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Table of Contents: Volume 11 Number 15 22 April, 2017

ARTICLES

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Full Length Research Paper

Chemical composition and anti-inflammatory effects of the EtOAc extract from *Capsella bursa-pastoris* (L.) Medic.

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The aerial parts of *Capsella bursa-pastoris* (L.) Medic are used to treat nephritis, edema and enteritis. Every barber knows that *C. bursa-pastoris* had a good anti-inflammatory effect. This suggests that the extracted components from *C. bursa-pastoris* could potentially treat inflammatory disease. For discovering of the anti-inflammatory effects and chemical composition of *C. bursa-pastoris*, EtOAc extract was extracted from *C. bursa-pastoris* (EECB) and researched on EECB's anti-inflammatory effects. On the carrageenan-induced paw oedema experiment, the EECB used at the doses (100, 200 and 300 mg/kg) after 10 h ($p < 0.01$), 5 h ($p < 0.01$) and 3 h ($p < 0.01$), respectively, showed significant anti-inflammatory effects. Moreover, on the egg-albumin-induced inflammation experiment, the EECB used at the doses 200 and 300 mg/kg after 4 h ($p < 0.01$) and 2 h ($p < 0.01$), respectively, showed significant anti-inflammatory effects. In accordance with the HPLC isolation of the EECB, there are four major compounds, namely, apigenin-7-*O*-*β*-*D*-glucopyranoside (S1), luteolin-7-O-*β*-D-glucopyranoside (S2), α-adenosine (S3), and uridine (S4), which may explain the activity.

Key words: *Capsella bursa-pastoris* (L.) Medic, anti-inflammatory, high performance liquid chromatography (HPLC) isolation, flavonoids.

INTRODUCTION

It is universally acknowledged that inflammation has very important effect on the initiation and progress of many diseases such as osteoarthritis, rheumatoid arthritis, ankylosing spondylitis and ancers. Inflammation can be carcinogenic with various mechanisms including furtherance of angiogenesis, inducing genomic instability alteration of the epigenetic status and enhancing cell proliferation (Woo et al., 2014; Vázquez et al., 2011; Huang et al., 2011). In today's pharmaceutical market, the synthetic anti-inflammatory drugs are in the leading position, but the toxic element of these drugs cannot be eliminated. Just because of adverse reactions of these

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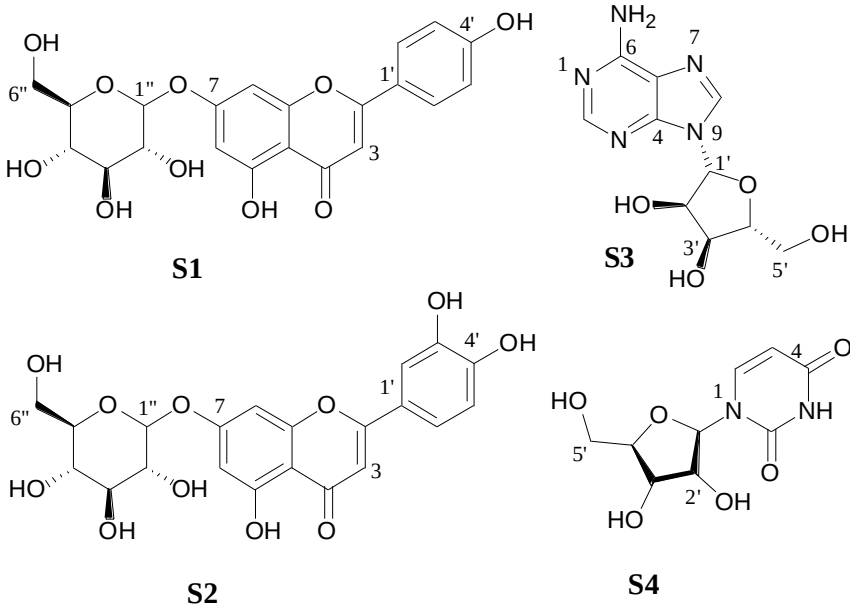

Figure 1. Structures of compounds S1-S4.

drugs, herbal medicines have returned and improved our basic health needs.

A lot of natural products like flavonoids or alkaloids isolated from plants, has been proved to have obvious anti-inflammatory effects (Hasan et al., 2012; Julião et al., 2010; Han et al., 2006) and they are cheap and have little side-effects (Dash et al., 2011; Gomase et al., 2011).

