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MORPHOLOGICAL COMPARATIVE STUDY OF THE STOMACH IN THE *FELIS CATUS* (DOMESTIC CAT) AND *SCIURUS CAROLINESIS* (EASTERN GRAY SQURRIEL)

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ABSTRACT : Stomach in both species are under study as simple stomach (unilocular stomach)takes like letter C has two curvatures, which greater & lesser & two orifices: Cardiac & pyloric orifices. Greater curvature in females of squirrels seemingly divided the stomach into two parts and stomach of males of squirrels is smooth of walls, transparent, it may be remark digested foods through its walls, but there were no registered morphological differences in the outer surface of the stomach in males and females of domestic cat. And the stomach in both of them divided into four regions are represented by cardiac, fundus, body & pyloric. Internal lining of the stomach in the *Felis catus* (domestic cat) consisted of longitudinal deep branched multiple of number folds relatively, whereas internal lining of the stomach in *Sciurus carolinesis* (eastern gray squrriel) distinguished by found low long folds and are with little numbers in areas of stomach and registered significant differences in various measurements for animals' weights, weights of stomach, length of the stomach and different width of regions of stomach in both types subject of study.

Key words : Mammalia, stomach, felis, squirrel.

INTRODUCTION

The stomach is regarded as considerable organ within digestive tract, where it digests and stores foods (Saladin and Kenneth, 2004). The main function of the stomach to destroy large molecules of foods into smaller parts to facilitate absorb them by intestines (Shrewood, 2002). The digestive tract shows morphological changes effected largely with type of nutrition, period of feed, number of times of take food, the need to store foods, size and form of animal body (Ghoshal and Bal, 1989). The *Felis catus* (domestic cat) belongs to Felidae and class of Carnivora and the human domesticated it before (4000 years). Cats are differed between each other in color, fur, size. The *Felis catus* (domestic cat) is mammal carnivorous and 20% of food of cats must be protein (MacDonal *et al*, 1984).

Whereas the (eastern gray squirrel) *Sciurus carolinesis* (Gmelin, 1788) belongs to sciuridae class from order of Rodents, there are 50 genes & 273t species, it is considered from mammals which live on trees, it has big and thick tail. It has large two eyes and round ear. Squirrels are founded in Asia, Europe, America and Africa continents. Squirrels are rodents differentiated in nutrition (Omnivores) eat barks and buds of trees, various kinds of seeds and even fungus are founded in woods (Lonkim, 1995; Thoring and Darorw, 2000). It was studied morphologically, anatomical structures of local various animals in Iraq previously, but information are incomplete or little about *Felis catus*, Eastern gray squirrel, therefore this study provides morphology informative base about stomach in under study of two animals.

MATERIALS AND METHODS

Ten adult specimens of ofspecies of mammals : *Felis catus* and *Sciurus carolinesis* from different localities at Baghdad city were collected during November 2016 un till April in 2017 and animals were brought to the laboratory alive and measure their weights (gr).

The animals were anesthetized and decapitated acording to the international protocol for biomedical investigation with hunan being and animals, then dissected carefully by making alongitudinal incision atthe middle line of skin from ventral surface of neck starts from first cervical vertebrae access to pelvic region and skin separated from muscles which under it. Then made transverse incision across thoracic region where, it links with longitudinal incision, then theskin was drawn from muscles. The peripheral muscles were removed within ventral wall, when skin was cut the muscle wall of body

appeared, then to cut right part of ventral surface, followed by cut left part of ventral wall and to complete incision across to thoracic girdle (112). Gastrointestinal tract was extirpated and stomach was removed and measurements related to formation study were taken which are length (cm), weight (gr) and relative weight of stomach was counted with grams and according to equation in below:

Relative weight of stomach = stomach weight / body weight (Ofusori *et al*, 2008)

RESULTS

External surface of stomach : The stomach of *Felis catus* (domestic cat) and *Sciurus carolinesis* (eastern gray squirrel) was large organ unilocular and formed letter C. Stomach has two orifices including cardiac and pyloricorifices, cardiac orifice connectes the cardiac region of stomach to the esophagus, while the pyloric orifice connects the pyloric region of stomach to the duodenum.

