Research Article

Emphasizing Small Farmers' Need to Develop Poultry Farming in District Tank; Khyber Pakhtunkhwa, Pakistan

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Abstract |Like other developing countries in Asia, poultry farming is the most prevalent practice among small farmers as backyard chicken production mostly owned by women for food security, economic and cultural aspects in Pakistan. Birds are mostly indigenous, scavenge for feed and perch in trees with hardly ever shelter. Several problems are responsible for domestic poultry farming low productivity. Agricultural extension is responsible to explore small farmers' problems and offer solution by communicating through suitable technology to increase productivity. Therefore, current study was conducted to highlight small farmers poultry related problems and need priority to offer solution for increasing productivity in the study area. Three hundred and twenty (320) small farmers were randomly selected on equal allocation basis from sixteen villages and interviewed. Data was collected through a pre-tested interview schedule and analyzed by SPSS. Chi-square test was used to find association among different attributes. Mean value (4.75) shows that majority farmers' ranked lack of poultry extension services/doctors 1st problem followed by (4.71) information shortage 2nd and (4.65) poultry diseases 3rd in the study area. On the other hand, mean value (4.75) shows that majority small farmers were strongly agree to lack of poultry extension services/doctors 1st need priority followed by lack of information (4.70) and vaccination shortage (4.65). Study recommends extension services and vaccination campaigns initiation, female extension workers hiring to offer advisory services for rural women, integrated formal efforts, mobile based system development and professional graduates' involvement inspiration through entrepreneurs to avoid doctors' deficiency and to extend technical recommendations.

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Introduction

Poultry farming is a significant agricultural sector (Shapa *et al.*, 2021). Most rural communities farm poultry (FAO, 2010). Poultry domestication is centuries' old for food security (Sonaiya and Swan, 2004). Backyard and commercial production are two common systems for poultry farming in the world (FAO, 1998). Small farmers and landless community farm local fowls under traditional extensive (rural

scavenging) or improved traditional (semi-scavenging) production system (Rezaei *et al*., 2016). Poultry is the smallest livestock possible investment for a village household (Sonaiya and Swan, 2004). Chickens dominate the small farmers' poultry production (FAO, 2010). Except chicken, rural poultry farming also include pigeon, guinea fowl, ducks and turkeys (Sonaiya and Swan, 2004 and FAO 2010). Small scale backyard chicken production occupies a significant feature concerning poultry farming (Tufail *et al*., 2012). Major rural population is involved in poultry farming in Asia (Samee *et al*., 2015). More than (90%) rural population involvement is projected in domestic poultry farming in Asia and (85%) in sub-Saharan Africa (Samee *et al*., 2015, Sonaiya and Swan, 2004 and FAO, 2010). Various studies show (80%) to (89%) rural households in Bangladesh, (89%) urban livestock farmers in India and (95%) population to farm poultry at rural backyards in Tanzania (Bibi *et al*., 2021, USAID and ICDDR, 2021 and Shapa *et al*., 2021). Like other developing countries, large number of rural population is involved in domestic poultry farming in Khyber Pakhtunkhwa, Pakistan ((Samee *et al*., 2015 and Habib *et al*., 2016). Research estimated 10 billion chicken in the world, 36.2 million in Tanzania, 80 to 91 million in Pakistan and 22 million in Khyber Pakhtunkhwa (Saxena and Sewak, 2016; Habib *et al*., 2016; Samee *et al*., 2015, GoP, 2020 and Shapa *et al*., 2021). Average flock size is little bit more than 5 birds per household in Bangladesh (Bibi *et al*., 2021). Generally, flock size is estimated to range from under five birds to more than 15 with an average ten (Sonaiya and Swan, 2004). On the average, a farmer may have 6-10 poultry birds in rural areas of Khyber Pakhtunkhwa (Ahmad, 2013). Researchers reported approximately 12 birds from Matta, Swat (Tufail *et al*., 2012). Generally, a flock is likely to contain 10 to 20 animals among them 3-4 roosters in rural areas (FAO, 1998). About 3-4 roosters were reported to constitute poultry flock in rural areas in Khyber Pakhtunkhwa (Bibi *et al*., 2021). Majority small farmers (39%) were estimated to have 10 to 20 birds, 34% with 5 to 10, 14% with 20 to 40, 10% to have <5 birds, 3% with 30 to 40 and 1% with more than 40 birds (Tufail *et al*., 2012). Majority flocks (41%) contain 10 to 15 birds, 38% five to ten birds, 14% more than 15 birds and 7% flocks composition under five birds with no comprehensive list concerning breeds and varieties except considerable information about indigenous populations from various regions (Sonaiya and Swan, 2004). Birds are mainly indigenous, sometimes mixed with foreign breeds and existing breeds are due to cross-breeding from centuries with exotic breeds and random breed within the flock with multiple characteristics and productive capability (FAO, 2010). Chickens usually perch on the tree branches for night in every season from hot summer to extreme winter (Bibi *et al*., 2021). Casual sheds are provided which are made of local materials (FAO, 2010). Poultry roam freely inside homes during the day and mostly scavenge in the yard for feed (USAID and ICDDR, 2021). A hen spends more than 90% day time to scavenge over 110 meter to 175 meter in a radius and use to scratch the ground for long time to expose hidden food (Sonaiya and Swan, 2004). Birds can also be seen scavenging around the home (FAO, 1998). But, livestock enclosures are preferred scavenging sites (Sonaiya and Swan, 2004). During scavenging, chickens find a variety of feed stuff including cereals, weeds, seeds, insects, worms, and various herbs (Bibi *et al*., 2021). Rarely cheap grains or leftovers from the farmers' own production are provided to kitchen for feeding (FAO, 2010). Some farmers usually supplement the chickens' diets with whole cereals once every morning (Bibi *et al*., 2021). Village poultry productivity is low due to minimum input resources and customary feature (FAO, 2010). Therefore, traditional poultry farming is often labeled as a low input/low output system (Rezaei *et al*., 2016). But, the current little output also contributes to a household income and provides access to high-quality protein which is generally shortly available (FAO, 2010). Women involvement is seem to be higher than men (Samee *et al*., 2015). Men involvement is mostly based on hobby (Tufail *et al*., 2012). Women are mostly empowered to decide on a chicken for slaughtering, purchase and sale (Samee *et al*., 2015). A few birds' farming in backyard primarily serves for family use and, surplus fowls and eggs are sold for income (Tufail *et al*., 2012). That may why, family poultry is defined as a small flock managed by an individual farm family for food security, income and employment for women and children (Sonaiya and Swan, 2004). Poultry rearing is dominant in arid areas where it is a subsistence source for local farmers (Samee *et al*., 2015). Poultry farming also plays a vital role in rural culture, social life and food security to maintain small farmers' nutritional status (VNSO, 2007; Rezaei *et al*., 2016 and Bibi *et al*., 2021). A bird or two are often slaughtered to prepare a good meal on a guest or relative arrival (FAO, 2010). Children are used to touch, carry, or play with poultry (USAID