Capsella bursa-pastoris (Cruciferae family) is widely distributed throughout in China (Wang et al., 2014). The aerial parts of *C. bursa-pastoris* are one of the traditional herbal medicines commonly used for treating edema, enteritis and nephritis (Zhang and Jing, 2012; Xu et al., 2007). Flavonoids (Wang et al., 2014; Song et al., 2007) and alkaloids (Kang et al., 2012) from this plant have been reported. However, few scientific studies have been reported to support these claimed medicinal effects and therapeutic.

This current study involves the anti-inflammatory of the EtOAc extract was extracted from *C. bursa-pastoris* (EECB) and a systematic chemical study on EECB. This study will provide a reliable basis for the anti-inflammatory mechanism of the EECB.

MATERIALS AND METHODS

Plant collection and authentication

C. bursa-pastoris was collected from Tongliao, Inner Mongolia, China, in June 2015. This material was identified by Dr. Burie Bao (College of Traditional Mongolian Medicine, Inner Mongolia University for Nationalities) and a voucher specimen (NO. 20150628) has been deposited at the herbarium of the College of Traditional Mongolian Medicine, Inner Mongolia University for Nationalities, Tongliao, Inner Mongolia, China.

Preparation of EECB

Dried and powdered plant material (aerial parts) of *C. bursa-pastoris* (2.5 kg) was extracted by EtOAc (20 L) after extracting with $CHCl_3$ (10 L). The EECB was concentrated to a residue (328 g) under reduced pressure. The dried EECB was stored in refrigerator at (4°C) before use.

Isolation and identification of EECB

HPLC isolation was performed on C_{18} semi-preparative column (250 mm × 20 mm, 5 µm). The mobile phase consisted of a mixture of MeOH (45%) in water. The flow rate was 3.0 mL/min and the injection volume was 200 µl. The quantification wavelength of these chromatograms was set at 254 nm and the column compartment was kept at the temperature of 30°C.

The dried EECB (10.0 g) was soaked with 200 ml water and acetonitrile solution (70:30, v/v) for 60 min at room temperature, then sonicated for 20 min and filtered through a 0.45 µm membrane filter. The solution separated by semipreparative HPLC to give S1 (208 mg), S2 (176 mg), S3 (124 mg) and S4 (91 mg) from 2.0 g of EECB. The purity of compounds S1 to S4 is 99.0, 98.5, 96.3 and 95.2%, respectively. The structures of compounds S1 to S4 (Figure 1) were all identified by different spectroscopic techniques.

Animals

All the experiments were carried out using Male Wistar rats (200 to 300 g), which were purchased from Changchun Yisheng Laboratory Animal Technology Co., Ltd. (Changchun, China). The rats were housed in polypropylene cages and maintained under standard laboratory conditions (25 ± 5°C, 40 to 70% relative humidity, 12 h light/dark cycle). They were fed with a standard diet (Rat sterile granulated feed, product executive standard: GB14924–2001, license: the confirmation number of SCXK–(Ji) 2010–0001) and water was given *ad libitum*. All experiments were conducted after overnight fasting but there was free access to water.

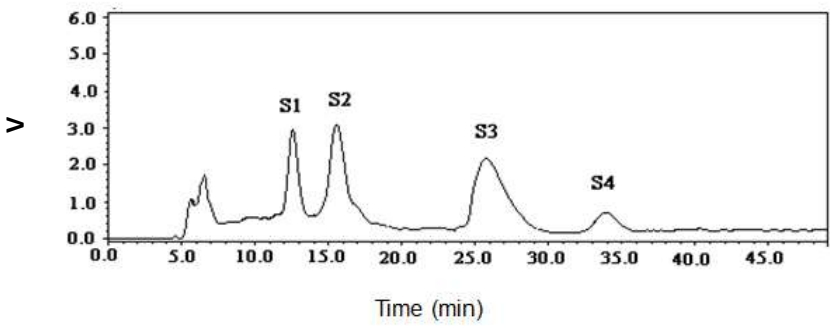

Figure 2. HPLC–UV chromatogram of EECB.

