Indian Journal of
Agriculture Business

Red Flower Publication Pvt. Ltd.
48/41-42, DSIDC, Pocket-II, Mayur Vihar, Phase-I
Delhi - 110 091 (India)
Tel: 91-11-22754205, 45796900
Fax: 91-11-22754205
E-mail: info@rfppl.co.in
Website: www.rfppl.co.in

The Indian Journal of Agriculture Business (IJAB) (ISSN 2454-7964) is a peer-reviewed journal publishes research that improves our understanding of how food systems work, how they are evolving, and how public and/or private actions affect the performance of the global agro-industrial complex. The journal focuses on the application of economic analysis to the organization and performance of firms and markets in industrial food systems. Subject matter areas include supply and demand analysis, industrial organization analysis, price and trade analysis, marketing, finance, and public policy analysis. International, cross-country comparative and within-country studies are welcome.

Subscription Information

Institutional (1 year): INR5500/USD413

Payment methods

Bank draft / cashier & order / check / cheque / demand draft / money order should be in the name of **Red Flower Publication Pvt. Ltd.** payable at **Delhi**.

International Bank transfer / bank wire / electronic funds transfer / money remittance / money wire / telegraphic transfer / telex

1. **Complete Bank Account No.** 604320110000467
2. **Beneficiary Name (As per Bank Pass Book):** Red Flower Publication Pvt. Ltd.
3. **Address:** 41/48, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091(India)
4. **Bank & Branch Name:** Bank of India; Mayur Vihar
5. **Bank Address & Phone Number:** 13/14, Sri Balaji Shop,Pocket II, Mayur Vihar Phase- I, New Delhi - 110091 (India); Tel: 22750372, 22753401. **Email:** mayurvihar.newdelhi@bankofindia.co.in
6. **MICR Code:** 110013045
7. **Branch Code:** 6043
8. **IFSC Code:** BKID0006043 (used for RTGS and NEFT transactions)
9. **Swift Code:** BKIDINBBDOS
10. **Beneficiary Contact No. & E-mail ID:** 91-11-22754205, 45796900, E-mail: info@rfppl.co.in

Online: You can now renew online using our RFPPL renewal website. Visit www.rfppl.co.in and enter the required information and than you will be able to pay online.

Send all Orders to: **Red Flower Publication Pvt. Ltd.,** 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091(India). Phone: 91-11-22754205, 45796900, Fax: 91-11-22754205, E-mail: sales@rfppl.co.in, Website: www.rfppl.co.in

IJAB

Indian Journal of Agriculture Business

January - June 2018
Volume 4, Number 1

Contents

Original Articles

Review Articles

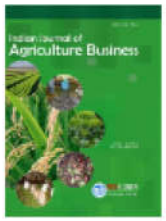
Secure | https://journals.indexcopernicus.com/search/form?search=Indian%20Journal%20of%20Agriculture%20Business

INDEX COPERNICUS INTERNATIONAL

ICI World of Journals | ICI Journals Master List | Contact

Login/ Register

Search Results



Journal title: Indian Journal of Agriculture Business
ISSN: 2454-7964
GICID: n/d
Country / Language: IN / EN
Publisher: Red Flower Publication Pvt. Ltd.

Citation:	N/A
MNISW 2016:	N/D
ICV 2016:	E/P
ICV 2015:	N/I

Indian Journal of Agriculture Business
Volume 4 Number 1, January - June 2018
DOI: http://dx.doi.org/10.21088/ijab.2454.7964.4118.1

Original Article

The Distance of Migration: An Analysis and Understanding

S.K. Acharya[1], Anannya Chakraborty[2]

Author's Affiliation
[1]Professor [2] Ph D Scholar (UGC fellow), Department of Agricultural Extension, BCKV, Mohanpur, West Bengal 741252, India.

Reprint Request
S.K. Acharya, Professor, Department of Agricultural Extension, BCKV, Mohanpur, West Bengal 741252, India.
E-mail: acharya09sankar@gmail.com

Received on 09.01.2018
Accepted on 09.02.2018

Abstract

Migration is one of the important factor after fertility and mortality that affect the demographic changes in a country. But whereas both fertility and mortality operate within the biological framework, migration does not. It influences size, composition and distribution of population. More importantly, migration influences the social, economic and ecological aspects of both destination and departure system. In this study we have discussed the several causes of migration with special emphasis on how these causes are affecting the distance of migration. The present study is conducted in Ghoragachha village under Saguna gram panchayet, Nadia, West Bengal. The numbers of respondents were 60 and they were selected randomly. the data were collected trough pilot survey, structured interview and focused group interview. The statistical tools used for data analysis are correlation coefficient, step down regression, path analysis and factor analysis.family Education (in years)-(X3), number of source information acquired-(X8), Cosmo politeness-(X13), Per capita income from Agriculture and livestock-(X16) and per capita annual other Expenditures-(X19); these are the independent variables which are significant with respect to dependent variable i.e. Y2: Distance of migration.

