PharmacologyOnLine
April 30, 2012
Archives • 2012 • vol.1 • 76 - 84

Public preferences for pain medication colour

Leanne Rhodes MBChB[1], Kate Antrobus MBChB[1], Margaret Mascarenhas MBChB[1],
Dr Lorna Donovan MBChB[1], Dr Jessica GroucuttMBChB[1],
Dr Sarah WhittikerMBChB[1], Dr Sheila Greenfield PhD[2*]

[1]College of Medical and Dental Sciences, University of Birmingham
[2]Primary Care Clinical Sciences, School of Health & Population Sciences
University of Birmingham, Birmingham B15 2TT, United Kingdom

*s.m.greenfield@bham.ac.uk

Abstract

Patient non-adherence to medication continues to be problematic. The visualappearance of medication including colour has been shown to be closely related to patients' general expectations of physiological effects, perceived strength of medication and acceptability.

Objectives

The aim of this study was to determine public preferences for analgesic tablet colour and the influence of socio-demographic characteristics on preferences. A cross-sectional questionnaire delivered as a street survey conducted in Birmingham city centre, UK. The survey obtained information from a sample (n=387) of people aged 16 to 75 years. Results were examined to identify associations between colour preference and socio-demographic characteristics. 60% of respondents preferred a white tablet colour for pain relief, with no significant difference reported by gender or ethnic group. A significant difference between males and females was observed for the second most preferred colour, which was pink for females (χ^2=5.221, p=0.022) and blue for males (χ^2=7.030, p=0.008). Black tablets were rated the least preferred colour by 37.5% of respondents. Red was regarded as the strongest tablet by 35.4% whilst 46.3% judged white to be the weakest tablet. Furthermore, 58.9% perceived white tablets to have the least side effects whilst 35.4% considered black to have the worst side effects. White is the most preferred tablet colour for pain relief. This has implications for future production of coloured tablets with respect to patient preference and compliance.

Key words: analgesic, colour, public preference

Introduction

The number of drugs prescribed and purchased over-the-counter (OTC) is steadily increasing however patient non-adherence continues to be a problem both in terms of cost and successful treatment outcomes.[1,2] A clear understanding of the wide range of reasons for this and finding effective strategies to increase adherence have yet to be determined.[3] A potential contributory factor which has received less emphasis has been the actual appearance of a drug and how this influences patient behaviour. Research suggests that characteristics such as the size and shape can influence patient views of medicines with capsules felt to be stronger than tablets and larger capsules stronger than small capsules.[4,5]

Tablet colour can also have an important role in terms of acceptability to patients and how easy it is to identify and distinguish from other tablets, a key factor for both patients, healthcare professionals and pharmaceutical companies.[6,7,8] Overgaard et al. reported that patients' "ideal tablet is small, white, strongly arched, circular and coated" as did respondents in Ibrahim's study carried out among the general public who also preferred 'white,round, small tasteless tablets'.[9,10] Capsule colours have also been ascribed expectations of what body systems drugs will act on: red is associated with cardiovascular activity whilst tan and beige are related to the skin.[5] Luscher proposed that tablet colour should correspond to the expected therapeutic effect in order for treatment to be efficacious, although Khan et al found that pharmaceutical companies did not appear to directly focus on this relationship in terms of the colour and shape of drugs acting on the central nervous system.[8,11]

Sallis and Buckalew reported that capsule colour may affect the perceived power of the drug as red and black capsules were judged to be more powerful than blue, green, orange and yellow capsules.[12] White capsules were judged to be least powerful, and the authors suggested that perceptual characteristics of medications may influence compliance.

Patient characteristics such as gender may influence the effect of colour. In a double blind crossover study, patients awaiting minor surgery were offered either orange or blue placebos as preoperative tranquillisers and 60% of males preferred orange whilst 60% of women favoured blue.[13] In arecent study in Malaysia investigating general public preferences for tablets women preferred pink and men blue.[10] Ethnicity may also be an important variable as drug colour had a lesser role in the expectations of black compared to white participants.[5] Brieger et al suggest that general cultural norms and beliefs about colours in a particular society may influence people's attitudes towards the colour of medicines.[14] They found that in Nigeria there was a relationship between medicine colour and perceived effect which derived from religious beliefs and the fact that some diseases in that society include colour descriptors.