Assay for anti-inflammatory activity

In accordance with the method (Winter et al., 1962), the EECB was checked out of anti-inflammatory activity on carrageenan (CAS:9000-07-1, Sigma-C1013, United States)-induced paw edema. Male Wistar rats were randomly assigned to five groups of eight rats: Group 1 (G1): Negative control, received 0.5 ml/kg, p.o. of distilled water; Group 2 (G2): Positive control, received 30 mg/kg, p.o. of luteolin; Group 3 (G3): Low dose, received 100 mg/kg, p.o. of EECB; Group 4 (G4): Middle dose, received 200 mg/kg, p.o. of EECB; and Group 5 (G5): High dose, received 300 mg/kg, p.o. of EECB.

The experiment was carried out using an electric plethysmometer 7140 (Ugo Basile, Italy). One hour after administration, 2.5% carrageenan (0.05 ml) was injected subcutaneously into the plantar surface of the rat's left hind paw. The volume of paw was measured at 0 h (before carrageenan injection) and 1, 3, 5, and 10 h later.

In accordance with the method (Meng et al., 2003), rats were randomly grouped into five groups of eight rats as in the previous experiment.

Half an hour after administration, 0.1 ml of fresh egg-albumin was injected subcutaneously into the left hind paw of each animal in all groups. Prior to and 60 min after albumin injection and at every 60 min up to 300 min, the volume of paw edema of each rat was measured using an electric plethysmometer 7140 (Ugo Basile, Italy).

Acute toxicity

The EECB in 300, 500, 800, 1200, and 3000 mg/kg doses was administered to rats (male and female) orally (p.o.), which were assigned to six groups of eight rats. The control group received p.o. distilled water (10 ml/kg). All animals were observed for 72 h after drug administration (Wang et al., 2016).

Statistical analyses

The observations were expressed as mean ± standard error (SE), statistical analyses were done by using Student's *t*-test. $P < 0.05$ is considered as significant.

RESULTS

Isolation and identification of EECB

Form Figure 2, there are mainly four compounds (S1-S4). Compounds S1-S4 were identified by different spectroscopic techniques and by comparison with those reported in the literature (Wang and Wang, 2007; Liu et al., 2007; Deng et al., 2005; Ren and Yang, 2001).

Apigenin-7-*O*-*β*-*D*-glucopyranoside (S1): Yellow powder; ^{1}H-NMR (DMSO-d_6, 500 MHz) *δ*: 6.80 (s, H-3), 6.45 (d, *J* = 2.0 Hz, H-6), 6.84 (d, *J* = 2.0 Hz, H-8), 7.97 (d, *J* = 8.0 Hz, H-2'), 6.95 (d, *J* = 8.0 Hz, H-3'), 6.95 (d, *J* = 8.0 Hz, H-5')7.97 (d, *J* = 8.0 Hz, H-6')12.9 (s, 5-OH), 4.47 (d, *J* = 7.5 Hz, H-1''), 2.97 (dd, *J* = 7.5, 6.5 Hz, H-2''), 3.17 (dd, *J* = 7.5, 6.5 Hz, H-3''), 3.01 (m, H-4''), 3.14 (m, H-5''), 3.68 (dd, *J* = 12.0, 2.0 Hz, H-6''a), 3.42 (dd, *J* = 12.0, 2.0 Hz, H-6''b). ^{13}C-NMR (DMSO-d_6, 500 MHz) *δ*: 164.2 (q, C-2), 103.2 (t, C-3), 182.1 (q, C-4), 163.1 (q, C-5), 99.6 (t, C-6), 161.5 (q, C-7), 94.9 (t, C-8), 161.2 (q, C-9), 105.4 (q, C-10), 121.1 (q, C-1'), 128.8 (t, C-2'), 116.1 (t, C-3'), 157.1(q, C-4'), 116.1 (t, C-5'), 128.8 (t, C-6'), 100.0 (t, C-1''), 73.2 (t, C-2''), 77.1 (t, C-3''), 69.6 (t, C-4''), 76.5 (t, C-5''), 60.7 (s, C-6'').

