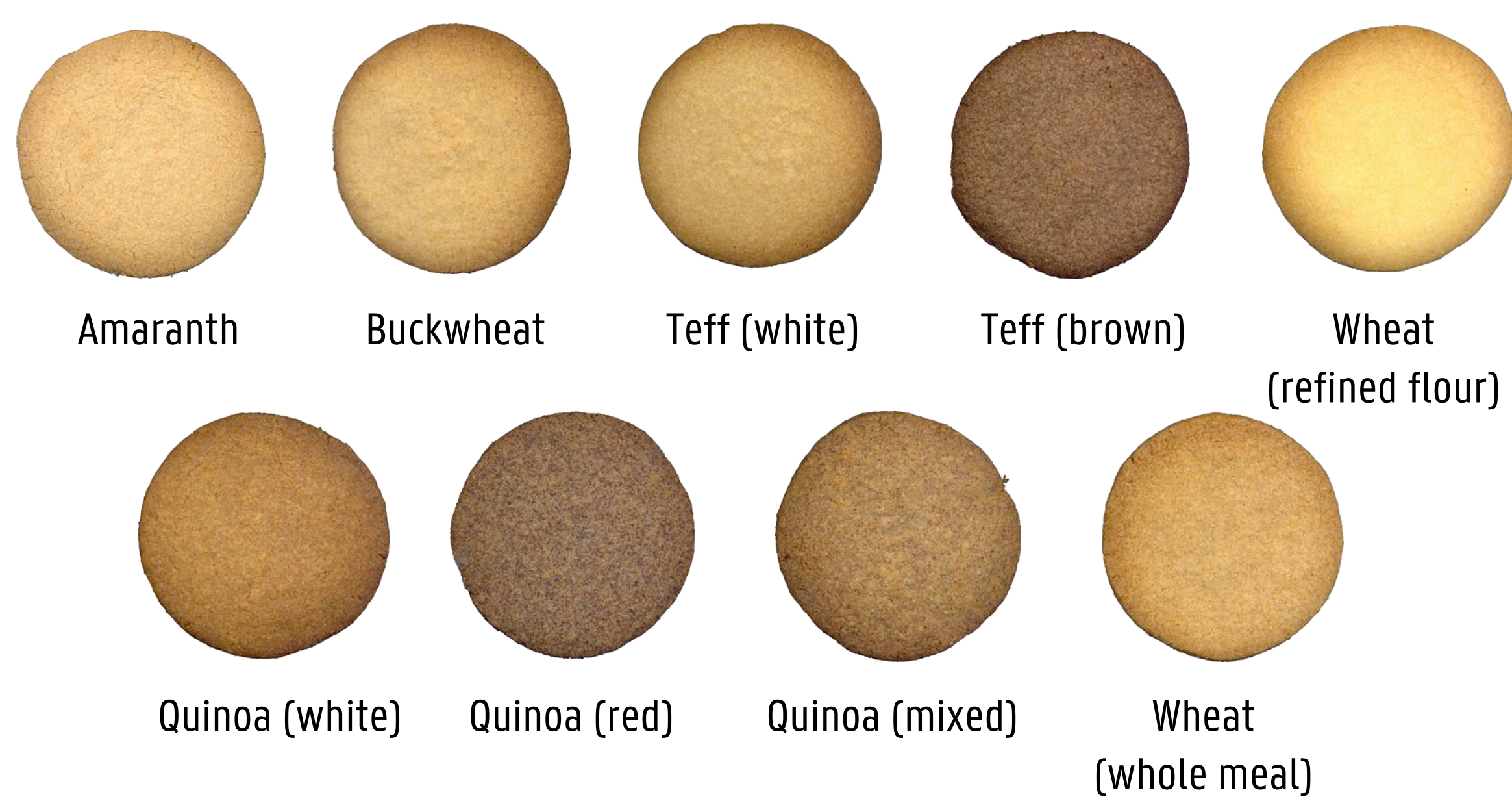


Fig. 1: Height, diameter (mm) and spread ratio of the cookies.

Fig. 2: Hardness (g) of the cookies 2 days after baking.