Keywords: Cosmopoliteness; Distance of Migration; Expenditures; Family Education; Income.

Introduction

Migration is a socio-economic and ecological phenomenon that characterizes Indian economy both by structure and function. It's an unending process of transfer, tra, there is no indicator of whether employment is in rural, semi-urban, or urban areas cultural constraint seem to be included. According to Herrendorfet et. al. (2016) Evidence shows that workers in urban areas – and rural-urban migrants – tend on average to be those with more education and higher returns to schooling. Mukhopadhay et. al. (1985) Finds that rural non-farm sector comprises two subsectors. Sector I inter alia includes those ventures that are administered on an approximately steady basis with an objective of generating surplus and registering growth, hiring labour and with a certain degree of technical sophistication. Sector II includes products or activities which are usually seasonal, managed exclusively with the help of unpaid family labour, relying on primal technology and catering mostly to the local market characterized primarily by petty production. Both these sectors of rural India find it better to go to the far or near urban areas where they will get better employment, better income, higher education opportunities and more access to modern amenities. So, on the contrary of becoming a carry catcher of past, they would rather prefer to shift to urban areas with higher options.

General Objective

Rural Urban Migration: The understanding and analysis on socio-ecological perspectives

Specific Objectives

- To build up concept rural urban migration, factors and consequences.
- To identify socio-ecological and socio-economic factors contributing to distance of migration.
- To estimate socio-economic and socio-ecological effect on the consequent factor i.e. distance of migration.
- To generate some micro-level policy implications, from this empirical study as applicable to socio-ecological setting having similarity with research location.

Research Setting

The area of investigation of this study is situated in the state of West Bengal located in the eastern part of India. The state of West Bengal in eastern India has a unique social and ecological background which influence the living standard and behavioural patterns of the people in many ways. The area of investigation belong to the Haringhata block in Nadia district. The area of the study in village Ghoragachha under Rautari gram panchayat.

Research Methodology

State, district, sub division, block, panchayet and village is selected through purposive sampling. Sixty respondents are selected through random sampling. Here, in this study we have considered 19 independent variables against one dependent variable that is distance of migration (Y).

Result and Discussion

Table 1 presents the coefficient of correlation between: Distance of migration vs. 19 independent variables(x1-x19). It has been found that following variables viz.family size-(X5), umber of source information acquired-(X8), Cosmo politeness-(X13), Per capita income from Agriculture and livestock-(X16) and per capita annual other Expenditures-(X19) have recorded significant correlation with the dependent variable.

Revelation (Table 1)

The sharing of responsibility and large liability is relatively more in large family size, with a good amount of knowledge regarding different socio-economic and ecological conditions helps easy acclimatization to new conditions along with this better support from information channel enable migrants to travel and stay at long distances.

Table 1: Coefficient of Correlation (r): Y: Distance of migration vs. 19 independent variables(x_1.x_{19}).

Sl. No	Variable	R value	Remarks
1	Age at the time of migration-(X1)	-0.021	
2	schooling of Migrant(number of years)-(X2)	-0.021	
3	family Education(in years)-(X3)	0.011	
4	Caste-(X4)	0.002	
5	family size-(X5)	0.309	*
6	number of years since Marriage-(X6)	-0.016	
7	change in number of occupations after migration-(X7)	-0.099	
8	number of source information acquired-(X8)	0.3	*
9	number of source of money for migration-(X9)	0.001	
10	family material possession-(X10)	-0.049	
11	family house type-(X11)	0.143	
12	family Social participation-(X12)	-0.056	
13	Cosmo politeness-(X13)	0.251	*
14	mass media exposure-(X14)	-0.111	
15	Per capita area(acre)-(X15)	0.161	
16	Per capita income from Agriculture and livestock -(X16)	0.286	*
17	Per capita income from other source-(X17)	-0.136	
18	Per capita annual Expenditure on education-(X18)	-0.059	
19	per capita annual other Expenditures-(X19)	0.292	*

r>0.250 and 0.320 are significant at 5% and 1% level respectively

Table 2 presents the multiple regression analysis between exogenous variable Y: distance of migration vs. 19 Causal variables (x1-x19): It has been found that the variable X13: Cosmo politeness, X8: number of source information acquired and x16 : Family income (Agriculture and livestock) has contributed to the substantive variance embedded with the consequent variable Y: distance of migration.

The R^2 value being 0.8450, it is to infer that 84.50 per cent of variation in the consequent variable has been explained by the combination of these 19 causal variables.

Table 3 presents the step wise regression and it has been depicted that the 2 causal variables X8: number of source information acquired and x16: Family income (Agriculture and livestock)that is has been retained at the last step.

