THE IMPACT OF BEER DISPENSE METHODS AND THE SENSORY EXPERIENCE

Beer is dispensed in different ways all around the world. Three of these popular methods include Belgian, Czech, and 'slow' style pours – and while these three are different in their execution – they all have a similar sensory impact on beer. That is, they result in a beer which can be perceived as less bitter, smoother, and sweeter.

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INTRODUCTION

Over the past couple of years there has been a growing intrigue in the different techniques used to dispense beer at pubs, bars, and restaurants. This poster explores those techniques and provides analytical data to support perceived differences.

Belgian pour

In Belgium and the Netherlands it's common to see a pour that includes a 'sacrifice', overspill and cut (Figure 1). One notable benefit in this technique is the 'cut' – this step enables any larger bubbles to be discarded off the top of the foam cap. Evans and Bamforth (2009) concluded that one of the key drivers of foam stability is uniformity of bubble size. When you have consistent, small bubbles the head will last longer than when larger and smaller bubbles exist at the same time. This uniformity is explored in this study - Foam Stability. The second impact of the 'cut' is the lowering of bitterness within the liquid itself, explored in this study as well - Over-foam Pour.

Czech pour

In the Czech Republic you will see three potential types of pours (Figure 2) – Mlíko (90-100% foam), Šnyt (~50% foam) and Hladinka (20-25% foam). To achieve these pours the use of a side-pull faucet (tap) is specifically used. This faucet utilizes a small internal mesh that creates consistently small, stable wet foam.

Slow pour

An increasingly common technique of pouring found in some parts of Europe (Czech Republic and Germany) and many parts of the USA. This technique uses a general 3:3 rule: three pours at three-minute intervals (Figure 3).

Increased foam formation

Primarily, foam is made up of the following components: carbon dioxide, proteins, iso-alpha-acids and metal ions, covered in depth by Bamforth (1985). What's important here are the iso-alpha- acids (IAA). Beer foam is more bitter than the liquid itself due to the concentration of IAA. When you pour using the Belgian, Czech or Slow technique, this causes large amounts of foam to be formed thus dragging out more IAA from the liquid into the foam. In a study by Ono et.al (1983) it was found beer liquid can lose approximately 1 IBU when using a strong foam overpouring technique.

Lower carbonation

A study by Kosin et.al (2012) focused on the impact of carbonation level and bitterness perception. It found, the lower the CO2 content of the beer, the lower the perception of bitterness in the beer (and also the harshness of the bitterness). The combination of the lowering of IBU levels in the liquid along with the lowering of CO2 results in perception that the beer is less bitter, smoother and sweeter. The key driver of the perceived difference being the change in CO2 content. Wise et.al (2013) highlighted that while most assume the carbonic acid bite of CO2 is due to tactile stimulation of the oral cavity by bubbles, it has been shown this sensation actually comes primarily from formation of carbonic acid on the skin of the inside of your mouth. Bubbles themselves are not required for the carbonic acid bite, however, they may well modulate perceived bite.

Higher temperature

In a study on the impact of carbonation on the human palate by Yau et.al (1991), it was found that a rise in temperature will lower the impact of carbonic acid bite on the palate. In combination with this, a study by Perez et.al (2007) found warmer temperatures enhance the perception of sweetness. The Czech and Belgian pours do not result in a temperature rise due to the fast nature of the pour. However, the slow pour technique can take 5-10 minutes. During this time the beer warms up and carbonation is lost.

Pour type	Change in beer	Sensory impact
Czech, Belgian, Slow	Increased foam	Less bitter
Czech, Belgian, Slow	Lower carbonation	Less perceived carbonation, less carbonic acid bite
Slow	Higher temperature	Less carbonic acid bite, sweeter perception

OBJECTIVE

The purpose of this poster is to further solidify and explore the impact of undertaking an over-foaming pour technique to understand the potential sensory impact on bitterness and the aesthetic appearance of a lasting foam head.

METHODOLOGY

Over-foam Pour

Beer at 4°C (International Lager, 15 IBU) poured heavily into standard non-nucleated shaker pint glass with foam scraped off top - similar to a classic Belgian pour. Both foam and the liquid analyzed using Skalar SAN++ for IBU levels. This was repeated for a standard pour with no over-foaming and cut. Statistical analysis was conducted to assess the impact on IBUs.

