

KNOWLEDGE AND ATTITUDE OF HEALTHCARE STUDENTS TOWARDS OVER-THE-COUNTER ORAL HEALTHCARE PRODUCTS AND DENTAL PRACTICES

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ABSTRACT

INTRODUCTION: The use and abuse of over-the-counter (OTC) products have been well-documented in multiple studies across the globe.

OBJECTIVES: To evaluate the knowledge and attitude of healthcare students (medical and para-medical students) of a private institution in India on OTC oral healthcare products and dental practices.

MATERIAL AND METHODS: A validated questionnaire comprising twenty questions in English was drafted. The questionnaire was divided into three sections. First section consisted of demographical data, and second and third sections involved questions regarding knowledge (9 questions) and attitude (11 questions) of participants about OTC oral healthcare products and their ingredients.

RESULTS: The current research included 1,024 participants. There were 376 male and 648 female participants. The participants selected their oral care products depending on various factors. A mixed response was found in certain aspects.

CONCLUSIONS: Overall knowledge and attitude of the study population regarding OTC healthcare products proved to be satisfactory. Additionally, even though the sample size was significant, it was limited to certain geographic boundaries.

KEY WORDS: oral hygiene, self-medication, dentifrices, non-prescription drug misuse, teeth whitening, good health.

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INTRODUCTION

The use and abuse of over-the-counter (OTC) products have been well-documented in multiple studies across the globe [1-3]. Consultation by specialized personnel for any ailment is a necessity for every individual, but the scenario in developing countries, such as India, is not quite

the same, as a vast majority of general population resorts to self-medication [4]. The World Health Organization (WHO) defines self-medication as “the use of drugs to treat self-diagnosed disorders or symptoms, or the intermittent or continuous use of a prescribed drug for chronic or recurrent diseases or symptoms” [5]. In oral healthcare, the procedure of self-medication is generally paved by easy

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accessibility of OTC products and medications. OTC dental products are oral healthcare products that can be marketed without a registered practitioner's prescription [6]. Many times these products are advertised in such a way that unrealistic expectations about these products are created and in turn, the real reason for the underlying ailment, from which an individual may be suffering, is undiscovered. Moreover, unscientific claims are made by producers of such products, making people believe these schemes of marketing. In 2020, the global oral care industry was estimated at \$53 billion US dollars, and it is anticipated to expand to \$96 billion by the end of 2031 [7]. However, the real in-depth advantages and disadvantages of oral healthcare products supported by sound evidence and long trials are often not implemented. The regulation of OTC oral health products regarding drug safety, adequacy, label of self-medication, and other notable criteria are governed by institutions, such as ADA (American Dental Association) or other federal organizations. Regulatory agencies, i.e., FDA, approves 800 ingredients, from which 100,000 drug products are provided [6, 7]. In India, OTC products are listed under "Schedule K" of categorization, and much of its guidelines are governed by the Drugs and Cosmetics Rules (DCR) 1945 [8]. However, the standard of safety of OTC products in developing countries, such as India, are rarely carefully followed due to poor implementation of laws [6]. This leaves further suspicion on the validity of claims made by producers of these products. Certainly, a basic level of understanding about OTC products and their ingredients along with their implications is required by individuals for safe self-medication. To our knowledge, no study evaluating the attitude and knowledge of OTC oral health products has been done so far in India. Therefore, in the current study, an insight into these topics was assessed and other oral health habit comprehensions among a population of undergraduate healthcare students (medical and para-medical students) of a private institution based in Dakshina Kannada, Karnataka, India.

OBJECTIVES

To evaluate the knowledge and attitude of healthcare students (medical and para-medical students) of a private institution in India on OTC oral healthcare products and dental practices.