Luteolin-7-O-*β*-D-glucopyranoside (S2): Yellow powder; ^{1}H-NMR (DMSO-d_6, 500 MHz) *δ*: 6.43 (d, *J* = 2.0 Hz, H-6), 6.76 (d, *J* = 2.0 Hz, H-8), 6.78 (s, 3-H), 7.42 (d, *J* = 2.0 H-2'), 6.89 (d, *J* = 8.0 Hz， H-5'), 7.45 (dd, *J* = 8.0, 2.0 Hz, H-6'), 12.3 (s, 5-OH), 5.02 (d, *J* = 7.0 Hz, H-1''), 3.01 (dd, *J* = 7.0, 6.0 Hz, H-2''), 3.19 (dd, *J* = 7.0, 6.0 Hz, H-3''), 3.04 (m, H-4''), 3.12 (m, H-5''), 3.61 (dd, *J* = 11.5, 2.0 Hz, H-6''a), 3.40 (dd, *J* = 11.5, 2.0 Hz, H-6''b). ^{13}C-NMR (DMSO-d_6, 500 MHz) *δ*: 164.7 (q, C-2), 103.4 (t, C-3), 182.1 (q, C-4), 163.1(q, C-5), 99.7 (t, C-6), 161.3 (q, C-7), 94.9 (t, C-8), 157.1 (q, C-9), 105.5 (q, C-10), 121.6 (q, C-1'), 113.8 (t, C-2'), 145.9 (q, C-3'), 150.1(q, C-4'), 116.2 (t, C-5'), 119.4 (t, C-6'), 100.0 (t, C-1''), 73.3 (t, C-2''), 76.6 (t, C-3''), 69.7 (t, C-4''), 77.3 (t, C-5''), 60.8 (s, C-6'').

α-Adenosine (S3): White needles crystals; ^{1}H-NMR (DMSO-d_6, 500 MHz) *δ*: 8.33 (s, H-2), 8.10 (s, H-8), 7.31(d, NH_2), 5.85 (d, *J* = 4.5 Hz, H- 1'), 4.61 (dd, *J* = 10. 0, 6.5 Hz, H-2'), 4.13 (m, H-3'), 3.95(m, H-4'), 3.66 (m, H-5'a), 3.55 (m, H-5'b). ^{13}C-NMR (DMSO-d_6, 500 MHz) *δ*: 152.6 (t, C-2), 149.3 (q, C-4), 119.7 (q, C-5), 156.3 (q, C-6), 140.2 (t, C-8), 88.2 (t, C-1'), 73.7 (t, C-2'), 71.2 (t, C-

Table 1. Anti-inflammatory effects of the different doses of EECB on carrageenan-induced hind paw edema in rats (n = 8).

Group	Dose (p.o., mg/kg)	Volume of edema (ml) by hour			
		1	3	5	10
G1		1.16 ± 0.17	1.79 ± 0.20	2.43 ± 0.25	2.67 ± 0.28
G2	30	1.20 ± 0.21	1.63 ± 0.17*	1.77 ± 0.23**	1.83 ± 0.21***
G3	100	1.18 ± 0.41	1.76 ± 0.21	2.31 ± 0.19*	2.11 ± 0.18**
G4	200	1.20 ± 0.24	1.52 ± 0.24*	2.04 ± 0.18**	1.51 ± 0.14***
G5	300	0.92 ± 0.09*	1.43 ± 0.17**	1.52 ± 0.30***	1.80 ± 0.22***

*p < 0.05 compared with negative control; **p < 0.01 compared with negative control; ***p < 0.001 compared with negative control.

Table 2. Anti-inflammatory effects of the different doses of EECB on albumin-induced -induced hind paw edema in rats (n = 8).

Group	Dose (p.o., mg/kg)	Volume of edema (ml) by hour			
		1	2	3	4
G1	-	1.33 ± 0.20	1.57 ± 0.33	1.89 ± 0.25	1.75 ± 0.31
G2	30	1.27 ± 0.15	1.26 ± 0.17*	1.42 ± 0.33**	1.08 ± 0.27**
G3	100	1.22 ± 0.31	1.42 ± 0.20	1.75 ± 0.24	1.46 ± 0.21*
G4	200	1.20 ± 0.18	1.38 ± 0.21	1.59 ± 0.12*	1.16 ± 0.23**
G5	300	1.09 ± 0.22*	1.05 ± 0.18**	1.29 ± 0.13***	1.03 ± 0.18**

*p < 0.05 compared with negative control; **p < 0.01 compared with negative control; ***p < 0.001 compared with negative control

3'), 86.3 (t, C-4'), 62. 2 (s, C-5').

