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STUDIES ON GENETIC POTENTIALS OF LOCAL BREEDS OF SHEEP/GOAT OF QUETTA

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C O N T E N T S

ABSTRACT

The results of the data collected on three different stocks of goat and four stocks of sheep, farmed at three different localities around Quetta are presented on the interstock variations in adult weight, seasonal/pregnancy associated variations in adult weights; the growth pattern, growth rates and reproductive performances including female fertility rate, once/twice a year lambing/kidding pattern, single/twin/tripple births, and the number of lambs produced/female/year. Limited data has been presented on sheep wool production, haematological characters (glucose level, haemoglobin level, RBC/WBC counts and ESR) in sheep/goats and milk analysis (fat, Non fat solid, Total Solids, pH) in sheep. It has been suggested that these stocks of sheep/goat are compareable if the general economic characters with other breeds maintained in Pakistan, and there is a wide variation in intrastock animals, which can support the future improvement programmes of the economic potentials of the stocks. The stocks/ farmers appear to be fully adapted to the general conditions around, and there appears to be some degree of improvement of stock through organized breeding programme is not being followed. Future research needs have also been suggested.

SUMMARY

In the wake of a limited body of informations available to scientific quarters on sheep/goat flock maintained in Pakistan in general and in Baluchistan in particular, the present preliminary study was instituted with the aim of developing the basic infrastructure for a wider study in the area. Three resident stocks were selected at three different localities, i.e., Agricultural College, Balalli, Urk and Randozai, where different number of the adults male/females and the newborn individuals of sheep/goat were selected, number tagged and monthly records on body weight and other environmental and biological parameters were maintained throughout the year to draw results on adult weight, growth rate, breeding performance, while a limited informations were collected on wool, haematological and milk. Well defined descritive stocks were not isolated.

The results on sheep suggested that with regard to adult weight the different stocks were not different from one an other, while the males were significantly higher than females. These stocks were heavier than Salt Range, equivalant in weight to Kajli, while lighter than Lohi, Awassi and Afghan breeds. The seasonal variations in weight was observed to be followed in all the stocks/sexes, the highest weight appearing in May and lowest in September. Such fluctuations in weight can be explained on the basis of the general vegetative cycle exhibited in the area. The females gain some 11 kg weight progressively during the pregancy and losses some 14 kgs at parturation. The general growth can be divided into three periods, first 4 months with a very rapid growth, a moderate growth period falling between 5-9 months of age and a slow period of growth persisting till 2 years of age. The weight gained per day per animal that it gradually rises from some 30-60 gms to about 200 gms in 4-5 month, whence onwards it decreases with each of increasing month of age. Though, the growth rates are equivalant to other breeds maintained in Pakistan; but the fact that our stocks were maintained on stressful natural grazing, while the other stocks for which informations are available are maintained under experimental controlled grazing/supplemented rationing, may suggest that the growth rate is generally higher in Quetta stocks than the other stocks. The fertility of the reproductively active females ranges from 90% in Urk, 75% in Karakuli, 69.23% in Baluchi and 64.13% in Randozai stocks, Urk stock matching with other stocks, whilevthe other three stocks remained below. The frequency of twice a year lambing pattern was higher in Urk (67.67%), follwed by Baluchi (44.44%), Karakuli (11.11%) and Randozai (0.00%), Urk and Baluchi breeds better in producing twice a year lambing at normal regimn.

The frequency of twining was highest in Baluchi (30.77%) followed by Urk/Randozai (15.29/14.29%) and none in Karakuli stocks. The number of lambs produced per ewe per year was 1.31 in Baluchi, 1.05 in Urk, 1.04 in Randozai and 0.83 in Karakuli stocks. The breeding activity mainly occurs during December-March period with some during May-July. An average of 1.69 kg wool is estimated to be produced by the sheep flock on per animal per year basis. The glucose, haemoglobin, WBC count, RBC count and ESR of blood suggested a normal parameters, while fat (6.30%), SNF (9.30%) TS (15.33%) and pH (5.96) has been recorded for the milk samples collected from the area.

The adult weight fluctuated from 44.35/39.17 (male/females) in Khurassani, 35.63/30.75 in Urk and 30.93/29.67 in Randozai stocks of goats generally higher than that recorded from the area. The weight was highest during May and lowest during June-July, explainable on general vegetative cycle. The females accumulate some 12 kgs during pregancy while she losses some 13-15 kgs on parturation. Different stocks of goat appear to show some degree of variations in growth pattern, though it extends till the age of some 2 years. It occurs in three phases in Khurassani stock (rapid 1-6 months, moderate 7-11, slow beyond), the initial period of rapid growth extends till 7th month in Randozai stock, while in Urk stock the distict growth periods can not be separated and growth appears to continue gradually throughout the 2 years of age. The growth rates are suggested to be high in Khurassani stock (average 84.07/66.42, males/females), followed by Randozai (78.31/51.63) and lowest in Urk stock (57.47/53.63). These growth rates are generally higher than that suggested for Teddy breed. The fer tility of females was high (100% in Randozai, 92% in Urk), a higher proportion of females kidding twice a year in Randozai (55.56%) than Urk (0.00), and 66.67% twin, 4.76% tripple births in Randozai and only 7.69% twin births in Urk. The Randozai breed appears to be significant better breeder (2.17 kids/year/female) as compared with Urk (1.08). The majority of births come during November-April period, though some (12.12%) in June. The haematological studies suggest glucose level of 77.80 mg/100ml haemoglobin 12.17%, WBC count 7.25 thousand/mm^3, RBC count 4.50 millions/mm^3 and ESR of 2.13 mm after one hour.

The prospectives of potentials of different sheep/goat stocks has been discussed. The intrastock variation suggest the chances of genetic improvements, while the harvesting at the age of 6-9 months for males has been suggested. The flock and the farmers appears to be adapted to the general conditions around. Further research line/needs has been suggested for the area in the field.

1. INTRODUCTION

1.1. Scope of Problem:

Pakistan, being basically an agricultural country, places a significant reliance on livestock, providing food of high nutritional value to fight malnutrition, muscle power for agricultural exploitation, bye products like skins, wool etc. used as raw material for industries/export and manure for maintenance of soil humus contents, all ensuring the well being of rural populace as well as development of the country. Sheep/goat play an important role in the economy of Pakistan, providing annually 400,000 tonnes of meat (43% of total produced in the country), 29 million skins (earning Rs 1.4 million in foreign exchange; and providing raw material for expanding leather industry), 52,000 tonnes of wool (for carpet industry earning Rs 2,000 million; 7,000 tonnes exported as raw wool earning Rs 100 million in foreign exchange plus providing jobs to thousands of artisan families) and produce about 400,000 tonnes of milk (4% of that produced in Pakistan) apart from being major source of livelihood of over a million livestock farmers, especially in the arid regions, where crop production is limited thus helping in saving the country from socio-economic problems though these constitute an important part of a mixed farming system exercised in irrigated tracts by about 4 million farmers (Hasnain, 1985).

Baluchistan is a vast province of Pakistan (343,000 km^2: 43.6% of total area under Pakistan), with a limited human population (4.3 million: around 5% of population of Pakistan: 12.39 persons per km^2) predominantly under arid conditions with limitations of surface/ground water resources to support active agriculture (1.5 million hectares under active/fallow land cultivation) leaving about 95% of its tracts available to be exploited as pastures for sheep/goat grazing (Hassan, 1982; Mian, 1983). The area is known for long as pasture land and is famous for wild sheep (Urial, Ovis orientalis) and goats (Sind Ibex, Capra hircus; Markhor, Capra falconieri) and domesticated sheep/goats deriving their origin from wild relatives, the first domestication occuring probably around 10,000 B.C. Zafaruddin (1981) has rightly suggested that 32.4 million hectares of the land in Baluchistan (92.7% of the available area: 1.5 million hectares under active cultivation, 1.1 million hectares under active forest vegetation- Anonymous, 1973) can be regarded as rangelands. For the reason of a limited irrigation resources and scanty rainfall, augmented by high summer temperature, increased surface evaporation and

soil moisture deficiency, erratic rainfall, all going against cultivation of crops (Iqbal, et al., 1982), by far the greatest part of the province is pastoral, where there is greatest scope for development/improvement of sheep/goat industry for improvement of standard of living of its inhabitants (Babar, 1978) as these animals are best suited to exploit natural vegetation of the area, which otherwise would remain unutilized (Iqbal, et al., 1982). The industry is the main-stay of more than 90% population of this province (Babar, 1978). Though, nomadic pattern followed in the area, makes the overall estimates of the livestock population of the Baluchistan unreliable and difficult (Iqbal, et al., 1982), still the available records suggest that there are some 14 million of the small ruminants in the province (Table I[a]: Mian, 1983) and their population is increasing each year, liable of causing stress on the general vegetation of the area. This stock of sheep/goat not only meet the needs of the animal protein in the area, but are exported to other parts of the country providing economic gains to the local populace, in the area, where other directly exploitable resources are limited, as also providing animal protein and raw industrial products to the other parts of the country, contributing their share in the national development.

In the wake of importance of the sheep/goat farming in development of the province as well as in national uplift as also the fact that the present availability of protein from animal origin is less than 1/3 of the recommended quantities (per capita daily availability being 10.7 gms, as against the minimum international recommended requirements of 45 gms- Shah, et al., 1980; Tahir and Naqvi, 1987), thus 2/3 of the population being facing malnutrition, ill health and reduced work stamina, and socio-economic backwardness, it appears justifiable to place sheep/goat farming on sound scientific footings, so that optimal benefits could be drawn. Despite the paramount importance of the basic research data on the flock of sheep/goat maintained in different parts of Baluchistan, to be exploited in future breeding/management programmes to extract optimal benefits, very little information is available from the area, which has remained relatively scientifically virgin for want of communication links, demanding some early action of workers in the tract.

The available records suggest that out of some 28 breeds of sheep distributed within different parts of Pakistan, 4 (Baluchi: Quetta, Sibi, Kalat, Makran, Chagai, Kharan; Bibrik: Quetta, Loralai, Zhob; Harnai: Quetta, Loralai, Sibi and Zhob; Rakhshani: Kharan, Makran; ? Karakul: an exotic breed being introduced into the area especially in northern tracts) are distributed in Baluchistan. Similarly, out of some 23 breeds

Table I: Total population of different types of livestock in Baluchistan (adapted from Mian, 1983).

Kinds of Livestock	Numbers		
	1972* Census	1976**	1982** (Projected)
Sheep	3,858,000	5,074,496	8,810,000
Goat	3,238,000	4,441,513	7,720,000
Cattle	483,000	684,230	714,000
Baffaloes	22,000	33,229	38,000
Camels	185,000	211,797	630,000
Asses	171,000	243,814	
Horse	20,000	22,930	
Mule	-	1,586	
Poultry	-	1,958,062	6,000,000

Source: * Committee, 1973, p. 58.
** Figures supplied by Baluchistan Livestock Department

of goat 3 (Kajli: Loralai, Dera Ghazi Khan; Khurasani: Quetta, Loralai, Zhob, Chagai; Lehri: Lehri, Kacchi) have been reported from Baluchistan. These breeds appears to have been adapted to respectives areas of the province, with a mastery developed by the breeders for their successful farming under natural systems. Apart from these regularly maintained breeds of sheep/goat there is a tendency of incorporation of certain exotic blood into the livestock flocks being maintained in different areas, the exotic breeds coming from adjacent areas of Iran, Afghanistan and the other three provinces pf Pakistan. Different breeds are generally being maintained as a mixed flock without following definite breeding programme to select better traits for future generations. The genetic potentials of these breeds as well as the new mixed flocks are not known in the scientific literature. The present project, thus, anticipate working on knowing the genetic potentials of different breeds/flocks maintained in the province, with the present study on Quetta, working as a model for some more elaborate studies on provincial basis, so that these potentials could be exploited in the educational programmes developed in organizing the future planned breeding, so that farming is managed on optimal level, causing minimum damage to the ecosystem, with greater economic returns to the farmers.

1.2. Review of Literature:

Hasnain (1985) has rightly suggested that livestock research in Pakistan is weak but that of sheep and goats is weaker, despite the fact that these are urgantly required to place their farming on sounder footings. These studies have mainly remained limited to Livestock Research Institute, Bahadurnagar (Okara: Punjab), alongwith some theses produced by the students of Agricultural University, Faisalabad. All such studies have remained limited to breeds of sheep distributed in Punjab alongwith some of the exotic breeds, with a limited work on goats.

1.2.1. Sheep:

Ahmad and Saleem (1981) recorded the birth weight of lambs of Lohi, Kacchi and Awassi breeds as 4.55, 3.31 and 3.93 kg, respectively, and selected the rams producing a higher birth weight progeny. Sharif, et al. (1981) reported birth weight of general flock of Lohi sheep, averaging 3.73±0.67 in males and 3.48±0.58 kg in females. Similar results were presented by Ahmad and Zafar (1980-81) in an allied study of Lohi sheep. Ahmad (1985) and Ahmad and Ahmad (1987) suggested birth weight of lamds of Afghan sheep, maintained at Livestock Research Institute, Bahadurnagar as 4.78 0.78 (males) and 4.50 0.85 (females). Keeping the pracrical difficulties of collecting the birth weight in view, Ahmad and Khan (1985) reported the average weight of lamds recorded with in 15 days of age in Lohi breed as 4.14 kg (males: 4.72 1.29; females 4.15 1.67 kg). These studies suggest that apart from difference of breed contributing in the birth weight, the sex of the new born lamb also proves as a significant factors in birth weight, the males being heavier than females. A substatial number of studies conducted in Pakistan and outside Pakistan suggest that single born lambs are heavier than twin/tripple born ones (Ahmad and Zafar, 1983; Ghneim, et al., 1959, Phillips and Domson, 1937; Shelton and Campbell, 1962; Gumlivske, 1979). Similarly, Saleem and Shah (1981, 1983) have concluded from their studies that spring born lambs are heavier than the autumn born ones, while a number of studies suggest that ewes aging between 2 and 6 years produce lamds with higher birth weight than those weighing less than 2 years and more than 6 years (Hazel and Tanil, 1945; Sriyanov, 1982; Ahmad and Zafar, 1983).

The weaning weight has been recorded at the age of 120 days, in most of the studies conducted in Pakistan, and appears to vary with the race, and type of the study material. Thus, weaning weight in Lahi sheep has been recorded as 32.08 (Ahmad and Saleem, 1981); males 24.59±5.46, females 20.62±4.40 (Sharif, et al., 1981); males 19.31±4.41, females 17.87±3.15,

overall 18.65 kg (Ahmad and Khan, 1985). Some insignificant variations in the weaning weight of Afghan sheep has been reported in two studies, showing the recorded weight as 34.37±4.81 and 29.00±5.02 kg (males and females, respectively, Ahmad, 1985), and 33.32 4.67 and 29.04 4.76 (males and females, Ahmad and Ahmad, 1987). Ahmad and Saleem (loc cit) reported the weaning weight of Kacchi and Awassi breeds as 23.34 and 25.86 kgs, respectively, while Ahmad (1985) recorded that Buchi males and females are heavier than Thalli and Sapli breeds, in all age groups. A number of studies consistantly suggest that weaning weight is more in males as compared with female lambs in all the breeds (Ahmad and Zafar, 1983; Ghoneim, et al., 1959; Sriyanov, 1982). Akram (1973) suggested that there is a decrese in the weaning weight of the lambs, if the carrying capacity of the pasture is less than the flock maintenance and the pasture does not provide full nutritional requirements in Lohi sheep. Bendicho, et al., (1979), Teeza and Szewezk (1981) suggested that sex, type of birth, rearing and age of the dam has a significant effect upon the weaning weight of lambs., while Ahmad (1983), Golodov and Tleuov (1975) and Kdyrniyazov and Nurgaliev (1976) suggested that the weaning weight is heavier in the lambs produced by heavier mothers.

Variations have also been reported in the adult weight in different studies. Mason (1967) reported that Awassi males and females range between 60-90 and 30-50 kg, respectively. The adult weight has been recorded in Lohi breed as 23.08-49.92 (Ahmad, 1982); males 55.00, females 32.41 6.25, overall 32.64 6.81 (Ahmad and Khan, 1985); Afghan sheep as male 85.00, females 46.29 kg (Ahmad, 1985), male 88.82, females 48.74 (Ahmad and Ahmad, 1987); Kajli 31.67-47.81 (Ahmad, 1982); Salt Range 20.10-40.00 (Ahmad, loc cit). Ahmad and Zafar (1980) and Hazel and Terril (1945) suggested that Lohi breeds attains maturity after two years of age, when these are heavier than those of less than two years age group.

Growth rate represented as weight gained per day, exhibit variations in response to breed under consideration and other associated factors. The data collected by Ahmad (1983) suggested that Kajli lambs are havier than Lohi and Salt Range breeds at all ages, however, Salt Range lambs are though lighter than Lohi at less than 30 days of age, but are heavier at 31-60, 61-90 and 90-120 days of age, suggestimg that different breeds has a different growth patterns at different ages. The growth rates calculated from different breed suggested figure: Lohi 0.17 (Akram and Ali, 1972), 0.125 kg per day (males 0.128, females 0.120, Ahmad and Khan, 1984); Awassi 0.20 (Akram and Ali, loc cit), males 0.22 and females 0.18 kg/day (Wardeh, 1969); Kacchi 0.15 kg/day (Akram and Ali, loc cit);

Afghan male 0.247±0.030, female 0.210±0.033 (Ahmad, 1985) and male 0.235± 0.036, female 0.210±0.035 kg/day; and general nomadic flock in lebanon 0.191 kg/day. (Bhattacharya and Harb, 1973). Ahmad and Ahmad (1975) suggested that different composition of the food has a significant bearing on the growth rate of flock of sheep, while observations of Saleem and Shah (1983) indicated that the growth rate was suppressed under the stress of early weaning as also twice a year lambing pattern in Lohi breed.

Little studies are available on the potentials of milk production in breeds of sheep farmed in Pakistan. Mason (1967), Find (1957) and Khoury (1965) recorded that Awassi breed produces about 125 kg of milk during 150 days of the lactation period, while Bhattacharya and Harb (1973) suggested an average for Lebenon nomadic stock of 2.25 lbs/day. The later studies also suggested that milk production was low soon after parturation and its quantity increased gradually with a maximum after 3-4 months, when pastures are green with natural vegetation, whence onward it decreased gradually. Some of the studies are available on the analysis of samples of milk collected from sheep flock farmed in Pakistan. Jabbar (1982) suggested that fat contents is higher in Lohi and Kajli than Salt Range; protein being higher in Kajli than Lohi and Salt Range and lactose contents are higher in Lohi breed. Another similar study by Jabbar, et al (1983) suggested that composition of milk is effected by breed, stage of lactation, season and age.

Direct economic gains and its exploitation in rapidly expanding carpet industry as also its increasing value in the export market has attracted the worker to allow a larger allocation of time to studies on wool. Different studies indicate a slight difference in the total annual production of wool by Lohi sheep averaging to 1.58±0.23 (Ahmad and Saleem, 1981), 0.619±0.257 (Ahmad, 1983), 2.24±0.26 kg (Ahmad and Khan, 1985) with a range Of 0.676 - 1.507 kg (Ahmad, 1982). Similar figures for other breeds suggest slight variation between breed so that Afghan breed produces 1.29 (male), 1.66 (female; Ahmad, 1985) and 1.515 kg (Ahmad and Ahmad, 1987), Kacchi yielding 1.58±0.23 (Ahmad and Saleem, 1981), Awassi 1.45±0.22 (Ahmad and Saleem, loc cit), Hissardale 4.18 0.62 (Ahmad and Saleem, loc cit), Kajli 0.750-1.736 (Ahmad, 1982), Salt Range 0.919-1.443 (Ahmad, loc cit) with mean 0.619± 0.257 (Ahmad, 1983). Jabbar and Ashraf (1975) worked on effect of 12, 4, 2, and 1 time shearing per year in Lohi and Hissardale breeds on different parameters of wool and suggested that though 12, 4 and 2 time per year shearing yields more wool, but the staple length remains below the standards set by the marketing committee in Pakistan, recommending

annual pattern of shearing for Hissardale breed and at the maximum twice a year shearing for Lahi breed. Bashir and Jabbar (1981) confirmed these findings and suggested that no seasonal variations occurs in growth of fleece/fleece weight produced, however, Ahmad and Ahmad (1982), Haq (1964) Ahmad (1977) suggested that Lohi and Hissardale breeds produce less wool during winters than summers. Khan, et al., (1971) suggested that fine wool grows slower than the coarse wool, indirectly suggesting that there is a possibility of finding interbreed variations in the total wool produced, but as majority of breeds farmed in Pakistan are of coarse wool type, therefore a significant difference is not expected as is exhibited by the available studies. Some studies have also been directed on qualitative analysis of the wool produced by different breeds. Ahmad (1983, 1985) undertook study on fibre diameter, percentage of the true wool, percentage of the heteritrophic fibres and degree of medullation present in wools of Sapli and Buchi, while found the effect of different interval of shearing on raw/secured wool, greese contents, staple length, average fibre diameter and other related factors in Lohi and Hissardale breeds. A more detailed study by Iqbal, et al., (1985) yielded that Salt Range breed produced highest yield of clean wool (83.92%) as compared with Lohi (60.01) and Kajli (57-89%). The data gathered by them suggested that though there is some variation in vegetative matter, greese contents, ash and fibre diameter, but these difference are not very significantly different. Ahmad and Ahmad (1987) has studied similar parameters in Afghan suggesting that the breeds produces a mixture of white and coloured wool, with 76.1% being true, 4.6 hetertypical and 19.3% medullated one with an average fibre diameter of 32.2 μm. Haq (1964) has found a positive correlation between the fibre diameter and the staple length in his studies on Merino and different Pakistani breeds.