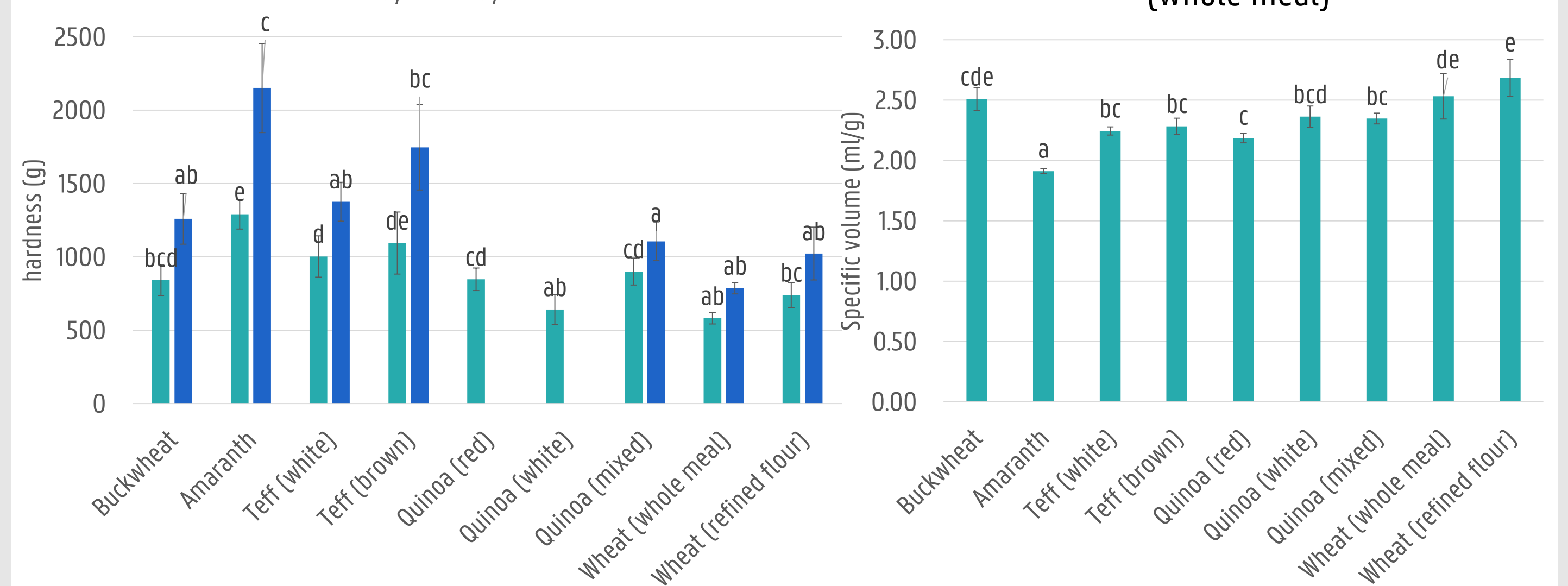


Fig. 4: Hardness (g) of the cakes 2 and 9 days after baking.

Fig. 5: Specific volumes (ml/g) of the cakes.