Colour has also been linked to patient expectations of what effect a tablet will have. Existing research has focussed mainly on drugs which act on the central nervous system. Red, orange and yellow tablets have been associated with stimulant effects whilst blue and green elicit sedation.[15,16] Similarly, Blackwell et al. found that blue capsules induce sedation whereas pink capsules are more likely to generate stimulant effects.[17] This claim was based on the results of a single-blind experiment in which medical student volunteers reported changes in their psychological and physiological state after receiving blue or red placebos. However, medical students may be more aware of side effects associated with particular coloured medication and thus whether these findings can be extrapolated to the general population is unclear. In a comparative study, Schapira randomly allocated 48 anxious patients to oxazepam delivered in three different colours, each patient receiving one week's treatment with each colour.[18] Although the study was limited by the small sample size and the results failed to reach statistical significance, anxiety symptoms responded better to green than to red or yellow capsules whilst yellow was recommended for depression. People also associate 'light colours' with sedatives and 'bright colours' with drugs with

an anti-depressant or tonic action, whilst in a qualitative study in a rural community in Nigeria associations emerged regarding the colour white with analgesics, yellow with malaria treatments and red with tonics.[14,19]

Much of this research on people's expectations of tablet colour and drug effects was carried out in the 1970s in the USA and only one UK study was identified.[18] Evolving attitudes and consumer choice require further investigation in the current context. We decided to make analgesics the focus of our study as pain is a common symptom and analgesics are one of the most widely used OTC medications for the treatment of a wide variety of minor ailments, including headaches, coughs and colds.[20] A survey which explored the existence of chronic pain and its treatment among the general public in 16 countries including the UK, found that one in five people experienced chronic pain.[21] 52% reported taking prescribed analgesics and 26% had done, but ceased to do so, whilst 36% reported using OTC analgesics of which only 32% said they were 'completely or very effective'. Apart from Brieger's focus group and interview research in a Nigerian rural community in which respondents linked the colour white with analgesics, no other study was identified which explored the relationship between general public colour preferences and this type of medication.[14] The study reported here investigated preferences for analgesic tablet colour among the UK general public to determine whether colour has an impact on perceived drug effectiveness, action and side effects. Secondary aims were to examine whether opinions are influenced by certain sociodemographic factors including gender, age, ethnicity, occupation, and education level.

Methods

Setting/study Population

Participants were recruited from the Birmingham region. Although there is no formal guidance in the UK regarding selling over the counter (OTC) medications to children under sixteen we decided on a lower age limit of sixteen and the sample population included subjects aged between 16-75 years.[22]

Using Raosoft survey software, a minimum sample size of 384 was considered sufficient to determine the proportion of people required to demonstrate colour preferences in the general population with 5% precision, 90% power and 95% confidence.[23]

Data Collection

A street survey was used to approach members of the public whowere asked to complete a five minute questionnaire about their tablet colour preference for pain relief and to treat different types of pain (headache, backache, period pain,cough/cold. It also assessed the relationship between tablet colour and perceived strength and side effects. Participation was voluntary and informed verbal consent was obtained. To account for colour blindness, respondents who had problems perceiving colour were excluded. Colour preference was assessed visually with a range of 10 coloured tablet pictures (black, blue, brown, green, orange, pink, purple, red, white and yellow), which had identical perceptual properties including size and shape. The tablets displayed were small, circular and arched, as this design has been shown by a previous study to be most desirable.[9] This was to try and reduce the effect that tablet size and shape could have on preference. Data was gathered on demographics, health condition, medication compliance, current analgesic use, colour preferences and perceived effects of different coloured tablets.

Readability and simplicity were important considerations in the questionnaire design to ensure that participation time for completion of the questionnaire was kept to a minimum. A pilot study was performed on members of the public and the questions modified accordingly.

