doi.org/10.36721/PJPS.2021.34.6.REG.2257-2264.1

REPORT

The phytochemical valuation and lipid profile impression with *Zanthoxylum armatum* (Rutaceae) through animal-model

Itique Munawar[1], Syed Saeed ul Hassan[2], Muhammad Abbas[3*], Muhammad Khalil ur Rehman[1] and Hammed Ahmed[2,4]

[1]College of Pharmacy, University of the Punjab, Lahore, Pakistan
[2]Khauldonia College of Pharmacy, opp EME Society, Multan Road, Lahore, Pakistan
[3]Mukabbir College of Pharmacy, Bhimber Road Gujrat, Pakistan
[4]Department of Pharmacology, Sialkot Medical College, Sialkot, Pakistan

Abstract: The exploration of promising anti-obesity influence of *Zanthoxylum armatum* (Rutaceae) is determined through our study of *in-vitro* and animal models. Obesity was induced in experimental albino rabbits by feeding highly fat diet (HFD) with regular feed for fortnight. The appraisal of anti-obesity of MZA and CZA extracts of leaves, fruit and stem of *Z. armatum* was performed in obese rabbits. Animals were divided into 04 groups. One group was categorized as control who received only HFD with no any extracts and drug. Other group was given orlistat orally a standard drug (10 mg/kg) in combination with the HFD regularly for 03 weeks and marked as positive control. Other 02 groups were allocated as experimental groups, 1st and 2nd experimental groups were administered daily 300 mg/kg of MZA and CMA extracts per oral route respectively for the same period. The substantial fall of lipid profile (total cholesterol, LDL, VLDL and TGs) and rise of HDL were perceived with methanolic extract on comparison to control groups. However, CMZ exhibited little response on serum lipid-profile. On conclusion, MZA extract of *Z. armatum* (areal parts) was considered a valid anti-obesity herbal remedy in experimental rabbits fed on high-feed diet.

Keywords: *Zanthoxylum armatum*, orlistat, anti-obesity, methanolic extract.

INTRODUCTION

The embracing approach of natural plants in the form of shelter, nutrition and management of various diseases is more common worldwide in current years. The reason for the significance of herbal medication is principally due to their miner adverse effects and comfort of availability. This trend of treatment is more common in Pakistan, India, China, Japan, Thailand and Sri-Lanka. Pakistan is the rich source of medicinal plants particularly, northern areas providing a plenty of herbs with momentous therapeutic potential. *Zanthoxylum armatum* is one of the famous plants regarding its tradition use in north Indian region such as Kashmir and Bhutan. It grows mostly in forest, wasteland and mountains at 2500 m altitudes and its growth observed in Nepal, Pakistan, China, North America, Malaysia and Philippines at attitudes around 1300 to 1500 meters. Traditionally *Z. armatum* seeds are used to treat indigestion, fever and cholera in Indian territories (Sourabh *et al.,* 2009). Depression and dyspepsia are effectively managed with *armatum* in Japan (Barua *et al.,* 2018). Relieve of symptom like diabetes mellitus, tonsillitis, numbness, dizziness and dysentery have been reported with plant (Timilsina and Tripathee, 2014; Alam *et al.,* 2018). In Pakistan, fruit (dried) of *Z. armatum* is used as spices (Batool *et al.,* 2010). Different chemical constituents found in *Z. armatum* such as; Alkaloids including chelelactam, berberine, dictamnine, haplopine, fargarine, magnoflorine, nevadensin, nitidine, sanguinarine, robustine, zanthonitrile and skimmianine. Terpenoid related compounds; thujene, terpinene, pinene, cymene, terpineol, terpinene, camphor, citral, citronellal, citronellol, geraniol, limonene, myrcene, piperitone, tagetonol, pinene, aromadendrene, amyrins and amyrone. Plant exhibited the existence of; β-Sitosterol, eudesmin, fargesin, sesamin, magnolin, kaempferol, tambuletin, palmitic acid, oleic acid, palmitolic acid (Nooreen *et al.,* 2019).

Larvicidal potential of essential oil of seeds of *Z. armatum* revealed against numerous species of mosquitos (Prashant *et al.,* 2011. Essential oil also exhibited appropriate antifungal (fungistatic) activity against 24 strains of fungi (Kumar *et al.,* 2008). The antinociceptive and anti-inflammatory responses were evaluated with ethyl acetate fraction acquired from ethanolic extract and found significant results using *in vivo* mice model (Guo *et al.,* 2011). Castor oil induced diarrhea in mice has expressively controlled with *Z. armatum* (300-1000 mg/kg) and relaxation of GIT motility was also analysed *in-vitro* on rabbit's isolated jejunum with plant extract (Gilani *et al.,* 2010). The hepatoprotection of ethanolic extract of *Z. armatum* (leaves) was evaluated and found significant fall of inflammation and liver enzymes

*Corresponding author: e-mail: abbaspk1@gmail.com

(Phuyal *et al.,* 2019). The effective antioxidant potential of ethanolic extract of its dried fruit was perceived with low concentration through scavenging of DPPH and hydroxyl radicals (Batool *et al.,* 2010).

