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Prevalence And Associated Factors of Anemia Among Reproductive Women in Eastern Ethiopia: A Cross-Sectional Study

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Abstract

Background: Anemia for women in reproductive age continues to be a serious public health issue, especially in countries in Africa like Ethiopia. It is the most frequent reason for serious effects for both the mother and the fetus in women. There have been few investigations on the prevalence and determinants of anemia among reproductive women in the Somali regional state of Eastern Ethiopia. Because of this, the purpose of this study was to identify the prevalence and risk factors for anemia in the Somali regional state.

Methods: From January 18 to June 27, 2016, a community-based cross-sectional investigation was carried out. STATA version 12 was used for the statistical analysis. We performed descriptive and summary statistics. To identify the significant factors connected to anemia, a multivariable binary logistic regression analysis was carried out after verifying for assumptions. In the multivariable model, risk factors for anemia were identified as adjusted odds ratios (AOR) with a 95% confidence interval (CI) and p-value < 0.05.

Results: In this study, the overall prevalence of anemia among reproductive women residing in the Somali regional state was 58.4% (95% CI (0.557–0.611)). Around 8.7%, 40.03% and 51.29% of which anemic level reproductive women (15-49 years) were with severe (*hemoglobin level*: < 7.0 g per dl), moderate (*hemoglobin level*: 7.0–9.9 g per dl) and mild (*hemoglobin level*: 10–10.9 g per dl) type respectively.

The multivariable binary logistic analysis revealed, predictors of rural residence (AOR =1.4; 95% CI: (1.08–1.93)), giving birth at older age of maternal 20–29 (AOR = 1.7; 95% CI: (1.19–2.54)), 30–39 (AOR =1.9; 95% CI: (1.27–2.76)), and 40–49 (AOR =1.8; 95% CI: (1.08–2.97)) years, being having antenatal care (ANC) follow-up (AOR = 0.44; 95% CI: (0.224–0.868)), and home place of delivery (AOR =1.5; 95% CI: (1.04–2.21)) were statistically predictors associated with anemia.

Conclusions: In general, it is still discovered that the prevalence of anemia among reproductive women in the research area is extremely high (far above the national average). Rural residence, home place of delivery, ANC follow-up, and giving birth at older age of maternal were investigated as significant associated predictors of anemia among the study participants. Therefore, filling in the gaps that were discovered should lessen the anemia that is now an issue for women in this study who are of reproductive age.

Keywords: anemia, somali; predictors; reproductive women; logistic regression

Introduction

Anemia is commonly understood to be a decrease in hemoglobin level concentration, hematocrit, or the number of red blood cells per litter below the reference interval for healthy individuals of similar sex, age, race, altitude, smoking status, and pregnancy status under similar environmental circumstances [1, 2]. It displays both inadequate dietary intake and poor health. The definitions of anemia disease vary according to the Centers for Disease Control and Prevention and the World Health Organization. It is categorized as follows: for children under the age of five, the threshold hemoglobin level for being anemic is hemoglobin level: < 11.0 g/dl, for non-pregnant women, < 12.0 g/dl, for pregnant women, < 11.0 g/dl, and for adult men, < 13.0 g/dl [2, 3]. 1.62 billion (24.8%) people worldwide are affected by anemia, a serious public health issue [2, 4-6]. Moreover, anemia continues to be a serious public health issue in countries across Africa. 35% of women who are fertile are affected [7]. Due to the recurrent blood loss associated with menstruation, childbirth, and pregnancy, women of reproductive age are more likely to develop anemia [7].

Although it can affect anyone at any time and at any stage of life, it is more common in women of reproductive age, including both pregnant and non-pregnant women [4-6, 8, 9]. It causes premature birth [10], underweight birth [11], fetal cognitive impairment [12, 13], and fetal mortality [12, 13] and is the most common risk factor for death and illness among reproductive-aged women in low-income countries. Although the Ethiopian government and its shareholders have done their utmost to reduce anemia prevalence in the nation, anemia is still a serious public health issue among Ethiopian women of reproductive age. The 2016 Ethiopian Demographic Health Survey (EDHS) report states that anemia in women of reproductive age continues to be catastrophic in Ethiopia (the prevalence is reported to be 24%). Additionally, the prevalence rates vary by geographical regional state. The Somali national regional state reported the highest percentage in Ethiopia, which was calculated to be at 59.5% [8, 14]. Studies done in the past in Ethiopia have a national focus [15, 16]. Such studies overlook a crucial consideration for those who build and plan policies since the results at the national level may not accurately reflect the situation at the regional state levels. To my knowledge, no regional research has been done on the causes of anemia in the Somali regional state. To fill in these gaps, the authors conducted a thorough community-based cross-sectional study design of the most recent 2016 EDHS survey in order to investigate the most significant risk factors for anemia in the Somali regional state, Eastern Ethiopia, while taking into account a variety of environmental and sociodemographic predictors [8, 14].