and ICDDR, 2021). Indigenous poultry farming serves as an income source (Rezaei *et al*., 2016). Eggs sale serve for small income (Sonaiya and Swan, 2004). Pullets and cockerels cannot be seemed in groups due to sale for cash and food security by consumption (Bibi *et al*., 2021). Live birds sale provides a more flexible source for required cash (Sonaiya and Swan, 2004). Chickens and the by-products are mostly sold in the nearby markets (Bibi *et al*., 2021).

Local poultry farming is an ignored sector in Pakistan (Butt *et al*., 2013). Small farmers take poor interest to develop poultry farming due to several institutional factors (FAO, 2010). That may why, domestic poultry is facing several problems (Sadaf *et al*., 2005). Higher poultry mortality is observed due to diseases, poor vaccination and housing management (Tufail *et al*., 2012). Proper feed unavailability is also a common problem (Habib *et al*., 2016). Diseases, suboptimal management and supplementary feed shortage are attributed to cause low productivity (Rezaei *et al*., 2016). Social sciences give the impression to inadequately and inattentively address such a commonly farmed small animal (FAO, 2010). Little efforts are made to develop poultry farming (Msoffe *et al*., 2018). That may why, small farmers consider poultry farming as a supplementary for living (FAO, 2010). Major research has been conducted to find out the best communication sources to offer poultry related information for farmers (Msoffe *et al*., (2018). Reviewed materials appear to suggest several institutional and structural reforms' implementation necessity (FAO, 2010). Agricultural extension is expected to transfer suitable technologies to farmers according to needs in each sector (Msoffe *et al*., (2018). Such interventions would have an important influence on people's poor ability to enhance poultry income and consumption and interest in doing so (FAO, 2010). To achieve the required mandate, it was felt necessary to question small farmers with objectives to be acquainted with the poultry problems and need priority in order to frame recommendations for solution to develop agricultural productivity by increasing the sector's contribution in national wealth (Msoffe *et al*., (2018). Current research impression would be experienced different than previous studies by underlining poultry problems and acquiring solution for each one in details through review for the sector development and most likely to use it as a tool to improve rural economy (Waheed *et al*., 2020). Therefore, small farmers were asked to rank poultry farming problems and need priority in the study area.