The main aim of the sheep breeders being to obtain more live weight for mutton production through production of a larger number of lambs, therefore the breeding performance of a breeds is important deciding factor to support its farming. This would suggest the importance of studies on the reproductive performance of different breeds with an aim of finding potentials of evolving stocks with higher reproductive performanc and hence a larger body of researches are available in the area. Sheep has been regarded as short day animal with reproductive activities dominating in autumn (general lebanon flock late June and July, Bhattacharya and Harb, 1978; Lohi mid September to mid October in low lands of Punjab, Ahmad, 1983; Afghan in autumn, Ahmad, 1985) with an average gestation period of around 150 days, thus lambing in late winters,

(general Lebanon flock; Bhattacharya and Harb, loc cit), spring and even till early summers. The fertility of ewes under normal breeding regmin has been recorded to be 96.1% in Lohi (Sharif, et al., 1981), 97.1% in Afghan (Ahmad and Ahmad, 1987) and 90% in general Lebanon flock (Bhattacharya and Harb, 1978). The number of lambs produced per ewe per year are variable (Lohi 1.18, Sharif et al., 1981, 1.89, Saleem, 1978, 1.04, Ahmad and Khan, 1985, 1.89, Saleem and Shah, 1983; Afghan 1.07, Ahmad and Ahmad, 1987) between breed as well as general conditions of the farm. Post-lambing estrus has also been frequently observed in Lohi and Afghan breeds in various proportions after parturation, suggesting their potentials for twice a year lambing. Ahmad and Khan suggested that in Lohi breeds 55.9% ewes lamb once, while 20.2% lamb twice a year, while Saleem and Shah suggested that 81.5% of the ewes show estrus in autumn, while 55.4% show estrus in spring. Twice a year lambing regimn can be effectively introduced in sheep exploiting photoperiodism and progesteron thus increasing the number of lambs produced per year per lamb and studies show that such a pattern has no adverse effect on mother and/or lamb born, if suitable substitute rationing can be arranged for the lambs and/or ewes and through early removal of the lactating lambs (Saleem and Shah, 1983, Ishaq, 1975, Land and McClelland, 1971; Land, 1978; Robinson, et al., 1975; Goot and Maijala, 1977; Sahani and Tiwari, 1977; Gunn and Maxwell, 1978). Ahmad (1983) suggested that in Lohi sheep the heavier weight groups are superior for ewe bred, alive lambs born and weaning weight of the lambs; while Ahmad (1981) provided data to suggest that in Lohi sheep rate of ewe lambed, alive lambs born, lambs weaned, birth weight etc. is significantly higher in 52-59 kg weight group, than those falling in higher and/or lower age groups. The proportion of single, twin and/or tripple births recorded in different studies are quite variable between and within breed (Sharif, et al., 1981, Ahmad and Khan, 1985, Ahmad, 1985; Ahmad and Ahmad, 1987). Quite a few studies are available from Punjab Livestock Production Research Institute, Bahadurnagar, showing heretability of different traits and hence the potentials has been exploited to select ram for increasing economic gains of the stock (Zaman and Shah, 1981; Ahmad, et al., 1985; Ahmad, et al., 1983, 1983-a; Ahmad and Naz, 1987).

Jabbar, et al. (1985) has undertaken haematological studies of various parameters in Lohi and Afghan breeds, with the view of finding the adatability of Afghan sheep to conditions of Punjab.

1.2.2. Goat:

Relatively few studies have been directed to the study of goat in

Pakistan (Hasnain, 1985), the Teddy breed being relatively better studied. Shah, et al., (1981) reported that the birth weight in Teddy goat avergaes to 1.68 (males) and 1.47 kg (females); while the studies of Khan and Ahmad (1985) suggested that Beetal goat has a significantly higher birth weight (males 4.92 1.28; female 4.76 kg; weighed within 15 days of birth) as compared with Teddy goat. Both these studies indicated that Teddy goat has a lower weaning weight (11.78 males, 9.98 kg females; Teddy: male 17.98 3.84, female 15.10 kg; Beetal) and adult weight (male 37.95, female 21.81 kg; Teddy: 53.52 kg; females 29.92; Beetal). An indirect conclusion of these studies would suggest that like various breeds of sheep, males are havier in goats also at all age groups.

Shah, et al. (1981) suggested an average of different growth rates, as judged by gms weight gained per day, during different age and sex. Thus male teddy goats gain 84 gms/day during first 4 months of age, 69 during 6 months, and 44 during 12 months; while in females the gained weight varied from 68 during 4 months, 65 during 6 and 38 during 12 months; suggesting that weight gained slows down with age. Khan (1981) suggested that normal growth rate in teddy goat averages around 61.5 gms/day, which is increased to 87.6 gms/day when fed with Dhaincha. A similar study the growth rate of the teddy goat was studied under different nutritional conditions (Khan, et al., 1984). Khan and Naz (1983) suggested that though the live weight is higher in caterated teddy goats, yet the difference is not significant; while Khan (1980) suggested that the growth rate in teddy males ranges between 55 and 67 gms/day and the casterated animals were not different from uncasterated ones. Khan (1981) concluded that teddy breed consumed 17.85 kgs of Dhaincha for production of 1 kg of body weight.

Shah, et al., (1981, 1975) worked on the average yield of milk in Taddy goat and suggested that it produces 105.8 kg milk per season. Beetal breed produces 0.66 kg/day for 210.62 days with an average of 139.19 kg per year with dry period of 120.25 days per annum.

Shah, et al. (1981, 1975) undertook study on reproductive performance of teddy goat. The study suggested a fertility rate of 145.07% per year, single births constitute 43.6%, twin birth 46.3%, tripple birth 10.1%, with an overall kidding rate of 1.65 kids/ewe/year. The multiple births are suggested to be common after the first kidding, with maximum kidding occuring in June. The gestation period has been worked out to be 146 days.

1.2.3. General:

The general review of the researches carried out on sheep/goat in Pakistan suggest a general paucity of researches in the area and limited

to a few breeds. Some of the scattered publications are available, generally recording the casual observations and/or experiences in the field on different aspects of sheep/goat in Pakistan, including prominantly Atkinson (1979), Alvi (1984), Abdi (1964, 1970), Akhtar and Haider (1976), Eckner (1981), Haq and Masud (1966), Hasnain (1983), Hasnain and Mir (1985), Khan and Sajjad (1978), Khan, et al., (1982), Khan (1969), Qureshi, et al., (1981), Sajjad and Azhar (1979), Salauddin (1984), Siddiqui (1983), Wahid (1975). Ishaq (1983) produced a useful compilation on describing different breds of goat farmed in different parts of Pakistan. Hasnain (1985) undertook a useful work to bring out a comprehensive status report on sheep and goats of Pakistan, mainly relaying upon various scattered regional reports, attempting at describing different breeds of sheep/goat in Pakistan, and their potentials of development.

Throughout the available spectrum of studies, Baluchistan appears to have remained unattended by the workers. Babar (1975, 1978) presented reports emphasizing the importance of the area for sheep production. Arid Zone Research Institute (Pakistan Agricultural Research Council) based at Quetta has tried to collect some basic informations on general practice and potentials of sheep and goat production in different areas of Baluchistan (Pishin: Iqbal, et al., 1981; Sibi: Iqbal, et al., 1982; Zhob: Iqbal, et al., 1983; Chagai and Kharan: Rafique and Munir, 1983; wool production/marketing in Baluchistan; Iqbal, et al., 1982-a), however none of these attempted studies on biological potentials of the races and/or general stock maintained in the area.

1.3. **Objectives:**

The project was designed to work as initial pilot project with a limited financial implications for acclaimitization of the staff and evolution of centre for elaborate studies on this important aspect. The project thus had a limited study area (around Quetta) and a limited scope of study and project proposal outlined the following parameters to be analysed in different breeds of sheep/goat:

a. Reproductive biology and reproductive efficiency
b. Growth rate and turn over rate
c. Quantity and qualitative analysis of milk and wool
d. Mortality and general health

A critical useful appraisal of the project proposal by our worthy refree provided us with thought provoking guidline, needed for persons, relatively new to the field. He also provided thus with a list of useful literature, which proved helpful in execution of the project. He rightly

suggested to contain our study to two breeds of sheep generally farmed in the areas around Quetta, leaving the goat to be dealt with in some other future project. However, Technical Committe of PSF approved to conduct the study on goat. Considering both the approaches we decided to institute the study on general flock of goat, though additional data was tried to be collected on sheep, which did not cost the project extra financial burdon.

1.4. Period of Study:

The project was initiated in June 1987. After a brief initial period of acclaimitization of the staff and selection of the areas having sedentary flocks with consultation of the Baluchistan Livestock Department, research activities started towards the end of June, 1987 and continued till May 1988, with the termination of the grant period.

Project Staff:

The project had a limited staff to conduct the research activities, which comprised:

1. Principal Investigator: Part Time, Mr. Afsar Mian.
2. Co-Principal Investigator: Part Time, Mr. Tassawar H. Khan.
3. Research Assistant: Full Time, Mr. Vaqar Azeem.

The project mainly pivoted around Co-Principal Investigator, the Principal Investigator, moving to Multan towards the middle of the project, handicapping the direct suppervision of the project for some time.

The study period has been an unfavourable year for the vegetation in particular and the general life in general. The area was under a prolonged spell of drought persisting for the last four years, thus limiting the only source of water in the area which is generally dry and where the surface evaporation is high. The total number of the animal flock maintained in the area dropped to certain minimum levels, some of it facing eminant starvation.

1.5. Area Under Study:

Quetta is the centrally located capital of Baluchistan, located at an altitude of some 1,800 m. The area represent a series of relatively narrow valleys ramifying between Murdar, Zarghun, Takatu, Chiltan and Muslakh ranges of mountains, some of the peaks touching heights around 3,500 m and falling the administrative district of Quetta with some parts falling in Kalat and Pishin. The northern parts of these valleys are under the influence of Pathan tribes, while the southern and southeastern parts are under increasing Baluch influence. The area has generally been regarded as highland arid tract with limitations of

rainfall averaging around 200-250 mm per year. The available data suggests that the major part of the rain is received during winters, with a limited showers during summers, and hence vegetation is greener with spring ephemerals sprouting between February to May/June in different parts in response to variations in altitudes. The rainfall generally exhibits a cyclic variation, with 3-4 years of relatively better rainfall, followed by an equal number of years with decreased precipitation (Roberts, 1973) and there is a gradual decrease in the overall rainfall/ snowfall received in the area. The area being the provincial capital/ business centre has a higher human population to depend upon the general biotic resources present around and hence the arid land vegetation is generally on a stress showing a rapid deforestation (Mian, 1983). The human population of Quetta valleys has been estimated to be around 150,000 (Multi-purpose Cooperative Research Project, 1971). The area faces a general severe below freezing temperatures, even in the valleys during winters, when the vegetation is very limited around. Such a pattern forces the majority of the livestock breeders to adapt a nomadic pattern of life, so that very limited flock of sheep/goats are maintained as sedentary, such a pattern provides a natural relief to the general vegetation to rejuvinate during favourable season to be exploited by the sheep/goat flock.

Farming a small ruminants appears to have been successfully adapted by the local populace, which place a heavier relayance on it for deriving their livelyhood. Areas around Quetta are expected to bear some 60,000 heads of sheep and 138,000 heads of goat (Hasnain, 1985). The indigenous breeds of sheep/goat appear to be admirably adapted to the extremes of the unfavourable conditions (Iqbal, et al., 1981). General literature suggests that 3 (Baluchi, Bibrik, Harnai; Hasnain, 1985) or 4 (Shanwari, Kakri, Bibrik and Harnai; Iqbal, et al., 1981) breeds of sheep are are present in these areas. However, the area being the business centre/ provincial meteropolitan, has always received some scattered individuals of other breeds found in Baluchistan and/or adjacent parts of Sind, Punjab, as also from Iran and Afghanistan, some of these being regular nomadic visitors. With the recent extension of communication links and movement of men and material, such an influx is on gradual increase. As practically no selection of breeding stock is being exercised in the area, these deccriptive types of the individuals are rare, and the majority of the stock is the out come of complex crossbreeding to produce non descriptive animals (Iqbal, et al., 1981).

The story of goat farming is not much different than sheep farming.

The available literature suggests that Khurasani breed of goat is maintained in the areas around Quetta (Ishaq, 1983; Husnain, 1985). Under the influence of gradual crossbreeding with the scattered individuals coming from different areas of Baluchistan and adjacent areas, the goat breeds being developed in the area are gradually becoming non-descriptive type; yet the basic Kharasani characters dominate.

The flocks in general are being maintained under natural feeding regimn on the general vegetation. The males are usually sold out while the females are maintained for breeding purposes. The young lambs are maintained exclussively on mother's milk, which they are allowed to suckle in the morning and evening, when the flock returns to barn after grazing in the field. Youngs are allowed natural grazing after one month of age as flock grazing separately from the adult lot, yet these are allowed to suckle their mothers in the morning and evening till the age of 4-5 months. No supplemetary rationing is being exercised for the major part of the flock. Government maintained flocks of sheep/goat are limited, only one being maintained around Quetta in Maslakh range for development of the Karakul breed, an exotic breed coming from Afghanistan. A mixed flock of sheep/goats (mainly sheep) are being maintained with the Agricultural College.

The vegetation of the area can be described as xerophytic, mostly consisting of shrub cover, the herb/small grasses emerging soon after rainfall; while the tree layer is completely absent, except for certain patches of favourable habitat conditions having generally very scattered trees. The general tract is sometimes considered as waste lands pastures, under a heavy grazing and wood cutting stress. The vegetation is limited to patches of favourable tracts, more vegetation occuring in depressions representing dried water courses, leaving the dominant part as bare tracts. For most part of the year a few dominant hardy desert adapted species of shrubs persist, predominantly including Artemisia maritima, Haloxylon griffithi, Hordium murinum, Peganum harmala, Salso baryosma, Alhagi maurorum, Gaillonia sp., Hertia sp., Saccharum griffithii, Bromus japonicus, Polygonum aviculare, Prunus sp., Sophora sp., Stocksia brahaui, Desmostachya sp, and Elymus hispidus.

1.6. Acknowledgements:

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ii. Dr. M.D.Shami, Chairman, and Dr. Azra Sultana Ahmad, Principal Scientific Officer of Pakistan Science Foundation, Islamabad, for taking personal interest in stream lining the official vagaries, whenever required.

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iv. Syed Muhammad Ishaq, Director (Retd.), Livestock Farms, Punjab; for his kind elderly guidance in procurement of the relevant literature. Mian Naseer Ahmad Saleem, Director, Livestock Production Research Institute, Bahadurnagar (Okara) for arranging the relevant literature. Dr. S. Karam Shah, Director, Pakistan Agricultural Research Council for guidance. We are sorry for not able to extract the full benefit out of the guidance available with these senior researchers due to our handicaps; yet we believe that the present shap of the research was not possible without their whole hearted support, which we received.

v. Dr. Faqir Muhammad, Director Research, Livestock Department, Government of Baluchistan, Quetta, proved pivot for execution of the project activities, apart from managing guidance/literature.

vi. Ch. Mumtaz Ali Khan, Principal, Agricultural College, Quetta, Dr. Abdul Wahab, Assistant Director (Vet), Quetta, Dr. Attaullah, Vet. Officer, Slaughter House, Quetta, Dr. M. Masood Bajwa, Vet. Officer, Milk Plant, Quetta and Mr. M. Siddique, Vet. Dispenser, Killi Randozai, Quetta, for providing all possible facilities for field studies. We believe that this research was impossible without their whole hearted support.

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viii. Mr. Muhammad Hassan Baluch, Vice Chancellor, University of Baluchistan, Dr. M. Nazir Roomani, Vice Chancellor, Bahauddin Zakariya University; Dr. Zahir Ahmad, Chairman, Zoology, Quetta, Dr. Mumtaz H. Bookhari, Dean Sciences & Director, Insitute of Biology, Bahauddin University, require special thanks for providing suitable working atmosphere required for research.

2. METHODS AND MATERIALS

2.1. Stock Selection:

Three different sites were selected for the purpose of sampling the flocks of sheep/goat maintained around Quetta. The Agricultural College maintains a flock, mainly sheep, representing a mixed breed flock, originating from collection of the animals coming from different parts of Baluchistan, alongwith some of the genetic material coming from other parts of Pakistan, Afghanistan as well as wild counterparts (i.e., Gad, Ovis orientalis blandfordi). This flock is being maintained under controlled conditions of the administration of the College, with some degree of relevant education. Urk is the orchard bearing area, with sufficient water resources, located in basically Pathan dominated part, with social affinities with northern Pathan tract of the Baluchistan and associated Afghan areas. The area is believed to have more of the influence of breeds maintained in the northern parts as also that of the Afghan breeds. Randozai has a limited orchards, with vast areas under normal vegetation. The area has the affinities with the southern Brahuii (Baluchi) tribes, and hence the flock being maintained in the area is believed to have more of the influx of the genetic material coming from southern Baluchistan and the adjacent parts of the Sind. Though surface water resources are limited in the area, yet the ground water resources appears to be sufficient to support active tube well/karaz supported irrigation.

The stocks selected for the purpose of sampling is basically sedentary in nature, and hence available for recording throughout the year, most part being maintained as nomadic shifting to lower altitudes during winter. All the three stocks are under natural grazing with no supplemented rationing/active feeding from cultivations. The newborn kids are maintained on mother milk exclussively for the first month of the life, while from second month through 4-5 months of age these are grazed as separate flock from adult on natural vegetation, allowing them to suckle the mother in the morning, noon and in the evening till the weaning age.

No organized breeding programme is being followed in these stocks and other present in the area under study. It was tried to collected informations on origin of each of the sampled individual, both through tracing their history from the farmers as well as through analysis of the physical characters, recorded previously in literature. However, the informations in this regards proved sketchy; and it was believed that

these stocks have evolved as mixed genetic stocks of the basic original stocks, and hence have been designated, in the present study, on the basis of the general sampling locality. In Agricultural College, howver, Karakuli sheep appears to have a recent introduction, and hence still maintain some of the basic characters.

The stocks under study are being maintained in Kaccha barn, with a limitation of space, specially in winters. Support health service is provided with vaccinations, as per schedule of the local Veterinary schedule, through the despensers.

2.2. Adult Weight:

Varying number of the adult males and females (sheep: males; Randozai 13, Urk, 11, Baluchi, 14, Karakuli, 6: females; Randozai, 17; Urk, 19; Baluchi, 12; Karakuli, 14; Goat: male; Randozai, 11; Urk, 13; Agricultural College, 4; females, Randozai, 17; Urk 19; Agricultural college,11) were selected from each of the regional stocks of sheep/goat, depending upon the availability of the research material, the time at disposal and sedentary nature of the flock. Some of the animals initially selected for studies were dead/sold out/slaughtered within the period of study were excluded from the final analysis. These animals were given a field number and maintained with the animal through a metallic disc with the neck. The informations on sex, breed, age, twin/single birth was recorded for each of the animal separately, however the effects of type of the birth, time of birth was not considered for the final analysis, as per limitations of the available data. The breeds being maintained as nonselective, hence the differently breeding stocks were considered in the final analysis.