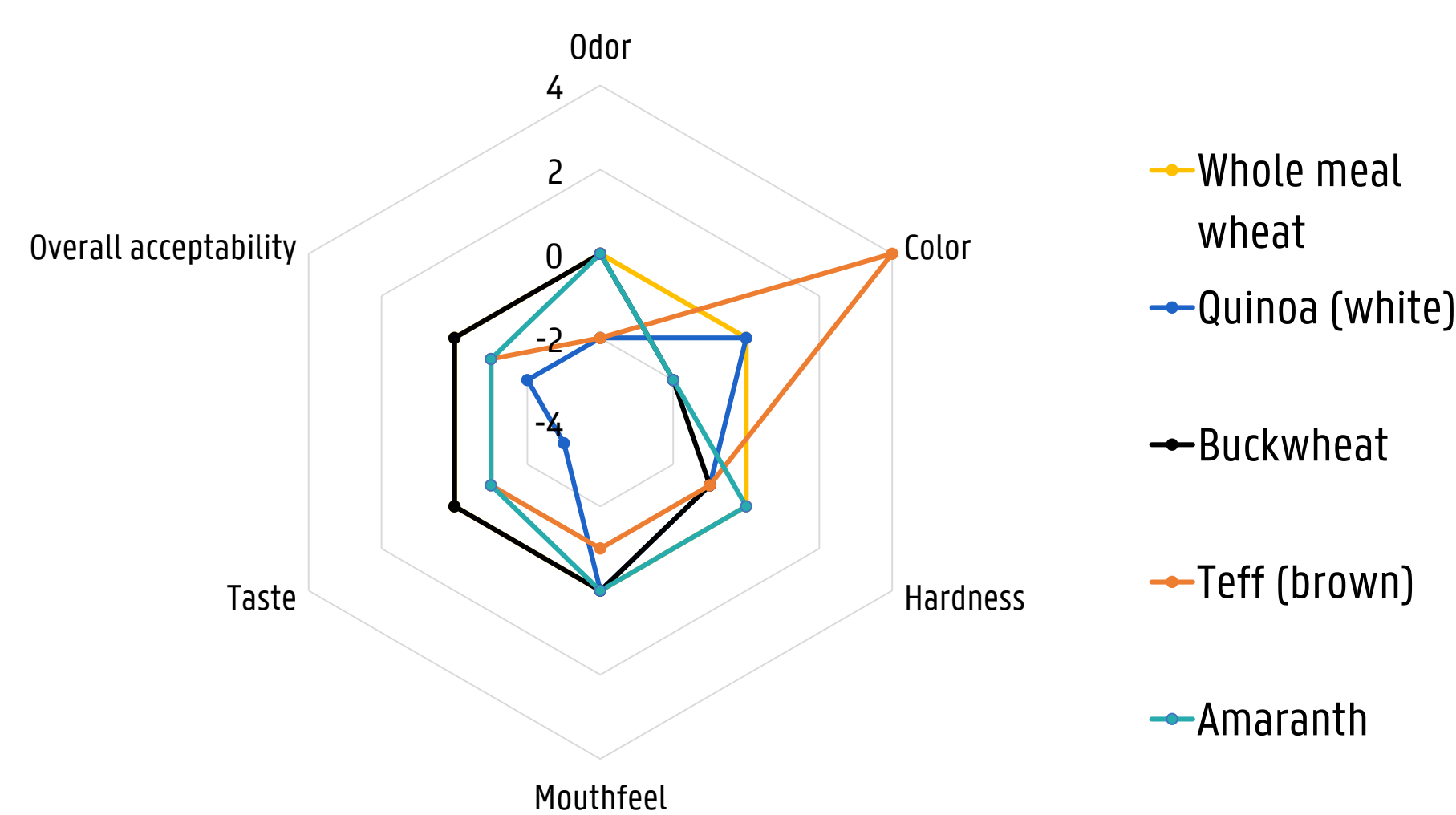


Fig. 3: Sensory evaluation of teff (brown), quinoa (white), buckwheat and amaranth cookies compared to whole meal wheat cookies

