The search for high-quality low- and non-alcohol beers: chemical-analytical and sensorial characterisation of commercial NABLAB

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1. BACKGROUND

While the global beer market is stagnating, the market value of non- and low-alcohol beers (NABLAB) is rising due to increasing consumer awareness of health and well-being. NABLAB are produced by removing ethanol after a traditional brewing and fermentation process (physical means) or by avoiding ethanol production during fermentation (biological means). To gain a better understanding of the current Belgian NABLAB market situation, the chemical-analytical and sensorial properties of 22 commercial NABLAB and three alcoholic reference beers were evaluated and correlated with their production method. This research is part of the TETRA project NABLAB (HBC.2021.0120).

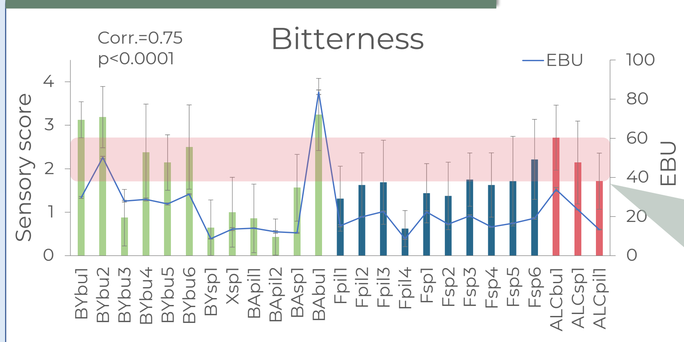
2. EXPERIMENTAL

Based on availability in the Belgian market, 22 NABLAB were selected: 12 produced by biological means and 10 by physical dealcoholisation. For each beer style (EBU>25, specialty beer and pilsner), one alcoholic reference beer was included. All beers were chemically-analytically characterised and sensorially evaluated by 8 internal tasting panellists. In each graph, a reference frame for the sensorial data (red bar) is shown, based on the 3 alcoholic reference beers. Sensory scores were used to describe intensities: (0=absent, 2=medium, 4=strong) and impressions (0=bad, 2=neutral, 4=good).

Production method	Style
BY: Biological - NABLAB Yeast	**bu:** EBU>25
BA: Biological - Alternative method	**sp:** Specialty beer
X: Biological - Unknown	**pil:** Pilsner
F: Physically dealcoholised	
Alc: Alcoholic	

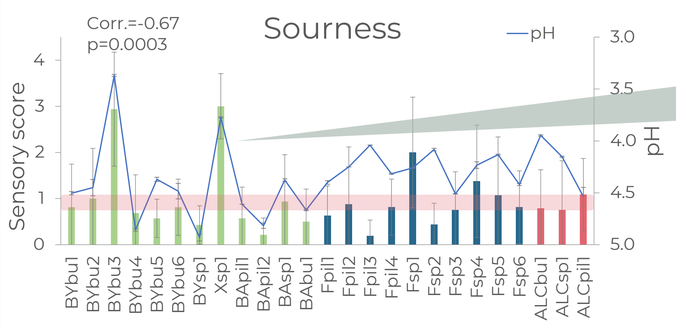
3. RESULTS

Taste

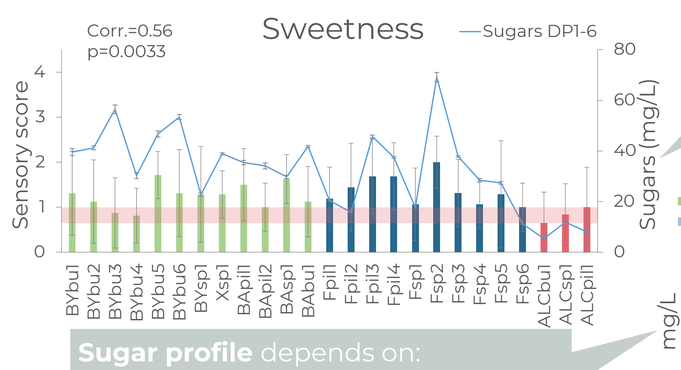


Alternative yeasts (BY)
- Often high bitterness (EBU>25)
- Generally unpleasant lingering aftertaste (data not shown)