Given a desired sample of 384 subjects, the 2001 Census was used to estimate proportions needed in each age bracket (16-19, 20-24, 25-29, 30-34, 35-39,

40-44,45-49, 50-54, 55-59, 60-64, 65-69, 70-75) and the distribution by gender.[24] Purposive sampling was used with the aim of recruiting sufficient volunteers within each subgroup. The survey was performed at varying times (between 11am-3pm weekdays and 10am-12pm at weekends over a 2 month period) to allow for maximum variety participation.

Statistical Analysis

Microsoft Excel 2007 was used for data analysis. A non parametric chi-squared test with Yates correction was used to analyse categorical variables comparing gender, ethnicity and age with painkiller colour preference.

This study did not require formal ethics approval as it was a street survey, but Birmingham City Council required protocols and questionnaires to be sent to them before commencement of public opinion surveys in the City Centre. The study was approved by the University of Birmingham College of Medical & Dental Sciences - Project Scrutiny Committee - non-NHS projects.

Results

387 participants were recruited and their characteristics are summarised in Table 1. The majority were female 243 (62.8%), of white ethnicity (76.0%), with college as a highest educational level (75%). Approximately one third (31.5%) were aged under 30, a further third (33.3%) aged 50 and over and just over half (52.2%) were employed full-time. 85.3% of participants said they had ever used analgesics, but only 2.3% were chronic users (defined as using pain relief daily), although the majority of people (64.9%) did not suffer from any medical conditions that required routine tablet use.

Tablet Colour Preferences

For the total sample of 387, the most popular tablet colour for pain relief was white (60.7%), followed by red (9.0%) (Figure 1). There was a statistically significant difference in the second most popular colour between genders. 11.5% of females preferred pink (χ^2 =5.221, p=0.02) and 11.1% males preferred blue (χ^2 =7.030, p=0.008). No females chose black or brown as their most preferred colour. The least preferred tablet colour for pain relief in the total population was black (37.5%) followed by brown (15.5%) with no observed gender differences (Figure 2).

Distribution of preference was analysed for ethnicity, age and employment status. White was preferred by all groups. Chi-square analysis showed no significant difference in preference for a white or non-white tablet between white and other ethnic groups (χ^2 =3.772, p= 0.052). Regarding gender, 16-19 year old males were the only group to prefer a colour other than white, with 44.4% preferring blue (χ^2 =5.423, p= 0.020).

Perceptions of Tablet Colour, Action And Side Effects

Red was perceived to be the strongest tablet (46.3%) and white to be the second strongest (22.0%). The weakest tablet was judged to be white (35.4%) and the second weakest yellow (21.7%). There were no significant gender differences.

35.4% of the 387 people sampled judged the black tablet to have the worst side effects, whilst 16.8% cited the red tablet. The white tablet was perceived to have the least side effects (58.9%), followed by yellow (8.0%). There were no significant gender differences regarding the perceived effect of colour on side effects.

Overall for all four types of pain surveyed, the first tablet colour preference was white (headache 66.2%, backache 48.1%, period pain in females 59.0%, cough/cold 49.9%) (Figure **3**). The second tablet colour preference varied by type of pain being red for headache (7.8%, pink for backache (10.0%) and period pain (17.8%) and yellow for backache (11.3%) In the analysis of period pain, males and post-menopausal women were excluded. The second

most preferred pain relief tablet colour varied between males and females for headache, backache and coughs. This was only significant for backache where a greater proportion of men preferred blue (13.2%, χ^2=5.487, p=0.019) and a greater proportion of the female population preferred pink (13.6%, χ^2=7.833, p=0.002).

Participants who regularly took any medication (defined as taking medication at least once daily) and those who did not, both preferred white tablets (58.8% and 61.7%, respectively), with no significant difference between the two groups (χ^2 =0.206, p=0.649). More people who said they had ever taken analgesics preferred white tablets (63.6%) than people who said they had never done so, of whom 43.8% preferred white (χ^2 =7.163, p=0.007). 77.8% of chronic users of analgesics and 60.3% of non-chronic users preferred white tablets for pain relief. There was no significant difference in the colour preference between these two groups (χ^2 =0.510, p=0.474).

The factors excluding colour most likely to influence choice of analgesic were previous experience (42.9%), price (23.9%) and doctor recommendation (23.8%). When directly asked 'what colour makes you think of pain and pain relief?' 73.4% associated the word pain with red and 61.7% associated pain relief with the colour white.