Materials and Methods

This section discusses the methodology used for the study which includes universe of the study, sample size, data collection, analysis and variables impact on each (Butt *et al*., 2013).

Study area

This study was conducted during 2015-16 in district Tank (Nisar and Idrees, 2019). District Tank lies from 31°-15' to 30°-31' N latitudes and 70°- 22' E longitudes (GoKP, 2015). Tank is considered the drier and hottest region in Khyber Pakhtunkhwa-Pakistan (Nisar and Idrees, 2019). June is the hottest month with lowest humidity and district remains under periodic storms (GoKP, 2015). Over 60% population is living under national poverty line (Nisar and Idrees, 2019). Agriculture is the main occupation and majority farmers are small in the study area (Tufail *et al*., 2012). Small farmers' major population is mostly dependent on agriculture by growing different crops, farm livestock and poultry for income in the study area (Tufail *et al*., 2012 and Nisar and Idrees, 2019). Domestic poultry significant population 137034, highlights the need to investigate the sector related issues in the study area (GoKP, 2015).

Sample size

Three hundred and twenty (320) male small farmers were randomly selected from four union councils (Nisar and Idrees, 2019). Each union council had several villages but four were selected from each on convenience basis (USAID and ICDDR, 2021). Totally, (16) villages were selected (Nisar and Idrees, 2019). Twenty (20) small farmers were randomly selected from each village on equal allocation basis (Msoffe *et al*., (2018).

Data collection

An interview schedule which covers all relevant aspects of the study, was designed for data collection (Tufail *et al*., 2012). Interview schedule was pre-tested (Butt *et al*., 2013). Appraised respondents were questioned about the types of poultry problems due to its importance as a source of income like livestock. That close ended question was positioned on serial number 42 in main interview schedule as presented below and was comprised of five poultry related problems to rank on the scale with priority

need. Small farmers were questioned in local dialects to rank their responses on five times Likert-scale where 1=SDA stands for strongly disagree, 2=DA disagree, 3=N neutral, 4=A agree and 5=SA strongly agree. Small farmers were usually interviewed at their fields, from time to time in hujras (common place) and shops in villages (Butt *et al*., 2013 and Nisar and Idrees, 2019).

Interview schedule validity

The board of three specialists' in agricultural extension discipline validated the instrument for appearance weight. Changes were made according to experts' recommendations. Content validity was measured for desired data generation by five experts after a long discussion using question's clarity regarding study's objectives. About 70-100% judges were agreed to retain the question in final instrument (Nisar and Idrees, 2019).

Data analysis

Collected data was coded and fed to the computer for analysis (Hassan *et al*., 2012). Statistical package for Social Sciences or statistical product and service solutions (SPSS) was used for data analysis, simple percentage, mean and standard deviations (Razzaq *et al*., 2011; Msoffe and Ngulube, 2017). Observed data is usually matched with predictable information by using Chi-square test which properties were first explored by Karl Pearson in 1900 (Yekinni and Taofeeq, 2015). Therefore, Chi-square test was used for association among poultry problems and need priority by following formula:

$$\chi^2 = \sum_{i=1}^{r}\sum_{j=1}^{c}\frac{(O_{ij}-e_{ij})^2}{e_{ij}}$$

Results were tabulated and presented in Tables 2 and 1.1 (Nisar and Idrees, 2019). Detail materials were used to reach the conclusions and explained below (Tufail *et al*., 2012).

Results and Discussion

Results in Table 1 show that majority small farmers were strongly agree to consider lack of poultry extension services/doctors 1st problem by mean value (4.75) followed by information shortage (4.71) subsequently by poultry diseases (4.65) in the study area. Similarly, mean value (4.61) shows that majority small farmers were strongly agree to rank vaccination

Table 1: *Sampled respondents' distribution regarding poultry problems and need priority.*