MATERIAL AND METHODS

A cross-sectional questionnaire-based survey aiming at undergraduate healthcare students was designed after approval by institutional ethics and scientific review board (approval No.: 18039). The questionnaire was designed on similar questionnaire-based surveys on oral healthcare practices and knowledge [9, 10], but no particular type of survey on OTC dental products targeted at Indian population was found. Subsequently,

a panel of experienced members further validated the questionnaire, which included twenty questions in English divided into three sections. The first section consisted of demographical data, and the second and third sections involved questions evaluating the knowledge (9 questions) and attitude (11 questions) of participants on OTC oral healthcare products and their ingredients. The second and third sections assessed the comprehension of respondents regarding their reasons for selection of their toothpaste, and their oral healthcare habits. Additionally, the attitude regarding different compositions of products available over-the-counter and other comprehensive questions regarding the participants' oral healthcare habits were also evaluated. A pilot study was conducted among 50 participants before the commencement of the original survey, in which timing of filling up of the questionnaire was assessed. These respondents were excluded from the main study. Sample size was selected by stratified random sampling from five departments of a private academic institution. Confidence level was set at 95%. Before the commencement, the purpose of the study was explained, and informed consent for voluntary participation was obtained from all participants. Knowledge-based questions were assigned with scores in numerical order. Attitude-based questions were evaluated using a three-point Likert scale for simplifying the questionnaire. Questionnaires were distributed using Google Forms among medical and para-medical students, including nursing, speech sciences, and psychology students. Data was compiled and analyzed using Statistical Package for Social Sciences (SPSS), version 16.0 (SPSS Inc., Chicago IL, USA), and descriptive statistics and frequencies were tabulated. Normality test was applied to verify distribution of data. Chi-square and Mann-Whitney tests were applied to confirm statistical association.

RESULTS

The current research included 1,024 participants, with a 100 percent response rate. There were 376 male and 648 female participants. The age of the participants ranged from 18-29 years, with the mean age of 22.2 ± 2.67 years. Regarding the choice of toothpaste being used, 39.8% of the respondents stated that they use a toothpaste recommended by their dentist, 23.8% considered the cost factor as the main criterion, whereas 29.8% of the students gave priority to the taste while choosing their toothpaste. Only 6.5% of the participants reported selecting their toothpaste based on advertisements. The contents of dentifrice was verified by majority of the participants, and only 34.7% reported checking the contents before purchasing the dentifrice. 59.2% of the students checked for the presence of fluoride and sodium lauryl sulphate in their dentifrice. Regarding the method of brushing, a mixed response was

received on an effective method of brushing, and only 6.3% of the participants reported that forceful brushing would be able to remove already present stains and deposits from the oral cavity. 48.6% of the participants were aware that all the mentioned mouthwashes are available as OTC products, and majority of them (86.5%) selected mouthwashes depending on alcohol presence. Furthermore, only 4.2% of the participants did not check for the presence or absence of alcohol in their mouthwashes, and 9.3% of the students reported no link between alcohol and mouthwash. A mixed response was obtained on the ideal time for the use of a mouthwash. 66.8% of the participants identified the need to consult a professional in case of problem with halitosis, whereas 29.7% declared that halitosis can be masked with using a mouth freshener. Only 3.5% of the respondents felt that vigorous brushing could solve

the problem of bad breath. Regarding tooth bleaching strips, 96.1% of the participants were unaware of commercial availability of tooth bleaching strips (Table 1). The attitude of the students was also assessed using the same structured questionnaire. A majority (94.9%) of the participants stated that oral healthcare should be given equal importance as general healthcare, whereas only 5.1% were neutral in their opinion. About half of the study population were neutral in their opinion on using activated charcoal toothpaste for tooth whitening. A mixed response was obtained on the form (gel/paste) of a toothpaste and its contents. The study participants reported equal effectiveness with herbal and non-herbal toothpastes; 88.6% opined that fluoridated toothpaste is safe to use during pregnancy. When testing their knowledge about toothbrush type, 48.4% of the students disagreed with the use of hard-bristled toothbrushes over

TABLE 1. Knowledge and awareness of oral care products among study participants (number and percentage)