Obesity is the consequence of elevated level of lipids (fats) which is associated to the commencement of cardiovascular diseases and usually monitored via lipid profile test. The plasma level of different constituents are lined to the total body fat are LDL, HDL, VLDL and TG (Buriro *et al.,* 2011; Guerciolini, 1997). The obesity in human being can be condensed with various anti-obesity remedies like; phenternine and fenluramine exhibited their response by suppressive effect on appetite through serotonin release (Connolly *et al.,* 1997). Orlistat and other drugs reduced obesity by suppressing the absorption of dietary-fat via inhibition of pancreatic lipase, nevertheless triggered abdominal pain, dyspepsia, diarrhea and insomnia (Maahs *et al.,* 2006). Because of these core adverse effects and complications, the curiosity was established to explore the innovative naturel products to develop harmless and effective anti-obesity remedies (Maahs *et al.,* 2006; Nakayama *et al.,* 2007).

MATERIALS AND METHODS

Plant Collection

In month of November leaves, fruit, stem and bark of *Zanthoxylum armatum* was collected from Muzafar Abad (Azad Kashmir), Pakistan. The taxonomical identification of plant was made with voucher specimen# GC-Herb-Bot-2212 from Herbarium, Department of Botany, Govt College University-Lahore and preserved for the future reference. Plant materials were shade dried for 10 days at 25˚C till humidity removed then ground to course-powder and stored in well closed container.

Extraction and Fractionation

Around 1.2 kg each of powdered material was soaked separately in 3.5 L of methanol (Sigma Aldrich made in Germany) and chloroform (Merck made in Germany) in 05 L round bottom flasks. Cold extraction was performed for 01 wk with frequent manual agitation of flask. Both extracts were passed through porcelain cloth first then filtered using whatman filter #2. Filtrates were concentrated to semisolid using rota evaporator (Heidolph Instrum, Schwabach Germany made) at 40˚C. Methanolic and chloroform extracts (gummy mass) were assigned specific codes MZA and CMA respectively and stored in amber color bottles at 4˚C for the further investigations. The % age yield of final extracts was determined by employing following formula:

Percentage yield = $W_2/W_1 \times 100$, where; W_1= Wt of crude powder, W_2= Wt of extract

Different fractions were acquired from the crude extracts through solvent-solvent fractionalization on the basis of their solubility. The mixture of 1:1 ratio of aqueous solution of MZA and n-hexane was taken in separating funnel (1L) and mixed well then upper n-hexane layer was collected. Using rotary evaporator and reformed to concentrated solution then stored in petri dish overnight at room temperature which converted to solid mass. This acquired hexane methanolic fraction of *Z. armatum* was assigned HFZA. The down water layer was extracted with equal volume of chloroform in separating funnel and yield chloroform fractions after concentrating with rotary evaporator (CFZA). By employing the same protocol, we conquered ethyl acetate (EFZA) and butanol fractions (BFZA) from the remaining residual/water layer respectively. However, last aqueous layer was powdered using freeze dryer (Christ-Alpha 1-4 LD-Plus) and assigned AFZA. The whole flavonoids and phenolic compounds were determined in all 05 fractions that resulted from MZA (Zhang *et al.,* 2014).

Phytochemical examinations

Secondary metabolites like; glycosides, carbohydrates, proteins, saponins, fixed oil, alkaloids, triterpenoids, flavonoids and tannins were identified using different standard phytochemical techniques (Kalaiselvi *et al.,* 2016; Ibrar *et al.,* 2017.

Proximate study

Proximate examinations comprises water soluble ash, acid insoluble ash, sulphated ash, alcohol soluble extractive value, moisture contents, water soluble extractive value and total ash of crude powder of *Z. armatum* were performed.