Objective of the study

General objective

The general aim of this study was to assess the prevalence and predictors associated with anemia in the Somali regional state, eastern Ethiopia using the 2016 EDHS data set.

Specific objectives

- To assess the prevalence rate of anemia among reproductive women.
- To identify the socio-demographic and environmental predictors associated with anemia.

Methods and materials

Source of data, study design, and period

On the basis of data from the 2016 EDHS, this study was based on secondary analysis of a community-based retrospective cross-sectional survey design that was carried out in the Somali regional state from January 18, 2016, to June 27, 2016. This fourth current survey report was conducted by the Ethiopian Ministry of Health (EMOH), Ethiopian Public Health Institute (EHI), and Ethiopian Central Statistics Agency Office (ECSAO). These records were obtained with permission from the Demographic Health Survey (DHS) measure program [8].

Study area

There were reportedly four million people living there. In the Somali regional state, there are three different ways of life: urban, pastoral, and agro-pastoral [17]. The majority (85%) of the projected regional population depends on pastoralism and agro-pastoralism for their livelihood. There are nine zones in the Somali regional state. With a land area of 375,000 km2, the Somali regional state is the second largest of Ethiopia's nine regional states. Sample size and sampling technique, study population, and data collection

The study covered all women between the ages of 15-49 who were fertile. Women who met the eligibility requirements were interviewed face-to-face for the data collection. According to the 2016 EDHS data, the Somali regional state has Ethiopia's highest prevalence rates of anemia among reproductive women. In the five years before to the census, 1,391 reproductive women in this regional state were recorded. Following that, the entire EDHS 2016 survey report showed reproductive-aged women with detailed information and sampling selection technique on anemia status within the preceding five years [8]. Finally, the study comprised samples totaling 1,262 reproductive women who provided complete dataset on all of the factors taken into account (Figure 1).

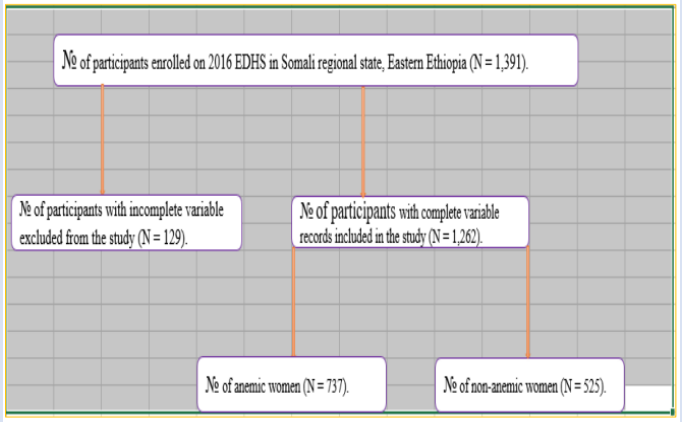

Figure 1: Schematic representation of the sampling procedure of anemic women in the Somali regional state, Eastern Ethiopia.

Study variables

The dependent variable in this study was the anemia status of reproductive women, which is a dichotomous variable coded as "0" if the women is non-anemic and "1" if the women is anemic. Such that

$$Y_i = \begin{cases} 1, \text{if } i^{th} \text{ women's had experinced with anemic (hemoglobin } level < 12.0 \text{ g/dl)} \\ 0, \text{if } i^{th} \text{ women's had not experinced with anemic (hemoglobin } level \geq 12.0 \text{ g/dl)} \end{cases}$$

The predictor variables included in the study were presented on Table 1 with its detailed definition and categorization. The degree for severity of anemia in pregnant women was determined based on hemoglobin concentration in blood adjusted to altitude. This adjusted concentration classified into three as per WHO criteria [3, 18, 19]:

Mild anemia (i.e., *hemoglobin* level: 10–10.9 g per dl)

Moderate anemia (i.e., *hemoglobin* level: 7–9.9 g per dl)

Severe anemia (i.e., *hemoglobin* level: < 7 g per dl).