Other NABLAB
- Bitterness rather faint or absent

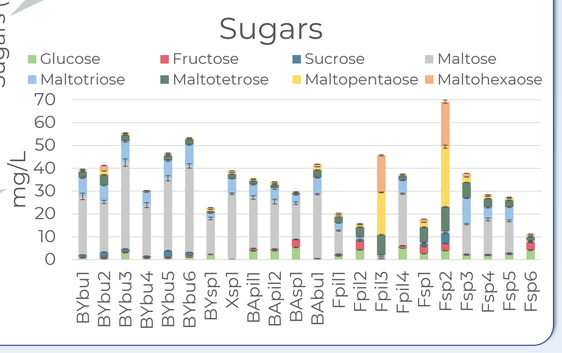


BYbu3 and Xsp1
- Acidified
- High sensory score for sourness
- More reminiscent of soft drinks



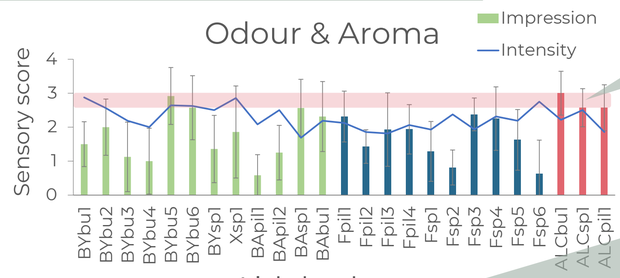
NABLAB
- Higher sugar concentration than alcoholic reference beers

→ Results in high sweetness

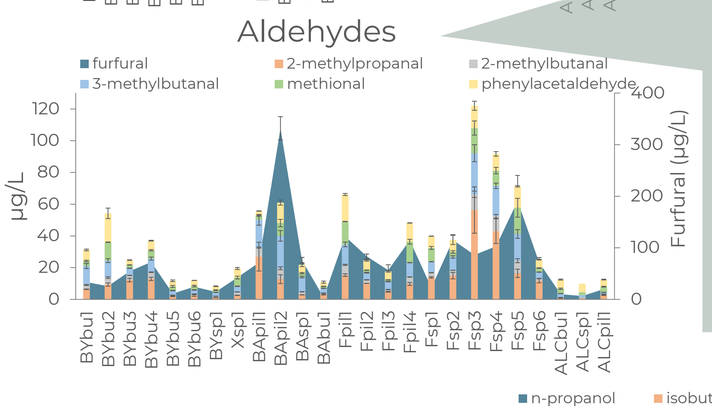


Sugar profile depends on:
- Production method (BY, BA, F)
- Pre-processing dealcoholisation
- Use of additives

Odour & Aroma



Most NABLAB underperformed on odour and aroma impression



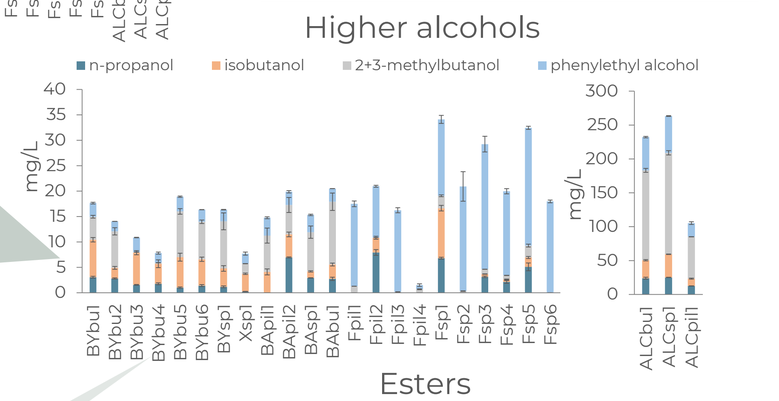
NABLAB
- Higher levels of aldehydes compared to alcoholic reference beers