Assessment of total ash

Dried crude powder (2g) of *Z. armatum* was placed in previously dried, cleaned and cooled silica crucible and burnt at 450˚C till free from Carbon. Then cooled at room temperature to achieve persistence weight. The % age was determined using following formula;

Total ash contents (percentage)= (wt. of ash / wt. of crude powder) × 100

Determination of water-soluble ash

Added 25 ml distilled water in crucible attained total ash contents and boiled (5 min). Filtered with ash-less filter paper, washed with hot water and collected insoluble matter in sintered-glass pot. Kept it at 450˚C for 15 min, cooled and determined the difference in wt between total and insoluble ash, subsequently calculated the percentage of soluble-ash with respect to air dried sample of crude drug (Yadav, 2018).

Acid-insoluble ash evaluation

25 ml dil HCl was added to pre-filtered total ash in crucible and for 05 min boiled, washed with purified water and sieved. Burnt the mixture after shifting in silica crucible, cooled and weighed it. The percentage content of acid insoluble ash was assessed with reference to the crude sample (Yadav, 2018).

Sulphated-ash examine

The crude extract (02 g) of the plant was burnt in crucible to charred powder, cooled, moistened with con H_2SO_4 (01 ml) and gently heated till no more white fumes were evolved. The resulting ash was attained after burning the blend at 800˚C, cooled and the measured its weight. The percentage content of sulphated-ash was evaluated with comparison to powdered specimen weight.

Assessment of moisture-content and dry stuff

Two silica crucible were placed in hot-air oven, first one was filled with 02 g crude powder and 2nd one was kept as empty and heated both at 105˚C for half an hr. Allowed to cooled at room temperature and measured the moisture contents and dry matter using following;

% age of dry matter= (Wt. of dried sample / Wt. of sample before drying) × 100

Moisture content (%)= 100 -% age of dry matter

Determination of Extractive Values

Alcohol-soluble

Mixed 5 g crude powder of *Z. armatum* with 100ml of Alcohol (95%) and stocked in measuring flask for 24 hrs. Firstly, flask was stirred mechanically for 06 hrs and subsequently kept at static position for 18-hr. Then gently filtered the mixture to avoid loss of alcohol and dried (25 ml) the filtrate at 105˚C after transferring to a petri dish. The % age of alcohol soluble extract value was calculated with relative to dried crude sample.

Water-soluble

Around 05 g powder of plant material was mixed with 100 ml chloroform-water in well closed stopper flask. After proper shivering, the mixture was stored for 24-hr. Filtered and retained the filtrate (25ml) in petri dish and dried at 105˚C. The percentage of water soluble extracted value was evaluated on comparison to dried crud sample.

Evaluation of entire phenolic and flavonoid content

The total phenolic quantity was analyzed from the crude extract of *Z. armatum* and specified in mg of gallic acid equivalent to per gram of dry extract (Ibrar *et al.,* 2017; Singleton and Rossi, 1965). The total phenolic amount was calculated through calibration-curve and data were expressed as mg of qurecetin equivalent/g of crude extract (Chang *et al.,* 2002).

Pooling of animals (Rabbits)

The diet selected for investigational animals were; normal diet (ND) which composed of standard pellet feed and second one was the high fat diet (HFD) which included butter, daisy ghee along with normal supplement. Rabbits were acclimatized at 55±5% humidity and 23±1˚C for 15 days, prior to divide into sets. Animals were distributed into 05 groups in stainless steel cages and each group had 03 animals. First control group was allowed to access on normal diet only, while other 04 experimental groups were kept on following mode for 05 wks;

a. HFD (high fat diet)
b. HFD +orlistat (standard drug)
c. HFD+MZA (mehanolic extract of *Z. armatum*)
d. HFD+CZA (chloroform extract of *Z. armatum*)

After every wk, blood sampling, gain and loss of rabbits' wt were calculated. In addition serum biochemical examinations and enzymatic assays were executed after 12 hrs fasting. The evaluation of lipid profile was determined following the centrifugation of serum. The experimental procedure was managed to the US-guidelines ˚NIH-publication# 85-23, revised-1985˚ and ethical committee of College of Pharmacy-University of the Punjab, Lahore, Pakistan allotted ID # UOP-IA09310918.

Lipid profile tests

The serum lipid profile including; triglycerides, total cholesterol, LDL, HDL, VHDL were determined by employing commercially available kits (Duhamel *et al.,* 1983).

STATISTICAL ANALYSIS

All numerical-values were presented in tabulated and graphical forms by mean ± standard error of mean. The statistical data was manipulated via SPSS version-12 software. All numerical values were mentioned as mean ± standard error of mean. By using SPSS version12.0 statistical data was determined. The substantial difference in means among experimental (crude extracts), reference, control and high fat diet groups were assessed using ˚Dunnett test˚, variance (ANOVA) and ˚student's T˚ test. Final results were considered to be significant at P value < 0.05.