The R^2 value being 0.6455, it is to infer that 64.55 per cent of variation in the consequent variable has been explained by the combination of these 2 causal variables.

Revelation (Table 2 and 3)

So the distance of migration has well been estimated by variable X8 that is number of source information acquired and X16: Per capita Family income (Agriculture and livestock)

The better return farm enterprise, generates enough financial resources for initial investment to go for long distance migration. A good number of information channels enrich different socio-economic and ecological knowledge which builds confidence in migrants to go long in search for better opportunity to earn better livelihood.

Table 4 presents the variableX10:family material possession has enrooted the highest indirect effect (for 12 times) on the consequent variable. Table 4 presents the path analysis to decompose the TE into direct, indirect and residual effect. It has been found that the variable X19: Per capita other Family annual Expenditure (0.459) has highest direct effect, while the variable X15: Per capita area(acre) (0.377) has exerted the highest indirect effect on the Y: Distance of migration.

Table 2: Regression Analysis, Y:distance of migration vs. 19 Causal variables (x1-x19)

Sl. No.	Variables	BETA	BETA × R	REG COEF-B	S E OF B	T-Val of B
1	X1: Age at the time of migration	-0.038	0.352	-0.391	0.729	0.184
2	X2: schooling of Migrant(number of years)	-0.171	1.525	-3.309	1.143	0.043
3	X3: family Education(in years)	-0.072	0.244	1.444	0.448	0.391
4	X4:caste	-0.190	-0.710	-4.362	1.303	0.525
5	X5:family size	1.171	-2.403	6.324	0.342	0.377
6	X6:number of years since Marriage	1.201	10.739	-0.749	1.329	0.563
7	X7:change in number of occupations after migration	-0.116	1.561	-1.477	0.502	0.106
8	X8:number of source information acquired	1.590	27.229	1.231	0.235	2.888
9	X9:number of source of money for migration	0.028	-0.983	000	000	0.303
10	X10:family material possession	0.058	2.207	-4.453	1.168	0.711
11	X11:family house type	1.150	8.433	9.379	3.108	1.048
12	X12:family Social participation	1.191	2.295	-5.892	1.558	0.918
13	X13:cosmopoliteness	-1.133	20.074	-4.735	4.287	1.523
14	X14:mass media exposure	-1.313	13.869	-6.151	0.300	0.738
15	X15: Per capita area(acre)	-0.113	20.712	19.332	0.200	1.353
16	x16 :Family income (Agriculture and livestock)	1.130	32.375	7.895	1.950	2.767
17	x17 :Per capita family income from other sources	1.711	10.944	-1.068	1.068	1.909
18	X18: Family annual Expenditure Per capita(education)	1.216	13.797	000	000	0.044
19	X19:per capita other Family annual Expenditure	-1.017	-2.460	000	000	0.173

Multiple R-SQ=84.50%
S.E=2.12

Table 3: Regression Analysis, Y: distance of migration vs. 2 Causal variables(x8 , x16)

Variables	Beta	Beta x R	Reg. coef. B	S.E. of B	t value
X8:number of source information acquired	0.323	31.921	15.897	6.636	2.395
x16 :Family income (Agriculture and livestock)	0.397	68.079	5.996	2.041	2.937

Multiple R-SQ=64.55%
S.E=8.44

Table 4: Path analysis: Decomposition of total effect (r) into Direct, Indirect and Residual effect Y: distance of migration VS 19 consequent variables(x1-x10)

Sl. No.	Variables	Total effect	Total Direct Effect	Total Indirect Effect	Highest indirect Effect
1	X1: Age at the time of migration	-0.021	-0.038	0.017	0.931(x17)
2	X2: schooling of Migrant (number of years)	-0.021	-0.007	-0.014	-0.826(x13)
3	X3: family Education(in years)	0.011	0.071	-0.06	-0.115(x10)
4	X4:caste	0.002	-0.090	0.092	0.059(x10)
5	X5:family size	0.309	0.071	0.228	-0.180(x10)
6	X6:number of years since Marriage	-0.016	-0.115	0.099	-0.446(x11)
7	X7:change in number of occupations after migration	-0.099	-0.016	-0.083	0.107(x10)
8	X8:number of source information acquired	0.300	0.027	0.273	-0.853(x10)
9	X9:number of source of money for migration	0.001	0.005	-0.004	0.489(x10)
10	X10:family material possession	-0.049	-0.144	0.095	0.158(x10)
11	X11:family house type	0.143	0.190	-0.047	-0.412(x13)
12	X12:family Social participation	-0.056	-0.132	0.076	0.705(x10)
13	X13:cosmopoliteness	0.251	0.313	0.062	0.865(x11)
14	X14:mass media exposure	-0.111	-0.112	0.001	-0.458(x13)
15	X15: Per capita area(acre)	0.161	-0.216	0.377	0.618(x10)
16	x16 : Per capita Family income (Agriculture and livestock)	0.286	0.010	0.276	0.303(x10)
17	x17 :family income (other per capita)	-0.136	-0.328	0.192	0.177(x10)
18	X18 : Family annual Expenditure Per capita(education)	-0.059	-0.130	0.071	0.166(x10)
19	X19: Per capita other Family annual Expenditure	0.292	0.459	-0.167	-0.499(x10)

Residual= 0.155

The residual effect being 0.155 per cent, it is to infer that with the combination of these 19 exogenous variables, 100 per cent of variance can be explained.