Problems	Problems identification scale					Mean	t-ratio (p-value)	Need priority scale					Mean	t-ratio (p-value)
	1=SDA	2=DA	3=N	4=A	5=SA			1=SDA	2=DA	3=N	4=A	5=SA		
Vaccination shortage	19(5.9)	-	1(0.3)	36(11.3)	264(82.5)	4.64	30.15(<0.001)	19(5.9)	-	1(0.3)	33(10.3)	267(83.4)	4.65	30.37(<0.001)
Diseases	19(5.9)	-	1(0.3)	34(10.6)	266(83.1)	4.65	30.29(<0.001)	19(5.9)	-	1(0.3)	36(11.3)	264(82.5)	4.64	30.15(<0.001)
Feed	41(12.8)	4(1.3)	1(0.3)	79(24.7)	195(60.9)	4.20	16.04(<0.001)	41(12.8)	4(1.3)	1(0.3)	66(20.6)	208(65.0)	4.24	16.48(<0.001)
Lack of information	20(6.3)	2(0.6)	1(0.3)	6(1.9)	291(90.9)	4.71	30.46(<0.001)	20(6.3)	2(0.6)	1(0.3)	7(2.2)	290(90.6)	4.70	30.38(<0.001)
Lack of poultry extension services/doctors	18(5.6)	-	1(0.3)	3(0.9)	298(93.1)	4.76	33.81(<0.001)	17(5.3)	1(0.3)	1(0.3)	6(1.9)	295(92.2)	4.75	33.99(<0.001)

Source: Field survey (Small Farmers' Need Assessment in Distt: Tank, Khyber Pakhtunkhwa, Pakistan 2015-16)
Values in parenthesis are percentages; SDA= Strongly disagree; DA=Disagree; N=Neutral; A=Agree; SA=Strongly agree

shortage 4th and feed shortage 5th problem by 4.20 also in the study area.

Table 2: *Association between poultry problems and their need priority.*

Variables (need priority)	Chi-square	p-value
Vaccination shortage	891.463	<0.001
Diseases	901.190	<0.001
Feed	1163.753	<0.001
Lack of information	1147.993	<0.001
Lack of poultry extension services/ doctors	693.977	<0.001

Source: Field survey (Small Farmers' Need Assessment in Distt: Tank, Khyber Pakhtunkhwa, Pakistan 2015-16)

Durgga and Subhadra (2009) opposed the current results by reporting women farmers to face feeding and management, health care, breeding, housing, marketing and financial problems in Thrissur district, India. Waheed *et al.* (2020) also opposed the current results by reporting (70%) farmers to face a few or no poultry related problem in Southern Punjab, Pakistan. Difference among results can be attributed to dissimilarity in research area.

Table 1 shows that majority small farmers were strongly agree to prioritize lack of poultry extension services/ doctors 1st need by mean value 4.75 followed by lack of information (4.70) subsequently by vaccination shortage 4.65. Poultry diseases were ranked 4th need by mean value (4.64) and feed shortage 5th on priority basis in the study area. Results were significant (p<0.001) at both sides.

Hassan *et al.* (2012) reported similar results regarding poultry extension services need. Sadaf *et al.* (2005) opposed the current results by ranking poultry disease management 1st, feeding 2nd, brooding 3rd, chicken boxes management 4th, eggs hatching 5th, making poultry boxes 6th, watering 7th, and egg collection and storage 8th need for women training in Faisalabad; Punjab, Pakistan. Dissimilarity among results can be supposed due to difference regarding research area.

Table 1 shows that attributes on left side of Table 1 like vaccination problem, poultry diseases, feed shortage and lack of poultry extension services/ doctors were significantly associated to attributes on right side like vaccination, diseases, information, feed and poultry extension services/doctors need priority by respective Chi-square and p-value (<0.001). This association may mean that increase or decrease in vaccination problem, diseases, feed shortage, lack of information and lack of poultry extension services/ doctors will increase or decrease associated problem need priority and vice versa.

Sonaiya and Swan (2004) supposed chicken to originate in Southeast Asia and introduction to the remaining world through sailors and merchants. Bibi *et al.* (2021) reviewed domestic chicken (*Gallus gallus domesticus*) to descend from the red jungle fowl and believe primarily to be originated in southwestern Asia and lately introduced into China about 1400 B.C. Sonaiya and Swan (2004) and Chandrasekaran *et al.* (2010) reported poultry different breeds and varieties' taming by small farmers since 2300 B.C. in Indus valley. But, FAO (2010) and Mata *et al.* (2018) reported majority small farmers to generally farm indigenous chickens at backyard. Tufail *et al.* (2012) reported domestic poultry farming as a common practice among 2/3rd rural families. Sonaiya and Swan (2004) defined domestic poultry farming for distinction between medium to large scale commercial farming as a flock of less than 100 birds belonging to unimproved or improved breeds in households under either extensive or intensive systems by using family labour and available feed resources. FAO (2010) widely acknowledged poultry as a livestock for poor and production part of countless small farmers. Tufail *et al.* (2012) reported (>75%) farmers to farm desi birds, fayomi (>12%), RIR (>8%) and fancy (>3%). Similarly, Waheed *et al.* (2020) reported (>41%) farmers to have desi, (29%) fayumi and other (29%) mixed birds. Bibi *et al.* (2021) reviewed Aseel poultry farming. Waheed *et al.* (2020) reported majority flocks to contain 3 to 9 desi hens, up to 4 brooding cocks and 15 chicks, and up to 12 egg laying hens. Sonaiya and Swan (2004) reported flock composition to show farming objective. Tufail *et al.* (2012) reported (45%) poultry farming for family consumption, (>37%) commercial and (17%) to pastime. On the contrary, Waheed *et al.* (2020) reported (41%) farming for chicken sale, (22%) for household needs and (35%) as a hobby. Sonaiya and Swan, (2004) cited domestic farming under free-range extensive, backyard extensive, semi-intensive and intensive production system. Tufail *et al.* (2012) described (>51%) farmers to use cage, (>27%) provide housing at night and (>21%) possess in open air. Likewise, Waheed *et al.* (2020) reported (61%) household to keep poultry in khuda, (>22%) in cages, and (16%) in bamboo baskets. But, Mata *et al.* (2018) referred around (99%) chickens farming under a traditional system with little or no housing,