Table 1: Statistical data processing and analysis Table 1 Operational definitions and categorizations of predictor variables.

Variables	Categorizations of predictor variables
Maternal age	Maternal age of participants (in year) (15–19, 20–29, 30–39, 40–49)
Residence	Residence place of women (urban, rural)
Education level	Education level of participants (no education, primary, secondary, tertiary)
Current history of malaria	Current history of malaria of participants (no, yes)
Birth type	Birth type of participants (multiple, singleton)
Type of toilet facility	Type of toilet facility of participants (yes, no)
Sex of child	Sex of children born (female, male)
ANC follow up	Antenatal care follows up of women (no, yes)
Place of delivery	Place of delivery of participants (heath facility, home)
Presence of current blood loss	Presence of current blood loss of reproductive women (yes, no)
First pregnancy iron supplements	First pregnancy iron supplements of participants (no, yes)
Smokes cigarettes	Smokes cigarettes of reproductive participants (no, yes)
Current breastfeeding	Current breastfeeding of participants (yes, no)
Occupation	Occupation of reproductive women (no, yes)
Sex of household	Sex of household of participants (male, female)

Using STATA version 12, the obtained data were cleaned, coded, input, and tested for accuracy. We performed descriptive and summary statistics. Analysis of binary logistic regression models with bivariable and multivariable contributions was used to determine the strength of the correlation between the response variable and the predictor variables.

The loglikelihood ratio test, Hosmer, and Lemeshow model tests all used the goodness-off fit test of model analysis.

Additionally, the Variance Inflation Factor (VIF) was used to evaluate the validity of the multicollinearity assumption on predictor variables. It was determined that significant risk factors for anemia in the multivariable model were adjusted odds ratios (AOR) with a 95% confidence interval (CI) and p-value < 0.05.

Results

Descriptive statistics

The cross-sectional study comprised 1,262 women in the reproductive age group, of which 737 (58.4%) were anemic. From the total of participants, 963 (76.3%) of them lived in rural areas and 1222 (96.8%) did not follow ANC service during pregnancy. The majority of participants 1105 (87.6%) of them were born to their children in a health facility place of delivery. From all, 641 (50.8%) of them were currently breastfeeding. On the subject of education, 950 (75.3%) of them were uneducated, 222 (17.6%) of them were complete primary education complete, and 64 (5.07%) were secondary education level (Table 2).

Table 2: Descriptive statistics of reproductive-aged women in the Somali regional state, Eastern Ethiopia, January 18, 2016 to June 27, 2016 (N=1,262).

Variables	Categories	Frequency	%
Outcome			
	Number of anemics	737	58.4
	Number of non-anemics	525	41.6
Maternal age			
	15-19	206	16.3
	20-29	450	35.7
	30-39	327	25.9
	40-49	279	22.1
Residence			
	Urban	299	23.7
	Rural	963	76.3
Education level			
	No education	950	75.3
	Primary	222	17.6
	Secondary	64	5.07
	Tertiary	26	2.06
Current history of malaria			
	No	178	14.1
	Yes	1084	85.9
Birth type			
	Multiple	915	72.5
	Singleton	347	27.5
Type of toilet facility			
	Yes	812	64.3
	No	450	35.7
Sex of child			
	Female	1169	92.6
	Male	93	7.37
ANC follow up			
	No	1222	96.8
	Yes	40	3.17
Place of delivery			
	Health facility	1105	87.6
	Home	157	12.4
Presence of current blood loss			
	No	789	62.5
	Yes	473	37.5
First pregnancy iron supplements			
	No	528	41.8
	Yes	734	58.2
Smokes cigarettes			

	No	1258	99.7
	Yes	4	0.32
Current breastfeeding			
	Yes	641	50.8
	No	621	49.2
Occupation			
	No	1010	80
	Yes	252	20
Sex of household			
	Male	878	69.6
	Female	384	30.4

Prevalence of anemia among reproductive women

In the current study, 1,262 reproductive women's overall anemia prevalence rate was discovered to be 58.4% with 95% CI (0.557–0.611) (see Table 2). Of the anemic reproductive women, 378 (51.29%) had mild anemia (10.0–10.9 g/dl), 295 (40.3%) had moderate anemia (7.0–9.9 g/dl), and 64 (8.7%) had severe anemia (< 7.0 g/dl) (see Figure 2).