Thermal dealcoholisation
- Generally, higher levels of furfural

BApil1 & BApil2
- Limited / no fermentation → limited reduction of aldehydes

Fsp3 & Fsp4
- Amber beers → higher levels of malt aldehydes

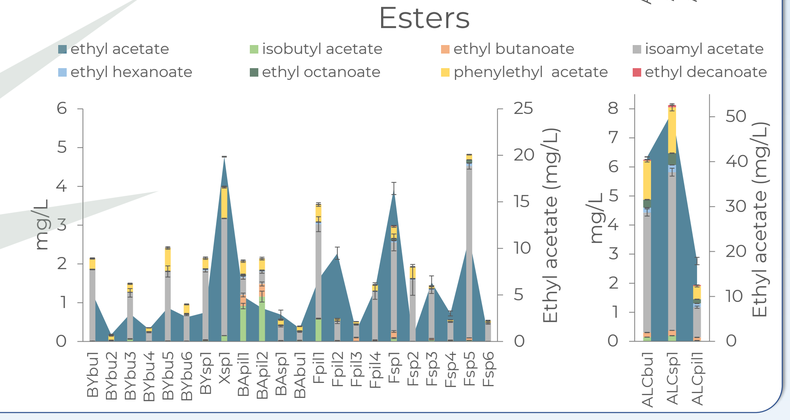
Fpil1
- Fastest to reach expiry date



Biological NABLAB: Higher levels of 2+3-methyl butanol & isobutanol

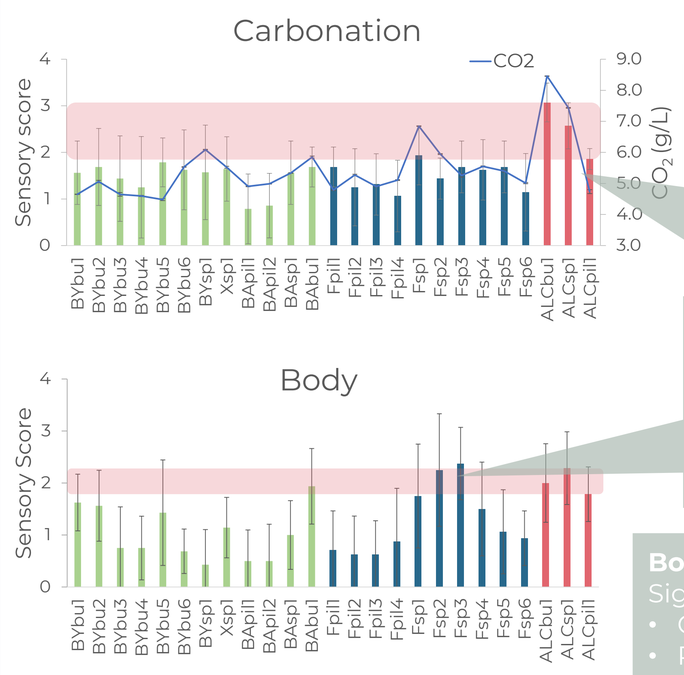
Physical NABLAB: Higher levels of phenylethyl alcohol