Discussion

This study is the first to investigate preferences and perceptions about analgesic colour within the general population and updates and extends the limited research evidence on public preferences for tablet colour in the UK context. It also aimed to examine whether colour preferences differ for different types of pain, and whether a tablet's colour affects its perceived effectiveness and side effects.

Our results show that white was the preferred colour for pain medication, with 60% of participants choosing this colour. White was preferred by males, females, all age groups, ethnicities and both regular and non-regular tablet takers. This is in agreement with the work of Overgaard et al and Ibrahim et al who also found a strong preference for white tablets generally in both Danish and Malaysian populations.[9,10] Overall, the second most preferred colour was red (9%). However, women's second preference was pink and men's second preference was blue. This gender difference in preference was statistically significant. Although this differs from the findings of Coffield & Buckalew in 1982 who found no difference in preference between genders it supports Ibrahim's recent findings.[10, 25] This is interesting as it would seem to conform to male and female stereotypes, is reflected cross-culturally and may be due, at least in part, to primary socialisation. Overgaard et al did not consider gender differences and found that pale blue was the second most preferred colour after white.[9]

We found that white was the most preferred colour for pain relief in all four different conditions featured in the survey. This implies that across the board, a white tablet was favoured as an analgesic for all types of pain relief. However, the second most preferred colour for each condition did differ, being red for headache, pink for back and period pain, and yellow for coughs and colds suggesting that certain colours may be associated with specific conditions. This is in keeping with the findings of a Nigerian study.[14] When we asked people which colour they most associated with pain and which they most associated with pain relief, 73.4% of participants associated red with pain and 61.7% associated white with pain relief. The association of white with analgesia lends support to the findings of Buckalew and Coffield and may be one of the reasons why white is chosen as the preferred colour for analgesics.[5]

Black was the most disliked colour (37.5%) and brown the second most disliked (15.5%) colour for pain relief. Buckalew and Ross also found that black and brown tablets were unpopular, along with beige and grey.[4] Overgaard et al. did not consider black tablets and found that brown and purple were the most disliked colours.[9] Black was

also considered to be the tablet with the worst side effects for the likely reason that participants disliked black owing to its inherent characteristics, for example as a colour for morbidity. White was considered to be the tablet with the fewest side effects. Again this could be due to its inherent properties, such as an association with purity.

Both males and females perceived the tablet with the strongest actions to be red (46.3%), and that with the weakest action to be white (35.4%). This is in accordance with the work of Sallis and Buckalew, who found that red and black were perceived as strong and white as a weak preparation colour.[12] Adams and Osgood proposed that many colours are ascribed universal meanings, thus our finding could be related to the fact that black and red are perceived as strong, stimulant colours.[26] However, the second strongest perceived colour in this study was white (22%), which would seem to be contradictory and shows that opinion is divided on this subject.

There are a number of factors that may have influenced the results of this study. As mentioned above, primary socialisation might go some way to explaining gender differences in colour preference. Also relevant is the fact that 85% of respondents reported having taken analgesics in the past, 35.1% were regular medication users and many of the participants will have seen medication represented in advertisements. There is a public perception that drug colour is linked to what it does and therefore the current appearance of analgesics, many of which are white, could have biased some participants' opinions. i.e. it it seen as the correct colour for this type of medication.[6] Additionally, the choice of yellow as the second most preferred colour for coughs and colds could be related to the colour of cold medicines in the UK such as Lemsip®. Potential limitations of the study include the sampling method, which was a street survey. An inherent problem with street surveys is the likelihood of introducing responder bias. Many of the people approached refused to participate and it is possible that those who took part in the survey were not representative of the general population.[27]

Due to the nature of the survey it was not possible to collect data about non-respondents. In addition, due to restrictions imposed by the council, we were only able to perform the survey on a single street in central Birmingham. We attempted to increase the range of people approached by performing the survey on both weekdays and at the weekend, but the fact that our sample was limited to this one area may limit the external validity of the results. It will also have excluded many of the chronically ill and elderly, who may be confined to the home or to hospital. Furthermore, we had hoped to carry out quota sampling in order to achieve a representative sample across all ages and genders. However, in the time available and the context of the street survey we were not able to meet all of our quotas. This again is probably a consequence of using a street survey, as people of certain ages and genders are less likely to participate.[27]