Each of the animal was weighted on approximately same date during different calender months of the year under study, and records maintained. The general informations on pregnancy status of each of the females was maintained, through direct observations and through the informations carried by the farmers. The general vegetation conditions in the pastures were recorded in each of the general area and these informations were corraroborated with the general weather/vegetational data available for the general area. Monthly mean weights were subsequently calculated for different categories of the animal flocks adopting the general statistical techniques, for the pupose of analysis of different factors.

2.3. Growth Studies:

Different number of the newborm lambs/kids of different sexes were selected out of each of the regional stocks (sheep: males: Randozai, 16; Urk, 13, Balùchi, 18; Karakuli, 14; Females: Randozai, 15; Urk, 17;

Baluchi, 12; Karakuli, 12: Goat: Males: Khurassani, 9; Randozai, 18; Urk, 15: Females: Khurassani, 7; Randozai, 15; Urk, 17) depending upon the cooperation of the farmers and availablility of the desired individuals/ time. Each of the individual was given a number and tagged through mettalic disc in the neck. The informations on the time of the birth were collected from the respective farmer/ through indirect informations available to the workers, and the related informations on sex, type of the birth and probable breed were maintained regarding each of the individual separately, though the informations on type of the birth/breed were not regarded to be sufficient for a more elaborate analysis and hence were excluded from the final analysis of the data.

Each of the individual was weighted on monthly basis on approximately same date during the calender month. Some of the informations on the previously born individuals were also collected to elaborate the scope of the growth curve. Since the growth pattern were similar to reasonable extend in different individuals, but same stocks and hence no difficulty was encountered in pooling the data for different age groups. Limited data could be collected on the birth weight, as per difficulties of approaching the nomadically maintained stocks/our limitations. Thus the data on the birth weights were supported with that available in literature regarding the general breeds being maintained in the area.

The average weights for each stock were calculated from the pooled data available for different months of age using normal statistical techniques (Sokal and Rohlf, 1969), the first weight recorded being regarded as ist month of age. Segregated data on growth being occuring in individuals born during different parts of the calender year as well as those having single/twin births were considered to be insufficient for reaching at definite conclusion, and hence excluded from final analysis. The data such available was exploited for development of the growth curves.

The growth rates, were calculated on the assumption that each month was of 30 days duration, and was judged by the weight gained by each animal per day. This was calculated by using a normal mathematical conversion of dividing the total gain in the average weight during the different months of age by 30. Though the growth rates were believed to be effected through different calender months as per seasonal variations expected under vegetational cycle, yet these could not be worked out under the limitations of the present data.

To cater the problem of recording the daily intake of the food by the respective animal as may be available directly under controlled feeding

conditions/direct weighting of the animal during morning pregrazing and evening post grazing periods, the body weight of the individual was considered was considered as suitable relative index for the quantity of the food in take. Such a relative parameter can be justified on the basis of the fact that the flock is being maintained on the general vegetation and it is giving satisfactory growth rate, suggesting adaptation of the stock to natural grazing conditions. The increase in the body weight on per day per animal per unit body weight thus was exploited as suitable option to the direct studies on turn over rate, with the belief that it works as relative index for turn over rate/efficiency. This relative index on turn over rate was thus calculated by dividing the average growth rate (average increase in monthly weight of the growing kids/lambs per day per animal) by the average weight for the relative month.

2.4. Breeding Performance:

The breeding efficiency of the general stock maintained in different areas was worked out through a comparision of the total potentially reproductively active females maintained in different flocks with the total number of the females lambing/kidding within the year under our study. These parameters regarding the total flock available for the study were exploited to work out the percent fertility of the females of the respective regional stock.

A selected number of the females from different stocks were exploited to maintain elaborate record on the birth of the young ones. This record was used to arrive at results on once a year/twice a year lambing/kidding pattern of each of the female under study. The data was used to arrive at conclusions on the proportion of females showing different patterns of lambing/kidding.

The records were also maintained on the selected females regarding the number of the offsprings produced by each female at each parturation. The data thus yielded used fruitful for calculation of the proportion of the single/twin/tripple births through a direct comparison with the total number of the parturations examined under the total study in different stocks. Simple mathematical conversions were exploited to reach at the percentages of the different types of the births.

The data on the number of lamds/kids produced during the total year of the study was divided by the total number of the females kept under observations to calculate the number of the lambs/kids produced per year per female, through regular mathematical conversions.

The elaborate data maintained on the time of the birth of each of the individual lambs/kids was exploited to be treated in suitable manner so as to reach at our results on the proportion of the births coming during different months of the year. These informations were also pooled so as to suggest the proportion of the births coming during winter and/or summer. The general informations available regarding the vegetational cycle in the area were exploited to correlated the time of the lambing with the general environmental conditions available. The information available through the detailed records on the growing lamb/kids were used in arriving at conclusion regarding the survival rate of each of the stock.

The informations on age of the females/males extracted from the farmers and those available with us with regard to the fate of each of the new born lamb/kids were used for reaching at our conclusions on reproductive age of the females. Limited body of the data could be collected on reproductive age of the males as these are usually sold out early in age and a few selected males are being maintained in the general flocks for 2-3 years only.

2.5. Wool:

A limited body of data could be collected on the fleece weight of 28 individuals sheared on annual basis. As per limitations of the facilities the sexing of these fleece weight could not be unfortunately done. The same resulted in our inability to study fleece weight in Randozai and Urk stocks. The qualitative characterization of the wool could not be undertaken due to problems of collecting wool samples.

2.6. Haematological Studies:

A total of 15 samples each of goat and sheep were collected from butchers shop , Quetta, taking due care that the animal sampled comes from the areas within Quetta valley. The blood was collected from jugular vein at the time of slaughter in sterilised test tubes and was added EDTA and Heparin in different tubes as anticoagulants for different types of analysis. The methods of Sood (1987) were used for analysis of different haematlogical parameters, while glucose contents were analysed through simpler colorimeric techniques using spectronic 20.

The Sahli's method was adopted for determination of the haemoglobin estimations. The haemoglobin tube was filled till 20 mark with N/10 HCl. To this was added blood till specific mark on the tube (20 μl). Kept the tube stirring for15 minutes and added distilled water until it matched with

brown glass standard. The haemoglobin contents were calculated on mg/ml basis.

The WBC count was achieved through diluting the bloof with Turke's fluid (Glacial acetic acid 1.5 ml; 1% aqueous solution of Gentian voilet, 1.0 ml, distilled water 98.0 ml) and WBC were counted on counting chamber. The RBC count was achieved in normal saline solution on the counting chamber. The total count of RBC/WBC was calculated as;

$$\frac{\text{No. of cells counted X Dilution factor X Depth factor}}{\text{Area counted}}$$

The erythrocyte sedimentation rate was worked out with Westergren's pipette, and fall recorded after 1 hour.

2.7. Milk Analysis:

10 milk samples of sheep were collected from Agriculture College, to represent the general flock of the area. The pH was recorded directly with the help of pH meter, after bringing the milk in Laboratory at University, Queeta. The other papameters were analysed by exploiting suitable methods memtioned by Melbourne (1966).

For determination of fat contents, the milk samples were mixed gently at 25°C. The milk was heated slowly upto 40°C, and reduced the temperature quickly to 20°C, and was maintained at room temperature for 3-4 minutes to allow air bubbles to rise. The fat was then separated from other constituents by treating the milk with sulphuric acid and amyl alcohol while the volume of the fat was measured in Gerber butyrometer tube.

The total solid-not-fat contents of milk was determined by gravimetric method, involving the evaporation of water from a weighed sample under standard conditions. The weight of the dry residue being expressed as a percentage of the milk taken. The total solid contents of the milk sample were then calculated by directly adding the respective fat and not-fat solid contents. The hydrometric method was also used for additional reliance of results, where the hydrometric reading recorded on each sample were converted into density figure ([hydrmetric redding - 1] x 1000) and the total snf contents calculated as:

$$\text{snf} = 0.25 \text{ Density} + 0.22 \text{ Fat contents (\% of total weight)} + 0.72.$$

3. SHEEP

3.1. Adult Weight:

A limited body of the data available on the adult weight of different stocks is presented in Table I. The data suggests that with regard to the adult weight of the individuals of more than 2 years of age, the males are significantly heavier than the females, confirming many of the previous reports coming from both within and outside the country. The weight of the females fluctuates around 32-34 kg, the Randozai and the Baluchi stocks appear to be lighter (33.67 and 32.65 kg) than Hanna and Karakuli stocks (34.08 and 34.08). The weight of the females in the different stocks is not significantly different from one another, when judged by methods of maximum approximation. The males of the different stocks though exhibits a wider variation, with the adult weights ranging from 42.51 in Karakuli, to 44.47 in Baluchi, 45.73 in Randizai and 46.56 kg in Urk stock, thus the Urk stock being the heaviest, followed by Randozai, Baluchi and Karakuli stocks with a gradually decreasing adult weights. Comparing with our present results with the previous ones recorded for different descriptive breeds found around Quetta suggest that the adult weights of both males and females under present study bear a higher body weight. The available informations reported on three breeds frequently found around Quetta, suggest that the male and female adult weight is 37 and 33 in Baluchi; 40 and 30 in Bibrik and 34 and 31 kgs in Harnai breeds (Hasnain, 1985). Comparaing our present results with the previously recorded ones, it appears that the present flocks have

Table I: Adult weights of different stocks of sheeps, being maintained around Quetta, during 1987-88.

Stock	Weight (kg)	
	Male	Female
Randozai	45.23 ± 0.63	33.07 ± 0.91
Urk	46.56 ± 0.84	34.08 ± 0.74
Baluchi (Agri. C)	44.47 ± 0.79	32.65 ± 0.79
Karakuli (Agri.)	42.51 ± 0.82	34.08 ± 0.48

a general heavier body weight as compared with the previous recorded for defined breeds present in the area. A direct comparison of the two body of informations does not appear to be valid, as the mode of collection of the data, the area of survey and type of the animal flocks used for such data has not been recorded in the reference under discussion. Thus the present results have to be taken with caution, so that these does not directly suggest an improvement of the flock or genetic potentials through selection and/or introduction of alleles from other breeds. The results of Hazel and Terril (1945) and Ahmad and Zafar (1983) tend to suggest that ewes above two years of age are heavier than those of less than two years, and there are possibility that the Hasnain (loc cit) included all the mature individuals in the data, while our data represent individual aging between 2 and 7 years. Variations in the adult weight in studies conducted at different times on the same basic stock has been reported previously, as the studies on the Afghan sheep flock maintained at Bahadurnagar Research Farm suggested and average male and females weight of 85.00 and 46.29 kg (Ahmad, 1985), and 88.82 and 48.74 kg (Ahmad and Ahmad, 1987).

Our results when compared with others reported for different breeds suggest that these stocks of sheep are heavier than Salt Range sheep (20.10-40.00 kg), while this flock falls within the weight range described for Kajli breed (31.67 - 47.81), and this is lighter in adult weights as compared with Lohi (males 55.00; females 32.41±6.25: Ahmad and Khan, 1985; range 23.08 - 49.92 kg: Ahmad, 1982), Awassi (males 60-90, females 30 - 50 kg; Mason, 1967), and Afghan sheep (88.82 and 48.74 in males and females: Ahmad, 1985). However, all these stocks have been maintained in controlled conditions of government sponsored farms, while our flocks are being maintained on the normal grazing in the basically arid land natural pastures, without supplemented rationing. Further, our results have been obtained from averaging the year long data, which exhibits seasonal variations as per vegetative conditions around.

Table II and Fig. I present the available data on the average adult weights of the different stocks during different months of the year. A look at the data suggests that adult weight exhibits a regular cyclic variation during different parts of the year. This variation appears to be remarkably persistent in the two sexes, as also in different breeding stocks of the sheep maintained in the area under study. The average body weights are minimum during July through October, whence onward the weights start increasing with a minor peak achieved during December. The body weight show a slight decrease during January through March, when

Table II: Annual variations in the adult weight of different stocks of sheep maintained around Quetta during 1987-88.

Month	Weight (kg) ± S.E							
	Randozai		Urk		Baluchi		Karakuli	
	♂	♀	♂	♀	♂	♀	♂	♀
June, 87	42.15± 3.15	35.29± 3.37	43.45± 4.23	36.10± 2.17	41.00± 4.14	33.95± 3.49	42.67± 3.18	33.00± 1.35
July	41.92± 2.19	33.32± 3.37	43.29± 2.34	35.23± 1.89	40.75± 3.40	31.42± 2.21	38.67± 1.45	30.89± 1.79
August	40.67± 4.37	31.12± 1.59	42.15± 3.36	32.09± 2.87	39.75± 3.09	29.80± 3.80	37.67± 1.33	31.43± 2.09
September	39.67± 1.97	30.85± 2.39	40.91± 2.86	31.82± 3.92	38.75± 2.66	29.90± 4.55	36.33± 3.92	30.67± 2.19
October	39.59± 2.37	30.67± 3.74	40.43± 1.42	31.50± 2.89	38.50± 2.75	29.60± 3.85	38.67± 2.40	30.25± 2.46
November	41.92± 1.53	32.82± 2.68	42.93± 4.39	33.50± 1.87	40.75± 2.66	31.60± 3.78	41.50± 1.76	32.33± 1.76
December	44.56± 4.32	35.38± 3.26	45.56± 3.19	36.37± 2.48	43.38± 2.55	34.42± 3.52	44.17± 1.59	34.25± 2.27
January, 88	45.07± 1.45	33.17± 2.78	46.26± 4.32	34.37± 3.45	44.00± 2.58	32.08± 2.18	45.33± 1.67	32.29± 1.87
February	43.62± 2.87	32.54± 1.92	44.56± 1.84	33.82± 2.31	42.75± 2.39	31.62± 2.05	44.50± 1.50	32.45± 1.30
March	43.52± 3.76	33.85± 2.45	44.28± 3.34	35.15± 3.67	42.00± 2.26	32.96± 2.02	44.00± 1.50	32.41± 1.12
April	45.92± 1.29	37.43± 2.31	46.92± 2.52	38.25± 1.37	44.88± 2.40	36.33± 1.99	47.33± 1.20	35.71± 1.06
May	48.31± 3.24	39.21± 4.31	49.05± 3.29	40.34± 2.87	47.13± 2.16	38.17± 2.20	49.33± 1.17	37.71± 1.10

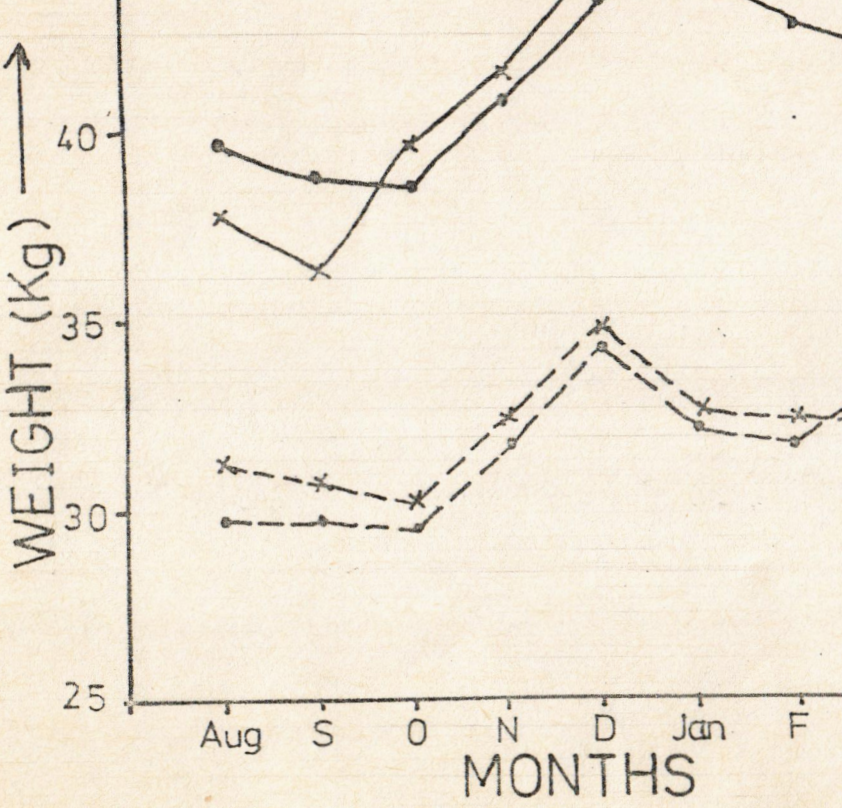


Fig. 1: Monthly variations in the ad
of sheep farmed around Quetta d

the average body weight starts increasing once again so that a prominant peak appears during the month of May, from where onward the weight starts decreasing to the lowest levels in July. Such a pattern of fluctuation in the body weights of the sheep flock can be explained on the basis of the vegetational cyclic changes expected to occur in response to the pattern of rainfall received in the area. Under the normal pattern of rainfall, the area receives a mild shower in July, so that some of the vegetation sprouts in the area which can be regarded as Monsoon ephemerals and under the effect of these better grazing conditions in the natural pastures an early wintering rise in the body weight occurs. The winter rains are heavier and more reliable and these showers/snowfall persists from Late December till late March or even upto early April. The effects of these rains appears on the vegetation after the winter low temperature subsides, and a spring ephemerals alongwith greener shrub vegetation appears in March through May, with the maximum green cover of the vegation appearing in this part of the year. Under the influences of best grazing conditions in the pastures during this part of the year, a corresponding increase in the adult weight is expected. No other identical analysis is in hand for a direct comparison of the data, and further studies would be required to provide support to the present pattern in cyclic changes in the adult weight. A detailed study in the area and other areas, may help in evolving a pattern whereby the conditions in the natural pastures can be optimally exploited for the best possible financial returns to the farmers, as also bearable pressure on the general arid land vegetation which is already under stress of limited availability of water and increasing stress of its over exploitation. The present results appear to be supported to certain degree by the general observations made by Bhattacharya and Harb (1973) on the general nomadic flock of sheep maintained in Labenon suggesting that the adult female weight decreases during December-January period, while it increases during April-May periods under the influence of better grazing condition in the wake of winter rains in the deserts.

