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EFFECTS OF THE ACCEPTABILITY OF AROMAS FROM DRINKS ON MOOD AND PERFORMANCE

Andrew P. Smith, PhD*

School of Psychology, Cardiff University, 70 Park Place, Cardiff CF10 3AT, UK.

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***Corresponding Author**
Dr. Andrew P. Smith, PhD
School of Psychology, Cardiff University, 70 Park Place, Cardiff CF10 3AT, UK.

ABSTRACT

Background: The effects of aromas on cognition and mood depend on aroma type, duration of exposure, the method of presenting the aroma, and the outcome measures used. The present study investigated the effects of aromas from drinks on mood and attention. The aromas used varied in acceptability, and pleasant, neutral and unpleasant aromas were used. **Method:** A parallel group design was used, with each group being exposed to a different aroma (Johnnie Walker whisky, J&B whisky, Guinness, Smirnoff vodka, Baileys Irish Cream, Jose Cuervo Tequila, Tanqueray gin, Captain Morgan rum, Coca-cola, orange juice, tonic, lemonade and water). Two hundred and seventy-three university students and staff completed the study. Participants carried out **a** baseline session without exposure to an aroma, followed by a test session where the aroma was sniffed throughout the session. The liking of the aroma was measured at a familiarisation session. **Results:** There were no significant effects of aroma type on mood. The only performance measures to show significant effects of the aromas were lapses of attention (occasional very long response times), where the unpleasant aromas (Tanqueray Gin and Vodka) were associated with fewer lapses of attention. **Conclusion:** The present study showed that sniffing aromas from drinks did not change mood but did have some effects on sustained attention. Future research may need to change the methodology to detect more robust effects, and using other aromas, such as lemon and other performance tasks, may be critical initial changes.

KEYWORDS: Aroma; Mood; Selective Attention; Sustained Attention; Choice Reaction Time; Aroma acceptability; Vodka; Tanqueray Gin; Irish Cream; Non-alcoholic drinks.

INTRODUCTION

Very small differences in odour intensity can be detected, and people can distinguish between 10,000 different odours. Perception guides our olfactory system, creating perceptions from the molecules in the nostrils. The present research addresses the question of whether odour molecules interact with the human brain and then change mood and cognition. The olfactory bulb connects to the olfactory cortex area, which is linked to the limbic system. The limbic system controls emotion and memory storage, and it is plausible that aromas may change mood and cognition. Indeed, the olfactory projections synapse more directly and specifically with the amygdala-hippocampal complex than do the afferents from other sensory modalities.[1]

Studies have found changes in mood when a person is exposed to aromas[2], and it has also been shown that aromas can change aspects of cognitive function.[3,4] Research has examined the effects of odour on memory tasks,[5] simple and complex tasks,[6] goal setting,[3] and risk-taking.[7] Experiments have often either used pleasant fragrances, such as those used in perfumery, or unpleasant odours, where the aim has been to mimic environmental pollution. Aromas come from many sources, and there are commercial products that circulate aromas in the home and at work. Aromatics are also key components in the treatment of the symptoms of mild upper respiratory tract illnesses.[8,9]

Research on aromas has a long history, and nearly a hundred years ago, it was suggested that unpleasant odours have an inhibitory effect on learning, whereas pleasant odours have a facilitative effect.[10] Since then, it has been widely recognised that aromas can have some effect on emotions and mood, although research has produced mixed results.[11] Methodological differences and odour delivery techniques can partially explain this lack of consistent results. Aromas are generally assumed to be either 'unpleasant' or 'pleasant', and it has proven rather difficult to find one which is consistently rated as neutral.[12] One study[12] used pleasant, unpleasant and no aroma conditions and investigated their effects on mood, performance tasks (odd-word identification, addition, multiplication, and proofreading) and perceived health. Ambient sporadic delivery was used to present the aromas, with delivery being controlled by two hidden fan units, which turned on randomly six times, each for one-minute periods. The pleasant aroma condition consisted of both lemon and ylang and had no significant effects. The unpleasant aroma condition had a

negative effect on perceived mood, health and performance, which may reflect the attitudes associated with the aroma.[13]

Other research[14] compared the effects of an 'alerting' aroma (peppermint), a 'relaxing' aroma (bergamot), and a 'no aroma' control condition on a sustained attention task. The results showed a significant difference between the relaxing aroma and the control condition but no difference between the alerting aroma and the control. Participants may not have been exposed to the alerting aroma for long enough for it to change attention. Other research has identified the specific conditions that affect the performance of an aroma.[15] It has been suggested that aromas may only facilitate performance under demanding experimental conditions. This view was supported by the finding that peppermint only had an alerting effect (more correct responses and better performance) in a complex task. The effects of the aroma may change over time, and one study[2] reported significant effects on mood after five minutes of exposure to the aroma but not after only two minutes of exposure. The initial effects of aromas may also disappear over time because of habituation.[16] Olfactory adaptation in humans can take place so rapidly that the person may soon become completely insensitive to an odour.[17]