Previous work has suggested that patient compliance can be influenced by the visual appearance of a drug.[6,25,28] Not only does a white tablet seem to be the public's colour of choice generally but also from the results presented here is also preferred for pain relief. This has implications for analgesic design, suggesting that white would be the best colour to use to increase the likelihood of patient compliance, and consequent effective treatment. These results may also extend to other types of medication, but further work is required to confirm this. However, a disadvantage of all medication being white is that people with chronic diseases may use the appearance of their tablets as a method of identifying different medications.[7] Overgaard et al. found that patients who took more than 10 tablets a day favoured coloured tablets, possibly for this reason. Therefore it is important to look at the most favoured colours besides white.[9] The present study suggests that the best coloured tablet to use would be red, while black and brown in particular are colours to be avoided.

The present study has shown that white was the preferred colour for pain medication. Although this result was consistent for both genders and for all

age groups and ethnicities, gender appeared to influence people's second preferred colour and to reflect traditional stereotypes reading male and female colours. Black and brown were the least favoured colours. These results have implications for drug design, marketing and patient compliance.

Acknowledgments

SG was funded by the National Institute for Health Research (NIHR) through the Collaborations for Leadership in Applied Health Research and Care for Birmingham and Black Country (CLAHRC-BBC) programme

The views expressed in this publication are not necessarily those of the NIHR, the Department of Health or the University of Birmingham