Question	1	2	3	4	5	Options elaborated
According to you, what is the prime criteria for selection of a toothpaste?	305 (29.8%)	244 (23.8%)	40 (39.8%)	67 (6.5%)	–	1. Taste 2. Cost 3. Recommendation from the dentist 4. Advertisements
You choose your toothpaste based on the presence of	504 (59.2%)	165 (16.1%)	–	355 (34.7%)	–	1. Fluoride- and SLS-containing (foaming toothpaste) 2. Non-fluoridated but herbal 3. Fluoride without SLS-containing 4. Do not see the content
Does forceful brushing remove the already formed stains and deposits from the teeth?	164 (6.3%)	318 (31.1%)	642 (62.7%)	–	–	1. Yes 2. No 3. Force of brushing is not related to removal of stains and deposits
In your opinion, the most effective brushing can be achieved by	372 (36.3%)	257 (25.1%)	207 (20.2%)	–	188 (19.3%)	1. Horizontal strokes 2. Vertical strokes 3. Type of strokes while brushing are not important
Which mouthwashes according to you are available over-the-counter (OTC)?	184 (18.0%)	129 (12.6%)	187 (18.3%)	28 (2.7%)	496 (48.4%)	1. Chlorhexidine 2. Peroxide 3. Fluoride 4. Cetylpyridinium chloride 5. All of the above
Do you choose your mouthwash depending on the alcohol content?	886 (86.5%)	243 (4.2%)	95 (9.3%)	–	–	1. Yes 2. No 3. Alcohol content and mouthwash are not co-related
Ideal time for using a mouthwash is	165 (16.1%)	398 (38.9%)	255 (24.9%)	206 (20.1%)	–	1. Before brushing 2. After brushing 3. Brushing and using a mouthwash are not related 4. Whenever you feel like as a mouth freshener
If you are suffering from halitosis (bad breath), you would	304 (29.7%)	36 (3.5%)	684 (66.8%)	–	–	1. Use mouth freshener 2. Brush vigorously 3. Consult a professional
Are you aware about commercially available tooth bleaching strips (teeth whitening strips)?	40 (3.9%)	984 (96.1%)	–	–	–	1. Yes 2. No

SLS – sodium lauryl sulphate, OTC – over-the-counter

soft/ ultra-soft bristled toothbrushes. A mixed opinion was received on the usage of water as a final rinse after using of a mouthwash. The majority of study participants reported using OTC oral healthcare products for more than recommended dosages and increased frequency if desired results were not achieved. Furthermore, the respondents supported the use of inter-dental aids along with a toothpaste and toothbrush use (Table 2).

Chi-square test was applied for statistical analysis. Statistically significant results were obtained among male and female participants in selecting a toothpaste for routine care. The availability of bleaching strips for tooth whitening also showed a statistically significant difference among male and female participants. A statistically non-significant difference was noticed in the use and selection of a mouthwash, duration, and ideal timing for a mouthwash utilization. The attitude towards the selection and usage of oral care products was similar among male and female participants (Tables 3 and 4).

DISCUSSION

A few studies investigating the knowledge of general population regarding oral health have been conducted in developing countries [10-12]. In the era of social media, where unrealistic claims by many dental care product companies are openly circulated for product promotion, the selection of such easily available OTC products overwhelms the common public. The respondents showed a satisfactory level of knowledge related to oral care and OTC dental products. Interestingly, in this study, 6.5% of the respondents chose their dentifrice

based on advertisements, and the majority (39.8%) relied on an expert opinion for choosing their dentifrice. Additionally, a large number of the participants reported verifying the contents of their dentifrice before purchasing, wherein fluoride and sodium lauryl sulphate foaming toothpastes were preferred by 59.2% of the participants. Among the different constituents present in toothpastes, SLS and triclosan have been documented as being related to many undesirable side effects [13]. SLS has been shown to cause denaturation of the glycoproteinaceous sub-surface of the oral mucosa by disrupting the protective mucin layer. This is achieved by the calcium-binding property of SLS. As a result, the oral cavity becomes more susceptible to irritants and antigens. Moreover, recent literature reveals an equal efficiency of SLS-containing and non-SLS-containing toothpaste in terms of safety, effectiveness, and even taste acceptance [14]. Among other OTC products, mouthwash and its adverse association with alcohol remain a matter of concern. Their uncontrolled availability and use have counter-productive results, such as dryness, ulcerations, resin-based restoration sorption, and detrimental effects on the liver and kidney [15]. Commercially available OTC mouthwashes have been found to have alcohol levels as high as 27% [16], and reports show a positive correlation between such products in association with oral carcinogenesis [17, 18]. In India, the availability of mouthwashes as OTC products makes them accessible without prescription, and their regulation of usage is not monitored. Abuse of OTC mouthwashes has been correlated with increased risks of diabetic changes [19, 20]. Anti-microbial mouthwashes often contain components