Also results have shown that stomach has greater and lesser curvature, greater curvature in females of squirrels divided the stomach into two parts (Fig. 3) and stomach in males of squirrels smooth transparent of walls, it is possible to see through digested food (Chyme) as comparison with females (Fig. 4: A, B).

The current study has shown many of measures which are : body weight, stomach weight, stomach length, width of four regions of stomach for both male and female species (Table 1).

Internal surface

The lining of stomach in domestic cat for both sexes show in brown color in cardiac region, composed of regulated longitudinal folds, these folds multiple numbers, zigzag in regions of fundus and body, but pyloric region seems white color and number of long folds was low (Fig. 5). However lining of stomach in eastern gray squirrel has shown contains longitudinal folds too but they are little and not deep (Fig. 6).

DISCUSSION

Current results of study have shown that stomach in *Felis catus* (domestic cat) and *Sciurus carolinesis* (eastern gray squirrel) seem as big organ relatively has unilocular takes form letter (C) linked to esophagus from upper part and duodenum from lower part, this conform with results of dog's stomach (Miller, 1964) stomach of *Mustella putorius* (Evans, 1998), stomach of *Sciurus anomalus* Persian squirrel (Sadeghinezhad *et al*, 2012), stomach of rodents (*Amblyosomus hottenes*) (*Crocidura cyanea* (Nzalak *et al*, 2012) and stomach of *Funisciurus*

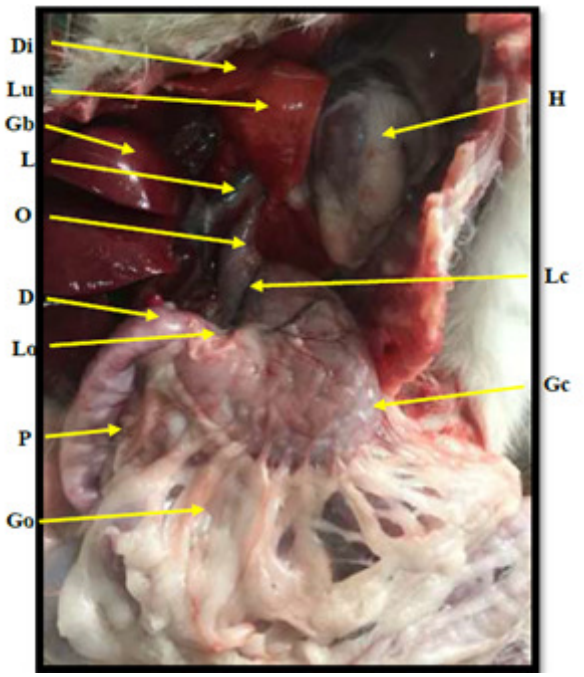

Fig. 1 : Location of stomach in dorsal surface in ventral cavity in domestic cat.(Gc) greater curvature, (Lc) lesser curvature, (L) liver, (Lu) lung, (H) heart, (D) dcuodenum, (O) oesophagus, (P) pancreas, (Gb) gall bladder, (Go) greaertomentum, (Lo) lesser omentum & (Di) diaphragm.

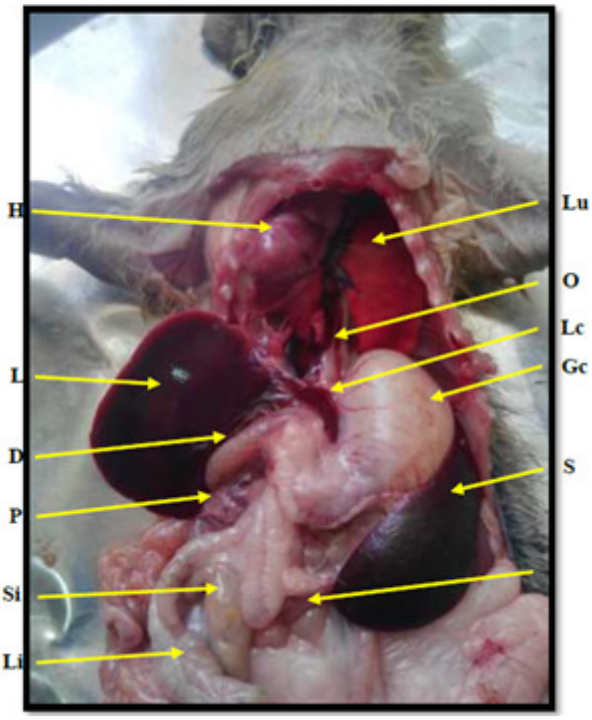

Fig. 2 : Location of stomach in ventral cavity in females of eastern gray squirrel. (H) heart, (Lu) lung, (L) liver, (S) spleen, (Lc) lesser curvature, (Gc) greater curvature, (D) duodenum, (P) pancreas, (Si) small intestine, (Li) large intestine, (O) oesophagus & (K) kidney.