feeding or health care and characterized by low output levels. FAO (2010) observed cocks to serve as the "alarm clock" in all regions. Waheed *et al.* (2020) also observed to use cocks for fighting.

Sonaiya and Swan (2004) and USAID and ICDDR (2021) reported poultry farming traditionally by women as primary raisers to own (70%) birds. Ishaq and Memon, (2016) and Shapa *et al.* (2021) acknowledged (58%) to (>80%) women role and involvement. Samee *et al.* (2010) reported (>69%) women involvement than men (31%) in poultry farming by applying indigenous techniques for rearing, brooding, breeding and management, based on the know-how from elders. Msoffe *et al.* (2018) reported domestic chicken and eggs high market demand. Sonaiya and Swan, (2004) assumed an indigenous hen to lay (30) eggs annually. But, Tufail *et al.* (2012) opposed by a hen to produce (131) eggs annually. Moreover, Sonaiya and Swan, (2004) reported local birds to lay an average (12) to (15) eggs in three to four clutches yearly. FAO, (1998) cited a hen to produce (40) to (60) eggs annually. Tufail *et al.* (2012) reported RIR to produce (141) eggs, Fayomi (145) eggs, Desi (115) eggs and Fancy (123) eggs each year. That may why, FAO, (2010) cited (80%) poor women from place to place to earn more than US$ (11.5) annually. Sonaiya and Swan, (2004) reported (50%) eggs consumption at household. However, Bibi *et al.* (2021) cited Aseel chicken to hatch lesser eggs. Sonaiya and Swan, (2004) reported egg laying between sunrises to mid-morning in a soft "litter" base darken nest. FAO, (2010) cited a household to consume (>23%) eggs, sale (27%) and use (>49%) for reproduction. Sonaiya and Swan, (2004) cited a hen to produce (12) chicks annually. Tufail *et al.* (2012) reported poultry care by women. But, Msoffe and Ngulube, (2017) reported majority women as illiterate. Butt *et al.* (2013) and Ishaq and Memon, (2016) reported (59%) to (86%) rural women as illiterate. GoKP (2015) reported hard working women population in the study area.

Sadaf *et al.* (2005) reported domestic poultry to face various problems. Various studies like Durgga and Subhadra (2009); Butt *et al.* (2013) and Msoffe *et al.* (2018) reported poultry health and extension services deficiency. That may why, FAO, (2010) reported farmers' poor accessibility to veterinary and extension services. Sadaf *et al.* (2005) and Msoffe *et al.* (2018) reported farmers to face information shortage. Therefore, Shapa *et al.* (2021) cited farmers to use the uncertified and non-technical recommendations for solving poultry issues based on information through unreliable sources like family members, neighbors, and friends with previous poultry keeping experience due to inadequate system. That may why, Durgga and Subhadra, (2009) reported farmers' short accessibility to technical guidance and then face poultry farming management related problems. Msoffe *et al.* (2018) attributed extension services and information shortage to poor research on poultry farming problems. Generally, Msoffe and Ngulube, (2017) and Parihar and Boyal, (2018) cited small farmers' inadequate access to information and underlined (60%) farmers without access to information. Msoffe *et al.* (2018) reported information shortage due to extraordinary expenditures, unreliable electricity, T.V. and radio poor signals and farmers' illiteracy. FAO (2010) blamed unfavorable institutional structure for small farmers' low production. Msoffe and Ngulube, (2017) reported unfitting and unproductive approaches' application responsible for laughable access to information. That may why, Parihar and Boyal, (2018) needed current extension approaches' reassessment to find the gap for unavailing the information.