Foam Stability

Beer at 4°C (IPA, 70 IBU), was poured into a non-nucleated shaker pint glass, forming a foam head with a height of 3.5cm. In one set, the foam was cut (over-foam pour), while in the other, it was left uncut (standard pour). The time for the foam to fully collapse was measured by counting down until the liquid surface became visible. Measurements were recorded for both conditions, and statistical analysis was conducted to assess the impact of cutting on foam stability.

RESULTS/FINDINGS

Over-foam Pour

The analytical results show that there is a statistically significant difference between the over-foam pour vs the standard pour data. The over-foaming pour resulted in the loss of 1 IBU within the liquid (Figure 4). The foam was also found to be higher in Hop acid content as well as IBU.

Foam Stability

The beer that was 'cut' with the over-foaming pour with uniform small bubbles had a longer lasting head on average by more than 120 seconds or 2 minutes (Figure 5). Visible uniformity was seen in the over-foaming cut pour as seen in Figure 6.

Figure 1: The three key types of Czech pour: Mlíko, Šnyt and Hladinka

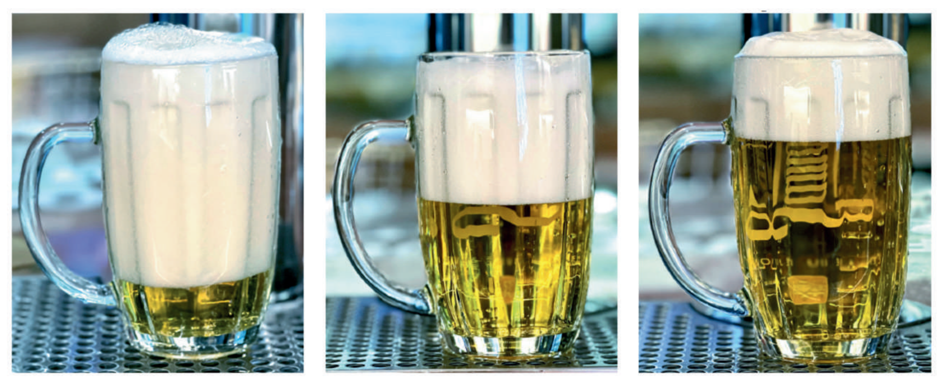

Figure 2: The three key types of Czech pour: Mlíko, Šnyt and Hladinka

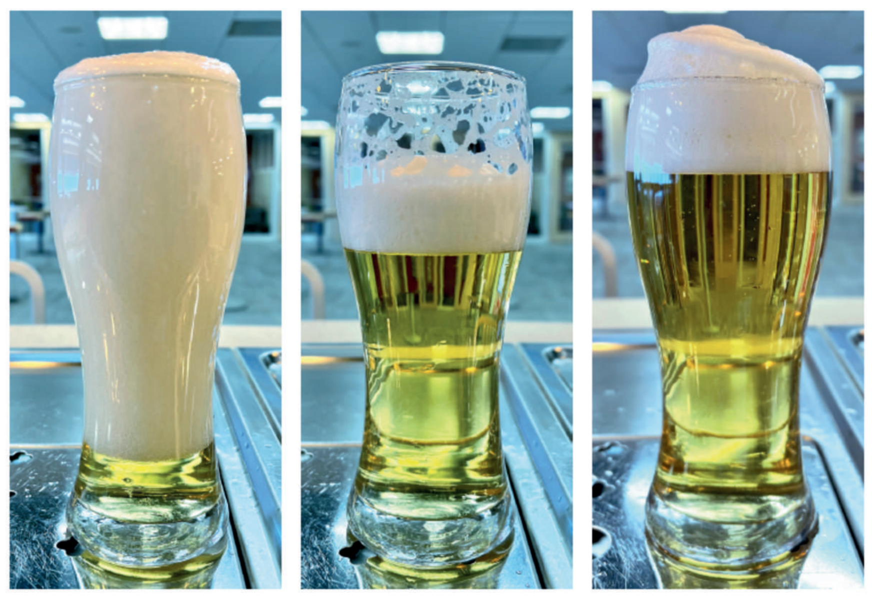

Figure 3: The 3:3 stages of a 'slow' pour: three pours at three minute intervals

IBU

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	14.62666667	13.93666667
Variance	0.034226667	0.191066667
Observations	6	6
Pooled Variance	0.112646667	
Hypothesized Mean Difference	0	
df	10	
t Stat	3.560824305	
P(T<=t) one-tail	0.002587072	
t Critical one-tail	1.812461123	
P(T<=t) two-tail	0.005174145	
t Critical two-tail	2.228138852	

There is a statistically significant difference between the standard pour and the over foam pour 'retains'.