Changes in the adult weights of the females are also expected under the pregnancy cycle, which have been presented in Table III, Fig II. It appears that there is a slight increase in the weight of the females at stage the females are preparing to conceive pregnancy, which may be an adaptation of the sheep to prepare itself for the oncoming pregnancy stress. The body weight starts increasing from 1st month of pregnancy, and gradually keep on increasing till fifth month, though a slighly more increase occurs in the later months, and the females gain on the

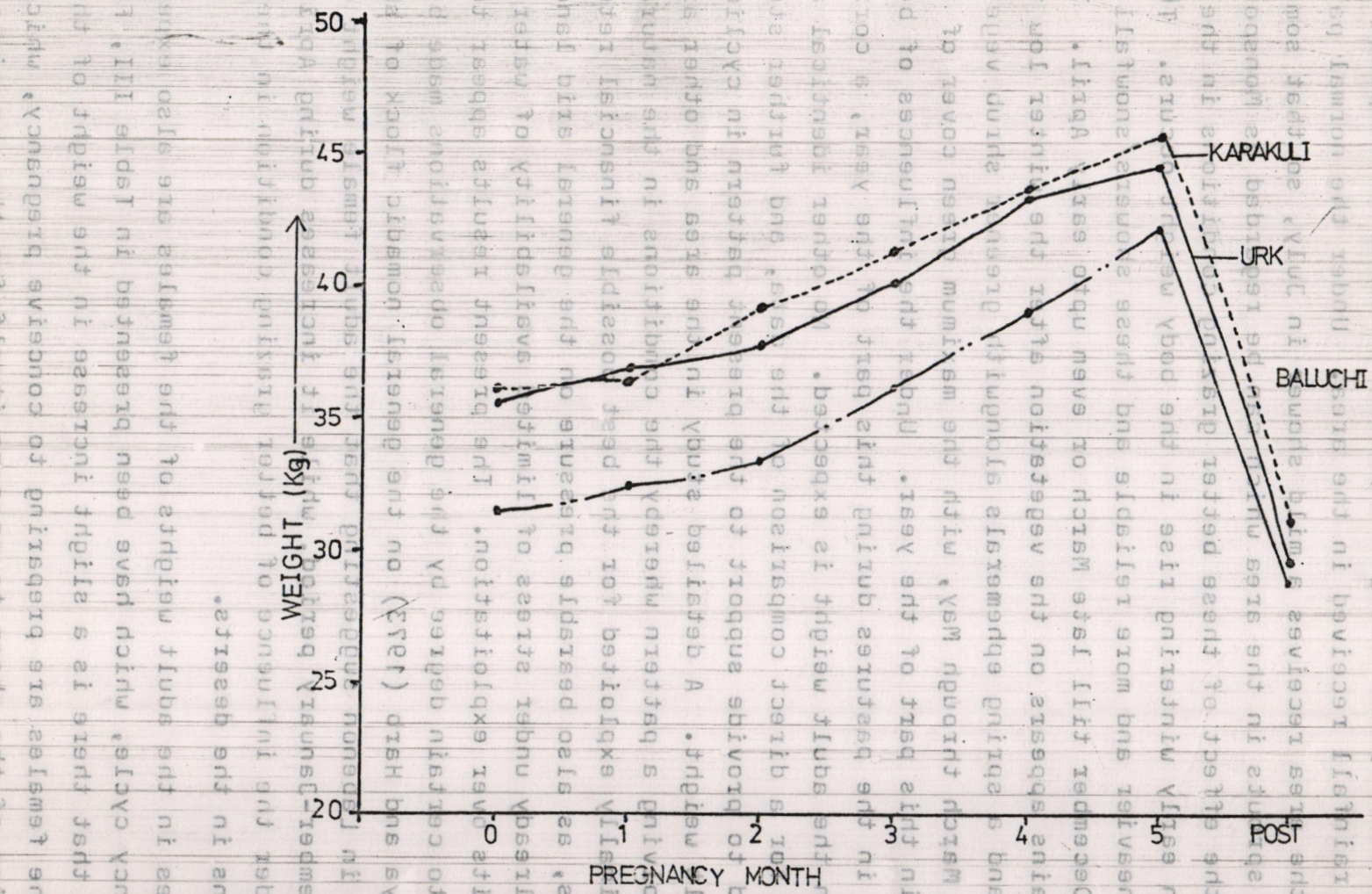


Fig II. A line representation of the variation in body weight of females in sheep stocks associated with pregnancy.

average some 9 kg of weight till the last pregnancy month. On parturation the females losses on the average some 14 kg of weight, so that the female weight after parturation is less than its weight at the time it conceived pregnancy. Thus females loss some 4-5 kgs of weight during pregancy, probably consuming the reserve fats present in the adult females, while norishing the foetus. Comparable data is not available; yet decrease in the weight may suggest that the females in the area remain undernorished during pregancy, so that they have to consume their own stored food during this period. This can be expected under the absence of supplement rationing to the pregnant females, and the stressful conditions may prove harmful to under weight females or those conceiving earlier in age.

Table III: Changes in the weight of the females in sheep under the influence of pregnancy, recorded during 1987-88 in the areas around Quetta.

Stock	Pregnancy month (weight: kg)						Post parturation
	0	1	2	3	4	5	
Baluchi	31.5	32.5	33.5	36.1	39.1	42.2	28.4
Karakuli	36.1	36.6	39.3	41.4	43.9	45.9	31.1
Urk	35.6	36.8	37.7	40.3	43.5	44.7	29.6
Randozai	33.7	35.4	39.5	43.8	46.3	48.2	34.1

3.2. Growth Curve:

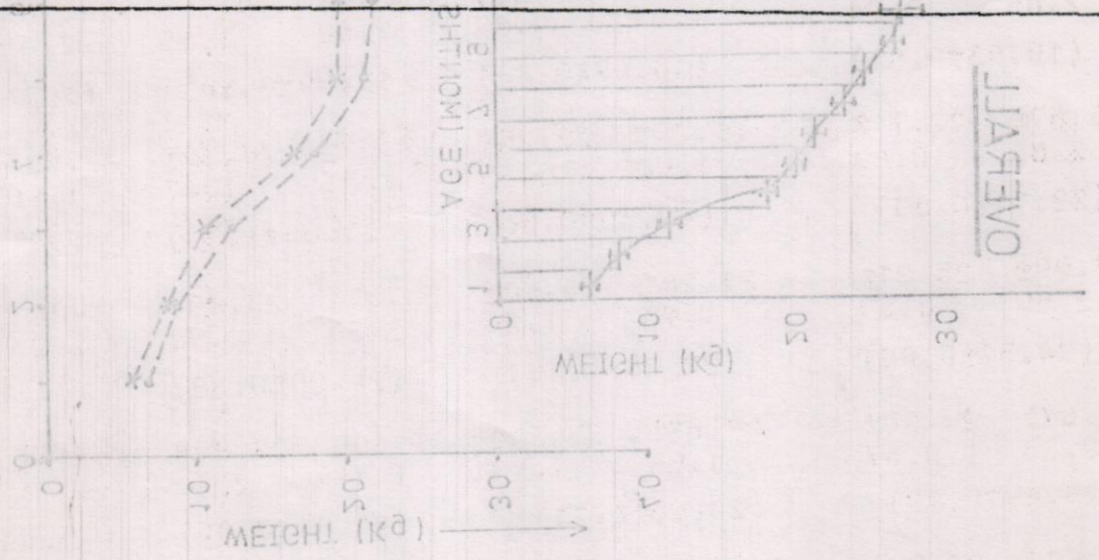
A synopsis of the weight of lambs recorded at different ages has been presented in Table IV as also in the form of growth curves in Fig III. A general look on the data presented in the table and the growth curve would suggest that the general growth curve can be divided into three different phases. An initial relatively rapid increase in the live weight occurs during the first four months of the age of the newborn lamb, increasing the average body weight from 6.05 ± 0.20 kg, with within one month of birth, to 18.16 ± 0.22 kg, at the age of 4 months. A moderate degree of increase in the live weight occurs in the lambs during the second growth phase, spreading over month 5 to 9 of the age. During this phase the body weight increases from 18.16 ± 0.22 to

Table IV: Average weight of different stocks of sheep maintained around Quetta, during 1987-88, at different months ages. The figures appearing in parenthesis represent the overall weights for the respective stock.

Age (months)	Weight (Kg) ± S.E.							
	Randozai		Urk		Baluchi		Karakuli	
	♂	♀	♂	♀	♂	♀	♂	♀
1	7.05± 0.29	6.71± 0.34	6.52± 0.19	6.13± 0.21	5.67 ± 0.33	5.57± 0.20	6.71± 1.19	6.00± 0.31
	(6.82±0.31)		(6.30±0.19)		(5.60±0.16)		(6.50±0.47)	
2	11.51± 0.41	10.75± 0.37	9.54± 0.59	9.02± 0.43	8.33± 0.88	8.14± 0.11	8.14± 0.51	8.25± 0.63
	(11.16±0.25)		(9.32±0.34)		(8.20±0.42		(8.18±1.82)	
3	18.13± 0.46	17.15± 0.48	11.07± 0.52	12.34± 0.62	12.13± 1.68	12.13± 1.03	11.29± 0.64	11.00± 0.58
	(17.61±0.36)		(11.74±0.43)		(12.08±0.84)		(11.18±0.42)	
4	21.33± 0.67	18.20± 0.93	14.51± 0.72	16.02± 0.84	17.00± 1.48	16.43± 0.65	15.83± 0.87	16.33± 0.88
	(19.38±0.89)		(15.26±0.71)		(16.71±0.78)		(16.00±0.62)	
5	23.76± 2.85	19.93± 0.74	16.27± 1.34	18.67± 0.88	20.20± 1.50	19.50± 1.15	20.00± 1.00	21.00± 1.00
	(19.93±0.91)		(18.67±0.88)		(19.89±0.84)		(20.40±0.68)	
6	25.67± 2.85	22.71± 0.83	18.00± 1.00	20.25± 0.35	22.67± 2.73	20.38± 1.67	22.50± 1.50	23.12± 0.86
	(22.71±0.83)		(19.50±0.56)		(21.00±1.39)		(22.67±0.76)	
7	27.00± 2.65	23.91± 0.69	21.28± 1.73	23.60± 1.36	24.67± 2.33	23.89± 0.98	23.04± 1.23	24.87± 0.87
	(24.57±0.80)		(22.25±1.16)		(24.08±0.88)		(24.02±0.93)	
8	28.67± 2.33	24.80± 0.57	22.67± 1.58	25.50± 1.19	25.25± 1.15	23.89± 2.14	24.13± 0.85	25.93± 1.13
	(25.69±0.79)		(23.80±1.11)		(24.02±0.85)		(25.02± 0.63)	
9	29.67± 2.33	26.30± 0.42	24.75± 2.25	26.00± 1.10	27.50± 1.15	27.13± 0.90	25.00± 0.25	26.84± 1.13
	(27.08±0.69)		(25.44±1.11)		(27.13±0.78)		(25.67±0.32)	
10	30.00± 4.00	27.60± 0.51	23.50± 0.67	26.00± 0.63	29.25± 1.15	27.33± 1.07	27.00± 0.89	28.15± 1.67
	(28.29±1.04)		(24.75±0.58)		(27.92±0.87)		(27.33±0.23)	

Table IV..... continued

11	31.67± 2.13	28.43± 0.81	28.33± 1.69	26.50± 1.19	30.00± 1.15	28.67± 1.30	30.00± 0.50	28.96± 0.35
	(28.88±0.83)		(27.60±1.11)		(29.08±0.97)		(29.67±0.35)	
12	33.67± 2.03	31.00± 0.68	28.88± 2.06	31.33± 1.20	29.50± 1.15	30.11± 1.71	31.00± 1.00	32.12± 2.13
	(31.38±0.74)		(29.50±1.05)		(30.53±1.15)		(31.33±1.98)	
13	35.67± 2.02	32.33± 0.68	28.67± 0.95	29.83± 1.68	29.75± 1.93	30.89± 1.48	31.50± 0.50	30.87± 0.93
	(33.00±0.74)		(29.25±0.94)		(30.53±1.15)		(30.67±0.47)	
14	37.00± 3.00	34.00± 1.03	33.00± 1.70	30.67± 1.74	32.75± 0.76	31.11± 1.07	30.50± 0.25	29.87± 0.98
	(34.75±1.06)		(29.25±0.94)		(31.50±0.50)		(30.33±0.46)	
15		33.50± 1.50	34.80± 1.85	32.17± 1.82	33.67± 1.22	30.71± 1.29	33.86± 1.85	33.75± 2.76
			(33.36±1.30)		(31.60±1.03)		(34.00±1.13)	
16			39.69± 1.22	32.00± 2.08		33.00± 1.86	35.50± 1.20	36.80± 1.31
			(53.83±2.02)				(36.05±0.75)	
17			42.00± 2.00			35.67± 1.89		



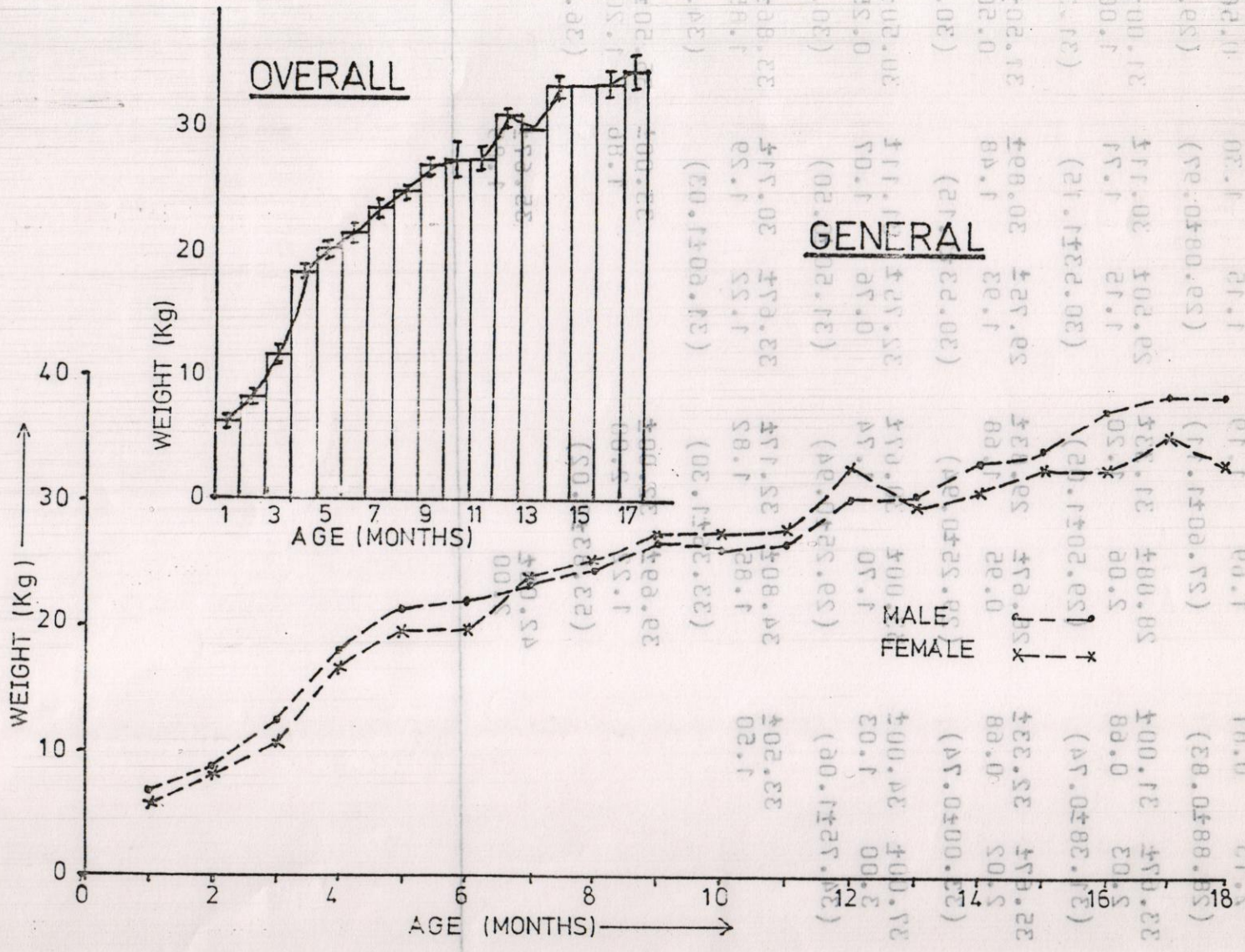


Fig III: Growth curve followed by the general male and female stock and the overall stock of sheep farmed around Quetta during 1987-88.

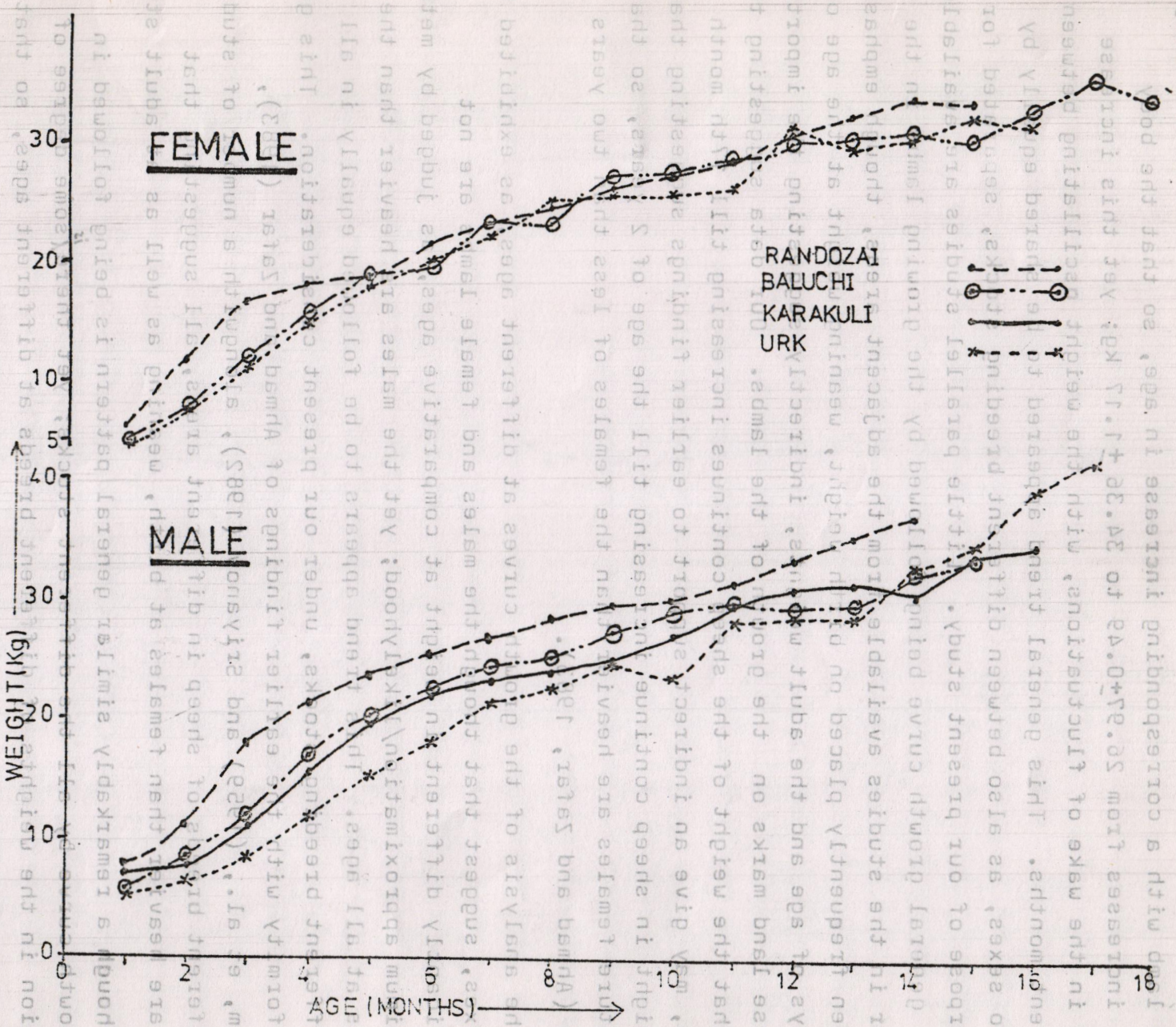


Fig III-a. Growth curves followed by males and females of different stocks of sheep farmed around Quetta during 1987-88.

26.97 ± 0.49 kg. In the third phase extending from the age of 9 months upto 17 months, though exhibits a progressive slow increase in the weight of the lamb with a corresponding increase in age, so that the body weight increases from 26.97±0.49 to 34.36 ±1.17 kg; yet this increase occurs in the wake of fluctuations, with the weight oscillating between different months. This general trend appeared to be shared equally by the two sexes, as also between different breeding stocks, separated for the purpose of our present study. Little parallel studies are available on the general growth curve being followed by the growing lambs in the area or in the studies available from the adjacent areas, though emphasis has been frequently placed on birth weight, weaning weight at the age of 120 days of age and the adult weights, indirectly suggesting the importance of these land marks on the growth of the lambs. Our data suggesting the fact that the weight of the sheep continues increasing till 17th month of age, may give an indirect support to earlier findings suggesting that the weight in sheep continue increasing till the age of 2 years, so that the mature females are heavier than the females of less than two years in age (Ahmad and Zafar, 1983).

The analysis of the growth curves at different ages, as exhibited by two sexes, suggest that though the males and female lambs are not significantly different in weight at comparative ages, as judged by methods of maximum approximation/likelyhood; yet the males are heavier than the females at all ages. This trend appears to be followed equally in all the different breeding stocks, under our present consideration. This goes in conformity with the earlier findings of Ahmad and Zafar (1983), Ghoneim, et al., (1959) and Sriyanov (1982), alongwith a number of studies on different breeds of sheep in different areas, all suggesting that males are heavier than females at birth, weaning as well as at adult stage.