So, the predominated factors, as formed by internationally accommodating them based on factor loading, can offer a strategic implication by effectively downsizing the sphere of variables into well textured factors.

Revelation (Table 4)

The family expenditure is a sign of lack of enough resources to fulfil the family needs and obligations. These downsize the options in rural areas to choose to migrate at distance places in search for job opportunities for better livelihood. Higher material possession and higher land holding generates good income, which can be used in initial investment to go long distances.

Table 5 presents the factor analysis, wherein 19 numbers of independent variables have been conglomerated into 6 dominant factors.

Factor 1 is consists of 4 variables viz. X3: family Education (in years), X5: family size, x16:Family income (Agriculture and livestock) and X19: Family annual Expenditure per capita (family). These variables contribute about 17.53 per cent of variance, and the factor renamed as Family capacity.

Factor 2 consists of 4 variables viz. X2: schooling of Migrant (number of years), X10:family material possession, X11:family house type and X13: cosmopoliteness. These variables contribute about 31.25 per cent of variance and are renamed as Family resource.

Factor 3 consists of 4 variables those are size of X2: schooling of Migrant (number of years), X10:family material possession, X11:family house type and X13:cosmopoliteness. Which contributes about 44.691 per cent of variance, and is renamed Migration chronology.

Factor 4 consists of 2 variables viz X4: caste and X12: family Social participation. These 2 variables contribute 54.670 per cent variance and is renamed as Community affiliation.

Factor 5 consists of 3 variables viz. X8: number of source information acquired, X9: number of source of money for migration and X14: mass media exposure. These 2 variables contribute 64.013 per cent

Table 5: Factor Analysis –Conglomeration of 19 variables in 6 Factors

Factors	Variables	Factor Loading	% of variance	Cumulative %	Factors Renamed
Factor 1	X3: family Education(in years)	.584	17.530	17.53	
	X5:family size				
	x16 :Family income (Agriculture and livestock)	.534 .746			Family capacity
	X19: Family annual Expenditure per capita (family)	.816			
Factor 2	X2: schooling of Migrant(number of years)	.533	13.795	31.32	Family resource
	X10:family material possession	.611			
	X11:family house type	.733			
	X13:cosmopoliteness	.687			
Factor 3	X1: Age at the time of migration	.585	12.366	44.69	
	X6:number of years since Marriage	.696			Migration chronology
	X7:change in number of occupations after migration	.569			
	x17 : Per capita family income (from other sources)	.579			
Factor 4	X4:caste	.618	9.978	54.67	Community affiliation
	X12:family Social participation	.502			
Factor 5	X8:number of source information acquired	.557	9.343	64.01	Communication proficiency
	X9:number of source of money for migration	.528			
	X14:mass media exposure	.542			
Factor 6	X15: Per capita area(acre)	.532	7.128	71.14	Economic proficiency
	X18 : Family annual Expenditure Per capita(education)	.543			

of variance and is renamed as agro ecological proficiency.

Factor 6 consists of 2 variables X15: Per capita area (acre) and X18: Family annual Expenditure Per capita (education). These 2 variables contribute 71.141 per cent variance and is renamed as Community affiliation.

Interpretation (Table 5)

The factor Family capacity 17.53% by becoming the prime mover of change in process of Rural-Urban migration, under the study has also contributed substantially towards start migration along with financial and information support to stay in urban areas.

Family capacity has rightly contributed the highest to become the prime factor in Rural-Urban migration

Rural-Urban migration, on other way higher the family capacity is higher family needs and aspiration along with better support that is how and why these factor percentage has contributed substantially towards Rural-Urban migration.

Conclusion

Bryceson, D.F. (2002) refers thatcertainly in Sub-Saharan Africa, diversification can be represented as a failure of agriculture to provide a sufficient livelihood for a substantial proportion of rural dwellers and an active process of 'deagrarianization' is occurring whereby farming becomes a part-time, residual, or fall-back activity and livelihoods become increasingly oriented to non-farm and non-rural activities. The same can be marked in this study also. Higher the sources of information, Cosmo politeness; higher would be tendency to migrate from rural areas. These factors along with the others like income, expenditure are the aspects on which distance of migration can be determined. Higher the information, higher would be the opportunity to find the best place of earning and living , no matter whether it is far or near. On the

other side higher the family expenditure, higher would be the vow to migrate in even distant places. So, in a nutshell we can say that higher the need higher the zeal and higher the sources of information, higher would be the opportunities to migrate to a better place.