TABLE 2. Attitude of study participants about oral care products (number and percentage)

Sl. No.	Question	Strongly agree	Neutral	Strongly disagree
1	In your opinion, should oral healthcare be given equal importance as general healthcare?	972 (94.9%)	52 (5.1%)	–
2	Is it safe to use activated charcoal toothpastes for teeth whitening?	93 (9.1%)	560 (54.7%)	371 (36.2%)
3	Does the form of a toothpaste (gel or paste) make any difference?	489 (47.8%)	263 (25.7%)	272 (26.6%)
4	Are SLS (sodium lauryl sulphate, foaming agents)-containing toothpastes as effective as toothpastes without SLS (non-foaming toothpastes)?	419 (40.9%)	233 (22.8%)	372 (36.3%)
5	Can SLS-containing toothpastes (foaming toothpastes) cause ulcers in the mouth?	198 (19.3%)	455 (44.4%)	371 (36.2%)
6	In your opinion, are herbal products safe and better than commercially available non-herbal toothpastes?	378 (36.9%)	263 (25.7%)	383 (37.4%)
7	Is it safe for pregnant women to use fluoridated toothpastes?	907 (88.6%)	71 (6.9%)	46 (4.5%)
8	Is the use of hard bristled toothbrush over soft/ ultra-soft bristled toothbrush better for the teeth?	306 (29.9%)	222 (21.7%)	496 (48.4%)
9	Should water be used to rinse the mouth after using a mouthwash?	472 (46.1%)	236 (23%)	316 (30.9%)
10	Can over-the-counter oral healthcare products be used for more than recommended dosages and increased frequency if desired results are not achieved?	–	550 (53.7%)	474 (46.3%)
11	Is inter-dental cleansing using floss or inter-dental brush along with a mouthwash necessary?	394 (38.5%)	474 (46.3%)	156 (15.2%)

SLS – sodium lauryl sulphate, OTC – over-the-counter

TABLE 3. Chi-square analysis of knowledge and awareness of the study participants

Question	Option 1. Strongly agree 2. Neutral 3. Strongly disagree	Sex		χ^2 value df p-value
		Male, n (%)	Female, n (%)	
In your opinion, should oral healthcare be given equal importance as general healthcare?	1	351 (93.4)	621 (95.8)	3.04 1 0.05
	2	25 (6.6)	27 (4.2)	
	3	0 (0.0)	0 (0.0)	
Is it safe to use activated charcoal toothpastes for teeth whitening?	1	39 (10.4)	54 (8.3)	2.06 2 0.35
	2	196 (52.0)	364 (56.2)	
	3	141 (37.5)	230 (35.5)	
Does the form of a toothpaste (gel or paste) make any difference?	1	182 (48.4)	307 (47.4)	2.35 2 0.30
	2	87 (23.1)	176 (27.2)	
	3	107 (28.5)	165 (25.5)	
Are SLS (sodium lauryl sulphate, foaming agents)-containing toothpastes as effective as toothpastes without SLS (non-foaming toothpastes)?	1	160 (42.6)	259 (40.0)	1.35 2 0.50
	2	88 (23.4)	45 (23.4)	
	3	128 (34.0)	244 (37.7)	
Can SLS-containing toothpastes (foaming toothpastes) cause ulcers in the mouth?	1	58 (15.4)	140 (21.6)	8.32 3 0.04
	2	166 (44.1)	289 (44.6)	
	3	152 (40.4)	219 (33.8)	
In your opinion, are herbal products safe and better than commercially available non-herbal toothpastes?	1	136 (36.2)	242 (37.3)	0.52 2 0.77
	2	94 (25.0)	169 (26.1)	
	3	146 (38.8)	237 (36.6)	
Is it safe for pregnant women to use fluoridated toothpastes?	1	345 (91.8)	562 (86.7)	6.15 2 0.04
	2	20 (5.3)	51 (7.9)	
	3	11 (2.9)	35 (5.4)	
Is using hard bristled toothbrush over soft/ultra-soft bristled toothbrush better for the teeth?	1	108 (28.7)	198 (30.6)	0.86 2 0.65
	2	87 (23.1)	135 (48.6)	
	3	181 (48.1)	315 (48.6)	
Should water be used to rinse the mouth after using a mouthwash?	1	175 (46.5)	297 (45.8)	0.54 2 0.76
	2	82 (21.8)	154 (23.8)	
	3	119 (31.6)	197 (30.4)	
Can over-the-counter oral healthcare products be used for more than recommended dosages and increased frequency if desired results are not achieved?	1	201 (53.5)	349 (53.9)	0.01 1 0.00
	2	175 (46.5)	299 (46.1)	
	3	0 (0.0)	0 (0.0)	
Is inter-dental cleansing by floss or inter-dental brush along with using a mouthwash necessary?	1	150 (39.9)	244 (37.7)	1.40 2 0.00
	2	175 (46.5)	299 (46.11)	
	3	0 (0.0)	0 (0.0)	