Though a remarkably similar general pattern is being followed in the growth curve by all the different stocks; yet there is some degree of variation in the weights of different breeds at different ages, so that some degree of variation exists in the interstock growth curves (Fig III b and c). In females such a pattern appears to be rather mixed one, so that all the different stocks appears to oscillate around a central growth line, none of the stocks emerging as significantly separate with remarkably different growth line. The female lamb weights of different stocks runs above or below one another at different stages in age. In males however, different stocks appear to follow different curves, each remarkably different from other. The male lamb of Randozai stock appears

to be remarkably heavier than the other three stocks at all the ages. The Karakuli and Baluchi stocks being maintained with the Agriculture College, are thoygh not significantly different from one another with regard to lamb weight at different ages; yet in general the Baluchi stock is heavier than the Karakuli. The Karakuli males have a higher birth weight than the Baluchi stocks. The Urk stock though bear a lighter live weight of the male lambs till 13th month of age, whence onward its weight starts increasing rather more rapidly, and it attains a higher weights at month14 through 16, as compared with the Baluchi and Karakuli stocks of Agriculture College, though still it remains below that of the Randozai stock. No previous study is available in the area for a direct comparison of our results. The variations in the weights of the lambs at different ages, as also adult age can be attributed to the interstock genetic variations, some of the stocks having the potentials of adding comparatively more body weight than others. These variations can also be attributeble to the rearing conditions available under different regimns, including the availability of pasture, additional rationing provided and the expertise of the breeders, to provide suitable conditions. The effects of better pasture conditions on the general weight of the individuals has been proved by our present study suggesting that in the favourable pasture conditions, the individuals gain weight, while it is lost under unfavourable conditions. However, the general vegetation conditions and cover remains remarkable same in the three different tracts under study, mainly sharing the general physical conditions. In the wake of the availability of water in the Hanna-Urk, valley one would expect a geater availability of pastures, if at all these are worker as potent controlling factor, but our result suggest that the stocks reared in the area has a general low body weights. Similarly, the protected area available with the Agriculture College, may also suggest a comparatively better pasture conditions; but still the stocks maintained in the area generally bear a low weight than Randozai stock. Though further research would be required to negate the effect of the available pasture conditions, yet at present the effect of the available vegetation conditions appears to be limited to produce the interstock differences in the growth curve, exhibited under our present study. No additional rationing has been provided to any of these stocks, thus shuning the possibility of such an effect on the growth curve of different stocks. The fact that a general grazing of the sheep is exercised in different areas, lambs being reared exclussively on mother's milk for the first month and flocks are maintained in Kaccha barns in all the different area, may also negate the effect of expertise

of the breeder, especially when believing that the area has traditional habit of maintenance of sheep/goat stocks; thus developing fair amount of expertise for general flock maintenance. This will leave us to a possible explanation of the interstock differences in the growth curve, to a considerable degree attributeable to the interstock differences, due to variations present at genetic level.

The birth weights recorded for the different breeds of sheep, being generally maintained in the area appears to fluctuate around an average range of 2.4-2.6 kg, in male and 2.0-2.4 for female lamb. The data on the actual birth weight appear to be limited with us, as per practical problems of reaching a partirating female. The data available with us, however, tends to suggest that the general birth weight of all the stocks is more than that suggested in the above compilation of Hasnain (1985). It remain between a range of 4.0 to 4.75 kg in males and between 3.5 and 4.5 in females, with Randozai, being heaviest, followed by Karakuli, Baluchi and the Urk stock having the lowest birth weights. The increase in the birth weight in the present study can be partially attributed to to a gradual selection of the stocks by the breeders, which is being exercised in the area generally. The studies of Ahmad and Saleem (1981) on Lohi, Kacchi and Awassi breeds has sufficiently indicated that selection of rams is liable of producing the progeny with higher birth weights.

With regard to birth weight, different stocks under our present study appear to be heavier than Kacchi and Awassi breeds (Ahmad and Saleem, 1981). These stocks also appear to be heavier when compared with the birth weights suggested for general flock of Lohi breed as suggested by Sharif, et al. (1981) and Saleem and Shah (1981), however, these stocks have a compareable birth weights with the selected stock of the Lohi breed as reported by Ahmad and Saleem (1981). These birth weight also fall within a permissible limits of the birth weights described for the Afghan sheep (Ahmad, 1985; Ahmad and Ahmad, 1987), a general nondescriptive sheep stock coming from Afghanistan.

The weaning weights, as recorded at the age of 120 days (4 months) of age can also be derived from the general growth curve suggested for different stocks, as also for the general pooled breeding stock for the area. The data suggests that the overall weaning weight of the stock fluctuates around 18.16±0.22; with the weaning weight in males being 18.50±0.98 and in females 17.48±0.56 kg. The weaning weight ranges from 16.00±0.62 kg (males: 15.83; females 16.33) in Karakuli to 16.71±0.78

(males 17.00; females 16.43) in Baluchi stock, to 19.38±0.91 in the Randozai stock (male: 21.33; females: 18.20). In Urk stock the data is limited on the weaning weight at the age of 120 days with a few females weighing around 19 kg. A considerable variations exist in the weaning weight of Lohi sheep as reported in different studies; with a range from 18.65 kg (Ahmad and Khan, 1985) to average weight of some 22 kg (Sharif, et al., 1981) and 32.08 (Ahmad and Saleem, 1981), suggesting that certain growth conditions are liable of having a significant effect on the weaning weight, and the studies of Akram (1973) provides support to the fact, suggesting that there is a significant decrease in the weaning weight, if the flock is being maintained in the ppstures with a crrying capacity lower than required for the total grazing animals. The weaning weights of different stocks under our present study generally fallsconsiderably less than reported for different breeding stocks, except for some matching of Randozai stock with the Lohi stock under study of Ahmad and Khan, (1985). The low weaning weight of all the stocks can be attributed to the fact, that whereas the stocks used in the other studies were maintained under control conditions with supplemented rationing and optimal grazing conditions, the stocks under our present study are being maintained on the normal grazing on the general vegetation, which is dry in character under the generally prevailing arid conditions, thus mostly surviving under sub-optimal conditions. The flocks of sheep maintained in the area appear to have adopted to the general available conditions, as despite the low weaning weight, which appears to be most adversely effected under the rearing conditions available, the adult weight is maintained, which remains higher and/or almost normal to the other breeds recorded in different areas. This observation, however, caution the farmers that the flocks of sheep are being maintained at sub-normal conditions, probably with a higher number of the grazing flock than the general carrying capacity of the area. Such a process is liable to have effects on the future life in the area, liable to face deforestation, erosion and desertification.

3.3. Growth Rates/Turn Over Rate:

A summary of the available data on growth rates, at different ages in different stocks being maintained around Quetta has been presented in Table V, and expressed graphically in Fig. IV. The variation in growth rate at different months of age show an interesting pattern. The general growth rate appears to gradually increase persistantly during the first four months of age. It inceases from some 60 gms of weight gained per

Table V: The growth rates, calculated on the basis of the weight gained per day per animal (gms) in different stocks of sheep maintained around Quetta, during 1987-88.

Age (months)	Average growth rate (gms/day/animal)									
	General		Randozai		Urk		Baluchi		Karakuli	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1	60	58	93	90	84	79	39	52	74	67
2	63	78	149	135	101	96	88	85	47	75
3	128	112	221	213	52	111	122	133	105	92
4	194	201	111	40	115	123	166	143	151	178
5	103	67	81	27	59	88	107	102	139	156
6	24	65	63	97	58	53	82	29	83	66
7	49	65	44	67	109	112	67	117	17	66
8	48	54	56	30	47	63	19	0	33	33
9	71	66	33	50	46	17	75	108	33	33
10	16	15	11	43	68	58	58	7	66	33
11	-16	12	56	28	68	58	25	47	100	33
12	107	43	67	86	18	58	33			100
13	7	43	67	44					16	

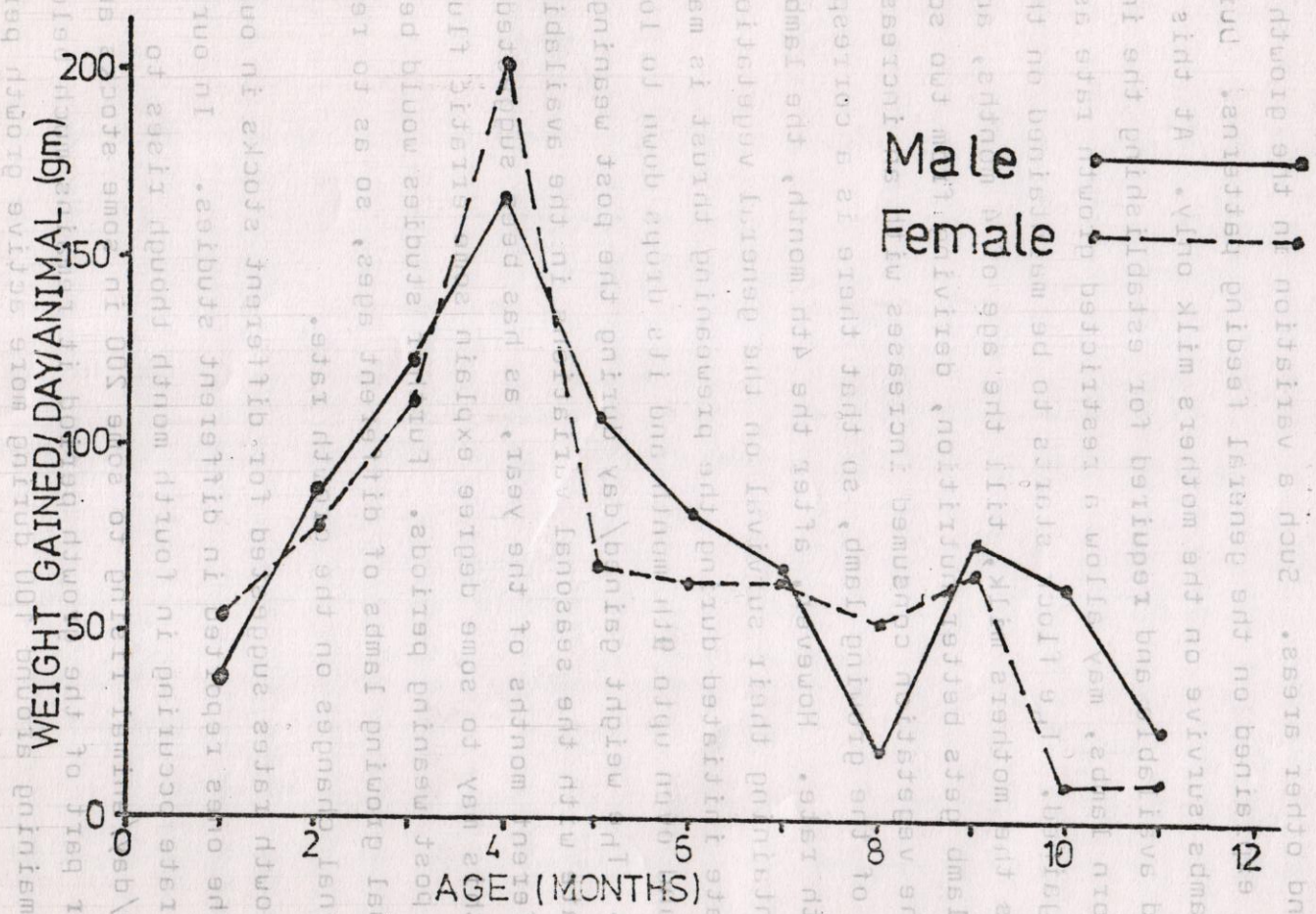


Fig IV: Variations in growth rate (weight gained/day/animal) in different months of age in different stocks of sheep farmed around Quetta during 1987-88.

day per animal during 1st month to 70 during 2nd, 120 during 3rd and the maximum growth rate of some 197 gm/day is recorded during 4th month. The growth rate then decreases slowly in month 5 to 9, with an average gain of some 59 gms/day/animal. The growth rate further slows down in older ages which averages around some 49 gms/day/animal. Similar general pattern is followed in all the different stocks, with some variations. No compareable study is available suggesting the growth rates at different ages, and hence further data may be required to support this pattern for this area and other areas. Such a variation in the growth rate at different ages can be explained on the general feeding patterns. During the first month the lambs survive on the mothers milk only. At this stage, the limited food available and required for establishing the initial survival of the newborn lambs, may allow a restricted growth rate as expressed by the weight gained. The flock starts to be maintained on the general grazing plus the mothers milk, till the age of 4 months, and during this period the lamb gets better nutrition, deriving from two sources. The amount of the vegetation consumed increases with an increase in the weight/size of the growing lamb, so that there is a corresponding increase in the growth rate. However, after the 4th month, the lambs are generally weaned, maintaining their survival on the general vegetation. Some degree of growth rate initiated during the preweaning thrust is maintained for month 5-6, and even upto 9th month and its drops down to lower levels at higher ages. The weight gained/day during the post weaning ages, may also fluctuate with the seasonal variations in the availability of the food in different months of the year, as has been suggested by our present study; and this may to some degree explain some erratic fluctuations occuring at post weaning periods. Further studies would be required on the individual growing lambs of different ages, so as to record the effect of vagetational changes on the growth rate.

The growth rates suggested for different stocks in our study generally fall below the ones reported in different studies. In our studies a peak growth rate occuring in fourth month though rises to figures falling above 150 gm/day/animal rising to some 200 in some stocks and sexes; yet for the major part of the growth period it remains much below these levels, generally remaining around 100 during more active growth periods and around 50 in rest of the growing periods. A growth rate of 172 gms/day/animal (Akram and Ali, 1972) and 125 (Ahmad and Khan, 1984) for Lohi; 200 (Akram and Ali, loc cit) and 217/177 (male/females; Wardeh, 1969) for Awassi, 154 for Kacchi; 195 for crossbred between Awassi, Lohi and Kacchi stocks (Akram and Ali, loc cit) and 247 ... 235 f... fghan males and

210 for Afghan females (A h m a d, 1985 ; and Ahmad and Ahmad, 1987). A growth rate of 191 gms/day/animal has been suggested for the general nomadic sheep flock studied in Lebanon by Bhuttacharya and Herb (1973). A direct comparison between our results and those obtained in the other studies quoted is not very useful in the wake of the fact that most of these stocks are being maintained under suitable breeding/farming conditions and mostly represent the preweaning growth rates. However, this might partially indicate some degree of genetic difference existing between the different breeds and stocks; but it appears to be mainly attributeable to the grazing conditions/availability of the nutrient conditions. Such a difference in the growth rate has been suggested in one of the study (Ahmad and Ahmad, 1975), where the same stock when maintained on different rationing pattern gave different growth rates. The growth rate in this study exhibited a significant change from 68 gms/day/animal when the normal grazing was supplemented with barseem leaf residue (68%) and 77 when supplementation occurred with Urea (1.5%), wheat bhossa (46%) plus cotton seed cakes (20.5%) to 113 when additional ration of baseem leaf residue (50%) plus urea (1.5%) and wheat bhoosa (16%) was provided and to 159 gms/day/animal when food was supplemented with wheat bhoosa (18%) plus cotton seed cake (50%). Similar results has suggested Saleem and Shah (1983) to propose that growth rate in Lohi sheep is suppressed under the stress of early weaning and twice a year lambing pattern. The general conditions of the pastures in the study area can be regarded as poor, under a consistantly increasing grazing stress. The area was also under the influence of persistant drought effecting the general vegetation adversely. Thus the stocks under the present study was under the abnormal stress conditions on available nutrition, which may be responsible for largely lowering the growth rate. Further studies would be required in the area to know the growth rates of different stocks in different years as also during the favourable pasture conditions, which may give an idea about the actual genetic potentials of the local stocks as compared with other breeds/stocks.

The data on the computed turn over rate as judged by the weight gained per day per unit body weight has been presented in Table VI. A general consideration of the available figures suggest that a relatively higher turn over rate is exhibited till fourth month of age, dropping significantly till the month 9, when onward the turn over rate can be regarded as very low. The present parameter on the turn over rate appears to be valid on the grounds that the increasing body weight of the individual results in an increased intake of food, and hence yield comparative figure for the

Table VI: The turn over rates, calculated on the basis of the weight gained per day per unit body weight (gms) in different stocks of sheep maintained around Quetta, during 1987-88.

Age (months)	Turn over rate (gms/day/unit body weight)									
	General		Randozai		Urk		Baluchi		Karakuli	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
1	12.96	14.50	13.19	13.41	12.88	12.89	9.75	13.00	16.44	16.75
2	9.78	10.96	12.95	8.37	8.81	10.64	15.52	15.44	7.00	12.50
3	15.37	13.86	12.19	12.42	4.70	9.00	14.65	16.34	12.90	11.15
4	15.94	17.57	6.17	2.35	7.92	2.50	13.83	11.79	13.37	16.18
5	5.72	3.83	3.80	1.48	3.63	1.45	6.29	6.13	8.78	9.55
6	1.14	3.33	2.65	5.10	3.22	2.83	4.06	3.74	6.95	3.14
7	2.32	3.08	1.71	3.06	5.06	5.53	2.96	3.58	0.76	2.87
8	2.06	2.06	2.07	1.25	2.21	2.67	0.77	2.26	1.43	1.43
9	2.87	2.67	2.48	2.16	2.03	0.67	3.04	2.26	1.38	1.26
10	- 0.60	0.56	1.21	1.63	2.75	2.23	2.16	0.26	2.64	1.22
11	0.61	0.46	1.20	1.01	2.89	2.23	0.95	1.72	3.70	1.18
12	3.98	1.63	1.13	3.02	0.64	2.19			1.10	3.45

general quantum of the food consumed. No comparative analysis of the data is available regarding the turn over efficiency of sheep stocks present in the adjascent areas, therefore the implications of the present findings are hard to be concluded. However, with the present body of the informations at hand it can be suggested that at least the males lambs, being generally exploited for meat production can be beneficially exploited, if these are sold at the age of around 6 months. With the increasing age, these lambs would have adverse effects on the general pasture conditions than the actual gains. Such a pattern can help in leaving the available pastures for the breeding male and female stocks, thus saving them from malnutrition and thence increasing their reproductive efficiency. The turn over rates, are also likely to vary with a variation in the type of the food available, which actually can not be judged under our presently evolved constant. Further studies would be required on controlled stocks, so as to estimate turn over rates with the actual quantity of the food consumed, giving due thought to different type of the food/condition of the food materials.

3.4. Breeding Performance:

A comparative account of the different parameters relating to reproductive efficiency of different stocks, under our present study has been presented in Table VII. The percentage of the reproductively active adult females, actually conceiving/reproducing, as represented by the fertility of the stock, suggest that Urk stock is reproductively more active with some 90% fertility, followed by Karakuli stock with 75% fertility, and Baluchi stock exhibiting 69.23% fertility. The Randozai stock appears to be least fertile with a fertility of 64.13% (column I, Table VII). No previous report presents data on fertility of the females in the sheep stocks maintained in this area or that in the adjascent areas. Different studies available on stocks/breeds maintained in Pakistan suggest a wide variation in the fertility of the female sheep. The studies on Lohi breed suggest a fertility of 96.1% (Sharif, at al., 1981), while fertility figures of 85.7% (Ahmad, 1985) and 97.1% (Ahmad and Ahmad, 1987) has been suggested for Afghan stock. Comparing these figures it appears that the fertility in all the stocks under our present study is lower than that suggested for two other breeds/stocks studied in Pakistan. This fact does not necessarily indicate a low reproductive efficiency of the stocks maintained around Quetta, and such a difference can be safely attributed to the available nutrition conditions for the different stocks under discussion. The stocks around Quetta being maintained on natural grazing, without organized breeding regimn

Table VII: A summary of the data on different parameters of breeding performance of different stocks of female sheep maintained around Quetta during 1987-88.

	Randozai	Urk	Baluchi	Karakuli
Fertlity (%)	64.13	90.00	69.23	75.00
Lambing Pattern (%)				
once/year	100.00	33.33	55.56	88.99
twice/year	0.00	67.67	44.44	11.11
Twining Pattern (%)				
singles	85.71	84.71	69.23	100.00
twins	14.29	15.29	30.77	0.00
tripple	0.00	0.00	0.00	0.00
No of lambs born/year/ewe	1.04	1.05	1.31	0.83
Breeding Season (%)				
summer	0.00	40.00	38.46	10.00
winter	100.00	60.00	61.53	90.00

facing grazing stress and low nutrition conditions, especially during the years under extreme drought conditions, are at obvious disadvantage as compared with the stocks farmed under expert management with supplemetation of rationing. Further, the present data is limited to one season only, and with limited observations, demanding further more elaborate studies to know the exact reproductive fertility of the stocks maintained in Quetta/Baluchistan.