References

1. Busfield J. 'A pill for every ill': Explaining the expansion in medicine use. Soc Sci Med. 2010;70:934-941.
2. Horne R. Adherence to medication: a review of the existing literature. In: Myers LB, Midence K, eds. Adherence to treatment in medical conditions. Harwood Academic Press, Amsterdam, 1998.
3. Donovan JL, Blake DR. Patient non-compliance: deviance or reasoned decision-making? Soc Sci Med. 1992;34:507-513.
4. Buckalew LW, Ross S. Medication property effects on expectations of action. Drug Devel Res. 1991;23: 101-108.
5. Buckalew LW, Coffield, KE. An investigation of drug expectancy as a function of capsule colour and size and preparation form. J Clin Psychopharmacol. 1982:245-248.
6. Abdo-Rabbo A, Al-Ansari M, Gunn BC, Suleiman BJ. The use of medicines in Oman. SQU Med J. 2009;9:124-131.
7. McCormack PM, Lawlor R, Donegan C et al. Knowledge and attitudes to prescribed drugs in young and elderly patients. Ir Med J. 1997;90:29-30.
8. Lüscher M. (1992) The psychological influence of capsule colours on the therapeutic effect of a drug. News sheet, Capsugel Library, B-2880 Bornem, Belgium. Available at www.capsugel.com/media/library/the-psychologicalinfluence-of-capsule-colours-ion-the-therapetuic-effect-of-a-drug.pdf. Accessed 22-02-12.
9. Overgaard ABA, Hojsted J, Hansen R, Moller-Sonnergaard J, Christrup LL. Patients' evaluation of shape, size and colour of solid dosage forms. Pharm World Sci. 2001;23:185-188.
10. Ibrahim IR, Izham M, Al-Haddad M. Preferences of color, size, shape, and taste of oral solid dosage forms. Pharmacologyonline. 2010;2:754-762.
11. Khan A, Bomminayuni EP, Bhat A, Faucett J, Brown WA> Are the colors and shapes of current psychotropics designed to maximiise the placebo response? Psychopharmacol. 2010;211:113-122.
12. Sallis RE, Buckalew LW. () Relation of capsule color and perceived potency. Percept Mot Skills. 1984; 58: 897-898.
13. Cattaneo AD, Lucchelli PE, Filippuci G. Sedative effects of placebo treatment. Eur J Clin Pharmacol. 1970; 3: 43-45.
14. Brieger WR, Kabiru KS, Oshiname FO. Perceptions of drug color among drug sellers and consumers in rural southwestern Nigeria. Res Soc Adm Pharm 2007; 3: 303-319.
15. Jacobs KW, Nordan FM. Classification of placebo drugs: effect of color. Percept Mot Skills. 1979; 49: 367-72.
16. De Craen AJM, Roos PJ, de Vries L, Kleijnen J. Effect of colour of drugs: Systematic review of perceived effect of drugs and of their effectiveness. BMJ. 1996;313:1624–1626.
17. Blackwell B, Bloomfield SS, Buncher CR. Demonstration to medical students of placebo responses and non-drug factors. Lancet. 1972; 1:1279-82.
18. Schapira K, McClelland HA, Griffiths MR, Newell DJ. () Study on the effects of tablet colour in the treatment of anxiety states. BMJ. 1970; 2: 446-9.
19. Sebellico A. The color of drugs: a preliminary survey. Boll Soc Ital Biol Sper. 1989;65:685-687.
20. De Craen AJ, Di Giulio G, Lampe-Schoenmaeckers, JE. Analgesic efficacy and safety of paracetamol-codeine combinations versus paracetamol alone: a systematic review. BMJ. 1996;313: 321-325.
21. Brievik H, Collett B, Ventafridda V, Cohen R, Gallacher D. Survey of chronic pain in Europe:prevalence, impact on daily life, and treatment. Eur J Pain. 2006; 10:287-333.
22. What age can children buy over-the-counter (OTC) medicines? Available at www.nhs.uk/chq/Pages/1009.aspx?CategoryID=62&SubCategoryID=65 (accessed 23-02-12)
23. Raosoft, [online] available at http://www.raosoft.com/samplesize.html [accessed 14th March 2011]
24. National Statistics (2001), Census 2001 [online] Available at www.statistics.gov.uk/census2001/census2001.asp (accessed23-02-12)
25. Coffield, K.E. and Buckalew, L.W. A study of color preferences for drugs and implications for compliance and drug-taking. J Alcohol Drug Educ. 1988;34:28-36.
26. Adams FM, Osgood CE. A cross-cultural study of the affective meanings of color. J CrossCultPsychol. 1973;4:135-56.
27. Miller KW, Wilder LB, Stilllman FA, Becker DM. The feasibility of a street-intercept survey method in an African-American community. Am J Public Health. 1997; 87:4655-4658.
28. Buckalew LW, Sallis RE. () Patient compliance and medication perception. J Clin Psychol. 1986; 42:49-53.

Characteristic		Number	%
Gender	Female	243	62.8
	Male	144	37.2
Age group	16-19	33	8.5
	20-24	36	9.3
	25-29	53	13.7
	30-34	32	8.3
	35-39	28	7.2
	40-44	36	9.3
	45-49	40	10.3
	50-54	31	8.0
	55-59	23	5.9
	60-64	27	7.0
	65-69	23	5.9
	70-75	25	6.5
Ethnicity	White	294	76.0
	Mixed	18	4.7
	Asian	31	8.0
	Black	25	6.5
	Other	19	4.9
Status	Full Time	202	52.2
	Homemaker	17	4.4
	Part Time	49	12.7
	Retired	52	13.4
	Self employed	2	0.5
	Student	48	12.4
	Unemployed	17	4.4
Education Level	Nil	5	1.3
	School	91	23.5
	College	143	37.0
	University	148	38.2
Regular Medication User	Yes	136	35.1
	No	251	64.9
Pain Killer Usage	Chronic	9	2.3
	Non-chronic	378	97.7
Ever used pain relief	Yes	330	85.3
	No	57	14.7