RESULTS

Extract and Fractions

The weight and % age yield of methanol and chloroform extracts of crude powder of plant parts (stem, leaves and fruit) of *Zanthoxylum armatum* were 68 g (5.6%) and 32g (2.66%) respectively. Fractions and their masses obtained from MZA were presented in table 1 showed highest yield in AFZA while least in EFZA extract.

Initial Phytochemcial evaluation

Identification of qualitative chemical nature of both MZA and CMA extracts of crude drug of *Z. armatum* was executed (Ibrar *et al.,* 2017) and confirmation of qualitative picture of our plant of Pakistani origin was done which presented in table 2.

Proximate study of crude drug

Crude powder of *Z. armatum* was subjected to determined acid insoluble, water soluble ash, alcohol soluble extractive value, sulphated ash, moisture contents, total ash and water soluble extractive value (table 3).

Table 1: Fractions with weights resulted from methanolic crude extract (MZA)

Plant Name	Fraction	Wt. in gram
Zanthoxylum Armatum	n-Hexane (HFZA)	3.1
	Chloroform (CFZA)	2.8
	Ethyl acetate (EFZA)	2.0
	n-Butanol (BFZA)	4.0
	Aqueous (AFZA)	7.5

Table 2: Phytochemical constituents of *Z. armatum* extract

Phytochemicals	*Z. armatum*	
	Methaonlic	Chloroform
Alkaloids	+ + +	+ + +
Glycosides	+	+
Carbohydrates	+ +	+
Flavonoids	+ + +	++
Proteins	− − −	− − −
Fixed-oil	+ + +	+ + +
Saponins	− − −	− − −
Tennins	+ + +	+
Sterols	+ + +	+ + +
Triterpenoids	+ + +	+ + +

+ indicates presence and – indicates absence

Table 3: Physicochemical parameters of *Z. armatum*

Parameters	*Z. armatum*
	Percentage w/w (%)
Acid insoluble ash	0.65
Water soluble ash	2.8
Sulphated ash	5.8
Moisture contents	6.15
Total ash contents	4.9
Alcohol soluble extractive value	5.6
Water soluble extractive value	10.25

Table 4: Total phenolic/flavonoid contents in *Z. armatum*

Extract & Fraction code	Phenolic-mg/g	Flavonoid-mg/g
MZA	42.82	123.5
CZA	39.22	141.7
HFZA	17.15	41.3
AFZA	8.29	28.7
BFZA	12.35	31.2
CFZA	90.29	156.7
EFZA	38.95	147.0

Evaluation of phenolic and flavonoid contents

The total phenolic and flavonoid quantity were evaluated and expressed in mg per gram dried crude powder of plant material (table 4).

Estimation of Anti-obesity Consequences

The gain in weight after 02 weeks administration of HFD to all rabbits of every group was studied and observed significantly increased in wt presented by applying sample ˚T-test and mean ± SE˚ of wt of animals (fig. 1a). Then weight loss at the end of 03 wks after treatment with MZA was determined on specific time intervals (1, 2 and 3 wks) and resulting data was near to significant on comparative to control group and reference group ($P< 0.056$). While, result with CZA was insignificant when compared with standard and negative-control ($P>0.05$). Data was analyzed by applying one way ANOVA and Dunnett's test (fig. 1b).

Evaluation of Lipid Profile

The lipid profile was determined by applying specified parameters such as; cholesterol, LDL, HDL, VLDL and triglycerides levels. Suppression of cholesterol and LDL levels with crude extracts of plant was observed. Triglyceride and HDL level were noticed with MZA, CZA, control and reference drug. The response of Plant's extracts against VLDL was also demonstrated.

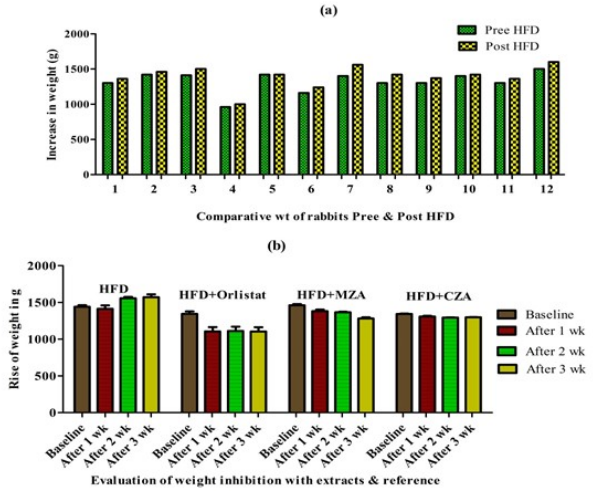

Fig. 1: (a) Pair sample T test was applied before and after high fat diet where values indicated as Mean ± SEM (65.50 ± 11.290) and p value 0.000 df=11. (b) Baseline Post 14-day body weight increased after high fat diet; Values are Mean ±SEM (n=3); One way ANOVA followed Dunnett's test, * P<0.05 specifies significant fall in body wt.