A look on column 2 and 3 of the Table VII would suggest that variations also exist in once a year or twice a year lambing pattern in different stocks. The Randozai stock all the females exhibit once a year breeding pattern, and none of the females, under our present study showed twice a year lambing. The majority of the females in Karakuli stock (88.99%) reproduce once a year, with a very minor proportion (11.11%) reproducing twice a year. In Baluchi stock, though the proportion of the ewes showing once a year and those showing twice a year breeding pattern is almost equal, yet once a year breeding ewes dominate in proportion (55.56%) over twice a year breeding ones (44.44%). In Urk stock, however, twice a year lambing ewes (66.67%) dominate in proportion over once a year breeding ones (33.33%). It may be kept in mind that in none of the area/stock orgainzed breeding is managed and the ewes remain exposed to the rams throughout the year, and the females mating/conceiving whenever these are physiologically ready/have a chance. The present study appears to be the first one in the area, and can be regarded as preliminary initial study, with a limited bearing, demanding some future detailed studies on this aspects, and in finding the effects of once/twice a year lambing pattern on mother/stock/ecomonic gains/general health of the lambs. Our present findings go in line with some of the preliminary data available on other stocks studied in Pakistan, with the fact that different stocks appears to have different potentials of breeding once/twice a year, the major part breeding once a year Lohi (Ahmad and Zafar, 1983), Afghan (Ahmad, 1985) under normal breeding regimn. Bhattacharya and Herb (1978) reported that once a year breeding pattern is allowed in the sheep stocks maintained by nomades in Lebanon. However, the studies of Ahmad and Khan (1985) suggested that in Lohi breed under the farming conditions available with Bahadurnagar Farm, allows 55.9% of the females to breed once a year and 20.2% breeding on twice a year pattern. The studies of Saleem and Shah suggested that while 81.5% of the reproductively active females show autumn estrus, some 55.4% do exhibit spring estrus, thus availability of potentials of twice a year breeding pattern in a part of the stock. Under special rich diet, early weaning

and injections of estradiol can help in commiting the ewes to twice a year lambing pattern.

The available data on twining pattern also exhibit variation between different stocks; yet all the stocks are unifirm in the fact that the rate of tripple births is very low, as suggested by appearing of none of the ewes showing tripple birth in the animals under our present study during the study period. The frequency of appearance of twins is lowest in Karakuli stock, maintained at the Agricultural College (0.00%), the Randozai and the Urk stocks having almost rate of appearance of twin births with twining frequency of 14.29% and 15.29%, respectively. The Baluchi stock, however, appears to have a significantly higher proportion of twin births (30.77%), as compared with other stocks, under study. Some widely different results has been quoted for Lohi breed in the two studies conducted on the same basic stock/similar farming conditions, with twining proportion varying from 28% (Sharif, et al., 1981) to 9.3% (1.6% tripple birth: Ahmad and Khan, 1985). In Afghan stock the proportion of twins has been reported to be around 8.53% (Ahmad, 1985). Though, environmental variations are expected to effect the proportion of twin/tripple births, for the analysis of which our present data has a limited bearing; yet it appears to have some degree of influence of genetic potentials of the stock under consideration. In the wake of the fact, that our stocks are surviving under stress conditions in the presence of persistant drought in the area, it appears that in general, the stocks maintained around Quetta under traditional sheep farming conditions have better potentials of twin births. Further studies would be required to substatiate the hypothesis, especially with elaborate data collected under different nutrional conditions and in different years. The fact that both Baluchi and Karakuli stocks are being maintained at identical farming conditions available with the Agriculture College; yet Baluchi stock exhibiting appreciable higher proportion of twining as compared with Karakuli; may suggest a greater genetic influence on the proportion of twin births, and the interstock variations can be attributed to the genetic hereditable variations within stocks. This may also suggest that swlecting breeding programme can help in development of the stocks having a higher tendency of twin births, thus increasing the economic returns to sheep farmers.

The number of lambs born per ewe per year can work as useful comprehensive parameter regarding reproductive efficiency of a flock in terms of direct economic returns, it is liable to fetch. With regard to this parameter, the Baluchi stock maintained at Agricul e College,

appears to bear higher potentials with an average of 1.31 lambs produced per female per year. Two locally maintained stocks have almost equal potentials, i.e., 1.05 Urk and 1.04 Randozai stocks, of production of lambs; while Karakuli stock maintained at Agricultural College has the minimum potentials (0.83 lambs/ewe/year). The present study appears to be the first one to work out this reproductive parameter for the breeds/stocks being maintained in this area and also in the province of Baluchistan, and hence the comparative data is lacking from the area to know the validity of the presently collected informations, as also knowing the general trends in the area. With regard to the breeding potentials as judged by lambs produced/ewe/year are in general our stocks runs close to the Lohi breed, though a widely different figure has been quoted in different studies, ranging from 1.89 (Saleem, 1978; Saleem and Shah, 1983), to 1.18 (Sharif, et al., 1981), and 1.04 (Ahmad and Khan, 1985). These stocks also appear to be similar to Afghan stock (1.07; Ahmad and Ahmad, 1987). Wide variations in the number of the lambs produced per ewe per year, reported from a basically same stock by workers during different years might suggest the influence of a number of environmental factors, apart from the genetic ones, which collectively contribute in the overall potentials of a breeding stock to produce the number of lambs. However, as our stocks were facing some extreme conditions of stress factors, attributable to a general effects of the over grazing of the pastures, alongwith its augmented effects through the persistence of drought in the area, may suggest that the results presented under the present study suggest some minimum potentials of these stocks, and under the better conditions of the available pastures these breeding potentials are liable to improve. Such an improvement of the potentials has been suggested whereby the heavier mothers (Ahmad, 1983), and better breeding conditions supported by supplemented rationing (Saleem and Shah, 1983; Land and McClelland, 1971). Saleem and Shah (1983) reported an increase from 1.06 lambs produced per ewe per year to 1.89 in Lohi sheep, under such an arrrangement, while Robinson, et al., (1975) increased lamb production from 2.3 to 3.3 lambs/ewe/year, using progesteron/photoperiodism controls. If these factors are considered together, it can be suggested that the stocks under our present study have good potentials of production of lambs, and this reproductive efficiency is specially high in case of Baluchi stock and further that the stocks are ecologically adapted to arid conditions of the area and to survive effectively under stress grazing conditions.

Different stocks appears to have different potentials of breeding

during summer and/or winters. In Randozai stock, virtually no parturation occurs in summer, suggesting that no winter/spring matting occurs and all the offsprings are a result of late summer or autumn breeding activity. In Karakuli stock, however, some 10% of the lambing occurs in summer, while lambing episode is restricted to winters. Urk and Baluchi, appears to have two reproductive seasons, and a good proportion of the flock lambing during summers and also in winters, though the major lambing episode occurs during winters.

Table VIII summarises the available data on annual variations in the lambing activities, as represented by percentage od the births coming during different months. Each stock appears to have a distict pattern of production of lambs. In Randozai stock, the lambing episode occurs during February and March, with some births coming during January and also in December. The Urk stock the major lambing occurs during June and also in December-January periods, though some limited lambing activity also appears in May and also in February. In Baluchi stock, a high level of lambing occurs during June and in January, though some significant lambing occurs in February and December. A low proportion of lambs are also produced in March, May and July. The lambing occurs in peak during February in Karakuli stock, with a low level of lambing activity during March and December. A low level of lambing activity also appears in January and June. All the different stocks appears to be remarkably similar to one another with regard to the fact that no lambing occurs in April and in the months Auguest through November. The direct information collected on the breeding activities during different parts of the year are limited; but when the informations available on the lambing pattern are combined with the fact that sheep in general has a gestation period of 150-160 days, it appears that the breeding activities starts in July extending upto Auguest to varying degrees in different areas/stocks, as per physico-biotic conditions available around. The second round of the reproductive activity occurs in November- December, some parts extending upto early January. These informations fits the general belief that sheep are short day animals. This pattern also appears to fit in the general vegetative cycle being followed in the area, so that new born youngs are being produced during the periods, when the vegetation conditions are favourable, under the winter/summer rains received in the area. Few studies are in hand suggesting monthly variation in the reproductive activity in sheep to support our present findings, though Bhattacharya and Harb (1978) suggested that in Lebanon, the general nomadically maintain stock breed in late June and July, with lambs appearing

Table VIII: A summary of the data representing cyclic annual variations in reproductive performance of the females in the stocks maintained around Quetta, during 1987-88.

Month of year	Randozai	Urk	Baluchi	Karakuli
January	15.23	31.80	23.08	9.21
February	45.17	6.67	15.38	40.46
March	32.93	-	7.69	19.25
April	-	-	-	-
May	-	15.13	7.69	-
June	-	25.15	23.08	9.88
July	-	-	7.69	-
August	-	-	-	-
September	-	-	-	-
October	-	-	-	-
November	-	-	-	-
December	6.67	21.25	15.38	20.12

in December-January periods, which goes in line with the pattern exhibited for winter lambing in the area.

The available body of the limited available data suggests that the sheep flocks maintained in the area under study remains reproductively active between the age of 2 and 7 years. Limited fertility has been exhibited in the ewes of more than 7 years of age, and those of less than 2 years of age. However, ewes aging 11 and 14 months have been recorded in Randozai and Urk stocks, respectively, which successfully lambed, suggesting that the females are sexually active and capable of successful mating at the age of some 6-8 months. Our present study go in conformity with the studies of Ahmad and Khan (1985), Hanzel and Tenil (1945), Ahmad and Zafar (1983), suggesting that though the optimal reproductive activity in Lohi sheep falls in age groups of 2 to 6 years of age, yet the females of less than 2 years and above 6 years are also reproductively active.

A general survival of lambs upto weaning age has been calculated to be around 93.75%, with slight interstock variations, explanable on the basis of chance deviations. This survival rate appears to be slightly higher than that suggested for Lohi (86.54%: Ahmad and Khan, 1985) and Afghan sheep (81.01: Ahmad and Ahmad, 1987) and general nomade maintained flock of Lebanon (91%: Bhattacharya and Harb, 1978). A relatively high lamb rearing rate would suggest the adaptability of general farmers to sheep breeding, so that sufficient care can be provided to young lambs, to ensure their survival. This may also suggest the adaptability of the general stock to the general natural conditions of the area. The present data is meagre to arrive at such a conclusion, demanding some more extenssive study extending over a longer period on the survival potentials of the new born lambs in the area.

3.5. Wool:

A limited body of data available on 28 fleece weight obtained from the flock maintained at the Agricultural College, suggested a computed average of 1.69±0.09 kg per animal per year of wool produced on the basis of one a year shearing pattern, with a range of 1.0 - 2.5 kg. Comparing the present data with that presented in the review of Hasnain (1985) regarding the breeds being maintained around Quetta, suggest that the stock under consideration remains within permissible limits, and its range includes the limits suggested for different breeds (Baluchi: 2.4 kg/year; Bibrik: 1.54; Harnai: 1.37; Rakshani: 0.92). A wide variation in the fleece weight suggest withstock variations, and can be partially

to the interbreed variation, contributed by the basic stock out of which the animals of the present stock have been derived. The overall wool production potentials of our present stock appears to be significantly less than that suggested for imported breed, i.e., Hissardale (4.18±0.62 kg/year; Ahmad and Saleem, 1981). Though, variations has been reported in the potentials of wool production in different studies conducted on local Lohi breed, ranging from 2.24±0.26 kg/year (Ahmad and Khan, 1985) to 1.58±0.23 (Ahmad and Saleem, 1981), 1.078±0.425 (Ahmad, 1983), range of 0.676 - 1.507 (Ahmad, 1982); yet in general the stock under our present study in general has the equivalant potentials of wool production when compared with Lohi breed. This stock appears to resemble with many other local breeds including Kacchi (1.30±0.29; Ahmad and Saleem, 1981); Awassi (imported breed, 1.45±0.22; Ahmad and Saleem, loc cit), and Kajli (1.342±0.051; Ahmad, 1983; range 0.750-1.736; Ahmad, 1982). However, this stock appears to be superior with regards to its potentials of fleece weight production, over the Salt Range breed with a reported range of 0.919 - 1.443 kg/year (Ahmad, 1982) and average of 0.619±0.257 (Ahmad, 1983). The present stock is to a large extent similar to Afghan breed (male; 1.29, female: 1.66; Ahmad, 1985; 1.515/year, clipped on half yearly basis; Ahmad and Ahmad, 1987). Further studies would be required for a detailed analysis of potentials of wool production, though it appears that selective breeding can help in increasing the overall potentials present within stock/breeds present in the area.

3.6. Haematological Studies:

The available informations on different haematlogical parameters of the stock of sheep maintained around Quetta is presented in Table VIII-a.

Table VIII-a: A synopsis of the data on different haematological parameters in stock of sheep, being maintained around Quetta during 1987-88.

Parameter	Average ± S.E.	Range
Glucose (mg/100ml)	85.31±2.35	70-95
Haemoglobin (%)	11.74±0.27	10.2-12.6
WBC count (X 1,000)/mm^3	6.48±0.17	4.6-8.1
RBC count (millions)/mm^3	4.97±0.23	3.44-6.98
ESR (mm) after Ist hr.	1.69±0.41	0-4

The results thus presented show that the glucose contents of the serum

fluctuates between a range of 70 - 95 mg/100ml with a computed average of 85.31 ± 2.35. The glucose levels has been suggested to show variations in Lohi (57.53%) and Afghan (64.82%) breeds, and with these standards our stock appears to have a higher glucese contents. The haemoglobin contents of the blood of our stock is calculated to fluctuate around an average of 11.74 ± 0.27 within a range of 10.2 - 12.6%. The haemoglobin contents of our stocks are thus relatively higher than that suggested for Lohi (9.81%) and Afghan (9.79%) breeds maintained at Bahadurnagar Farm (Jabbar, et al., 1985). The average of the WBC count is calculated as 6.48 ± 0.17 thousands/mm^3. No comparative data is in hand for different breeds maintained in Pakistan. The RBC count suggests an average of 4.97 ± 0.23 million/mm^3 fluctuating within a range of 3.44 - 6.98. The comaparative data on RBC count is also not available on the breeds of sheep being maintained in adjacent areas of Pakistan. The observations collected on the erythrocyte sedimentation rate has allowed us to compute an average of 1.69 ± 0.41 mm, after the first hour with calculated range of 0 - 4 mm. The comoparative figure quotated by Jabbar, et al. (1985) for Lohi and Afghan breeds suggest an average of 0.77 mm and 0.00 mm, respectively, suggesting that the average yielded by our stock is relatively higher than the other two stocks for which the data is in hand.

3.7. Milk Analysis:

The pooled data on 10 samples of milk collected from sheep stocks farmed around Quetta, regarding different biochemical/physical parameters is presented in Table VIII-b. The results show that the milk has an average

Table VIII-b. The pooled data on different parameters of milk samples collected from the sheep stocks, being maintained around Quetta during 1987-88.

Parameter	Average ± S.E.	Range
Fat (%)	6.30 ± 0.17	5.6 - 7.3
S.N.F. (%)	9.03 ± 0.21	8.1 - 10.1
T.S. (%)	15.33 ± 0.19	14.0 - 17.4
pH	5.96 ± 0.08	5.5 - 6.7

fat contents of 6.3% ± 0.17 with a range of 5.6 - 7.3%. The total solid non-fat

solid (S.N.F.) components of the milk has been calculated to range between 8.1 and 10.1%, averaging to 9.03 ±0.21%. The results on total solid (T.S.) components of the sheep milk has been computed to average 15.33 ±0.19% which fluctuate within a range of 14.0 and 17.4% . The pH of the milk samples has exhibited a variation between the samples and the different samples range between 5.5 and 6.7, suggesting an average of 5.96 ±0.08 for the total sample.

The sole study available on the analysis of the milk of three breeds of Punjab, maintained at Bahadurnagar Research Farm (Jabbar, 1982), suggest some minor variations in fat (Lohi: 5.98%; Kajli: 5.96; Salt Range:5.53%), SNF (Lohi 10.72%; Kajli: 10.80%; Salt Range: 11.16%) and TS (Lohi: 16.66%; Kajli: 16.44%; Salt Range: 16.69%). Our stock appears to have a comparatively higher fat contents, while relatively less SNF and T.S. contents, though the fat contents fall within the range suggested by our sample. Variations are expected in the fat and non-fat contents of the milk with the stage of lactation, and hence it is difficult to conclude from the present data as to whether the higher fat contents are due to the genetic potentials of the sheep stock of Quetta or it is just a chance sampling variation and/or it is being induced through the environmental conditions caused by the type of food plants available. Further studies in the area may yield rewarding results in this regards.

4. GOAT

4.1. Adult Weight:

The available data on the adult weight of the different stocks of goat, under our present study has been presented in Table IX. The table suggests that the stock of goat, maintained at Agricultural College, has an average male adult weight of 44.35±2.31, while that of the female averages to 39.17±2.97 kg. The stock has been said to have been basically derived from the Kharasani breed, maintained around maintained around Quetta, with some genetic mix up with Sind Desi and some non-descriptive goats of Sind origin. The average weight of Urk stock of goat has been calculated to be 35.63±1.98 and 30.75±2.05 kg, for males and females respectively. The Randozai stock exhibits the lowest average adult weight with computed figures of 30.93±2.67 and 29.67±2.71, for males and females, respectively. The adult weight recorded under the present study are higher than than recorded for most of the stocks suggested to be present in Baluchistan (Hasnain, 1985). Except for the Randozai stock, which falls in resonable approximation with Lehri breed (males: 32.7; females 30.4), Khurasani stock is significantly higher than that suggested by any local breeds, even the Urk stock generally appears to be havier than the descritive stocks mentioned by Husnain (loc cit). The Khurassani stock of the Agricultural College appears to be similar to Dera Din Panah breed, which is being mainly maintained in Muzaffargarh and Multan Districts; while Urk stock appear to approach Kaghani breed being mainly farmed in Kaghan valleys of N.W.F.P. The present data does

Table IX: Adult weight of different stocks of goat, being maintained around Quetta, during 1987-88.

Stock	Weight (kg)	
	Male	Female
Agric. College (Khurassani)	44.35 ± 2.31	39.17 ± 2.97
Urk	35.63 ± 1.98	30.75 ± 2.05
Randozai	30.93 ± 2.67	29.67 ± 2.71

not conclussively suggest that there is some improvement in the adult weight of the stocks of the goat maintained presently in Baluchistan. This may be attributeable to two factors. Firstly, our present stocks appear to be non descriptive type, with the result that different parental breeds are generally crossbred in the area and are maintained as mixed flock without organized breeding programme. With the extension of the communication links in the area in the recent past there appears to be a greater influx of the genes from different adjacent parts into the genetic pool of domesticated goats of the area, with an obvious effects of the different genetic characters. Secondly, the origin of the information exploited by Hasnain (loc cit) has not been fully documented, and hence the type of the flocks exploited for the purpose of the yielding average adult weight is not know, as also the physico-biotic conditions persisting around the study flock. Further studies would be required to arrive at some definite conclusion towards the hypothesis suggesting that the there is some definite improvement of the adult weight. Some degree of variations can also be found in the average adult weight suggested by Hasnain (loc cit) regarding Beetal breeds of Punjab (male 36.3; female: 29.5 kg) and that suggested for the same breed by Khan and Ahmad (1985) suggesting the average adult weight of 53.52 kg for males and 29.92 kg for females, which can be attributed to the better farming condition available to the stock at Bahadur-Nagar Institute. It appears that the farming conditions available to the stocks under our consideration are sufficiently good to yield better adult weight, as per acclaimitization of the local farmers to goat breeding. This is despite the fact that the period under our present study was stress years for general vegetation under persistent drought. The acclaimitization of the farmers and the rearing conditions available gets further support from the fact that a limited data on Teddy goats, maintained in Randozai exhibited adult weight more in approximation with that of the flock maintained at Bahadurnagar (Shah, et al., 1981) than that reported by Hasnain.

Generally the males are havier than the females, though this difference is not significant in Randozai stock, suggesting that the males produce more dressed weight as compared with females. This sexual dimorphism in adult weight appears to be the universal character in different breeds of goat, as has been suggested by all the different studies. Different degree of sexual dimorphism in different stocks, as has been suggested under our present study, may suggest inter breed differences, the data presented by Hasnain (1985) suggested a different degree of variation in adult weight of the two sexes in different breeds of goats.