Reference

1. Bryceson, D.F. The Scramble in Africa: Reorienting Rural Livelihoods, World Development, 2002 May;30(5):
2. Chadha GK. Non-Farm Employment for Rural Households in India: Evidence and Prognosis, The Indian Journal of Labour Economics, 1993;36(3): 296-327.
3. Herrendorf, B., and T. Schoellman. Wages, Human Capital, and Structural Transformation, Unpublished Manuscript, Arizona State University. 2016.
4. Mukhopadhay, S and CP Lim. Development and Diversification of Rural Industry in Asia, Asian and Pacific Development Centre, Kuala Lumpur. 1985.
5. Acharya S K, Chethana. K, Anannya Chakraborty and A Biswas. Migration: The Dream Destination and Destiny, Delhi, Nirmal Publication. 2008.

Indian Journal of Agriculture Business
Volume 4 Number 1, January - June 2018
DOI: http://dx.doi.org/10.21088/ijab.2454.7964.4118.2

Original Article

Detection of Canine Parvovirus from Suspected Clinical Samples in Pups

G. Deepika Kumari[1], R.N. Ramani Pushpa[2], B. Keerthi[3], S. Lakshminarasaiah[4]

Author's Affiliation
[1]Assistant Professor [2]Professor and Head
[3]PG Scholar [4]Research Associate,
Department of Veterinary Microbiology,
NTR College of Veterinary Science,
Gannavarm, Krishna, Andhra Pradesh
521101 India.

Reprint Request
G. Deepika Kumari,
Assistant Professor,
Department of Veterinary Microbiology,
NTR College of Veterinary Science,
Gannavarm, Krishna, Andhra Pradesh
521101 India.
E-mail: deepu.angrau@gmail.com

Received on 09.05.2018
Accepted on 09.06.2018

Abstract

Canine parvovirus is one of the most devastating viral disease of dogs causing high morbidity and mortality. Parvovirus proliferates mainly in the gastrointestinal tract of adults and myocardium in case of pups. Two clinical cases were presented to the teaching veterinary clinical complex with a history of dogs of age group 3 months, having a temperature of 101^0F, diarrhea with foul odors and the dogs were not yet vaccinated. The clinical cases suspected of parvoviral infection were preliminarily screened by haemagglutination test and later confirmation was done by employing Polymerase Chain Reaction for the suspected fecal samples.

Keywords: Canine Parvovirus; HA; PCR Assay.

Introduction

Parvovirus a DNA virus belonging to the Parvoviridae family affects felines, canines and porcines. It is a non–enveloped, icosahedral virus, negative sense linear single stranded DNA virus with genome size of 5.2Kbp. It has two structural VP1 & VP2 and two non- structural proteins NS1 & NS2 of which VP2 protein is highly immunogenic and is responsible for the disease [1]. Canine parvovirus also named as CPV-2 is responsible for causing the disease in canines.

CPV is a highly mutant virus and undergone various changes in single nucleotide position, forming new CPV variants, namely CPV-2a, CPV-2b, new CPV-2a, new CPV-2b, and CPV-2c depending on the geographical locations [2,3].

The CPV in faecal samples can be detected by several methods like haemagglutination test, latex agglutination test, immunochromatographic test (IC), PCR based methods, Enzyme Linked Immunosorbent Assay and DNA hybridization.

Hence the present study was taken up to characterize the clinical cases both phenotypically and genotypically.

Material and Methods

The two fecal samples were collected in 0.2M Sorenson's PBS (pH 7.0) from the dogs presented to the Teaching Veterinary Clinical Complex, NTR CVSc., Gannavaram with a history of dogs of age group 3 months both were females having a temperature of 101°F, vomition and diarrhea with foul odors and the dogs were not yet vaccinated.

Methodology

Phenotypic Characterization

The fecal samples collected in 0.2M Sorenson's PBS (pH 7.0) were clarified by centrifuging at 3000 rpm for 10 minutes at 4°C and the supernatant was screened for CPV infection by haemagglutination (HA) test using 0.8% swine RBC. Ninety microlitres of processed faecal sample was treated with 10µl of chloroform and mixed well. The mixture was kept at 4°C for 10 min and later centrifuged at 10000 rpm at 4°C for 10 min. The supernatant was collected and used for haemagglutination test.