Uridine (S4): White needles crystals; ^{1}H-NMR (DMSO-d_6, 500 MHz) δ: 8.29 (s, NH), 5.61 (d, J = 7.8 Hz, H-5), 7.86 (d, J = 7.8 Hz, H-6), 5.36 (d, J = 7.5 Hz, H-1'), 4.41 (dd, J = 10. 0, 6.5 Hz, H-2'), 4.20 (m, H-3'), 3.75 (m, H-4'), 3.60 (m, H-5'a), 3.51 (m, H- 5'b). ^{13}C-NMR (DMSO-d6, 500MHz) δ: 150.5 (q, C-2), 163.0 (q, C-4), 101.3 (t, C-5), 140.3 (t, C-6), 87.6 (t, C-1'), 69.9 (t, C-2'), 73.5 (t, C-3'), 84.8 (t, C-4'), 60.8 (t, C-5').

Acute toxicity

The results of acute toxicity test showed that there is no mortality and LD_{50} values are more than 3000 mg/kg.

Anti-inflammatory activity

The results of anti-inflammatory activities of the EECB with carrageenan and egg-albumin in rats are shown in Tables 1 and 2.

As is shown in Table 1, the EECB had significantly anti-inflammatory effect at 100, 200 and 300 mg/kg observable to 10 h ($p < 0.01$), 5 h ($p < 0.01$) and 3 h ($p < 0.01$), respectively. The results (Table 2) showed that the EECB caused a dose dependent and significant inhibition of increase in paw edema.

DISCUSSION

The experimental study disclosed that the EECB was provided with significant anti-inflammatory activity at a dose of 300 mg/kg in experimental animals. On the carrageenan-induced paw edema experiment, at the doses used the EECB (300 mg/kg) after 5 h ($p < 0.001$) showed significant anti-inflammatory effects. Moreover, on the egg-albumin-induced inflammation experiment, at the doses used the EtOAc extract (300 mg/kg) after 3 h ($p < 0.001$) possessed significant anti-inflammatory effects. The results were more important than that of luteolin (standard drug).

According to the HPLC isolation of the EECB, there are two major classes of compounds, flavonoids and alkaloids. Flavonoids (apigenin-7-*O*-*β*-*D*-glucopyranoside and luteolin-7-O-*β*-D-glucopyranoside) involved in the late phase of acute inflammation and pain perception (Morimoto et al., 1988). Furthermore, alkaloids including adenosine and uridine were isolated from many plants possessing the significant pharmacological activities including anti-inflammatory, analgesic, antibacterial and anticancer effect (Bai et al., 2013; Meng et al., 2003). Furthermore, different phytochemicals produces have

been found to have a broad range of activities, which may help in protection against chronic diseases (Rahman et al., 2012). These compounds are known to be biologically active. Alkaloids are one of the largest groups of phytochemicals in plants, which have amazing effects on humans and have led to the development of powerful pain killer medications (Da Silva et al., 2010). It should be noted that the anti-inflammatory activities of many plants have been attributed to their alkaloids or flavonoid contents (Bai et al., 2013; Meng et al., 2003; Morimoto et al., 1988). Accordingly, the existence of flavonoids and alkaloids may be a contributing factor to the EECB's anti-inflammatory activity.

The pathogenesis of fever involves several mediators or multi process. Inhibition of any of these mediators may lead to antipyresis (El-Shenawy et al., 2002). The reliable nature of the anti-inflammatory mechanisms of flavonoids and alkaloids from EECB has not been clarified, but the present study's results were confirmed from the popular use of this plant in the treatment of inflammatory diseases. These studies are valuable for identifying lead compounds for anti-inflammatory drugs, bearing in mind the side-effects of synthetic and chemical medicines. In addition, human studies are needed to demonstrate the efficacy and safety of EECB in the long-term management of potential anti-inflammatory agents in everyday clinical practice.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Irrational use of medications among elderly patients in an Ethiopian referral hospital

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Geriatric is potentially vulnerable to drug related problems. Inappropriate prescribing to these patient groups causes substantial morbidity and has become an important public health issue. The purpose of this study was to evaluate prescription practice in geriatrics patients attending medical ward of Dessie Referral Hospital (DRH). A cross sectional study design was used to collect data from patient cards aged more than or equal to 65 years old that visited DRH in south wollo zone over the last one year period from September 11/09/2014 to September 10/09/2015. Assessment of the prescription pattern was done by using Beers criteria and WHO core indicators. A total of 244 charts were evaluated. 868 drugs were prescribed to the study population. Number of encounters with antibiotic prescription was 155 (63.5%). The percentage of encounters in which an injection was prescribed was 82.4%. Analysis of the prescribed medications using the 2012 Updated Beers Criteria showed 56 patients with at least one potentially inappropriate medication prescribed giving a prevalence of 23%. The study indicates the prescribing practices in the hospital associated with greater poly-pharmacy and inappropriate medication use.