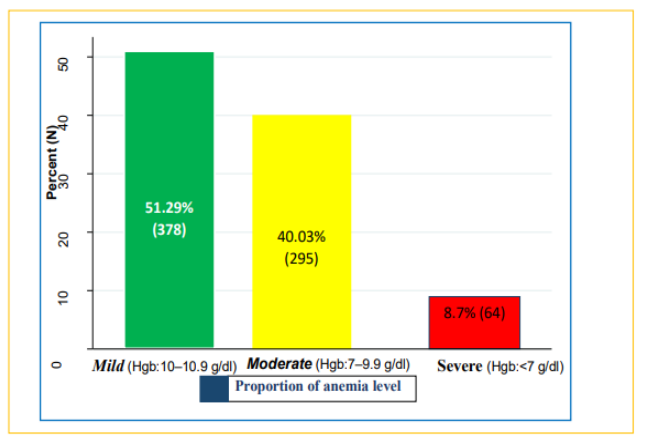

Figure 2: Shows the prevalence degree of anemia among reproductive women in the Somali regional state, Eastern Ethiopia (January 18, 2016 to June 27, 2016).

The degree of multicollinearity assumptions of the binary logistic regression model was tested on each predictor individually and on average using the Variance Inflation Factor (VIF) value < 10. The authors then proceed from there. None of the predictors violated a needed assumption in a failed binary logistic regression model (see Table 3). Additionally, the loglikelihood ratio test (LRT), Hosmer, and Leme show tests were used to evaluate the model's overall goodness of fit. This LRT result therefore discovered a X^2 (chi-square) value = 82.3 (P-value = 0.000), which would suggest a better match for the model's analysis. Correspondingly, the Hosmer and Leme show tests result obtained that the observed dataset was good explained through the model analysis (X^2 value = 2.6 and P-value = 0.956) (Table 4).

Table 3: Test the degree of multi-collinearity of a logistic regression model.

Variables	Categories	VIF
Maternal age	15–19 (ref.)	
	20–29	3.26
	30–39	2.45
	40–49	4.05
Residence	Urban (ref.)	
	Rural	4.52
Education level	No education (ref.)	
	Primary	1.75
	Secondary	1.33
	Tertiary	1.27

Current history of malaria	No (ref.)	
	Yes	7.41
Birth type	Multiple (ref.)	
	Singleton	4.41
Type of toilet facility	Yes (ref.)	
	No	1.86
Sex of child	Female (ref.)	
	Male	1.12
ANC follow up	No (ref.)	
	Yes	1.1
Place of delivery	Health facility (ref.)	
	Home	1.21
Presence of current blood loss	Yes (ref.)	
	No	3.24
First pregnancy iron supplements	No (ref.)	
	Yes	5.44
Smokes cigarettes	No (ref.)	
	Yes	1.04
Current breastfeeding	Yes (ref.)	
	No	4.18
Occupation	No (ref.)	
	Yes	1.39
Sex of household	Male (ref.)	
	Female	1.53
	Mean VIF	2.77

Predictors associated with anemia among reproductive women

The multivariable binary logistic regression model analysis of major determinant risk predictors associated with anemia disease was revealed in Table 4. This result presented residence, place of delivery, maternal age, and ANC follow up of mothers were found to be statistically significant predictors associated with anemia.

The probability of being anemic increased with increased age. Women with age of 20–29, 30–39, and 40–49 years had 1.7, 1.9, and 1.8-times higher odds of being anemic compared to those aged 15–19 years respectively (AOR = 1.7; 95% CI: (1.19–2.54)), (AOR =1.9; 95% CI: (1.27–2.76)), and (AOR =1.8; 95% CI: (1.08–2.97)).