Two fold serial dilutions of 50µl amounts of the chloroform treated samples were made in 0.2M Sorenson's PBS of pH 7.0 in a 96 well 'U' bottom microtitre plates. To each well 50µl of 0.8 percent pig erythrocytes were added, mixed gently and allowed to settle at 4°C for 4 hrs. One well, added with 50µl of 0.2 M Sorenson's PBS of pH 7.0 and 50il of 0.8 percent pig erythrocytes, served as cell control. The highest dilution of sample showing complete haemagglutination was considered as the haemagglutination titre.

Genotypic Characterization

Genotypic characterization of the fecal samples was done by using PCR assay with CPV 2ab type specific primers [4]. The processed samples were screened by primer pair CPV- 2ab (F)/2ab (R) [5] that amplified at 681bp fragment of the gene encoding capsid protein VP2 of both CPV-2a and CPV-2b types having the sequence as CPV-2ab [F] 5'-AAGAGTGGTTGTAAATAATT-3' and CPV-2ab [R] 5'CTATATAACCAAAGTTAGTAC-3'. The DNA was isolated from faecal samples by boiling method [6].

A total of 100µl of processed faecal sample was used for template DNA preparation. The samples were boiled at 96°C for 10 min and immediately chilled in crushed ice. Then samples were centrifuged at 12,000×*g* for 10 min at 4°C. The supernatants were diluted 1:5 in distilled water to reduce residual inhibitors of DNA polymerase activity [7] and used as sample for PCR.

The PCR reaction mix was prepared with 10µl of Gotaq master mix, forward and reverse primer 1µl each, 6µl of DNA template and 2µl of nuclease free water. Amplification was carried out with an initial denaturation of 95°C for 5 minutes, followed by 30 cycles of denaturation [94°C for 30 seconds], annealing [55°C for 2 minutes], extension [72°C for 2minutes] and then final extension for 4 minutes at 72°C. After completion of the cycles, the PCR product obtained was subjected to 1% agarose gel electrophoresis. The gel was visualized under UV transilluminator at medium wavelength in GENE FLASH.

Results and Discussion

The earlier studies on canine parvovirus infections revealed that the occurrence of parvovirus in dogs is higher in unvaccinated dogs. Pups of age group 8 – 10 weeks are more prone to infection and the mortality rate is 91% as the severity of symptoms is relatively high. On preliminary screening of the two fecal samples fromhaemagglutination test with 0.8% swine R.B.C., both samples were shown a clear agglutination reaction with a HA titre of 1:512 and 1:128 indicating that the concentration of virion particles voided in the affected dogfeces is high[Fig. 1].

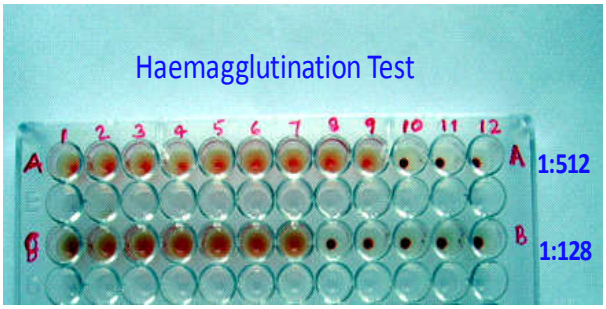


Fig. 1: Haemagglutination test for the two fecal samples showing titre 1:512 and 1:128

Parvoviral infected dogs excrete more than 10^9 virus particles per gram of feces and play a major role in transmission of infection among the dogs [8]. Further molecular confirmations were done by subjecting both the samples for PCR and were amplified with CPV2ab primers with a VP2 gene product size of 681 bp. The first sample produced a thick band as the concentration of the virion particles is high when compared to sample 2. The product size of 681 bpsuggests that the strain belongs to CPV-2a, further confirmation of the strain can be revealed by partial sequencing of the VP2 gene of the obtained PCR product.

Sequencing of the VP2 gene aids in analysing the substituted amino acid at the 426 bp position of the VP2 gene which determines the type of strain. In the present study the two samples revealed a product size of 681bp indicating that

Fig. 2: PCR Product [681bp] positive for CPV-2a strains of two fecal samples

the strain belongs to CPV-2a [Fig. 2]. The best reviews emphasizes that the most prevalent strain of CPV in India was CPV-2a.The detection of two CPV-2a strains in canines strongly correlates with theprevious reports [9,10]. Further, while co-relating the phenotypic and genotypic characterization in the first sample the HA titre is 1:512 indicating the virus voided in the faeces is relatively high when compared to the second sample which is having a lesser titre of 1:128. Based on the concentration of the virus, variations in the intensity of the PCR band emphasize that more virion particles are present in sample one when compared to sample 2.

Conclusion

The Parvoviral infection can be detected by both phenotypical and genotypical methods and are 100% accurate in confirming the presence of infection. Polymerase chain reaction is highly sensitive [11] and employing specific CPV-2ab primers aids in detecting the type of circulating strains. Further confirmation of the strain should be carried out by partial sequencing of the VP2 gene, which is highly sensitive in identifying the strain.