Key words: Elderly, Dessie referral hospital, beers criteria, WHO core indicators.

INTRODUCTON

Geriatric is a population whose age is 65 years and above. Optimizing drug therapy is an essential part of caring for an older person.

Prescribing error is defined as prescribing practice that deviates from the accepted standards and ordering drugs with greater risk of adverse drug reactions (ADR) (Sloane et al., 2002). Geriatrics is potentially at higher risk of drug therapy problem than other patient groups.

Poly-pharmacy is common in geriatrics patients due to the presence of comorbidities, increased occurrence of chronic diseases involving various systems and aging related complications. All these factors call for prescribing many medications to treat disorders and improve quality of life of geriatrics patients. On the other hand, increased used of multiple medications will contribute to the occurrence of drug related problems in this patient groups. Old age related physiologic changes which lead to altered pharmacokinetics and pharmaco-dynamics also make them more prone to the unwanted effect of medications (Sapkota et al., 2011).

Drug related complications in the geriatrics are becoming a major concern in aged care. The control of this problem needs understanding of the medication use practice, because assessing of this practice is the basic

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first steps in identifying and resolving problems. Different factors are attributable to high incidence of drug related problems in geriatrics (Taskeen et al., 2012). Although, these are prevalent in geriatrics, many can be preventable which consequently improves patient outcomes. Studies on medicine use in geriatrics are limited in developing countries like Ethiopia.

Therefore, the purpose of the current study was to evaluate general medication utilization patterns using WHO core prescribing indicators (El Mahalli, 2012) and assess drug prescribing according to Beers criteria 2012 method (an explicit process measure for assessing potentially inappropriate prescribing (PIP) in older people) in geriatric patients (Campanelli, 2012), in a referral hospital.

METHODOLOGY

Study setting

The study was done in Dessie Referral Hospital, which is located 401 km North of Addis Ababa, Ethiopia, Amhara region and South wollo zone. The hospital has different units: internal medicine, pediatrics, gynecology/obstetrics, surgery, dentistry, psychiatry, ophthalmology, hospital pharmacy and antiretroviral therapy (ART) clinic and there are about 4 different pharmacies within the hospital.

Study design and period

A cross sectional study design was used to collect data from patient cards aged more than or equal to 65 years that visited DRH in south wollo zone over the last one year period from September 11/09/2015 to September 10/09/2016. Cards with missed relevant data were excluded from the study.

Operational definition

Inappropriate prescribing

This is defined as prescribing practice that deviates from WHO core indicator and Beers criteria.

Study procedure

Structured data abstraction tool was used to extract the necessary demographic and relevant points from the patient chart. The relevant data collected from case sheets were properly documented in a separate data collection form. The obtained data were then analyzed using fine WHO core prescribing indicators and the appropriateness of the prescriptions using Beers criteria, 2012.

Ethical considerations

The formal letter was taken from Wollo University, College of Medicine and Health Science before the study was conducted. During data collection process, all elderly patients' related data was kept confidentially. Patient confidentiality was ensured, thus name and address of the patients were not recorded in the data collection format. The medical information was not disclosed to any external subjects/media so that the patients' confidentiality can be kept.

RESULTS

Among 244 charts evaluated, 150 (61.5%) were males. Most of the patients were in the age group of 65 to 74 years (n=160, 65.6%) followed by 75 to 84 years (n=70, 28.7%), >84 years (n=14, 5.7%).

Prescription pattern

Number of prescribed drugs to the study population was 868. The mean of drugs prescribed per prescription was 5.1. Depending on the number of drugs prescribed, prescriptions with greater than 5 medicines were considered as poly-pharmacy and 56 (23.0%) poly-pharmacy were found out. Number of prescriptions encountered with antibiotic, injection was 155 (63.5%), 82.4% respectively. And those prescribed by generic name was 744 (85.7%) and the drugs given by brand name were 124 (14.3%). Among the 868 medicines prescribed, 850 (97.93%) were prescribed from EDL of Ethiopia (Table 1).