Concerning ANC follow up, having ANC follow up of women during pregnancy were less likely to be anemic keeping all other variables constant. The odds of being anemic were 56% times lower among reproductive women with ANC follow up than the counterpart (AOR = 0.44; 95% CI: (0.224–0.868)).

In women of reproductive age, the place of delivery was discovered to be a statistically significant prognostic factor of anemia infection. When we related to reproductive mothers who were born at home, those mothers who were born in a health facility had significantly higher odds of anemia (AOR = 1.5; 95% CI: (1.04–2.21)). Finally, it was discovered that the place of residence was also substantially related to anemia infection. The odds of being anemic were around 1.4 times higher among women who live in rural areas than its counterpart (AOR = 1.4; 95%CI: (1.08–1.93)).

Table 4: Bi-variable and multivariable analysis using the logistic regression model for predictor of anemia among reproductive women in the Somali regional state, Eastern Ethiopia (January 18, 2016 to June 27, 2016).

		Bi-variable result	Multivariable results
Variables	Categories	COR (95% CI)	AOR (95% CI)
Maternal age	15–19 (ref.)		
	20–29	1.8(1.26, 2.46) *	1.7(1.19, 2.54) *
	30–39	2.1(1.45, 2.96) *	1.9(1.27, 2.76) *
	40–49	1.2(0.804, 1.65)	1.8(1.08, 2.97) *
Residence	Urban (ref.)		

	Rural	1.8(1.35, 2.28) *	1.4(1.08, 1.93) *
Education level	No education (ref.)		
	Primary	0.64(0.480, 0.864) *	0.84(0.569, 1.23)
	Secondary	0.48(0.289, 0.805) *	0.74(0.409, 1.35)
	Tertiary	0.39(0.174, 0.865) *	0.69(0.272, 1.75)
Current history of malaria	No (ref.)		
	Yes	1.9(1.37, 2.60) *	1.2(0.806, 1.86)
Birth type	Multiple (ref.)		
	Singleton	0.57(0.445, 0.732) *	0.76(0.482, 1.20)
Type of toilet facility	Yes (ref.)		
	No	1.3(1.06, 1.69) *	1.1(0.844, 1.46)
Sex of child	Female (ref.)		
	Male	0.82(0.534, 1.25)	0.74(0.479, 1.14)
ANC follow up	No (ref.)		
	Yes	0.46(0.244, 0.881) *	0.44(0.224, 0.868) *
Place of delivery	Health facility (ref.)		
	Home	1.5(1.062, 2.15) *	1.5(1.04, 2.21) *
Presence of current blood loss	Yes (ref.)		
	No	1.8(1.45, 2.33) *	1.3(0.860, 1.81)
First pregnancy iron supplements	No (ref.)		
	Yes	0.60(0.476, 0.755) *	1.2(0.808, 1.74)
Smokes cigarettes	No (ref.)		
	Yes	0.24(0.025, 2.28)	0.52(0.062, 4.43)
Current breastfeeding	Yes (ref.)		
	No	0.51(0.403, 0.636) *	0.73(0.519, 1.036)
Occupation	No (ref.)		
	Yes	0.72(0.547, 0.953) *	0.84(0.619, 1.14)
Sex of household	Male (ref.)		
	Female	1.0(0.793, 1.29)	0.59(0.298, 1.18)

Note: LRT [X^2 (DF = 19)] = 82.3 and p-value = 0.000, Hosmer-Lemeshow Test [X^2 (DF = 8)] = 2.6 and p-value = 0.956, ref.: reference, *significance at p-value < 0.05, COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio

Discussion

This study looked into the prevalence and risk factors for anemia, a significant public health issue, among reproductive women in the Somali regional state of eastern Ethiopia. Overall, the current study's anemic prevalence was 58.4% with 95% CI (0.557–0.611). This study was in line with previous studies conducted in India, 62.4% [20], Central and West Africa, 56% and South Asia, 52% [6]. However, it was noted that our results were higher than those of similar earlier studies in Debre Berhan, 9.70% [21], Sudan, 10.0% [22], Addis Ababa, 11.60% [23], Iran, 13.60% [24] and southern Ethiopia, 27.6%% [1] and lower than other studies conducted in Jhalawar, Rajasthan, 81.8% [25], Pune, India, 81% [26] and Katihar Medical College & Hospital, Bihar, 88.5% [27].