Acknowledgements

The authors acknowledge the Associate Dean, NTR CVSc., Gannavaram, Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh for providing the facilities to carry out research work.

References

1. Parrish CR, Have P, Foreyt WJ, Evermann JF, Senda M, Paradiso PR, Rhode SL, Singer II. Canine parvovirus: a biological and structural characterization. J. Gen. Virol. 1982;62:113-25.
2. Deepika Kumari G, Dhanalakshmi K, Reddy YN. Detection and Diagnosis of Strain Variation in Canine Parvoviral Infections in Dogs Ind. J. Agri. Busi. 2015;1:29-36.
3. Srinivas VMV, Mukhopadhyay HK, Thanislass J, Antony PX, Pillai RM. Molecular epidemiology of canine parvovirus in southern India. Vet. Worl. 2013; 6(10):744-49.
4. Panda D, Patra RC, Nandi S Swarup D. Antigenic characterization of canine parvovirus by polymerase chain reaction. Ind. J. Ani. Sci. 2009;79:876-79.
5. Senda M, Parrish CR, Harasawa R, Gamoh K, Muramatsu M, Hirayama N, Itoh O. Detection by PCR of wild type canine parvovirus which contaminates dog vaccines. J. .Clin. Microbiol. 1995;18:110-13.
6. Vieira JM, Silva E, Oliveira J, Vieira LA, Decaro N, Desario C, Muller A, Carvalheira J, Buonavoglia C, Thompson G. Canine parvovirus 2c infection in central Portugal. J.Vet. Diagn. Inv. 2008;20: 488-91.
7. Decaro N, Gabriella E, Martella V, Desario C, Sante R, Campolo M, Lorusso A, Cavalli A, Buonavoglia C . A minor groove binder probe real- time PCR assay for discrimination between type-2 based vaccines and field strains of canine parvovirus J. Virol.Meth. 2006;136:65-70.
8. Carmichael LE, Binn LN. New enteric viruses in the dog. Advanced Veterinary Science Comp. Med. 1981;25-37.
9. Chinchkar SR, Mohana Subramaniam B, Hanumantha Rao N, Rangarajan PN, Thiagarajan D, Srinivasan VA. Analysis of VP2 gene of canine parvovirus in India. Arch.Virol. 2006;151:1881-87.
10. Nandi S, Anbazhagan R, Kumar M. Molecular characterisation and nucleotide sequence analysis of canine parvovirus strains in vaccines in India. J. Virol, 2010;461:69-81.
11. Sharma P, Rastogi A, Kukreti K, Narwal P. Sensitivity assay of polymerase chain reaction for detection of Canine Parvo Virus infection in dogs. Open Journal of Clinical Diagnostics, 2012;2:45-47.

Revised Rates for 2018 (Institutional)