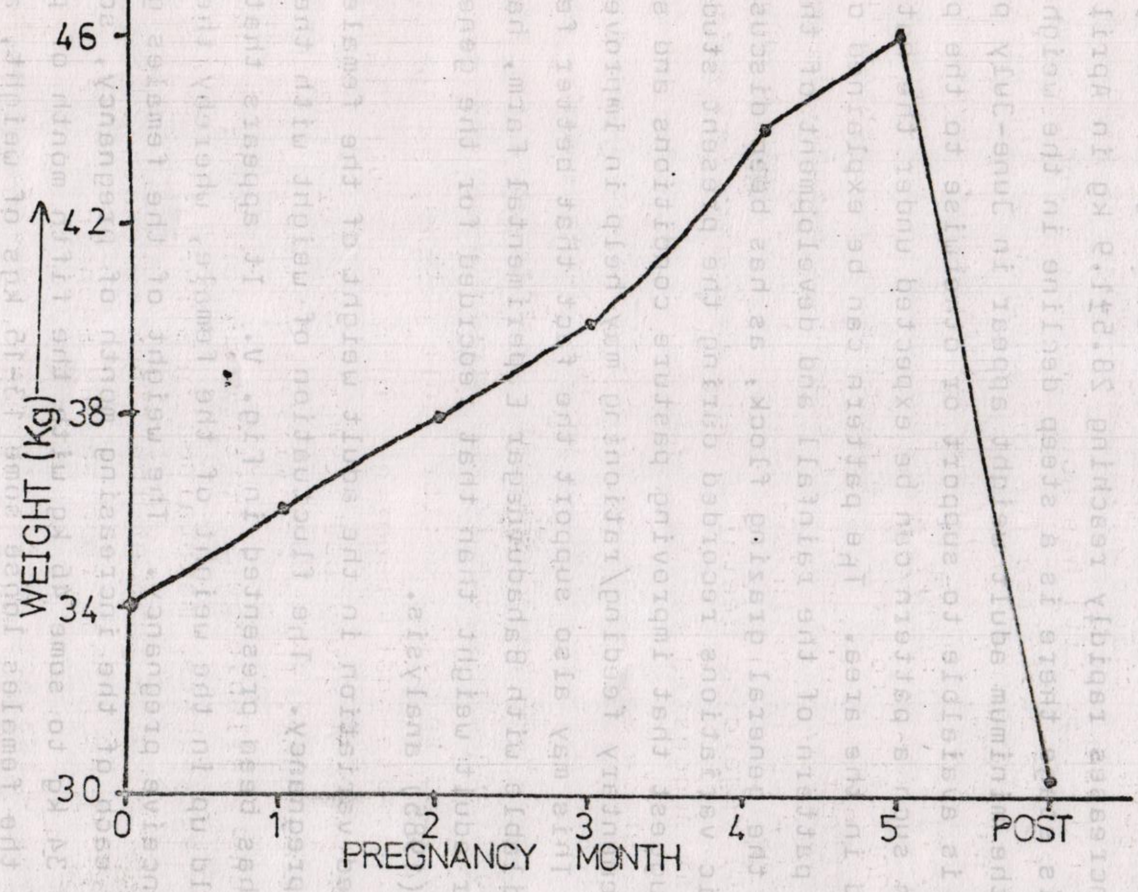


Fig. V: Variations in adult female weight in general stock of goat, associated with pregnancy.

Fig. V presents the summary of a limited data on the variations in the adult weight during different months of the year, in the pooled stock maintained around Quetta. It would be apparent from a general consideration of the figure that the adult weight fluctuates in the different months, so that the highest weights are achieved during the month of May and the lowest during June-July. The adult weight appears to gradually increase from 21.5±1.2 in July through January, so that a minor peak appears in January. The adult weight decreases during February-March period, touching the minimum of the winters to 25.8±1.5 kg in March, when the adult weight increases rapidly reaching 28.5±1.9 kg in April and 30.7±1.1 in May. At this stage there is a steep decline in the weight of the adult goat, so that the minimum adult weight appear in June-July period. No previous study is avaialble to support or otherwise to the present results, though such a pattern can be expected under the natural grazing regimn, adopted in the area. The pattern can be explained on the basis of the general pattern of the rainfall and development of the greener vegetation for the general grazing flock, as has been discussed in an identical cyclic variations recorded during the present study in sheep. The data may suggest that improving pasture conditions and supply of the suitable supplementary feeding/rationing may help in improvement of the adult weight. This may also support the fact that better feeding co conditions available with Bahadurnagar Experimental Farm, has generally produced higher adult weight than that reocrded for the general flock under Hasnain (1985) analysis.

An expected variation in the adult weight of the female is also caused by the pregnancy. The fluctuation of weight with the progress of the pregnancy has been presented in Fig. V. It appears that there is an initial build up in the weight of the female, whereby the females prepares to conceive pregnancy. The weight of the females gradually increases with each of the increasing month of pregnancy, so that it increases from 34 kg to some 46 kg with the fifth month of pregnancy. On parturation the females loose some 13-15 kgs of weight, and the post parturation weight is always less than the pre-pregnancy weight of the females. A similar pattern has been observed in sheep, under the present study.

4.2. Growth Curve:

Table X and Fig. VI presents, present that available data on the body weight of different stocks of goat at different months of age. It appears from the consideration of the available data that different stock has some degree of variation in the general growth pattern, though in all

Table X: Average weight of different stocks of goat maintained around Quetta, during 1987-88, at different months of ages.

Age (months)	Weight (kg) ± S.E.					
	Khurassani		Randozai		Urk	
	♂	♀	♂	♀	♂	♀
1	8.10 0.43	8.03 0.34	5.69 0.67	2.25 0.13	4.19 0.32	2.51 0.12
2	11.69 0.79	9.91 0.54	7.87 0.57	3.96 0.34	5.71 0.54	2.95 0.25
3	14.13 1.24	14.12 2.26	11.00 2.34	6.00 1.34	8.91 3.56	5.12 1.28
4	19.52 3.85	17.00 3.53	11.50 2.17	7.94 2.32	10.56 2.76	7.23 2.11
5	22.85 3.62	20.67 2.43	13.53 1.76	9.89 2.62	12.48 2.13	11.56 1.39
6	26.50 1.96	24.33 3.56	16.23 2.63	11.20 2.86	15.25 2.75	12.50 2.94
7	28.33 4.52	25.07 3.48	18.06 2.95	11.40 2.59	17.15 1.73	15.75 3.42
8	29.33 1.75	25.67 2.57	20.50 3.71	12.05 3.17	18.50 2.60	17.94 3.16
9	30.00 3.29	27.35 4.12	22.47 2.61	14.10 2.14	20.51 2.12	18.40 1.93
10	32.11 1.83	29.31 2.17	23.89 2.16	15.60 2.68	22.33 3.21	18.00 2.43
11	35.33 2.53	32.04 2.65	25.53 1.64	18.40 1.96	22.75 2.64	19.54 3.19
12	35.93 3.17	32.52 1.97	28.53 3.12	20.20 3.84	22.52 4.13	20.67 1.81
13	36.48 2.17	34.67 3.27	31.52 2.46	22.13 2.85	24.75 1.93	24.10 2.36
14	36.94 1.05	37.33 2.18	34.50 1.64	23.80 1.94	25.89 2.63	25.50 1.57
15	38.33 2.52	38.00 1.17	--	26.04 3.05	27.13 3.26	26.53 2.16
16	41.36 3.17	-	--	27.05 1.24	28.96 2.16	28.00 1.27

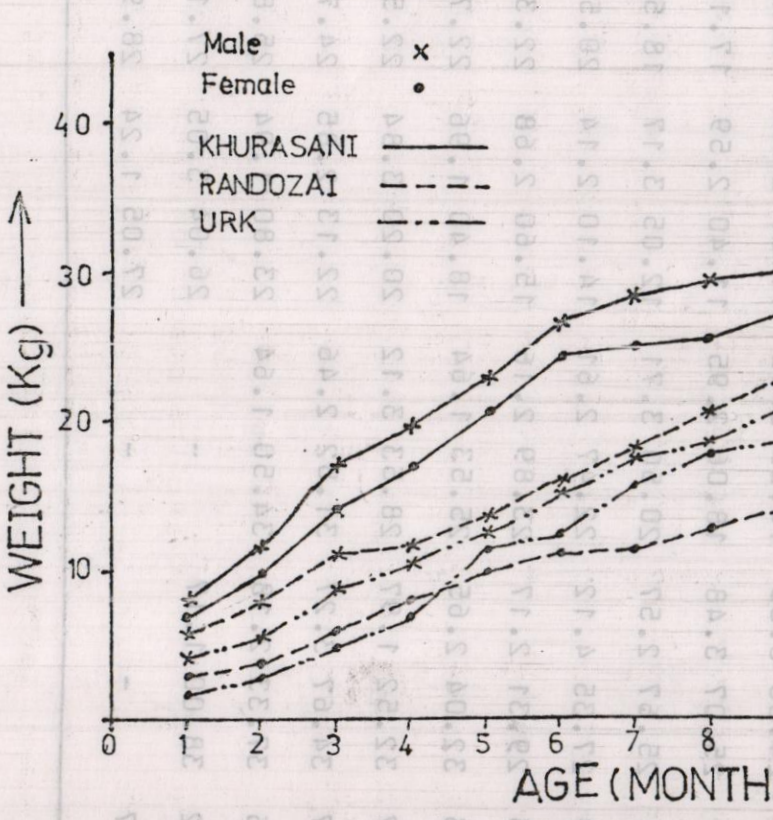


Fig VI: Growth curves followed by
Quetta, during 1987-88.

the different stocks are similar to one another with regard to the fact that there is a consistent increase in the body weight till 16th month of age. In Kharasani breed, maintained as Agricultural College stock, the growth can be anticipated to have been occuring in three phases. There is a rapid increase in the body weight from some 2.5 kg, birth weight to 25-28 kgs in the first 6 months of age. The rate of growth, i.e., increase in the body weight appears to be slow down so that this weight increases to 32-36 kgs at some 11 months of age. During the age periods falling beyond 11th month the increase in the weight further slows down. In Randozai stock, a similar pattern of growth curve appears to be generally followed, with the exception that the initial rapid increase in the body weight continues till 7th month of age. In Urk stock however, the three growth periods can not be very vividly separated, so that the gowth appears to continue gradually throughout the first 16 months of age, with some minor variations. No previous study is available from the area/stocks under our consideration; and similar data is also lacking from this general region, so a direct comparision of our results is not possible, at this stage. The interstock variation in the growth curve pattern, can be partially attributed to the genetic variations possibly existing between the stocks. However, the major part of these variations are attributeable to the environmental variations, which are mainly responsible the general vegetational cycle/grazing conditions of the pastures, alongwith the time/season of the birth of the kids. Our studies have shown that there is significant increase in the adult weight at different parts of the year, associable with development of vegetation/rainfall pattern. Such changes are also liable of influencing the growth rate at different parts of the year and hence at different ages, as may be determined by the time of birth of the kid.

The analysis of the data also suggests that the males are generally heavier than the females at all the stages of the growth curve. This sexual difference appears to be more pronounced at lower ages than at adult age. This appears to be in general conformity with the data quoted by different workers, suggesting the average weight of male and females at different ages; where the males are generally heavier than females (Hasnain, 1985, Ishaq, 1983; Shah, et al., 1981; Khan and Ahmad, 1985). The present data appears to be meagre to suggest significance/ pattern of the growth curves being adopted by different stocks/sexes; and analysis of the variance attributeable to different inherent and/or environmental factors, suggesting the need for collection of more elaborate data, keeping in view the time of the birth of the kids and

associated environmental conditions at different stages of the growth of the newly born kids. The fact that there is a rapid increase in the body weight of the kids during the first six months of age in goat, indirectly supports the previous reports suggesting the importance of the 6th month in recording the weight of different breeds by Hasnain (1985) and Ishaq (1983).

4.3. Growth/Turn Over Rate:

The summary of the computed growth rates, as judged by the weight gained per day per animal, at different ages has been presented in Table XI. The table suggests that different stocks and sexes exhibit different growth rates. The growth rate is generally more in the males (78.31; 57.47; 84.07 gm/day/animal, in Randozai, Urk and Khurassani stocks) as compared with those appearing in females (51.63; 53.07; 66.42, appearing in same sequence). Now previous study is in hand to provide support or otherwise to our present conclusion, but the general feeling that the males are heavier than the females at all ages, and that the different in live weight increases with the age, indirectly support of findings.

The interstock variations in growth rate suggest that the Khurassani stock, being maintained at the Agricultural College appears to have a higher growth rate (male 84.07 gm/day/animal; females 66.42) followed by Randozai stock (male 78.31; females 51.63) while the Urk stock has the least growth rate (males 57.47; females 53.07), though the growth rate of females of Randozai and Urk stock are not very significantly different. The studies have been conducted on the analysis of the growth rate in Taddy breed in Punjab (Bahadurnagar Research Institute) suggesting a growth rate of 55-67 gm/day in both casterated and uncasterated stocks (Khan, 1980), while in another study the normal growth rate of 61.5 gms/day has been increased to 87.6 gms/day, when fed on Dhaincha (Khan, 1981). This may suggest that our Khurassani stock is has a higher growth rate than Teddy breed, while the other two stocks have growth rates compareable with Teddy breed. It may be kept in mind that the stocks under our study are being maintained on normal grazing under the stressful vegetation conditions in the year/area with very significant effects of drought. The diet of the growing kids, appears to have significant effect on the general growth rates (Khan, 1981), therefore it appears that the growth rate is expected to increase significantly in the years under better vegetation conditions. It the light of these facts it can be suggested that the stocks under our study have a significantly higher growth rate

Table XI: The growth rates, calculated on the basis of the weight gained (gms) per day per animal, in different stocks of goat maintained around Quetta, during 1987-88.

Age (months)	Average growth rate (gms/day/animal)					
	Randozai		Urk		Khurassani	
	♂	♀	♂	♀	♂	♀
1	106	8	65	23	170	184
2	73	57	51	15	120	63
3	105	68	107	68	81	140
4	17	67	53	67	183	96
5	67	67	67	150	108	122
6	83	40	92	33	122	122
7	67	1	58	108	61	22
8	83	20	50	13	33	22
9	67	67	67	18	22	55
10	50	53	61	18	67	67
11	100	93	14	39	111	89
12	100	60	75	111	22	17
13	100	60	42	50	17	72
14	-	60	33	33	44	3
15	-	73	67	50	100	22
16	-	33	-	-	-	-
Overall	78.31	51.63	57.47	53.07	84.07	66.42

than that of the normally maintained Teddy goat stock. Further studies on different other breeds maintain in this area and the adjacent areas can further help us in evaluation of the growth potentials of these stocks/ allied stocks.

The analysis of the growth rates at different ages yield different patterns in different stocks. The growth rates appears to be very high in the first six months (males 130.67 gm/day; females 121.22) in the Khurassani stock of the Agricultural College, where an almost steady growth rate is maintained at low levels (52.67, 53.67 between 6 month to year and above one years of age, respectively, in males; females, 45.33 32.33 during two corresponding periods). In other two stocks a constant growth rate appears to be maintained throughout the period under our study, though the males in Urk stock have significantly higher growth rate during the first 6 months of age. The pattern of growth rate fluctuations with the increasing age exhibited by the presently designated Khurassani breed appears to be compareable with that suggested for the Teddy breed (Shah, et al., 1981), suggesting a decrease in the overall growth rate with the increasing age; however, it does not resembles with the pattern exhibited in Randozai and Urk stocks. It may be suggested that the grazing conditions, being better in the protected areas present around the Agricultural College, may yield better grazing conditions to the Khurassani stock and hence a normal compareable growth pattern. In Randozai and Urk stocks, which are under the stressful grazing conditions under grazing competition as also under the stressful years of drought, the normal growth patterns are not being exhibited, thus resulting in slowed and delayed growth persisting for a longer duration in the age. It is expected that further studies in the better grazing conditions in these stocks may yield the characteristic growth pattern, as has been partially observed in the Agricultural College stock.

Table XII presents a synopsis of the computed data on the turn over rate, being derived from the weight gained per day per unit body weight. This parameter of the turn over rate appears to be a suitable relative parameter, as it is generally presumed that the individuals having a higher body weight are expected to consumed more of the food. The available data on the turn over rate, appears to yield some degree of inconsistent results, so that significant variations have been recorded at different months of the growing kid. No regular sexual dimorphism is exhibited, and turn over rate fluctuates between males and females in different months of age. However, generally it appears that the turn over rate is higher in the

Table XII: The turn over rate, calculated on the basis of the weight gained per day per unit body weight (gms) in different stocks of goat maintained around Quetta during 1987-88.

Age (months)	Turn over rate (gms/day/unit body weight)					
	Randozai		Urk		Khurassani	
	♂	♀	♂	♀	♂	♀
1	18.63	3.56	15.51	9.16	20.99	22.91
2	9.28	15.45	8.93	5.08	10.27	6.35
3	9.55	11.33	12.01	13.60	5.73	9.92
4	1.48	8.38	5.05	9.57	9.33	5.64
5	4.96	6.70	5.34	13.04	4.73	5.95
6	5.19	3.57	6.03	2.87	4.60	5.01
7	3.72	0.00	3.41	8.64	2.15	0.88
8	4.05	1.67	2.70	0.83	1.13	0.80
9	2.98	4.79	3.27	1.00	2.23	2.01
10	2.08	3.40	2.73	0.98	2.09	2.28
11	3.92	4.23	0.62	2.17	3.14	2.78
12	3.51	2.97	3.29	5.69	0.61	0.52
13	3.17	2.72	1.70	2.42	0.47	2.08
14	-	2.52	1.27	1.38	1.19	0.08
15	-	2.81	2.48	1.96	2.61	0.60
16	-	1.22	-	-	-	-
Overall	5.57	4.60	4.96	5.23	4.72	4.52

trimester, persisting uptill the first six months. The turn over rate appears to be low in the higher ages. Though, a general identical pattern of turn over and growth is being followed in the different stocks of sheep, studies in this area under our present study, yet it appears to be more consistent in sheep as compared with that exhibited by goat. No directly compareable data is available on the turn over rates for providing support or otherwise to our present results. The data appears to be limited on a very broad analysis and further data is required. The present inconsistent pattern, suggested by our results can be partially attributed to the limitations of the data and hence the amplified effect of the chance error; but these can be partially these can be attributed to the seasonal variations of the vegetational conditions, thus effecting the quality of the food. The higher turn over rate in the first six months of age can be attributed to the nutritions coming from two sources, i.e., mother's milk and the vegetation; the reliance on milk decreasing with the age, and hence the turn over rate. Controlled studies on the flocks maintained under controlled rationing/feeding can help in further elaborating the effect of different independently acting factors, and can also help in further evaluation of the local breeding stocks. These informations, if collected under suitably designed controlled conditions, can also help in isolation of stocks with better genetic potentials of growth and/or turn over rate.

The turn over rates exhibited in goat appears to generally fall in permissible range of that exhibited by sheep flocks, in the area. Thus these turn over rates can be suggested for the general domesticated ungulated stocks, which can be decided by the general quality and quantity of the food material available in the area. Each type of the available food has a different growth potentials, depending upon the digestability of the food and/or assimilation, depending upon the genetic potentials of the livestocks variety and/or the available quality/quantity of the food in the respective plant species.

There appears to be some degree of interstock variations in the turn over rate. The Khurassani stock of the Agricultural College, appears to have a general higher turn over rate, while the other two stocks, i.e., Randozai and Urk, have almost compareable low rates, during the first month of the age. However, theaverage turn over tates are higher in the Randozai/Urk stocks.

4.4. Breeding Performance:

Table XIII summarises the available data on the breeding performance

Table XIII: A summary of the data on different parameters of breeding performance of different stocks of female goat maintained around Quetta during 1987-88.