→Clear distinction in aroma profile based on the production method



NABLAB
Low level of esters & higher alcohols compared to alcoholic references

Mouthfeel



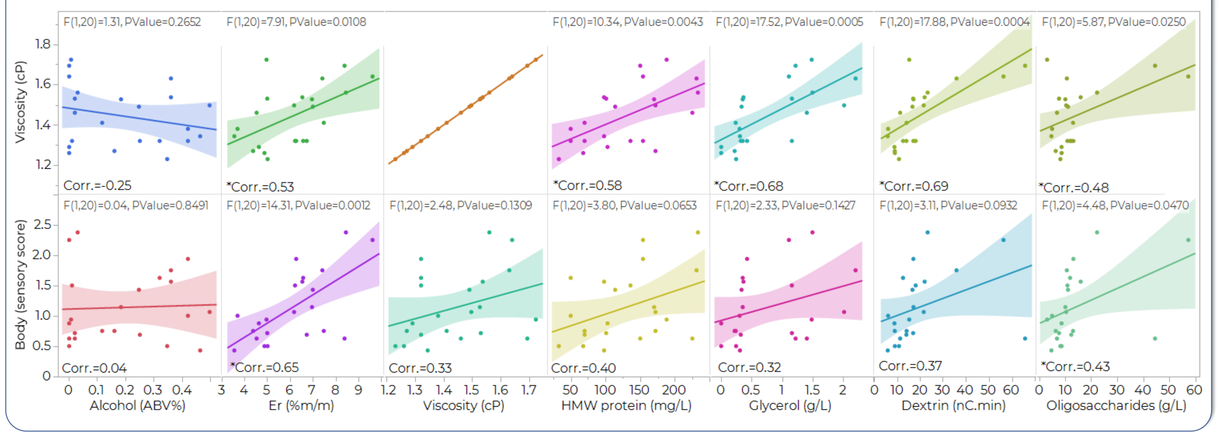
NABLAB
- Sensorially under-carbonated to the alcoholic reference beers
- CO_2-concentrations are in the same range as the alcoholic pilsner

Only 4 NABLAB have **body** within range of alcoholic reference beers:

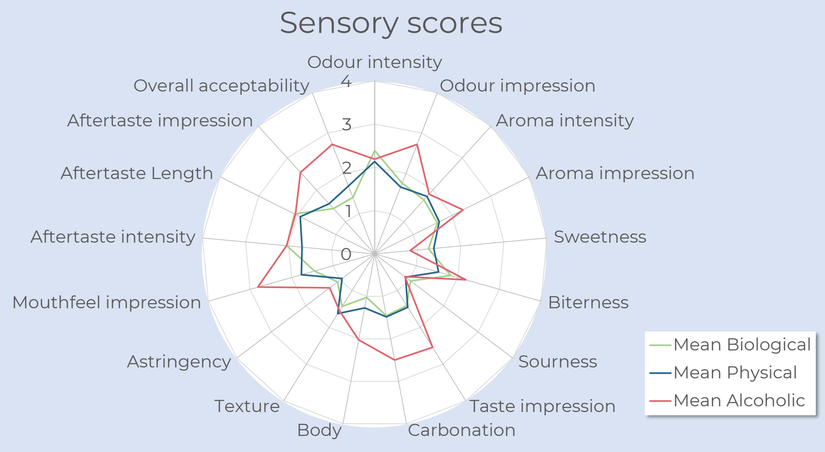
Fsp1 → high in dextrin, glycerol, HMW-protein
Fsp2 → high in dextrin
Fsp3 → high in HMW-protein

Body of NABLAB
Significantly positively correlated with:
- Oligosaccharides
- Real extract (Er %m/m)

Correlations determined without the 3 alcoholic reference beers. *=significantly correlated



4. CONCLUSION



- ✓ Generally, compared to the 3 alcoholic reference beers the NABLAB underperform on odour & aroma , taste, aftertaste and overall mouthfeel impression, on their perceived carbonation and body, and on their overall acceptability
- ✓ The taste of NABLAB is often unbalanced
  - Produced with alternative yeasts: often flavoured by extra hopping or acidification
  - Due to the high residual sugar content, NABLAB are perceived as having little bitterness, even though the EBU falls within the same range as the alcoholic ref beers
- ✓ There is a clear distinction in aroma profile between biologically and physically produced NABLAB
- ✓ The perception of body for NABLAB is positively correlated with the amount of dissolved solids and oligosaccharides
- ✓ Altogether, three NABLAB (BAsp1, Fpil1, Fsp3) scored similarly in overall acceptability as the alcoholic reference beers

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