anerythrus African rope squirrel (Igbokwe and Obinna, 2016). Whereas do not conform with results of *Herpestes edwardsii* which are small ferocious because their

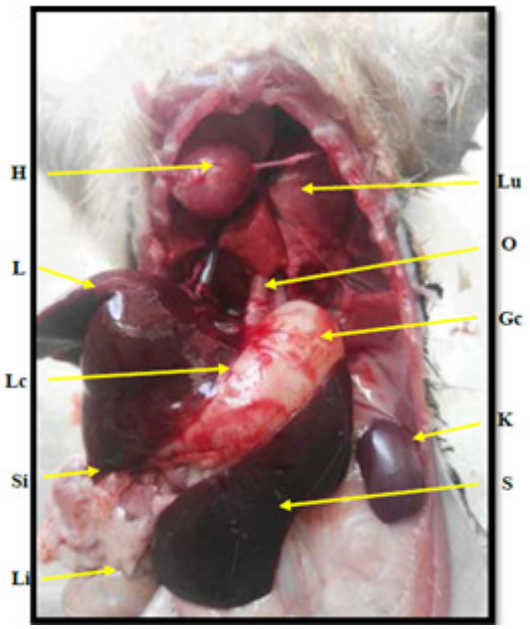

Fig. 3 : Location of stomach in ventral cavity in males of eastern gray squirrel. (L) liver, (S) spleen, (K) kidney, (L) lung, (H) heart, (O) oesophagus, (Si) small intestine, (Li) large intestine, (Gc) greater curvature & (Lc) lesser curvature.

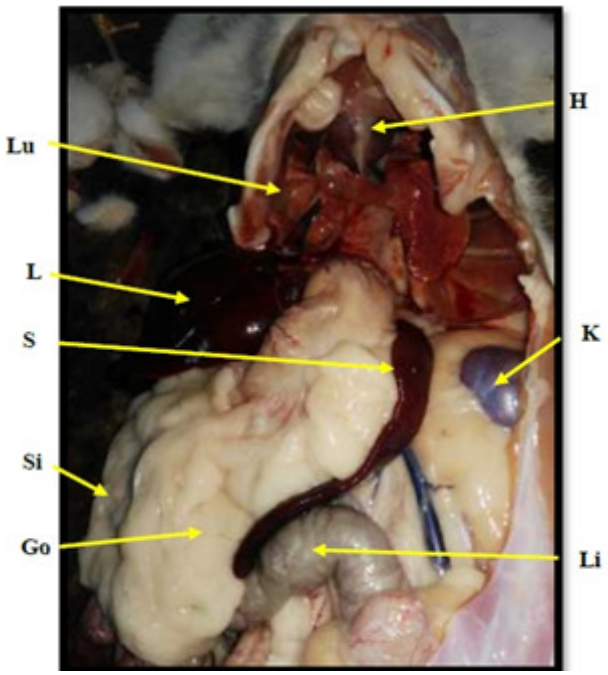

Fig. 4 : Location of stomach in ventral cavity in domestic cat. (L) liver, (S) spleen, (H) heart, (K) kidney, (Si) small intestine, (Li) large intestine, (L) lung, (Gc) greater curvature.