Sonaiya and Swan (2004), Sadaf *et al.* (2005) and Tuffail *et al.* (2012) reported diseases to suffer poultry and a common issue among maximum flocks to cause (>29%) mortality. Bibi *et al.* (2021) reviewed chicks' more susceptibility to diseases. That may why, Sonaiya and Swan, (2004) and Bibi *et al.* (2021) attributed chicks more mortality (60%) to (75%) to diseases with significant increase during rainy season and changeable weather humid periods on either side. Earlier, FAO (1998) reported (80%) to (90%) poultry mortality within the first year after producing in traditional system. Sonaiya and Swan (2004) classified young chicks' (50%) mortality within or up to two months with (25%) thereafter up to sexual maturity due to diseases. FAO (1998) confirmed high chicks' mortality rate under 3 months. Sonaiya and Swan (2004) reported eight chicks mortality out of ten due to disease, predators and road accidents. That may why, FAO (1998) reported hardly ever survival chance for whole flock. Hassan *et al.* (2012) reported poultry mortality due to unknown diseases. Sonaiya and Swan (2004) and Sadaf *et al.* (2005) reported farmers' acquaintance about disease's symptoms but failure to name the infections. Therefore, FAO (2010) reported health services unavailability and high mortality rate to cause low awareness and interest among farmers

regarding improved husbandry practices. Durgga and Subhadra (2009) reported bacterial and viral diseases to cause major losses. Sonaiya and Swan (2004) exampled Newcastle to kill many poultry in the dry season. FAO (1998) cited high mortality rate as the main reason for low production. Tufail *et al.* (2012) attributed diseases to poor housing and management. Sonaiya and Swan (2004) cited less space to create stressed social behavior, disease vulnerability, cannibalism and leaving weaker birds without feed or perch space. Durgga and Subhadra, (2009) reported farmers to have inadequate knowledge regarding low cost scientific cage construction due to short funds, land, and construction materials. FAO (2010) blamed poor extension services to cause unawareness about the disease control benefits. That may why, Sonaiya and Swan, (2004) attributed farmers' little consideration about poultry health which increases disease vulnerability.

FAO (2010) and Tufail *et al.* (2012) reported poor vaccination problem and farmers' inaccessibility to vaccines and drugs to cause and increase infection. Whaeed *et al.* (2020) reported (>64%) unvaccinated poultry. While, Tufail *et al.* (2012) reported only (<50%) birds' immunization. Durgga and Subhadra, (2009) reported poor information to small farmers about vaccination schedule. FAO (2010) reported poor extension services responsible for reducing farmers' ability to access vaccination. Msoffe and Ngulube (2017) cited a top-down approach use for information. Moreover, Sonaiya and Swan (2004) reported vaccines' ineffectiveness due to inefficient cold chain, motivation shortage among farmers, scattered flocks, bad roads and poor transportation to cause low immunization rate. Habib *et al.* (2016) and Durgga and Subhadra (2009) reported feed shortage and malnutrition common issues for domestic poultry due to local resources' deficiency and low eggs' hatchability in summer. Sonaiya and Swan, (2004) cited more eggs laying during crop harvest as a clear relationship between egg production and nutrient intake. Durgga and Subhadra (2009) reported poultry farmers to face financial problems. Therefore, FAO (2010) reported poor households to avail less services than better-off due to more fee against health facilities. In addition, Bibi *et al.* (2021) cited haphazard crossbreeding and breed replacement, production changes, and environmental destruction as major threats for poultry.