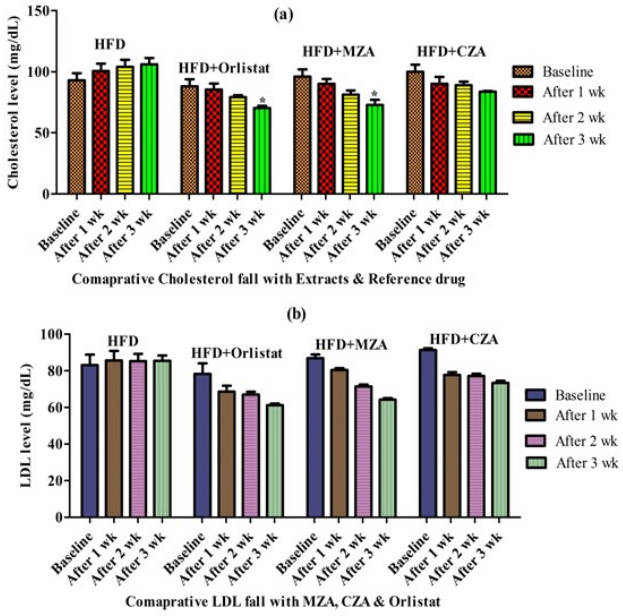

Fig. 2: (a) Increased serum cholesterol (mg/dL) after high fat-diet intake (02 wks); Figures are Mean ±SEM (n = 3); One way (Dunnett's test); the significant decreased cholesterol level with extracts and reference drug (*P< 0.05). (b) The fall of Increased LDL level after HFD determined by applying Mean ± SEM (n=3); One way (Dunnett's test) with reference to control groups (*P< 0.05).

Effect on Cholesterol and LDL levels

The increased level of cholesterol with 02 wks high-fat diet was expressively controlled with MZA (P<0.017) while chloroform extract of *Z. armatum* showed no substantial response after comparison with control and standard drug by applying one way ANOVA (fig. 2a). The suppression of LDL level after three weeks of treatment with extracts (MZA & CZA) and orlistat was assessed. The distinguished methanolic extract has a significant response (P<0.094) on lowering LDL-level than CZA (P< 0.381) on comparison to standard drug (P< 0.057) using one-way ANOVA (fig. 2b).

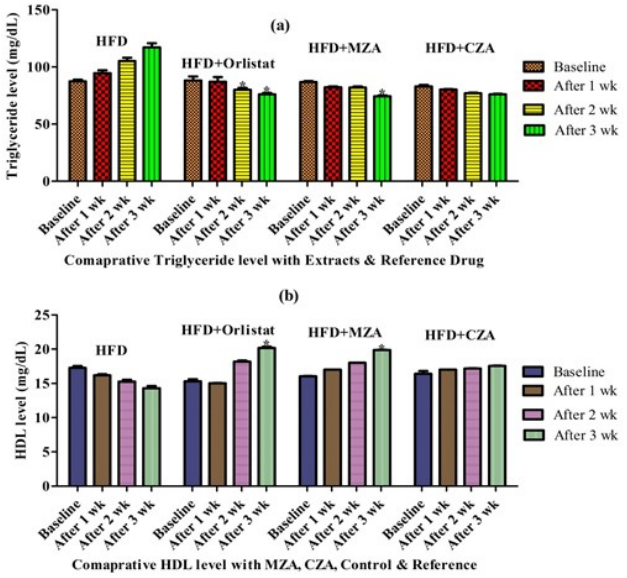

Fig. 3: (a) The Consequence of extracts of Z. armatum on Triglycerides after HFD values by applying one way ANOVA, Dunnett's test and Mean +SEM. *P<0.05 shows the significant fall of serum triglyceride level comparative to reference drug. (b) Represent the serum HDL with drug and extracts using same statistical parameters and found significant rise of HDL (*P<0.05).

Response on Triglyceride and HDL concentration

The effect of drug and investigated extracts on promptly rise of triglyceride-level was perceived and concluded that both extract had satisfactory control on triglycerides particularly after 3rd wk of treatment but MZA (P<0.000) has bit better response than other extract CZA-(P<0.018) by amplification of ANOVA (one-way) (fig. 3a). As rise of HDL-level is imperative regarding control of lipid profile, when data was analyzed after treatments, MZA displayed significant rise of HDL serum level (P<0.011) but CZA exhibited insignificant effect on HDL (P> 0.05) (fig. 3b).