Table 1 : Morphological measures of stomach in *Felis catus* and *Sciurus carolinesis.*

Animal properties	*Felis catus*		*Sciurus carolinesis*	
	Females	**Males**	**Females**	**Males**
Body weight (gr)	2344.333	3433.333	269.667	228.333
Stomach weight (gr)	16.013	20.500	9.803	8.703
Relative weight of stomach	0.007	0.006	0.036	0.0381
Stomach length (cm)	9.400	9.233	3.967	3.600
Cardiac region width (cm)	1.700	2.633	0.600	0.600
Fundus region width (cm)	3.067	4.333	1.300	1.333
Body region width (cm)	4.200	5.100	1.633	2.267
Pyloric region width (cm)	2.167	2.800	0.733	0.967

stomach appear with form (J) (Shill *et al*, 2012), stomach of cattle and deers because their stomach composed of four locular which are rumen, reticulum, omasum and abomasum (Samuelson, 2007; Perez and Jerbi, 2012), stomach of camel being its stomach structured, composed of three locular only where there was no omasum with it (Nitovsk *et al*, 2015) and this non conformity come from stomach form in mammals which are adaptations according to many coefficients like nature of food, times of eat food, period of store, form, size of body (Ghoshal and Bal, 1989), indicated (Perrin and Curtis, 1980) that there are teeth may play role in determine morphology of stomach (Langer, 2002) has indicated that small mammals which are shown high degree of differentiation in the part away from digestive tract and it shows low degree differentiation in the stomach, because of nature of food of carnivorous, which are digestible good largely. And dissection of them simple as comparison with other kinds of feeding (Stevens and Hume, 1995).

Results of present study of domestic cats have shown that stomach contains convex surface represents greater curvature, where it is being large, extends in dorsal at cardiac region of stomach, then bows over left side of body region and descends towards right side across medium level, also bend to reach end of pyloric region, however second surface of stomach is concave represents lesser curvature, this result agree with in some studies as domestic ferret (Poddar and Murgatroyed, 1976), dog, cat (Evans and Delhunta, 2013; Nickel *et al*, 1979) indicated (Kent and Miller, 1997) to that bows of stomach are not stable, but depend on quantity of food digested which contain them.

Results of gross test of stomach of females of *Sciurus carolinesis* have shown that stomach contains greater bow, as stated that bow divides stomach into two parts extends from cardiac orifice of stomach to near distance of body region to tip of pyloric orifice. Whereas, in stomach of males of *Sciurus carolinesis* the greater bow is as one convex part.

Owl and Batzli (1998) has indicated to gastrointestinal morphology differentiated in rodents as a result from variables in food, conditions of people, such as seasons (Hume, 1994) indicated to digestive tract morphology in *Sciurus carolinesis* may vary within one type and

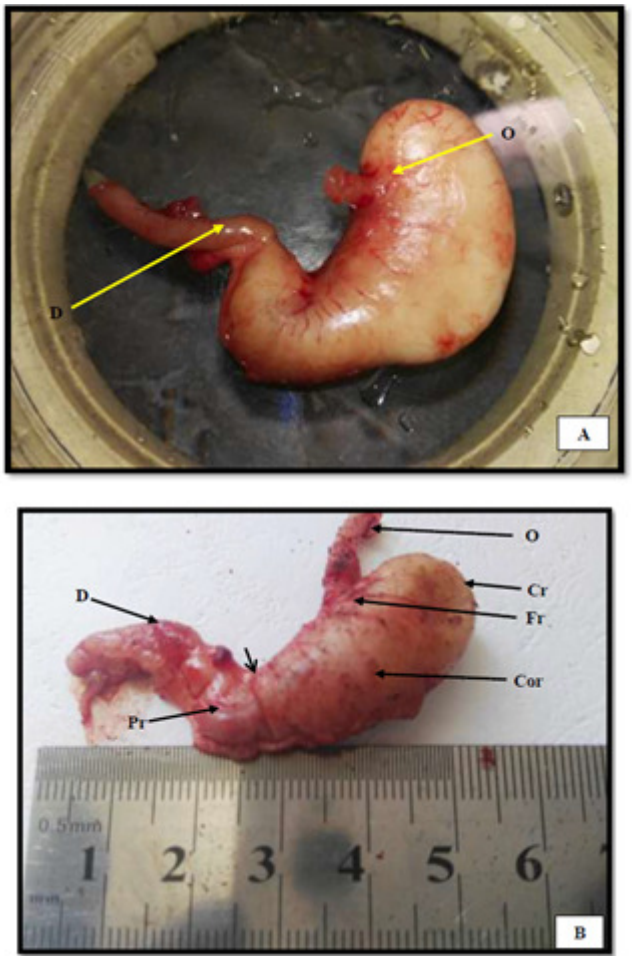

Fig. 4 : Form, locations of stomach in eastern gray squirrel : (A) Stomach in females of eastern gray squirrel&(B) Stomach in males of eastern gray squirrel. (O) oesophgus, (D) duodenum, (Cr) cardiac region, (Fr) fundus region, (Cor) corpus, (Pr) pyloric region.