Analysis of prescribing practice using the 2012 Updated Beers Criteria revealed 56 patients with at least one potentially inappropriate medication prescribed with a prevalence of 23% (Table 2).

DISCUSSION

This study showed poly-pharmacy in elderly patients with a mean number of drugs per prescription to be 5.1. This is higher than the WHO standard of 1.6-1.8. And lower than the result from Indian study (9.09 per prescription) (Febin et al., 2015), but comparable to similar studies conducted by Taskeen et al. (2012), where the average drugs per prescription were 6.07 and by Ramesh et al. (1999) where the average drugs per prescription were 6.33. Poly-pharmacy may lead to noncompliance and extra-costs. But the recommendation of WHO is not applicable for inpatient set ups and in such cases, poly-pharmacy can be justifiable.

Significant number of prescription drugs was prescribed by brand names (14.3%). This result is comparable with other studies but deviates from WHO's recommendation of 100%. This implies that the prescribers are not complying with the recommendations of WHO prescribing indicators. Generic prescription is highly recommended because it allows dispensing cost effective brand products. Brand prescription has so many short comings, above all, it poses high economic burden on patients. The presence of high brand prescription in the current study may be attributable to promoter's impact and prescribers' knowledge gap in the importance of generic prescription.

Table 1. Frequency of prescribing indicators as compared to WHO standards.

Prescribing indicator (per prescription)	Frequency	WHO standard
Mean of drugs	5.1	1.6-1.8
Percent of generic prescription	85.7%	100%
Percent of antibiotics	63.5%	20-26.8%
Percent of injections	82.4%	13.4-24.1%

Table 2. Sample of potentially inappropriate drugs prescribed as per Beers criteria, 2012.

Drugs	Concern
Diphenhydramine	increased risk of anticholinergic effects or toxicity
Diazepam	Increased sensitivity to benzodiazepines side effects
Atropine	Highly anticholinergic, uncertain effectiveness
Digoxin (>1.25 mg/day)	Beyond this dose the risk outweighs the benefit

The antibiotics prescription practice showed the prevalence of 63.5% which is very high as compared to the WHO standard (20.0 to 26.8%). But comparable with the study conducted by Gopinath and Rajalingam (2011) where 63% of patients received antibiotics. The high percentage of antibiotics prescribed in this study setting may be due to the set up being inpatient where unstable patients with comorbidities might require higher numbers of antibiotics and these patients may develop hospital acquired infections (Gopinath and Rajalingam, 2011). Consequences of overuse of antibiotics leads to antibiotics resistance and extra cost to treat drug resistant conditions.

The prevalence of injection drug use was 82.4% which is also beyond the recommended range of WHO (13.4-24.0%). This figure found in this facility may be due to the setting where the study was conducted. In general, in patient departments or units, patients that are unable to take oral medication are seen and followed up routinely, so the need for injections might be maximal. The use of injections will probably be lower had it been was conducted in the outpatient department of the hospital.

Percentage of prescribed drugs from essential drug list of Ethiopia was 97.93%. A study at Jimma Hospital, south west Ethiopia (Mohammed and Tesfaye,1997) and Hawasa Hospital (Desalegn, 2013) showed comparable results, where almost all drugs prescribed for the health problems were on the essential drug list of the country. Prescribing drugs from essential drug list is very important for economic use of health care budget and to ensure continuous supply of essential drugs (Hogerzeil et al., 1989).

Based on Beers criteria evaluation, the prevalence of inappropriate prescribing was 23%. This figure is comparable to other studies conducted by Veena et al. (2012) and Fadare et al. (2013) where 21.69 and 25.5% prescriptions were found potentially inappropriate, respectively. This high figure may be attributable to the absence of protocols and unavailability of safer alternatives.

CONCLUSION AND RECOMMENDATIONS

This study revealed the current prescribing practices in the hospital associated with greater poly-pharmacy and inappropriate medication use. Prescribers and pharmacists are recommended to take care in managing geriatrics and familiarize themselves with tools that can be used by practitioners to optimize patient outcomes. Further prospective studies are recommended. Protocols should be developed on geriatric drug use with focus on medication safety by multi-disciplinary approach.

Abbreviations

EDL, Essential drug list; **DRH,** Dessie Referral Hospital; **PIM,** potentially inappropriate medications.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

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