Sonaiya and Swan (2004); FAO (2010) and Rezaei *et al.* (2016) reported poultry vulnerability to ecto and endo parasites, and predators. Mata *et al.* (2018) reported parasites significance due to association with health and production capability. FAO (1998); Sonaiya and Swan (2004) and Mata *et al.* (2018) reported ectoparasites and endoparasites very common in free-range systems and farmers' less attention towards ectoparasites management than endo and diseases. Bare (1943) and Rezaei *et al.* (2016) observed five lice, three mites, one tick and two flea species to infest backyard chicken and six to infest pigeons. Rafdar *et al.* (2012) observed three ectoparasites species to infest chicken. Mata *et al.* (2018) reported lice (28%) infestation scattered on whole body. Bare (1943) reported domestic birds' common exposure to lice, bedbugs (*Cimex lectularis*), common mite (*Dermanyssus gallinae*), scaly leg mite (*Cnemidocoptes mutans*) and other mites. Kaufman and Rutz (2000) reported external parasites infestation increase during cooler months than warmer. FAO (1998) reported mosquitoes (*Culicidae*), black flies (*Simuliida*), midges (*Ceratopogenidae*), house flies and stable flies (*Muscidae*) as potential guests for chicken including other birds to irritate or suck blood and also serve as vectors. Kaufman and Rutz, (2000) reported mites to feed on blood and cause irritation, stress the birds to reduce (10%) to (15%) egg production, reduce weight gaining potential, reduce seminal fluid volume and annoy egg handlers and others. Bare (1943) reported common mites (*Dermanyssus gallinae*) to mostly leave the birds before daylight to hide in any nearby shelter, and return at night for reattack. Khalid *et al.* (2017) observed ticks to suck huge quantity blood to cause anemia and dehydration. Shah *et al.* (2004) cited ticks to mostly and frequently transmit spirochaetosis. Kaufman and Rutz, (2000) reported beetle larvae to suck blood and transmit several diseases like acute leukosis (Marck's disease), fowl pox, numerous pathogenic *Escherichia coli* serotypes, several *Salmonella* species, and tapeworms. FAO (1998) and Ahmad (2013) reported protozoans to cause coccidiosis and *Salmonella* common inhibition in intestinal tracts. Mata *et al.* (2018) attributed change in parasite to change in management practices, environmental factors and location. Rezaei *et al.* (2016) reported ectoparasitism high prevalence due to poor hygienic practice. That may why, Kaufman and Rutz, (2000) reported adult beetle and larvae due to dung and litter. Rafdar *et al.* (2012) identified (3) nematodes and (4) cestodes species to infest chicken. But, FAO (1998)

reported (>50) nematodes' species. Sonaiya and Swan (2004) reported internal parasites to weaken the birds. Kaufman and Rutz, (2000) reported to rely on pesticide for pest management under economic injury levels.

Sonaiya and Swan, (2004); FAO (2010) and Bibi *et al*. (2021) reported poultry loss due to predators which may include prey birds like hawk and eagles, and snakes, cats and dogs, rats, mongoose, fox, jackal and raccoon, and thieves to mostly reduce flock size during summer and the rainy season in the cropped fields and ascribed it to farmers' inattention. But, USAID and ICDDR, (2021) cited half farmers to keep birds inside dwelling rooms at night. Sonaiya and Swan, (2004) reported more or less rural community to place few chickens even under the bed at night to avoid stealing. Kaufman and Rutz, (2000) and Bibi *et al*. (2021) suggested integrated approach like close monitoring during scavenging, and proper housing consideration during the night, predators hunting, trapping, or poisoning to decrease predation level. Sonaiya and Swan, (2004) cited multicolored feathers' birds to serve as camouflage against predators during scavenging.

Butt *et al*. (2013); Msoffe *et al*. (2018) and Shapa *et al*. (2021) cited information a key for effective decision making and needed extension services with diverse information. Parihar and Boyal, (2018) reported agri clinic and agri business center (ACABC) scheme useful for getting expert services and advice, and inputs and machinery. Tufail *et al*. (2012) highlighted vaccination need. Sadaf *et al*. (2005) reported need to manage diseases. Habib *et al*. (2016) looked-for feed. Shapa *et al*. (2021) cited information need about feed. Msoffe *et al*. (2018) prioritized information need about disease transmission, identification, management and control; egg production, feed, varieties, lodging and marketing respectively. Msoffe and Ngulube, (2017) reported farmers' chosen information sources like extension officer, and family, friends and neighbors, radio, researchers, books, leaflets and posters to be used for dissemination. Ishaq and Memon, (2016) rarely reported a women to utilize formal or private extension source for information and suggested husbandry training and educational programs. Sadaf *et al*. (2005); Hassan *et al*. (2012) and Butt *et al*. (2013) needed extension education and training regarding disease management, watering, hatching, brooding, egg collection and storage, feeding, chicken boxes making and management, and marketing information for women to enhance production and management. GoKP (2015) reported capacity building necessary for women to live and contribute in income generation through local resources. Sadaf *et al*. (2005) suggested for extension to arrange trainings for women awareness according to their needs. Tufail *et al*. (2012) suggested training for women through female extension worker. Razzaq *et al*. (2011) and Mata *et al*. (2018) recommended extension services establishment and strengthening to improve husbandry techniques and to train extension staff about improved production practices. Waheed *et al*. (2020) recommended for government and NGO's to offer improved management practices, modern husbandry techniques and nutritional guidance through proper extension services to increase production. Sonaiya and Swan (2004) recommended approximately 30 cm cubic a soft "litter" base darken nest with some privacy for a hen with unnecessary changes in location for potential production. Msoffe and Ngulube (2017) and Msoffe *et al*. (2018) recommended for experts to adapt bottom-up and participatory approach for disseminating information and hearing rural voices to satisfy need at individual basis. Sonaiya and Swan (2004) and Tufail *et al*. (2012) suggested for vaccination programs like mass campaigns at appropriate time and epidemiological studies essential for the village-based poultry health programs' development. That may why, Msoffe and Ngulube (2017) and Mata at al. (2018) recommended more extension officers' recruitment and training with reference to disease control and necessary resources to perform responsibilities. Msoffe *et al*. (2018) and Shapa *et al*. (2021) recommended virtual system services for user-centered information and Mobile-based Decision Support System establishment due to its usefulness for communicating frequently enquired information. Msoffe and Ngulube (2017) recommended interpersonal communication to offer information. FAO (2010) recommended microcredit for poultry development.