It has been reported that odours influence mood and emotion via the nerve endings of the olfactive mucosa, and a lemon aroma has been identified as one such stimulating essence.[2, 18] Gordon (1925) asked a sample of 200 people to rate ten aromas and found lemon to be rated the most pleasant.[11] Findley (1942) had his sample rate 19 aromas, and, again, lemon was the preferred aroma.[11] Furthermore, researchers have suggested the use of lemon aroma to treat depression.[19] A recent study[20] examined the effects of lemon from a commercial diffuser on performance and mood. Those in the aroma condition reported a more positive mood (higher hedonic tone scores) both before and after the performance tests. Those in the aroma condition were also more accurate but slower, and they also showed faster encoding of new information. Another recent study also investigated the effects of a lemon aroma from a drink.[22]

There are differences in the changes in brain function when sniffing and smelling an odour. Sobel et al.[21] found that sniffing and smelling aromas activate two different parts of the brain, with olfactory exploration (sniffing) and olfactory content (smell) showing different brain organisation profiles. The current study involved active sniffing rather than smelling. The aromas came from different drinks, and it is widely acknowledged that the aroma from

the drinks is an important feature of the product. A good example of this is the bouquet associated with different wines. Similarly, other alcoholic drinks have aromas, and this may be related to their acceptability. In a recent study, the aroma came from drinks rather than diffusion of aromatic vapours[22], and the present study was an extension of that research. The present study had the following aims

1. To select aromas from alcoholic and non-alcoholic drinks which were rated as pleasant, neutral and unpleasant.
2. To examine the effects of aroma acceptability on mood and cognitive performance.

METHOD

The study was carried out with the informed consent of the volunteers and the approval of the School of Psychology Ethics Committee, Cardiff University.

Details of the drinks

The present study investigated the effects of aromas from a wide range of different drinks (Johnnie Walker whisky, J&B whisky, Guinness, Smirnoff vodka, Baileys Irish Cream, Jose Cuervo Tequila, Tanqueray gin, Captain Morgan rum, Coca-cola, orange juice, tonic, lemonade and water). The aim was to compare the most liked and most disliked drinks with those with a more neutral rating.

Details of the tasks

Mood rating: Mood was assessed both before and after each set of performance tests using 18 computerised visual analogue rating scales (e.g. Drowsy/Alert; Happy/Sad; Tense/Calm.).[23,24] These yield three mood dimensions: Alertness, Hedonic tone and Anxiety.

Focussed Attention Task

This task was developed by Broadbent et al.[25,26] Target letters appear as upper case A's and B's. On each trial, three warning crosses are presented on the screen, with the outside crosses separated from the middle one by either 1.02 or 2.60 degrees. Volunteers were told to respond to the letter presented in the centre of the screen and ignore any distracters presented in the periphery. The crosses are on the screen for 500 ms and are then replaced by the target letter. The central letter is either accompanied by 1) nothing, 2) asterisks, 3) letters which were the same as the target or 4) letters which differ - the two distracters are identical, and the targets and accompanying letters are always A or B. The correct response to A is to press a key with the forefinger of the left hand, while the correct response to B is to press a different

key with the forefinger of the right hand. Volunteers were given ten practice trials followed by five blocks of 64 trials. In each block, there are equal numbers of near/far conditions, A or B responses and equal numbers of the four distracter conditions. The nature of the previous trial is controlled. The task gives three types of outcome measures:

1. Global indicators of speed, accuracy and lapses of attention.
2. Speed of encoding of stimuli
3. Resistance to distraction and focusing of attention.

Categoric search task

This task was also developed by Broadbent et al.[25,26] Each trial starts with the appearance of two crosses in the positions occupied by the non-targets in the focused attention task (i.e. 2.04 or 5.20 degrees apart). Volunteers do not know which of the crosses will be followed by the target in this task. The letter A or B is presented alone on half the trials and is accompanied by a digit (1-7) on the other half. Again, the number of near/far stimuli, A versus B responses and digit/blank conditions are controlled. Half of the trials lead to compatible responses (i.e. the letter A on the left side of the screen or the letter B on the right), whereas the others are incompatible. The nature of the preceding trial is also controlled. In other respects (practice, number of trials, etc.), the task is identical to the focused attention task.

The task gives four types of measures

1. Global indicators of speed, accuracy and lapses of attention.
2. Speed of encoding of stimuli
3. Speed of response organisation
4. Measures of spatial attention.

These tasks have been shown to be sensitive measuring instruments that are capable of detecting subtle changes in state.[27-46] In addition, there were pauses in the tasks every 64 trials, which provided opportunities for exposure to the aromas.

Ratings of Liking of Aromas

At familiarisation, volunteers also rated how much they liked each of the aromas using a visual analogue scale of 1-100. They also completed questionnaires measuring demographic and psychosocial characteristics, as well as health status.

Participants

Two hundred and seventy-three volunteers (Female: N =161; mean age 35.4 years, age range 17-65 years) were recruited from the staff and students of Cardiff University.