Consequence of Z. armatum on VLDL-level

The evaluation of VLDL suppression with extracts and reference drug was performed and perceived MZA has important fall of serum VLDL, whereas experimental group treated with CMA showed insignificant suppression when assessed among other groups and using ˚one way ANOVA˚ (fig. 4).

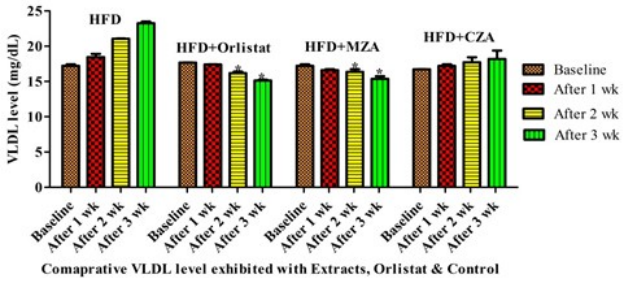

Fig. 4: The significant (*P<0.05) fall of VLDL level with both extracts of ZA comparison with standard drug was determined by following one way ANOVA and Dunnett's test.

DISCUSSION

The methanolic (MZA) and chloroform extracts (CZA) were prepared from crude powder of leaves, stem and fruit of *Zanthoxylum armatum*. The resulting w/w % age yields of MZA and CZA were 5.6% and 2.66% respectively. In addition various fractions were screened from MZA and their percentage yields were determined and shown in table 1. Because of therapeutically significant and better yield of plant's extracts, hence were considered for our focal *in-vivo* and *in-vitro* studies. The phytochemical investigation of *Z. armatum* exposed the existence of; flavonoids, alkaloids, phenolic compounds, coumarins, terpenoids, lignins, sterols, fatty acids, reducing sugars, amino acids and alkenic acid (Ibrar *et al.,* 2017). The chloroform extract identified the existence of alkaloids, flavonoids, cardiac-glycosides, triterpenoids and sterols shown in table 2. Because of these vital constituents in *Z. armatum,* it is considered therapeutically imperative to treat various ailments. As concern the toxicity of this plant, both extracts with a dose of 300 mg/kg body wt. of animal, were found safe and free from any morbidity and mortality signs.

Ash content is directly associated to the mineral matter in drug that lined to pharmacological effect. In addition ash value is important for the determination of purity and authenticity of drug. The pharmacognostic and ash content evaluation of crude powder of plant provided a precise picture of mineral found in herbal drugs (Chaudhari and Mahajan, 2015). The various phytochemical parameters on the mixture of crude powder of leaves, stem and fruit of *Z. armatum* like; total ashes values, acid insoluble ash, water soluble ash, sulphated ash as well as moisture content, alcohol soluble extractive and water soluble extractive values. The high percentage of total ash value in *Z. armatum* indicated the appropriate concentration of carbonates, silicates, phosphates, calcium, potassium and magnesium (Ibrar *et al.,* 2017). Less acid insoluble ash means minor digestibility. Sulphated ash showed the existence of free sulphated metal in crude drug. A smaller amount of moisture content in crude drug is helpful to prevent the growth of bacteria, yeast and fungi and our plant showed a beneficial humidity. More water soluble extractive value means that plant contained high amount of polar compounds presented in table 3.

Phenolic and flavonoid compounds (secondary metabolites) screened from natural plants proved biologically and pharmacologically worth (Stankovic, 2011). Many bioactive compounds (genistein, apigenin and catechin) have therapeutically employed to manage obesity (Rayalam *et al.,* 2008). Dried fruit powder of *Z. armatum* showed highest flavonoid and phenolic contents than bark. These compounds in substantial amount were found in ethanol extract of *Z. armatum* (Batool *et al.,* 2010). The investigation of MZA and CZA as well as various fractions of *Z. armatum* was done in our work and found appropriate quantities of phenolic and flavonoid substances. The flavonoids found in CMZ and MZA were 141.7mg/g and 123.5mg/g respectively, while total phenolic contents in MZA (42.84mg/g) and CZA (39.22mg/g) were identified in table 4. We determined anti-obesity potential of *Zanthoxylum armatum* first time in this study. The data proved that significant control of body weight of rabbits with MZA when compared with standard, control and CZA group. The high-fat diet was administered to all rabbits for fortnight and increased in body weights was monitored comparative to the masses of pre-treated with high-feed diet. Using paired sample T-test and mean± SE regarding body weights were measured and shown in fig. 1a. The anti-obesity effect of methanolic-extract of *Z. armatum* was evaluated and shown near to the significant (P<0.056) while chloroform extract exhibited paltry (P>0.05) on comparison to the control and reference drug (fig. 1b). The decreased in body wt was may be credited to the compound (Berberine) present in plant extract through lowering the glucose level (Zhou *et al.,* 2007).