Habib *et al*. (2016) and Mata *et al*. (2018) recommended formal policy formulation to ensure adequate feed supply and trainings for extension staff regarding methods which improve poultry feeding. Tufail *et al*. (2012) suggested the government to encourage private sector to prevent feed shortage. Mata *et al*. (2018) recommended awareness regarding ectoparasites control due to overall impact on production. Bare

(1943) recommended to clean up poultry places or houses as a first step before any control measure. FAO (1998) and Rezaei *et al*. (2016) suggested a hygienic and a favorable environment along with antiparasitic drugs. Shah *et al*. (2004) cited various chemicals to control tick infestation either direct application on birds or houses. Kaufman and Rutz (2000) recommended fly population regular monitoring regarding chemical management timing. Khalid *et al*. (2017) suggested ivermectin @ 0.2mg/Kg through oral dosage for two days and a fipronil direct spray for effective tick control. Kaufman and Rutz (2000) and Mavlanov *et al*. (2021) recommended pyrethrin space spray with fly pheromone muscalure baited jug traps combination for adult fly quick knockdown and cypermethrin for effective management. FAO (1998) suggested to avoid densely populated flocks, and separate older animals, change scavenging pens, clean pens, routine deworming, adequate nutrition and genetic resistance for efficient parasitic control. Bare (1943) and Mata *et al*. (2018) recommended farmers' special acquaintance necessary regarding parasites chemical management and the government to take charge regarding chemical control. Shah *et al*. (2004) suggested for epidemiological study to develop an effective measure for tick control.

Conclusions and Recommendations

Research show small farmers' more involvement in domestic poultry farming globally especially in developing countries. Women mostly own the domestic poultry. Local poultry farming is an ignored sector in Pakistan. Therefore, small farmers take poor interest to develop poultry farming due to several factors like diseases, poor vaccination and feed shortage etc. Little efforts are made to develop poultry farming and extension sciences also ineffectively and dreamily address the sector which pushes the small farmer to consider it as supplementary. Previous studies mostly address to find out the best communication sources for information by also suggesting the need to implement reforms and further research. Therefore, it was felt necessary to question the small farmers about poultry problems and need priority to be acquainted with the problems and need priority to frame recommendations for solution to play a development role by agricultural extension. After a deep investigation, results show that majority small farmers were strongly agree to lack of poultry extension services/doctors, information shortage and, poultry diseases, vaccination shortage and feed shortage problems in the study area.

The following recommendations were formulated on study results, review and research area visual observation:

- Poultry extension services may be extended to small farmers especially women for domestic farming development.
- Vaccination campaigns may be started to prevent poultry diseases.
- Female workers may be hired for extension services and to offer poultry husbandry training for rural women.
- Agricultural extension and poultry departments may jointly concentrate to aware the small farmers about the sector importance through workshops, seminars and especially while field advisory services.
- Extension agents may be trained to create awareness among small farmers regarding poultry problems by offering solution.

Mobile based information system may be developed to offer required information for poultry farmers.

Professional graduates may be encouraged to contribute informally through entrepreneurs to avoid doctors' shortage and may extend technical recommendations.

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Novelty Statement

Author is pleased to contribute through a novel study from Agriculture extension platform with a hope to share basic problems, need priority and recommendations for poultry sector development.

Authors' contribution

Muhammad Nisar: Proposed to include existing issue and developed relevant questions for interview

schedule.

Muhammad Idrees: Supervised the whole study process till current manuscript preparation, reading and pleasure for submission.

Khalid Nawab: Supervised and contributed through valuable inputs as a major member.

Yousaf Hayat: Contributed by extending technical cooperation during data putting, analysis, tabulation and results writing till current manuscript development.

Generative AI or AI assisted technology statement

The authors have declared that no generative AI or AI-assisted technologies were used to create this manuscript.

Conflict of interest

The authors have no conflict of interest.

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