Geographical differences, differences in sociodemographic status, dietary habits of study participants, and the inclusion of reproductive women who take iron-folate supplements in the paper could all be contributing factors to the gap [23]. Additionally, the higher prevalence of parasitic illnesses like malaria and hookworm in the study area may be a factor in the higher prevalence of anemia sickness there. In this investigation, the most of anemic respondent cases, 51.29% (378/737) were mild, followed by 40.03% (295/737) moderate cases of anemia infection. A similar distribution of anemia disease was stated in Ethiopia and Kenya (62.50% & 37.50%) [3, 28] & Nepal (67.10% & 28.60%) [29] in which most of the respondent cases was mild anemia disease followed by moderate anemia disease respectively. However, in contrast to this investigation, studies done in Kenya (70.70% & 26.30%) [30] and southern Ethiopia (60.0% & 34.30%) [31] most of the anemic respondent cases were moderate followed by mild similarly.

Among the Somali regional state, it was discovered that place of residence was a significant predictor of anemia among women of reproductive age. It was discovered that anemic women were less likely to reside in urban areas than in rural ones. This

investigation agreed with studies carried out in several regions of Ethiopia [15, 14, 32]. This discrepancy may be caused by the higher household income, better antenatal care services, and better access to mass media for health service usages among women who live in metropolitan regions. Maternal age was discovered to be a major predictor of anemia in women in the Somali regional state in this study. This result is consistent with the study conducted in Uganda and Ethiopia [7, 15]. The reason could be that women in reproductive age groups give birth to more children overall. Similar to this, women who underwent ANC follow-up during pregnancy had a decreased risk of anemia than women who did not. This result is in line with the results of the Ethiopian study [1]. This may be due to the fact that mothers who make adequate use of maternal health services, such as ANC follow-up, may receive the right information about their own health and adopt the right feeding habits to ward off diseases like malaria. Finally, the home place of delivery for reproductive women was a possible risk factor for anemia (AOR =1.5; 95% CI: (1.04-2.21)). This investigation was in line with studies carried out in several regions of Ethiopia [8, 33]. This variation may be the result of efficient management and utilization of preventive plans in hard work controlling as the mothers are cared for by a health expert professional.

Conclusions

This study showed that, compared to the national average, the prevalence of anemia among reproductive women in the Somali regional state was remained relatively high. Rural residence, home place of delivery, ANC follow-up, and giving birth at older age of maternal were investigated as significant associated predictors of anemia among the study participants. Therefore, filling in the gaps that were discovered should lessen the anemia that is now an issue for women in this study who are of reproductive age.

Limitations of the study

The anemia issue in the study area was detected by this investigation. However, some of the restrictions need to be considered. Due to the secondary nature of the data used in this study, significant predictor variables such hookworm infection, gestational age, and nutritional information would be overlooked. The study was conducted six years ago, therefore it is unlikely to reflect the most recent anemia statistics in the area.

Abbreviations

ANC: Antenatal Care; AOR: Adjusted Odds Ratio; CI: Confidence Intervals; COR: Crude Odds Ratio; ECSAO: Ethiopian Central Statistical Agency Office; EDHS: Ethiopian Demographic and Health Survey; EMOH: Ethiopian Ministry of Health; EPHI: Ethiopian Public Health Institute; LRT: Loglikelihood Ratio Test; SPSS: Statistical Package for Social Science; WHO: World Health Organization; VIF: Variance Inflation Factor.

Declarations

Ethics approval and consent to participate

Since the study was a secondary data analysis of publicly available survey data from the MEASURE DHS program, ethical approval and participant consent were not necessary. We requested DHS Program and permission was granted to download and use the data from http://www.dhsprogram.com. There are no names of individuals or household addresses in the data files.

Availability of data and materials: The data set is available online and any one can access it from www.measuredhs.com.

Funding: The author(s) received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Authors' contributions

GGG conceived and designed the study. GGG wrote the background section reviewed literature. GGG and BTH analyzed the data, interpreted the results and participated in the drafting of the manuscript. Both authors read, reviewed and approved the final manuscript.

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