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	14.62666667	15.73
Variance	0.034226667	0.08108
Observations	6	6
Pooled Variance	0.057653333	
Hypothesized Mean Difference	0	
df	10	
t Stat	-7.958938621	
P(T<=t) one-tail	6.15873E-06	
t Critical one-tail	1.812461123	
P(T<=t) two-tail	1.23175E-05	
t Critical two-tail	2.228138852	

There is a statistically significant difference between the standard pour and the over foam 'foam'.

Figure 4: IBU analysis of standard pour vs over-foaming pour.

Parameter	Cut Foam Set	Uncut Foam Set
Mean Collapse Time	442 seconds	319 seconds
Standard Deviation	10.21 seconds	11.36 seconds
Sample Size (n)	3	3
t-statistic	14.02	
Degrees of Freedom (df)	3.96	
p-value	0.00016	

Figure 5: Cut vs uncut foam stability.

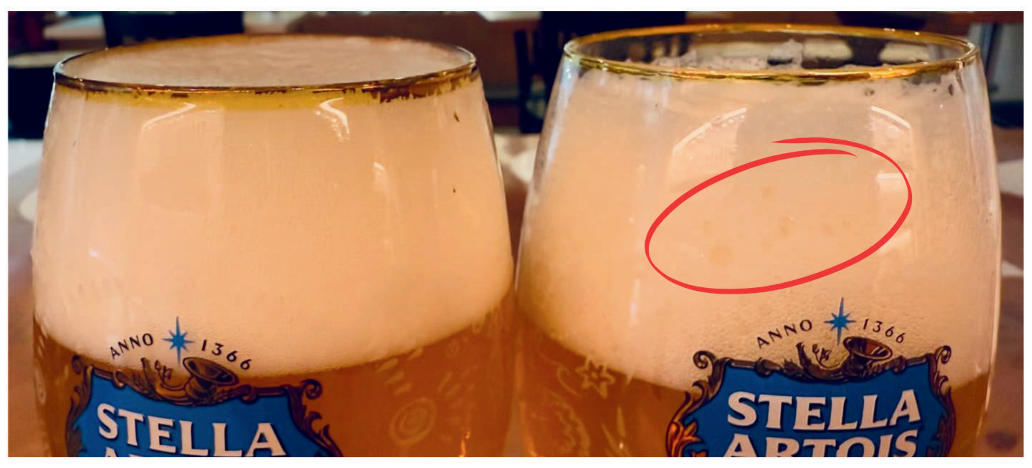

Figure 6: Uniform bubbles in cut (left) vs uncut pour (right).

ANALYSIS

Over-foam Pour

The two-sample t-tests were conducted to compare IBU values between standard and over-foam pours, assuming equal variances. Both tests resulted in statistically significant differences, with t-statistics of 3.56 and -7.96 and p-values of 0.0052 and 1.23×10^{-5} (both < 0.05), confirming a meaningful difference between the pour methods. The results suggest that over-foam pouring significantly impacts IBU retention compared to the standard pour.

Foam Stability

Welch's t-test to compare foam collapse times between cut and uncut beer foam, accounting for small sample sizes and unequal variances. Mean and standard deviation were calculated for both groups, and the test yielded a t-statistic of 14.02 with a p-value of 0.00016, indicating a highly significant difference. The degrees of freedom (df = 3.96) were adjusted using the Welch-Satterthwaite equation. Results confirm that cutting the foam significantly impacts its collapse time.

CONCLUSION

The impact of the over-foaming pour and cut results in a less bitter beer with a longer lasting head. CO2 was not tested as a part of this, but most likely would have contributing factors to sensory perception of these pours . There is no sensory data to back up if a difference in 1 IBU unit would be detectable by sensory. The combination impact of lower CO2 and reduced IBUs provide some analytical data to describe the impact of these unique pours.

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