Table 1: Characteristics of Participants

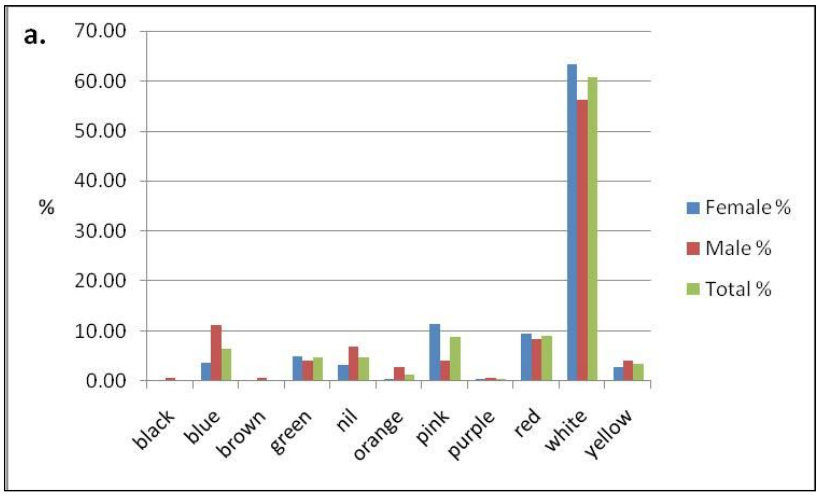

Figure. 1:Most preferred tablet colours as percentages of total sample population and showing gender distribution (n=387).

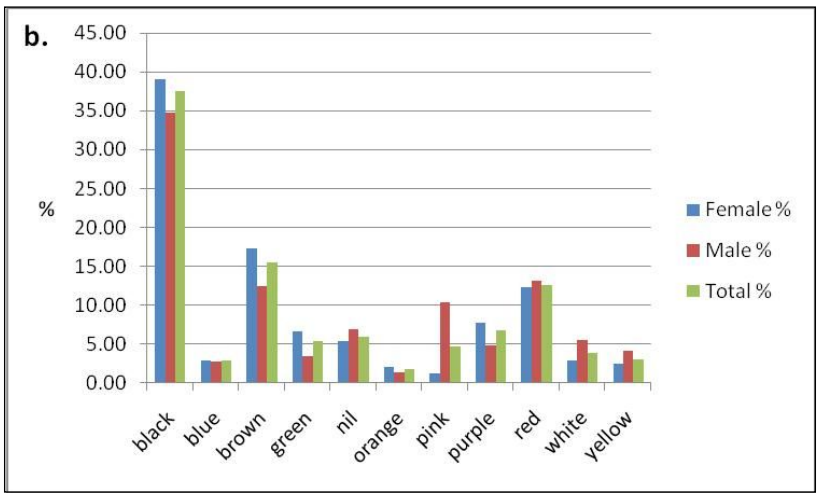

Figure 2:Least preferred tablet colours as percentages of total sample population and showing gender distribution (n=387).

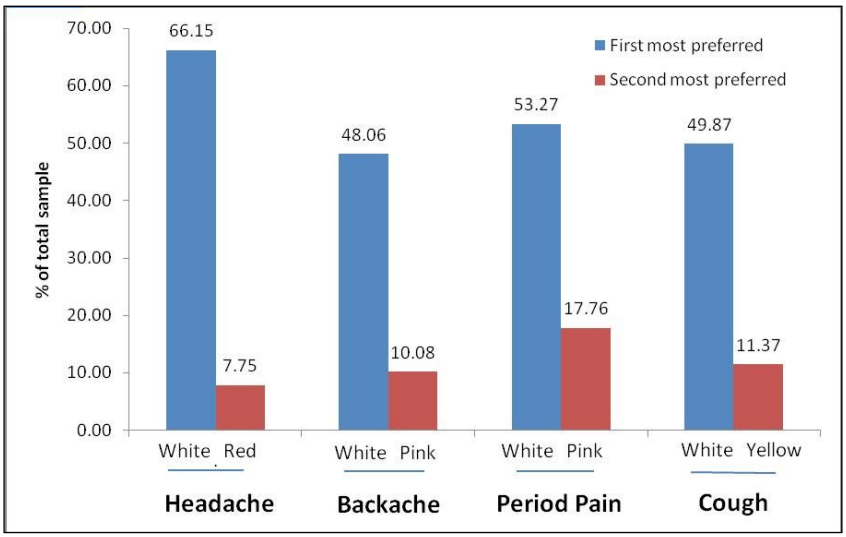

Figure 3: Tablet colour most and second most preferred for different types of pain as a percentage of total sample population (n=387)