The subsequent high fatty diet increased the serum level of cholesterol. Assessment of lowering the cholesterol level with extracts and standard drug were executed at the end of 03 wks and observed significantly (P<0.017) fall with MZA, however, CZA exhibited non-significant (P >0.05) response by applying ˚Dunnett's˚ when compared to the reference and control group (fig. 2a). The CZA and MZA presented non-momentous lowered LDL serum level when applied one-way ANOVA P<0.381 and P< 0.094 respectively (fig. 2b). The rise of triglycerides was also perceived in rabbits feeding with high fat diet. Then

groups were treated with extracts and drug regarding decrease of triglycerides for 03 wks and found MZA exhibited almost similar level of suppression of triglycerides as reference drug (fig. 3a). The effect of plant extracts on HDL level was also studied and concluded that MZA significantly raised the HDL level ($P<0.011$) as compared to CZA which having least response ($P>0.05$) to keep the level of HDL up (fig. 3b). The trend of falling of obesity marker is also alike in case of VLDL serum level when switched with MZA (17.70±1.35-15.27±0.42) after 03 weeks treatment, while, chloroform (16.73±0.42-19.39±0.64) extract has miner VLDL suppressive response on compared to negative control (17.45±0.84-23.52±1.35) and standard control group (17.70±1.35-15.27±0.42). The current study proved that control of lipid profile (anti-obesity) with methanolic extract of *Zanthoxylum armatum* as compared with reference groups. The components found in leaves, fruit, bark and stem of *Z. armatum* (alkaloids, flavonoids, polyphenols) could played a vital role in ruling lipid profiles. However, further learning is also required to explore the *Z. armatum* regarding isolation and structural characterization of active compound that has precise therapeutic effect (anti-obesity).

CONCLUSION

The existence of phytochemicals in *Z. armatum* and their medicinal consequence regarding management of obesity has studied. After administration of highly fat diet to various groups of rabbits (albino) and evaluated the anti-obesity outcome of MZA and CZA against LDL, cholesterol, TG, VLDL and HDL levels with reference to standard drug (orlistat). The significant control of lipid profile was determined which mainly attributed to the berberine, sitosterol, phenolic and flavonoid contents in *Z. armatum*. The area of interest is to explore more Pharmacological action and to isolate the therapeutically active compound from fraction and extract.

REFERENCES

Alam F, Saqib QN and Ashraf M (2018). *Zanthoxylum armatum* DC extracts from fruit, bark and leaf induce hypolipidemic and hypoglycemic effects in mice-in vivo and in vitro study. *BMC Complement Altern Med.*, **18**(1): 1-9.

Barua CC, Haloi P, Saikia B, Sulakhiya K, Pathak DC, Tamuli S and Ren X (2018). *Zanthoxylum alatum* abrogates lipopolysaccharide-induced depression-like behaviours in mice by modulating neuroinflammation and monoamine neurotransmitters in the hippocampus. *Pharm Biol.,* **56**(1): 245-252.

Batool F, Sabir SM, Rocha J, Shah AH, Saify ZS and Ahmed SD (2010). Evaluation of antioxidant and free radical scavenging activities of fruit extract from *Zanthoxylum alatum*: A commonly used spice from Pakistan. *Pak J Bot.,* **42**(6): 4299-4311.

Buriro MA, Tayyab M and Dttta A (2011). Effects of *Nigella sativa* and sunflower oil diet on weight of albino rats. *Professional Med. J.,* **18**(03): 530-534.

Chang CC, Yang MH, Wen HM and Chern JC (2002). Estimation of total flavonoid content in propolis by two complementary colorimetric methods. *J. Food Drug Anal.,* **10**(3): 178-182.

Chaudhari GM and Mahajan RT (2015). Comprehensive study on pharmacognostic, physico and phytochemical evaluation of *Terminalia arjuna* Roxb. stem bark. *J. Pharmacogn. Phytochem.,* **4**(3): 186-190.

Connolly HM, Crary JL, McGoon MD, Hensrud DD, Edwards BS, Edwards WD and Schaff HV (1997). Valvular heart disease associated with fenfluramine–phentermine. *New Engl J Med.*, **337**(9): 581-588.