	Randozai	Urk
Fertlity (%)	100	92
Kidding Pattern (%)		
..... Once/year	44.44	100.00
..... twice/year	55.56	0.00
Twining Pattern (%)		
..... Single births	28.57	92.31
..... Twin birth	66.67	7.69
..... Tripple	4.76	0.00
No. lambs/year/ewe	2.17	1.08
Breeding season		
..... Summer births	11.11	13.13
..... Winter births	88.89	86.87

on two stocks, i.e., Randozai and Urk, of goat, limited adult females available for Agricultural College stock for analysis. The available data suggests a fertility rate of 100% for Randozai stock and the fertility rate of 92% for the Urk stock. These stocks thus have high fertlity rate, which can be partially attributed to the adaptability of these stocks to the natural conditions of the area, and partially to the acclaimitization of the farmers to the normal breeding exercise. These stocks are being selected for centuries for high reproductive performance, though unconciously, therefore a high fertility is expected to be present as genetic potentials of the stocks. This fertlity rate is almost equivalant to the Teddy goats, which are sometimes believed to have a strong genetic potentials of high fertility (Shah, et al., 1975). Very few other studies are available on allied breeds/stocks of goat in the areas under our present study and/or adjacent areas, therefore the comparative informations are generally lacking for a general assessment of the breeding potentials of our stocks. Further studies/analysis of the elaborate data in this regard may help in evaluations of these potentials in local breeds of Baluchistan, as well as that of Pakistan.

The informations collected on the kidding pattern followed by different stocks suggest that Randozai stock is the most potent breeding stock with some 55.56% of the females breeding twice a year, as compared to none of the females exhibiting twice a year lambing pattern in the Urk stock, wher 100% of the potentially breeding females kid only once a year. Compareable data on these stocks/ather stocks in the area, are not at hand, so as to evaluate the kidding pattern of these stocks. Further studies in this regard could be helpful in analysis of the total economic gains provided by different breeds. With sheep standards, the twice a year kidding potentials are high in the Randozai goats, and low in the Urk goats.

The twining pattern exhibited by the two stocks of goat, suggest that in Randozai stock a high proportion of the twins appear (66.67%), as compared with 28.57% of single birds and some 4.76% of the tripple births. Comparatively, the Urk stock has a limited potentials of twin births (7.69%), the major part of the births (92.31%) being coming as single births; while no tripple birth has been reported to be present in the females of the stock under our present study. The review of Hasnain (1985) suggests that the twin births are rare in Kajli and Khurassani breeds; while these are common in Lehri breed, after the first birth. Thus, with regard to twing pattern, our Randozai goat stock is more similar to Lehri while Urk stocks resembles more with Kajli and

Khurassani breeds, of this area. The Randozai stock also resembles Lehri breed to the fact that breeding is reported to occur at an average interval of 7-8 months, thus greater chances of twice a year lambing in both Lehri and Randozai stocks. Our Randozai stock appears to be better than Taddy goat in respect to the production of twin births, while the proportion of the tripple births is lesser than that exhibited by the Teddy breed (10.1%; Shah, et al., 1981).

The potentials of number of the lambs produced per year has a direct impact on the overall breeding potentials of a breed/stock. The available data on this parameter suggests that Randozai has a very high potentials, where an average of 2.17 kids are born per year per ewe. Such potentials appears to be significantly low in Urk stock, with an estimated potentials of 1.08 kids/ewe/year. No information is in hand about the kidding potentials of the three breeds being generally maintained in Baluchistan, as also for those maintained under natural grazing in different other parts of Pakistan. The sole study, suggesting some data on this aspect is the one conducted by Shah, et al. (1975; 1981) is on the Teddy flock, being maintained at the Bahadurnagar Experimental Farm, under controlled grazing. Comparing our results with that of Shah, et al. (loc cit), it appears that the Randozai stock under our present study has a significantly higher potentials of producing kids than that of the Teddy Goat (1.65 kids/ewe/year). However, such potentials appears to be significantly below Teddy breed in our Urk stock. The present data is limited in nature with a limited degree of implication, suggesting that more detailed informations, on a larger flock, both with natural and controlled grazing conditions are eminantly required to provide further support to our present preliminary fact finding study, in this regard.

The data on the reproductive activities occuring during different months of the year in Randozai and Urk stocks has been presented in the form of proportion of the kids appearing, in Table XIV. A look on the table will suggest that the kidding in the general goat stock under our present study appears in major flux in January-March, and during this period some 69.69% of the total kidding occurs. A limited kidding activity also occurs in April (15.15%) and June (12.12%) and some very limited kidding occurs during November (3.03%) and December (3.03%). No kidding occured during the month of May and in the months between July and October. This pattern of kidding appears to suit the general phenological cycle of the vegetation in the area, as also the general character of the goats being generally regarded as short day animals, with breeding activitie coming in the months between June and December. Under the short day

nature of the goats, the kids are expected to appear between November and May, some part of it extending into the month of June; with the anticipated gestation period of 150-170 days. Under the summer rains some part of the vegetation in the area persists till November-December period, while under winter rains a rich growth of the vegetation starts in February which extends uptill June-August period, thus providing food for the mother and more importantly to the young kids for normal grazing. This pattern is generally followed in the sheep tocks under our present study, which like goats are also short day animals, and probably adapted to the general phenological cycle of the same area. Our stocks appears to be different from the Teddy goat stock under the study of Shah, et al., (loc cit), where the maximum kidding is reported to be occuring in June. The two stocks are different from one another, apart from the basic interbreed genetic variations, in the fact that these are being maintained in different areas and under different grazing arrangement. The stock under our present study is on natural grazing in the highlands, where the major part of the rain is received in winters, with scatttered rainfall occuring during June/July. The Teddy stock under our discussion is however, maintained on organized controlled grazing with supplemented rationing and farmed in the area where the major spell of rainfall occurs during July-Auguest and the growth of the ephemerals occuring during Auguest-September period, with limited rainfall during winters associated with spring sprouting.

There appears to be some degree of interstock variations in the kidding pattern. In Urk stock, the major part of the kidding occurs during January-February period (60.00%), while some kidding also occurs during April (20.00%) and June (13.13%) and a limited kidding occuring during March (6.67%), with no kiding occuring during the period June and January and also during May. In Randozai stock, the kidding activity appears to be extended over a larger part, with some limited kidding occuring during November and December (5.56% during each month). Maximum kidding in Randozai stock appears in March (38.87%), with some kidding also occuring during January (16.67%), Fenbruary (16.67%) and also during April (11.11%) and June (11.11%). No very valid explaination can be aforded with the informations at hand and further research may be required to provided data to separate genetic/environmental influence on the interstock variations in kidding patterns. Interbreed variations in the annual pattern of kidding in Teddy, Beetal, Nachi, Dera Din Panah and Beetal-Hissar crossbred has been reported for different areas of Punjab (Ishaq, 1983), suggesting the influence of genetic potentials

Table XIV: A summary of the data representing cyclic variations in in reproductive performance of the females in the stocks maintained around Quetta during different months of 1987-88.

Month of Year	Randozai	Urk	Overall
January	16.67	26.67	21.21
February	16.27	33.33	24.24
March	38.87	6.67	24.24
April	11.11	20.00	15.15
May	-	-	-
June	11.11	13.13	12.12
July	-	-	-
August	-	-	-
September	-	-	-
October	-	-	-
November	5.56	-	3.03
December	5.56	-	3.03

on the cyclic variations in breeding potentials of stocks of goat. Such an interstock genetic variations appears to be of larger importance in determining the presently reported variations, as the general environmental conditions around both these stocks remain essentially same.

The goats remain sexually active between the age of 2 and 7 years, though one of the females kidded at the age of 14 months suggesting that it attained maturity at the age of 8-9 months and some of the females aging above 7 years have been recorded to show reproductive activity. This data appears to be consistent with the general observations of Husnain (1985) on three different breeds recorded for Baluchistan, suggesting that breeding activity starts at 14-18 months of age, with some small interbreed variations, and the females generally remain sexually active till 4-7 years in different breeds. The minimum age recorded in one of the goat appears to be exception and intrastock variations can explain such a phenomenon. Further elaborate data is required to know the impact of genetic or environmental influence on the onset of breeding during the life of the females.

The survival of the kids to adult age has been calculated to be 87.5%, averaging to 95.0% in Urk stock and 83.9% in Randozai stock. This survival rate appears to be good, but no comparative data is in hand from this area or other areas of Pakistan, whereby the parameter can be used in assessment of the survival potentials of the stocks under our present study. The survival rate is, however, slightly lower than that recorded for sheep in the area. The major part of the deads in the early age, appears to be contributed by twin births, where some 55% survival rate has been suggested by our data. The proportion of the twins birth , being higher in the Randozai stocks as compared with the Urk stock, which partially suggests a lower survival rate in Randozai. There is a very high survival rate (96.3%) of the single birth. The data on the birth weight of the single/twin births is not available, which might suggest as to whether weaker born kids under twins births are more liable to a low survival. This might indirectly suggest that improvement of the nutritional conditions and supplementary rationing of kids/mothers can improve the survival rate of the kids.

4.5. Haematological Studies:

The available informations on different haematological parameters of the general stock of goats, maintained around Quetta has been presented in Table XV. The average glucose contents of the blood serum has been calculated to be 77.80±3.63 mg/100ml with a range of 45 to 94

mg/ml. The average contents of haemoglobin in the goat blood is calculated to be 12.17±0.36%, distributed with a range of 10.6 and 14.1%. The WBC

Table XV: Average and range of distriburion of different haematlogical parameters in combined stock of goat, being maintained around Quetta, during 1987-88.

Parameter	Average S.E.	Range
Glucose (mg/100ml)	77.80 ± 3.63	45 - 94
Haemoglobin (%)	12.17 ± 0.36	10.6 - 14.1
WBC count/mm^3 (X 1,000)	7.25 ± 1.04	4.0 - 12.0
RBC count (millions/mm^3	4.50±0.27	3.20- 5.40
ESR (after one hour) mm	2.13 ± 0.40	0.0 - 4.0

count per mm^3 has been calculated to be averaging around 7,250 1,040 with a range of 4,000 -12,000. A similar calculation of the RBC count/mm^3 has suggested an average of 4.50 ± 0.27 millions with a range of 3.20 - 5.40 millions. The Erythrocyte Sedimenatation Rate has been calculated to be exhibiting a range of 0.0 - 0.4 mm with the computed average of 2.13±0.40 mm, after the termination of the first hour. No comparative data is in hand to suggest the significant of the present results. Some of the comparative studies on Teddy goat (Jabbar, 1982) suggest RBC count of 12.42 million/c.c. while the haemoglobin contents of 9.15 mg/100 ml, which are significantly altered when the animals are treated with 5% copper sulphate given in the dose of 1 gm/goat. These results are not directly compareable.

5. CONCLUSIONS

5.1. Stock Potentials:

The valid conclusion on the potentials of different stocks require their maintenance at some degree of identical conditions, so that different parameters can be judged through a direct comparison. In the wake of this fact it would appear that some very valid conclusions can not be ideally drawn through a direct comparison of our results with other available for different breeds, as our stock is being maintained on natural grazing without supplemented rationing, while the others being maintained at organized institutions with additional fooder and ratioing available. However, this preliminary study can lead us towards some preliminary results on the genetic potentials of this stock of sheep/goat in comparison with some of the others for which some body of data is available.

Sheep: The general flock under our study appears to be havier than those reported for this province. This might not actually suggest an improvement of the stock during the course of time as mode of collection of the comparative data are not known, yet it may indicate some influx of genetic material from the breeds being maintained in the adjacent areas, as also some degree of organized selection of rams for breeding exercised by the farmers.

The fact that our results suggest that our stocks are heavier than Salt Range, compareable in weight to Kajli and lighter in weight to Awassi and Afghani breeds. This is despite the fact that the stock under our study has been facing harsh drought conditions persisting in the area for 4 consecutive years. The available vegetation has a known direct effect upon the body weight. The results birth weight suggest that the Quetta stock has a heavier birth weight, which might indirectly suggest a higher survival rate of the stock. A low weaning weight and growth rate can possibly be explained on the basis of the limited nutrition conditions available in the overgrazed natural pastures, effect the general growth coming through the vegetational resources as well as potentials of the mother to produce milk 9qualitatively/quantitatively). The overall synthesis on the reproductive performance suggests that these breeds are generally equivalant to the others maintained at Bahadurnagar Institute with regards to the number of the lambs produced per female per year. The general consideration of all these parameters suggest that our stock has a comparative genetic potentials to other breeds of sheep maintained in the area. This is despite the persistant conditions of drought and

the limited nutrition expected to be available under normal grazing regimn. Under better conditions of nutrition this stock can prove to probably have better genetic potentials than the comparative stocks.

Goat: Our results suggest that the general goat stock maintained around Quetta, and considered for the purpose of the present study has a heavier adult weight as conpared to the three known descriptive breeds from different areas of Baluchistan. This significantly higher adult weight may suggest an increase in the general genetic potentials of this stock, attributeable to the general influx of the genetic material from other goat stocks maintained in the adjacent areas as also the passive selection of the stock through ages to obtain higher live weight. It appears that our Randozai stock is compareable to Lehri stock, Khurassani to Dera Din Panah while Urk stock is compareable to Kaghani breeds. The general growth rates has been estimated to be compareable with the Teddy breed, maintained at controlled conditions, and in fact our Khurassani stock has a general higher growth rates compared to Teddy flock. The Teddy has been general regarded as an economical breeds with regards to growth/reproductively parameters, hence suggesting that the Quetta stock has equivailant economic potentials, with sufficient genetic back up. The information that this stock has compareable fertility and a general potentials of number of kids produced per year per female, to Teddy breed is also encouraging for the goat breeding in this area, given the conditions that our present study pertains to a period of adverse growth conditions with the hope that all the parameters are expected to improve with the improvement in the growth conditions, as may be expected with normal rainfalls and with supplemented rationing.

5.2. Intrastock Variations:

Different stocks on sheep and goat analysed under present study suggest a wide vatiation in all the different parameters. These variations pertain to variations existing between the different stocks as well as those within each of the stock. The wider variations recorded in all the economically exploitable characters within the same stock suggest a wider genetic base still existing in the area. This wide base can be exploited in future organized breeding programmes so as to certain better breeds of sheep/goat to be farmed in the area with greater economic returns to the farmers and out of the limited vagetation available in the area.

The genetic improvement of the basic stocks can be expected to be occuring passively under the present breeding arrangements. The genetic improvement can be anticipated under nomadic movements and thus a passive

influx of the genetic material from the stocks present in the range of the nomadic movement. In the recent years this influx is expected to have increased with the development of the communication links, especially in the areas falling around the Provincial cosmopolitan. Sheep/goat farming being exercised in the area for a long time and its contribution in the main stay of the economy of the general masses in the area is expected to develop a general desire in the farmer to improve the stock for better economic returns. A passive type of the selection of the stock is exercised through the tendency of selling out all the males at an earlier age, maintaining 2-3 in the stock for breeding purposes. Generally little selection of the stock is done through females, except for a higher reproduction potentials of some of the females of the stock and hence their greater contribution in the total genetic pool of the individual stocks. Such a selective passive breeding has probably resulted in different stock having some degree of interstock variations, suggested under our present study.

Different stocks of nondescriptive breeds of sheep/goat maintained in different areas appears to have different trends with regard to different parameters. Such a variation existing between the regional stocks is a healthy sugn for the future development of stocks and for evolution of economically beneficial strains through organized breeding programme. At present different interacting factors appears to work in such a way that the net gains remain almost same. The chances of breeding of these stocks with wild ones may further provide further basis for providing a wider genetic base to be exploited in future breeding programmes.

5.3. Harvesting:

Organized harvesting of the flock has on the one hand potentials of increasing the economic gain of the farmers, while on the other hand it is useful in causing optimal exploitation of the limited vegetation conditions available in the area, and which is already under an ever increasing stress of over grazing. A different harvesting pattern is followed for the two sexes. The major part of the male flock is generally sold out at an early age, while the major part of the female stock is retained by the farmers to be used in the production of new individuals of the flock. The present preliminary studies can be used to give an idea on the harvesting strategy, though elaborate studies would be required to base the harvesting pattern on sound scientific footings, yielding optimal benefits for the farmers and ecosystem.

In males the harvesting pattern can be suggested by the analysis of the growth pattern studies. Our results suggest that in sheep there

an initial rapid growth period spreading over the first four months of life. This is followed by a moderate growth spreading between 5-9 months. The growth in male sheep though persists till 2 years of age, yet it is slow in the periods beyond 9 months of age. This may suggest that an age of some 8-9 months would be optimal age for the harbest of the male sheep flock, and maintenance of these in the later periods would be an overall disadvantage for the farmer and/or ecosystem. I goat, though it appears that a slow but continued over a longer spell of age, yet there is a rapid period of grouth during the first 6 months of age, followed by a relatively slow growth rate till the age of 10 months. The growth rate is very slow in the age beyond 10 months though it has a tendency of increase till 2 years of age. This may suggest that the male goat flock can be optimally harvested at the age of 9-10 months.

The females are reproductively active between the age of 2-7 years in both the sheep and the goat. The reproductive performance is low in lower age groups as also in higher age groups. This may suggest that the females may be culled at the age around 5-7 years and their maintenance beyond this age is not in the benefit of the farmer and/or ecosystem.

5.4. Flock Adaptation:

There are all the indications that suggest that the flock of sheep/goat are fully adapted to the general conditions around and the farming conditions available. A high reproductive rate, high fertility of the female, an average growth/turn over rates, the favourable adult weight, the number of lambs produced by the female all suggest that the flock is fully adapted to the area. The normal haematological parameters also provide further support to the adaptability of the flock to rather harsh conditions persisting in the area. A general high survival rate, a reasonably good health of the flock, a low mortality of adults also go in favour af adaptability of the flock. Further, the activities of the flocks has also adjusted to the general cyclic changes exhibited by the area. Thus production of the lambs/kids at the time when sufficient support is provided by the vegetation in the area, as also gaining the body weight at the time of better vegetation and its loss during the unfavourable vegetation conditions also suggest adaptive changes to support a better survival of the flock. Such a adaptation appears to be caused by a long term selection of the flock in the area through natural as well as artificial selection afforded by the general environmental conditions as also be the farmers. This suggest that there is sufficient genetic backing present in the flock which help in maintenance of the

sheep/goat flock in the otherwise very harsh looking conditions of the highland deserts distributed around Quetta. The presence of sufficient genetic backing to adjust the normal rearing of the sheep/goat flocks, may provide sufficient raw material for future selection of the stock.

The maintenance of the normal sheep/goat flock in the area with compareable growth rates/survival in the area indicate that the farmers are fully adapted to the maintenance of the flocks under normal conditions. The mastery achieved by the farmers in the farming of sheep/goat is understandable on the fact that the area is exploited for sheep/goat farming for centuries, with success.

5.5. Research Frontiers:

The present research had a limited scope and a limited facilities, and hence can be truely regarded as a basic fact finding study, to work out the feasiabilty of such a future study. The present report generally suggests that there is very limited study available in the area on both sheep and goat, though there are tremendous potentials present for such a future study so that the future sheep/goat farming could be placed at sounder footings fetching more economic gains to the farmers as also some sustainable pressure on the general ecosystem, which requires to be judiciously exploited for the general life in the area. A more detailed study can provide some basis for future more organized breeding programme to trape the genetic potentials present in the present stock. Some of the future lines of the action for a basic adaptive research can be outlined as:

a. Studies on growth pattern under different conditions, including:
   ... Single/twin births
   ... Births occuring at different time of the year, so as to see the effect of the vegetational cycles.
   ... Under once/twice a year birth conditions
   ... Effect of quantity and quality of the mother's milk on growth as also effects of electrolytes present in mother's milk

The overall benefits of such series of research would be a better understanding of the genetic potentials present in different stocks and also helping in separating out the environmental impacts on the growth of the newborn. This would also help in developing some basis for organizing the future breeding schedule to suit the general environmental conditions, thus fetches optimal benefits.

b. Studies on the controlledc conditions of farming for a better

understanding of effects of different factors.

... Effects of different food/grazing conditioms of general growth rate/pattern

... Effects of different grazing/food conditions on reproductive parameters.

... Genetic improvement of the stock through controlled breeding programme. These studies can be exploited for singling out the different inter/intrastock variations and their influence in stock improvements.

... Studies on deworming/disease control to fight some future epidemic break up.

c. A detailed studies on the haematology including the sex, age, breed and seasonal variationa. This would help in developing normal standards for the flocks so that these are used in future studies in selection of the stock to the conditions in the area, and to analyse the general health conditions of the flock.

d. A detailed studies on milk compsition and its effects on lamb/kid health and its value for human consumption. The studies on inter/intrastock variations may also be studies, alongwith the effect of lactation period.

e. A detailed studies on wool, including qualitative and qualitative ones.

g. A detailed studies on reproductive parameters.

The scope of the future studies is required to be expanded to cater the total area under the Baluchistan. This will help in developing a meaningful research so that furture farming activities in the area are developed on scientific footing at an early date.

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