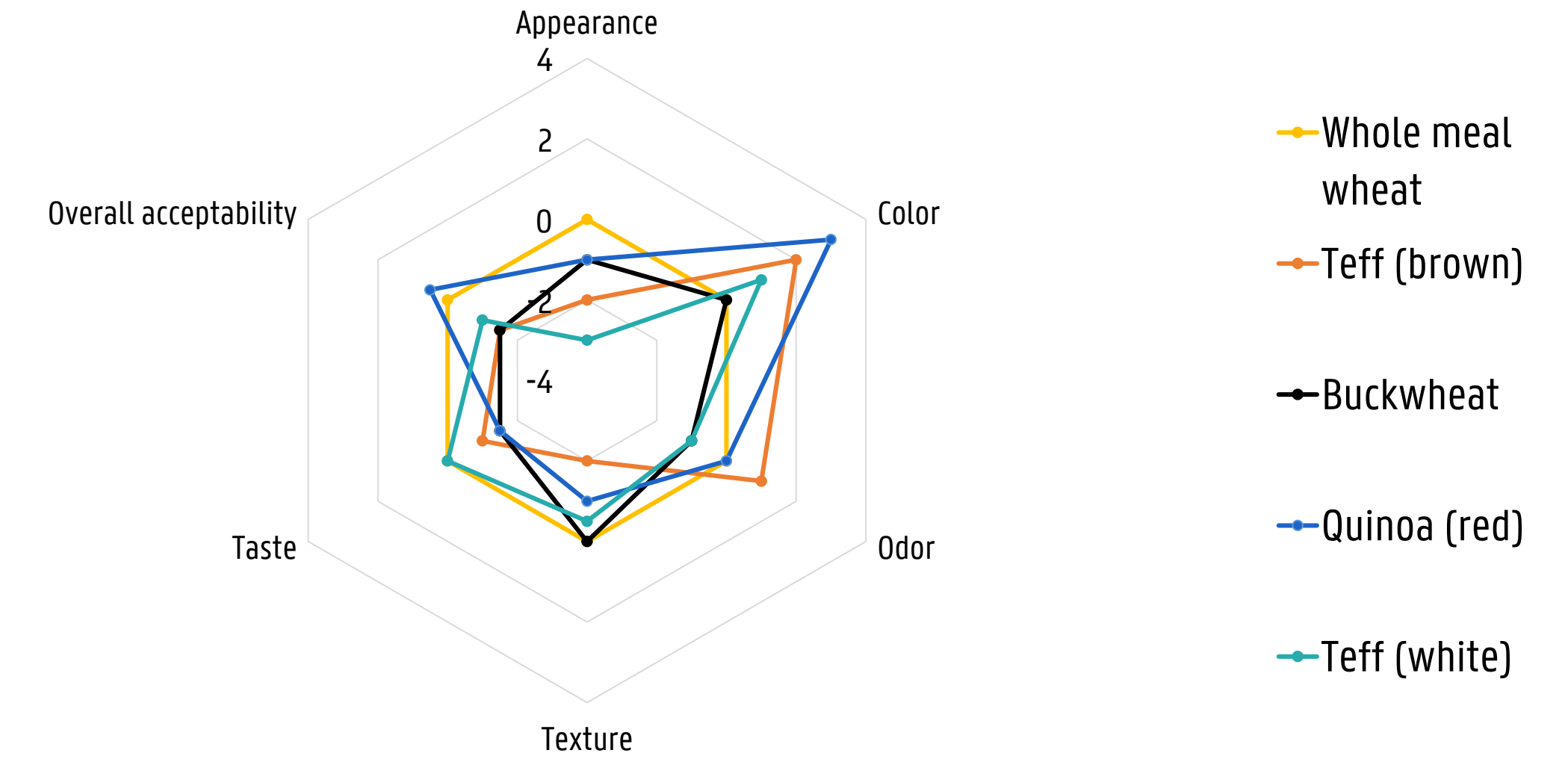


Fig. 6: Sensory evaluation of teff (brown), quinoa (red), buckwheat and teff (white) cakes compared to whole meal wheat cake

Conclusion

Gluten free cakes and cookies made with pseudocereals or teff showed differences with the reference cakes and cookies, but are processable. As the pseudocereals and teff have higher mineral, protein and fat content compared to wheat flour, nutritional improvement of cookies and cakes can be obtained. All gluten free cookies had a lower spread ratio (stayed more compact in the oven) compared to the reference cookies, except teff (brown). This cookie was also the most fragile and lost its circularity. The dough was sticky and was not able to hold the water. Cookies made with buckwheat were appreciated similar to the reference cookie. The quinoa (white) cookie scored the worst on taste and overall acceptability. Even though all cake batters were less dense than the whole meal wheat batter, specific volumes were still lower than or equal to the volume of the reference cake. Cakes made with amaranth had the hardest crumb after 2 and after 9 days. Cakes made with quinoa (white) and buckwheat had a similar hardness. Due to a measuring error, no values are shown for quinoa (red) and quinoa (white) hardness after 9 days. Quinoa (red) scored well on overall acceptability, even though it scored negative (-3) on taste. Participants described the taste of red quinoa as chocolate, cacao and burned honey. Teff (white) also scored good on taste, but because of his greenish color scored lower on overall acceptability. The cakes and cookies look different mainly because of the different seed colors. Different recipes for cakes and cookies, as well as extensive sensory tests could be done in the future.

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