Duhamel G, Forgez P, Nalpas B, Berthelot P and Chapman M (1983). Spur cells in patients with alcoholic liver cirrhosis are associated with reduced plasma levels of apoA-II, HDL3 and LDL. *J Lipid Res.,* **24**(12): 1612-1625.

Gilani SN, Khan AU and Gilani AH (2010). Pharmacological basis for the medicinal use of *Zanthoxylum armatum* in gut, airways and cardio-vascular disorders. *Phytother. Res.,* **24**(4): 553-558.

Guerciolini R (1997). Mode of action of orlistat. *Int. J. Obes.,* **21**: S12-23.

Guo T, Deng YX, Xie H, Yao CY, Cai CC, Pan Sl and Wang YL (2011). Antinociceptive and anti-inflammatory activities of ethyl acetate fraction from *Zanthoxylum armatum* in mice. *Fitoterapia.,* **82**(3): 347-351.

Ibrar M, Muhammad N, Khan A, Khan SA, Zafar S, Jan S and Hussain J (2017). Pharmacognostic and phytochemical studies of *Zanthoxylum armatum* DC. *Pak. J. Pharm. Sci.,* **30**(2): 429-438.

Kalaiselvi V, Binu TV and Radha SR (2016). Preliminary phytochemical analysis of the various leaf extracts of *Mimusops elengi* L. *South Indian J. Biol. Sci.,* **2**(1): 24-29.

Kumar A, Shukla R, Singh P, Prasad CS and Dubey NK (2008). Assessment of *Thymus vulgaris* L. essential oil as a safe botanical preservative against post harvest fungal infestation of food commodities. *Innov. Food Sci Emerg.,* **9**(4): 575-580.

Maahs D, Serna DG, Kolotkin RL, Ralston S, Sandate J, Qualls C and Schade DS (2006). Randomized, double-blind, placebo-controlled trial of orlistat for weight loss in adolescents. *Endocr Pract.,* **12**(1): 18-28.

Nakayama T, Suzuki S, Kudo H, Sassa S, Nomura M and Sakamoto S (2007). Effects of three Chinese herbal medicines on plasma and liver lipids in mice fed a high-fat diet. *J Ethnopharmacol.,* **109**(2): 236-240.

Nooreen Z, Tandon S, Yadav NP, Kumar P, Xuan TD and Ahmad A (2019). *Zanthoxylum*: A review of its traditional uses, naturally occurring constituents and pharmacological properties. *Curr. Org. Chem.,* **23**(12): 1307-1341.

Patil P, Venkatanarayanan R, Argade P and Shinde P (2012). Assessment of pharmacognostic and phytochemical standards of *Thespesia populnea* (L.) root. *Asian Pac J Trop Bio.*, **2**(3): S1212-1216.

Phuyal N, Jha PK, Raturi PP and Rajbhandary S (2019). *Zanthoxylum armatum* DC.: Current knowledge, gaps and opportunities in Nepal. *J. Ethnopharmacol.,* **229**: 326-341.

Prashant TB, Kumar M and Gurpreet Kaur H (2011). Phytochemical screening and extraction-A review. *Int Pharm Sci.,* **1**(1): 98-106.

Rayalam S, Della-Fera MA and Baile CA (2008). Phytochemicals and regulation of the adipocyte life cycle. *J Nutr Biochem.,* **19**(11): 717-726.

Sourabh D, Arunachalam A and Das A (2009). Indigenous knowledge of Nyishi tribes on traditional agroforestry systems. *Indian J. Tradit Know.,* **8**(1): 41-46.

Stankovic MS (2011). Total phenolic content, flavonoid concentration and antioxidant activity of *Marrubium peregrinum* L. extracts. *Kragujevac J Sci.,* **33**(2): 63-72.

Timilsina Y and Tripathee Y (2014). Effect of applied treatments on growth performance of three cultivated medicinal plants of Kaski District, Nepal. *Intern J. Interdis St.,* **2**(1): 31-40.

Yadav VK (2018). Phytochemical and pharmacognostical studies of *Blumea lacera* (Roxb.) DC. *Int. J. Green Pharm.,* **12**(01): 110-115.

Zhang Y, Wang D, Yang L, Zhou D and Zhang J (2014). Purification and characterization of flavonoids from the leaves of *Zanthoxylum bungeanum* and correlation between their structure and antioxidant activity. *PloS one.,* **9**(8): e105725.

Zhou L, Yang Y, Wang X, Liu S, Shang W, Yuan G and Chen J (2007). Berberine stimulates glucose transport through a mechanism distinct from insulin. *Metabolism.,* **56**(3): 405-412.