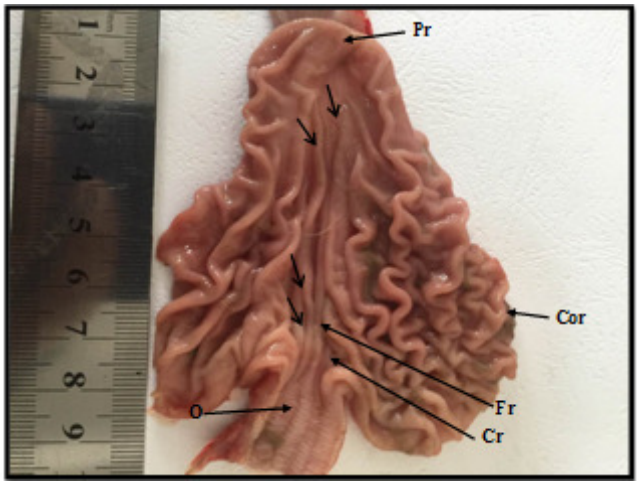

Fig. 5 : Arrangment of folds (→) in the internal surface of lining in stomach regions in domestic cat. (O) oesophagus, (Cr) cardiac region, (Fr) fundus region, (Br) body region & (Pr) pyloric region.

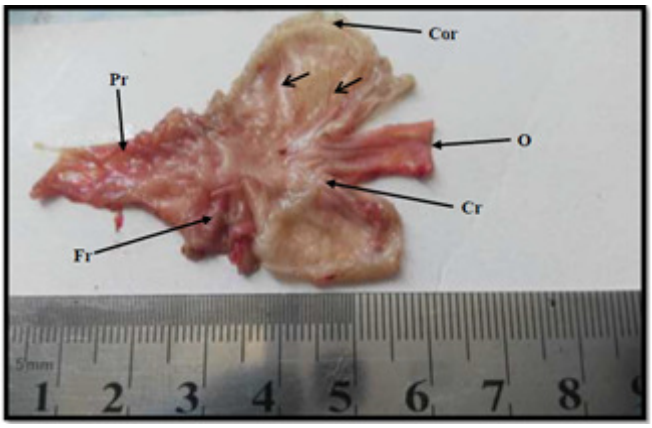

Fig. 6 : Folds (→) in the internalsurface of lining in stomach regions of eastern gray squirrel. (O) o esophagus, (Cr) cardiac region, (Fr) fundus region, (Br) body region & (Pr) pyloric region.

between other classes.

Results of gross test for stomach of *Felis catus* (domestic cat) and *Sciurus carolinesis* (eastern gray squirrel) that females stomach longer than males' stomach. Where its length rate (9.400, 9.233cm) subsequently in domestic cat and its length rate (3.960, 3.600 cm) subsequently in *Sciurus carolinesis*. And length of stomach in Indian grey mongoose (9.5 cm) (Shill *et al*, 2012) and in *Sciurus anomalus* Persian squirrel amounted (4.9 cm) (Sadeghinzhad *et al*, 2012), in *Funisciurus anerythrus* (African rope squirrel) amounted (4.32 cm) (Igbokwe and Obbina, 2016), in camel amounted (110 – 160cm) (Abdel-Magied and Taha, 2003) in elephant amounted (45cm) in age (3) years, (90cm) in age (4) years (Indu *et al*, 2016). This varies may return in length of stomach to method, type of food and difference of age between both genders.

The results of the current study showed that the average body weight in males of domestic cats was higher than that of females where were (3433.33 and 2344.33 grs), respectively. The body weight rate of females of gray squirrels was higher than that of males, which amounted (269.667, 228.333 grs) subsequently. The result was not consistent with the results of *Felis silvetris*, where the average body weight was (2.95 grs) (Spines and Spine, 1998) and the gray Persian squirrel. The body weight rate was (310 grs) and the Aberts, which body weight rate amounted (511.7grs), singer squirrel which had a mean body weight (532.2 grs) (Sadeghinzhad *et al*, 2012).