P-value ≤ 0.05 ; *p-value statistically significant; df – degree of freedom; n – number of responses; SLS – sodium lauryl sulphate; OTC – over-the-counter

that inhibit nitric oxide formation by microbes in the oral cavity. This often leads to an increase in metabolic disruptive conditions, such as diabetes or pre-diabetes. In the present study, though most of the respondents knew about the availability of OTC mouthwashes, their knowledge of appropriate utilization was still unclear. In the post-COVID-19 era, the mandatory use of mouth masks has led to the concept of ‘mask-mouth’, in which

a long duration of face mask wearing is associated with halitosis. More than 90% of cases of halitosis originate in the oral cavity, and there is enough evidence to indicate that poor periodontal condition, caries, dry mouth, and other extra-oral conditions are the most common causes of halitosis [21]. Frequently, therapeutic masking of the odor is a common way opted by individuals leading to abuse of mouthwash or ignoring the real cause

TABLE 4. Chi square analysis of attitude of the study participants

Question	Option	Sex		χ^2 value of <i>p</i> -value
		Male, <i>n</i> (%)	Female, <i>n</i> (%)	
According to you, what is the prime criteria for selection of a toothpaste	1. Taste	98 (26.1)	207 (31.9)	75.20 3 0.00*
	2. Cost	146 (38.8)	98 (51.1)	
	3. Recommendation from the dentist	114 (30.3)	294 (45.4)	
	4. Advertisements	18 (4.8)	49 (7.6)	
Do you choose your toothpaste based on the presence of	1. Fluoride- and SLS-containing	193 (51.3)	311 (48.0)	40.01 2 0.00*
	2. Non-fluoridated but herbal	90 (23.9)	75 (11.6)	
	3. Fluoride without SLS-containing	–	–	
	4. Do not see the content	93 (24.7)	262 (40.4)	
Would forceful brushing remove the already-formed stains and deposits from the teeth?	1. Yes	30 (8.0)	34 (5.2)	3.26 2 0.196
	2. No	118 (31.4)	200 (30.9)	
	3. Force brushing is not related to removal of stains and deposits	228 (60.6)	414 (63.9)	
In your opinion, the most effective brushing can be achieved by	1. Horizontal strokes	137 (36.4)	235 (36.3)	1.17 4 0.088
	2. Vertical strokes	90 (23.9)	167 (25.8)	
	3. Type of strokes while brushing are not important	77 (20.5)	130 (20.1)	
Which mouthwashes according to you are available over-the-counter (OTC)?	1. Chlorhexidine	73 (19.4)	111 (17.1)	3.06 4 0.54
	2. Peroxide	43 (11.4)	86 (13.3)	
	3. Fluoride	68 (18.1)	119 (11.6)	
	4. Cetylpyridinium chloride	7 (1.9)	21 (3.2)	
	5. All of the above	185 (49.2)	311 (48.0)	
Do you choose your mouthwash depending on alcohol content?	1. Yes	339 (90.2)	547 (84.4)	6.77 2 0.03
	2. No	11 (2.9)	32 (4.9)	
	3. Alcohol content and mouthwash are not co-related	26 (6.9)	69 (6.7)	
Ideal time for using a mouthwash is	1. Before brushing	58 (15.4)	107 (16.5)	1.31 3 0.72
	2. After brushing	147 (39.1)	251 (38.7)	
	3. Brushing and using a mouthwash are not related	100 (26.6)	155 (23.9)	
	4. Whenever you feel like as a mouth freshener	71 (18.9)	135 (20.8)	
If you had halitosis (bad breath), you would	1. Use mouth freshener	103 (27.4)	201 (31.0)	2.38 2 0.034
	Brush vigorously	11 (2.9)	25 (3.9)	
	3. Consult a professional	262 (69.7)	422 (65.1)	
Are you aware about commercially available tooth bleaching strips (teeth whitening strips)?	1. Yes	26 (6.9)	14 (2.2)	14.32 1 0.00*
	2. No	350 (93.1)	634 (97.8)	