Statistical Analyses

Analyses used the change scores from the baseline. Unpleasant aromas (Vodka and Tanqueray Gin) were compared with a pleasant aroma (Irish cream), neutral aromas (the remaining drinks) and water. A MANOVA was carried out with all the mood and performance scores as dependent variables. Univariate effects were then examined, as were the comparisons between the groups.

RESULTS

Liking of aromas

There were significant differences in the liking of the different aromas ($F_{12, 271} = 2.56$ $p < 0.005$). The Irish cream was rated the most pleasant, and the Vodka and Gin the least pleasant. These were used as the pleasant and unpleasant aromas, and the other drinks as the neutral aromas. Water was kept as a separate category.

Table 1: Ratings of the liking of the different drinks.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
JW whisky	21	62.71	30.94	6.75	48.63	76.80
JB whisky	24	58.75	24.04	4.90	48.60	68.90
Guinness	21	57.90	25.20	5.50	46.43	69.38
Smirnoff Vodka	21	49.86	23.34	5.09	39.23	60.48
Baileys Irish Cream	22	81.23	16.99	3.62	73.69	88.76
Tequila	19	57.21	22.27	5.10	46.48	67.94
Tanqueray Gin	18	48.83	25.04	5.90	36.38	61.29
Rum	22	60.00	23.76	5.06	49.46	70.54
Coca Cola	21	68.95	18.16	3.96	60.68	77.22
Orange	21	65.67	27.51	6.00	53.14	78.19
Tonic water	21	62.81	24.93	5.44	51.46	74.16
Lemonade	22	66.68	20.49	4.37	57.59	75.77
Water	19	59.58	23.83	5.46	48.09	71.07

Mood ratings prior to and after the performance tasks

There were no significant effects of aromas on mood before or after the performance tasks.

Table 2: Mean change in mood ratings prior to and after the performance tasks.

	Aroma	Mean	Std. Deviation	N
Pre-tests change in hedonic tone	Unpleasant	18.4	24.7	39
	Pleasant	21.8	29.8	22
	Neutral	11.4	97.7	193
	Water	21.9	22.8	20
Pre-tests change in anxiety	Unpleasant	.3	22.1	39
	Pleasant	1.1	11.2	22
	Neutral	-5.7	83.5	193
	Water	-1.4	11.6	20
Pre-tests change in alertness	Unpleasant	35.4	66.2	39
	Pleasant	31.9	48.5	22
	Neutral	30.5	109.8	193
	Water	45.0	50.0	20
Post-test change in alertness	Unpleasant	-3.0	63.2	39
	Pleasant	-12.4	28.6	22
	Neutral	-7.4	43.0	193
	Water	6.1	44.6	20
Post-test change in hedonic tone	Unpleasant	5.5	27.7	39
	Pleasant	-1.4	15.6	22
	Neutral	-1.7	24.4	193
	Water	-3.7	24.7	20
Post-tests change in anxiety	Unpleasant	1.3	17.5	39
	Pleasant	4.8	10.8	22
	Neutral	.8	16.8	193
	Water	-.05	10.9	20

Performance tasks

The only significant effect was that the unpleasant aromas were associated with fewer lapses of attention in the categoric search task ($F_{3,270} = 2.74$ $p < 0.05$). This is shown in Table 3.

Table 3: Mean change in lapses of attention in the categoric search task.

Aroma	
Unpleasant	-6.8
Pleasant	-0.8
Neutral	-3.5
Water	-0.9

DISCUSSION

The results from the present study showed very few differences in the behavioural effects of the specific aromas. Vodka and gin were associated with fewer lapses of attention, which confirms a recent result.[22] The absence of other effects of the aromas may reflect the type of aroma selected. Future research should also include aromas like lemon that have shown more robust effects on mood and performance. Sniffing may also be less effective than smelling the aroma due to the short exposure duration. Other performance tasks should also be used as this is the second study to identify changes in sustained attention as the sensitive measure.

CONCLUSION

The effects of aromas on cognition and mood have been found to be variable and depend on the method of presenting the aroma, aroma type, duration of exposure, and the outcome measures examined. The present study investigated the effects of aromas from drinks on mood and performance of focused attention and categoric search tasks. The aromas used varied in acceptability, and pleasant, neutral and unpleasant aromas were sniffed. A between-subject design was used, with each group being exposed to a different aroma (Johnnie Walker whisky, J&B whisky, Guinness, Smirnoff vodka, Baileys Irish Cream, Jose Cuervo Tequila, Tanqueray gin, Captain Morgan rum, Coca-cola, orange juice, tonic, lemonade and water). Two hundred and seventy-three university staff and students completed the study. They carried out a baseline session with no exposure to an aroma, followed by a session where the aroma was sniffed over the course of the testing. The liking of the aroma was measured at a familiarisation session. There were no significant effects of aroma on mood. The only performance measure to show significant effects of the aromas was lapses of attention, where the unpleasant aromas (Tanqueray Gin and Vodka) were associated with fewer lapses of attention. In summary, the present study showed that sniffing aromas from drinks did not change mood but did influence sustained attention. Future research may need to change the methodology to detect more robust effects, and the use of other aromas, such as lemon, and the use of other cognitive tasks may be important initial changes.

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