And this varies in results made because body weight may be has relation with mode of feed or used animals in present study were young especially that age of animals were not limited in current study and previous studies.

Byanet *et al* (2010) indicated to rate of animals' weights may have no effect on morale relation with length of different organs, but have relation morally with

different weights of digestive tract.

Results of current study of domestic cat and Seastern gray squrriel have shown that rate of stomach rate in males of feliscatus was more than rate of stomach weight in females amounted (20. 500grm) in males and amounted (16.013 grm) in females.

However, the weight average of the stomach in the gray squirrel was higher in females than in males amounted (9.803 and 8.703 grm) respectively and this result differs from the (Persian squirrel) *Sciurus anomalus* which its weight rate amounted (17.7 grm) (Sadeghinzhad *et al*, 2012) and *Funisciurus anerythrus* (African rope squirrel) (4.89 grm) (Igbokwe and Obinna, 2016). This variation returns to relation of size of stomach weight with mode of nutrition (Byanet *et al*, 2015), the cause may belongs to females which be in pregnancy or feeder because they were gathered within different seasons.

The results of the present study, which dealt with the anatomical, morphological and structural description of the stomach in males and females of the domestic cat and *Sciurus carolinesis*, have shown they were divided into four regions, represented by cardiac region, the bottom, the body and the pyloric. This result is consistent with the *Funisciurus anerytheus* (African rope squirrel) (Igbokwe and Obinna, 2016), a cat and dog's stomach (Evans and Delahunta, 2013; Nickel and Seiferle, 1979). While are not consistent with the results of the glandular portion of the wild African giant pouched rat *Cricetomys gambianus*, is being divided into three regions: the cardiac, the bottom and the pyloric (Byanet *et al*, 2010).

This non harmony is caused by varies in mode of nutrition, where regions of stomach specialized to requirements of foods for animal types (Hilderbrand and Goslow, 2001).

The results of the present study showed an increase in the width of the cardiac region, the bottom, the pyloric of stomach in males of domestic cat (2.633, 4.333, 5.100 and 2.200 cm) respectively, compared to domestic cat females (1.700, 3.066, 4.200, 2.166 cm) subsequently.

As related to *Sciurus carolinesis*, the results showed that there were no expansion with width of cardiac regionof the stomach in males and females amounted (0.600 cm), while there was expansion in the width of the bottom area. Body and the pyloric orifice of stomach of males of *Sciurus carolinesis* amounted (1.333, 2.266, 0.966 cm) rrespectively, compared to females of gray squirrel (1.0300, 1.633, 0.733 cm), respectively. Langer (1984) pointed out that the cardiac area did not expand where it makes a narrow area in the stomach of cat, dog and man. And that the results of the domestic cat and the gray squirrel fully agree with the above mentioned details.

The variation in the width of stomach areas in the domestic cat and the gray squirrel between males and females may be due to, method, the nature of nutrition and fullness of the stomach. And Devyn *et al* (2000) indicated to consume huge quantities of food regularly as increase to expand rub muscles in stomach.

The gross test results for males and females' stomach of domestic cat and gray squirrel longitudinal folds where were little in number and higher than in gray squirrels. This result was consistent with African rope squirre, *Funisciurus anerythrus* (Igbokwe and Obbina, 2016), and with stomach of *Mustella putorius* (Poddar and Murgatroyed, 1076), such as in consistent with results of *Lanostes aenigmamma* (Scopin *et al*, 2015) and the *Cavia procellus* (Abd-ALrhman, 2016) of containing anterior surface of stomach of longitudinal folds, but they are not harmonized with them of containing anterior surface of stomach for transverse folds as well as longitudinal folds. As they were founded quirky folds in rodents *Paruromys, Maxomyshell waldii dominator* (Scopin *et al*, 2016). Langer (1984) referred to difference in gastric folds have an important role in regulating the crossing of digested food. Longitudinal folds and height in the domestic cat appear to increase the breadth of the stomach when swallowing food. This is consistent with the size of the large prey and these folds are very clear when the stomach the folds become empty and when the stomach expands according to its fullness (Evans and Delahunta, 2013; Nickel and Seiferle, 1979).

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