P-value ≤ 0.05 . **p*-value statistically significant; *df* – degree of freedom, *n* – number of responses, OTC – over-the-counter

of halitosis [22]. A good percentage of our study population (66.8%) agreed on consulting a professional rather than masking halitosis with a mouth freshener.

Teeth whitening bleaching strips are marketed routinely in Indian media, and are one of the most promising developments in cosmetic OTC oral care products. These strips are often analogous to unmonitored peroxide release. Moreover, all cases do not clinically fit the criteria for bleaching, and when used without supervision, side effects of hypersensitivity and resorption can easily be associated [23]. Strangely, the majority of the popula-

tion (96.1%) did not know of the existence of teeth whitening bleaching strips. This finding show that the Indian market for such products has still not reached a high level of popularity compared with Western countries. Equating medical and dental health awareness stands as a major hurdle in developing countries, such as India. The majority of the respondents (94.9%) agreed with that, and 38.5% required additional inter-dental aids for oral hygiene refinement, which shed light on an improving scenario in this aspect. However, awareness regarding the form of dentifrice used, differences between herbal

and non-herbal toothpastes, and the basic knowledge on the method of using a mouthwash proved to be unclear among the participants. The current study showed that although 62.7% of the students had the idea that forceful brushing would not remove the already-formed deposits, the correct methodology of tooth brushing was still not well-understood by many. As a result, 48.4% of the respondents preferred hard-bristled toothbrushes over soft-bristled ones. Studies on the abrasiveness of toothpaste reveal a high-rate of destruction that can be caused by abrasiveness when used in an unregulated manner [24, 25]. Furthermore, the use of unmonitored particle size, along with long-term use of wrong tooth brushing technique can cause irreversible tooth structure wear. Frequently, toothpastes marketed as containing whitening agents have a very high relative dentin abrasivity (RDA) value. Charcoal paste formulations of dentifrices often surpass safe limit of the permitted level. Our study highlighted the unawareness among the respondents, as 54.7% were neutral about the use of such OTC products. Between medicated and non-medicated herbal toothpastes, strong research trials to support the use of the latter need to be performed. Moreover, most herbal toothpastes contain unregulated ingredients under the umbrella of the epithet “herbal”. According to a study by Agarwal *et al.* [24], brands of Indian dentifrices contained questionable amounts of nicotine, and many of these were tagged as “herbal” dentifrices [26]. Frequently, herbal toothpastes are also lacking fluoride ingredients, and are labeled as “chemical-free” or “fluoride-free”. This tag might often mislead the lay population, as such statements label fluoride as a toxic ingredient. Although an unregulated amount of fluoride is detrimental, the use of fluoridated dentifrices is a necessity for healthy dentition [27, 28]. In our study, the respondents had almost equal opinions about herbal and non-herbal dentifrices. Awareness and regulation of such products remain immensely important.

CONCLUSIONS

To our knowledge, this is the first study conducted in India, especially among medical and para-medical community. Though considerably mixed responses regarding the basic knowledge and usage of OTC products were observed, the overall knowledge and attitude of the study population regarding over-the-counter healthcare products proved to be satisfactory. This might be attributed to the fact that the study population was already in the field of health sciences, and their knowledge and awareness regarding OTC products might as well be pronounced. Furthermore, some drawbacks in our survey need to be emphasized. Studies that are using questionnaires are often related to errors and bias. Additionally, the sample size, though vast, was limited to a certain geographic boundaries, and pan-Indian re-

sponses to similar questions should not be generalized. Further studies in this field with larger sample sizes are necessary for better understanding.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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