Title	Frequency	Rate (Rs): India		Rate ($):ROW	
Community and Public Health Nursing	Triannual	5500	5000	430	391
Dermatology International	Semiannual	5500	5000	430	391
Gastroenterology International	Semiannual	6000	5500	469	430
Indian Journal of Agriculture Business	Semiannual	5500	5000	413	375
Indian Journal of Anatomy	Bi-monthly	8500	8000	664	625
Indian Journal of Ancient Medicine and Yoga	Quarterly	8000	7500	625	586
Indian Journal of Anesthesia and Analgesia	Monthly	7500	7000	586	547
Indian Journal of Biology	Semiannual	5500	5000	430	391
Indian Journal of Cancer Education and Research	Semiannual	9000	8500	703	664
Indian Journal of Communicable Diseases	Semiannual	8500	8000	664	625
Indian Journal of Dental Education	Quarterly	5500	5000	430	391
Indian Journal of Emergency Medicine	Quarterly	12500	12000	977	938
Indian Journal of Forensic Medicine and Pathology	Quarterly	16000	15500	1250	1211
Indian Journal of Forensic Odontology	Semiannual	5500	5000	430	391
Indian Journal of Genetics and Molecular Research	Semiannual	7000	6500	547	508
Indian Journal of Hospital Administration	Semiannual	7000	6500	547	508
Indian Journal of Hospital Infection	Semiannual	12500	12000	938	901
Indian Journal of Law and Human Behavior	Semiannual	6000	5500	469	430
Indian Journal of Legal Medicine	Semiannual				
Indian Journal of Library and Information Science	Triannual	9500	9000	742	703
Indian Journal of Maternal-Fetal & Neonatal Medicine	Semiannual	9500	9000	742	703
Indian Journal of Medical & Health Sciences	Semiannual	7000	6500	547	508
Indian Journal of Obstetrics and Gynecology	Bi-monthly	9500	9000	742	703
Indian Journal of Pathology: Research and Practice	Monthly	12000	11500	938	898
Indian Journal of Plant and Soil	Semiannual	65500	65000	5117	5078
Indian Journal of Preventive Medicine	Semiannual	7000	6500	547	508
Indian Journal of Research in Anthropology	Semiannual	12500	12000	977	938
Indian Journal of Surgical Nursing	Triannual	5500	5000	430	391
Indian Journal of Trauma & Emergency Pediatrics	Quarterly	9500	9000	742	703
Indian Journal of Waste Management	Semiannual	9500	8500	742	664
International Journal of Food, Nutrition & Dietetics	Triannual	5500	5000	430	391
International Journal of Neurology and Neurosurgery	Quarterly	10500	10000	820	781
International Journal of Pediatric Nursing	Triannual	5500	5000	430	391
International Journal of Political Science	Semiannual	6000	5500	450	413
International Journal of Practical Nursing	Triannual	5500	5000	430	391
International Physiology	Triannual	7500	7000	586	547
Journal of Animal Feed Science and Technology	Semiannual	78500	78000	6133	6094
Journal of Cardiovascular Medicine and Surgery	Quarterly	10000	9500	781	742
Journal of Forensic Chemistry and Toxicology	Semiannual	9500	9000	742	703
Journal of Geriatric Nursing	Semiannual	5500	5000	430	391
Journal of Global Public Health	Semiannual				
Journal of Microbiology and Related Research	Semiannual	8500	8000	664	625
Journal of Nurse Midwifery and Maternal Health	Triannual	5500	5000	430	391
Journal of Organ Transplantation	Semiannual	26400	25900	2063	2023
Journal of Orthopaedic Education	Triannual	5500	5000	430	391
Journal of Pharmaceutical and Medicinal Chemistry	Semiannual	16500	16000	1289	1250
Journal of Practical Biochemistry and Biophysics	Semiannual	7000	6500	547	508
Journal of Psychiatric Nursing	Triannual	5500	5000	430	391
Journal of Social Welfare and Management	Triannual	7500	7000	586	547
New Indian Journal of Surgery	Bi-monthly	8000	7500	625	586
Ophthalmology and Allied Sciences	Triannual	6000	5500	469	430
Otolaryngology International	Semiannual	5500	5000	430	391
Pediatric Education and Research	Triannual	7500	7000	586	547
Physiotherapy and Occupational Therapy Journal	Quarterly	9000	8500	703	664
RFP Indian Journal of Medical Psychiatry	Semiannual	8000	7500	625	586
Urology, Nephrology and Andrology International	Semiannual	7500	7000	586	547

Terms of Supply:

1. Agency discount 10%. Issues will be sent directly to the end user, otherwise foreign rates will be charged.
2. All back volumes of all journals are available at current rates.
3. All Journals are available free online with print order within the subscription period.
4. All legal disputes subject to Delhi jurisdiction.
5. Cancellations are not accepted orders once processed.
6. Demand draft / cheque should be issued in favour of "Red Flower Publication Pvt. Ltd." payable at Delhi
7. Full pre-payment is required. It can be done through online (http://rfppl.co.in/subscribe.php?mid=7).
8. No claims will be entertained if not reported within 6 months of the publishing date.
9. Orders and payments are to be sent to our office address as given above.
10. Postage & Handling is included in the subscription rates.
11. Subscription period is accepted on calendar year basis (i.e. Jan to Dec). However orders may be placed any time throughout the year.

Order from
Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi - 110 091 (India), Tel: 91-11-22754205, 45796900, Fax: 91-11-22754205. E-mail: sales@rfppl.co.in, Website: www.rfppl.co.in

Indian Journal of Agriculture Business
Volume 4 Number 1, January - June 2018
DOI: http://dx.doi.org/10.21088/ijab.2454.7964.4118.3

Review Article

Managemental Interventions to Reduce Pre-Weaning Mortality in Piglets

Ajay Kumar[1], B. Roy[2], D.N. Singh[3], R. Sirohi[4], Y. Singh[5], Mamta[6]

Author's Affiliation
[1,3,4,5,6]Assistant Professor, Department of LPM, College of Veterinary Science & AH, DUVASU, Mathura, Uttar Pradesh 281001, India.
[2]Associate Professor, Department of LPM, College of Veterinary Science & AH, Nanaji Deshmukh Veterinary Science University, Jabalpur, Madhya Pradesh 482001, India.

Reprint Request
D.N. Singh,
Assistant Professor,
Department of LPM,
College of Veterinary Science & AH,
DUVASU, Mathura, Uttar Pradesh
281001, India.
E-mail: drdeep25@gmail.com

Received on 03.11.2017
Accepted on 09.12.2017

Abstract

Pig rearing plays an important role for improvement of socio-economic condition of poor farmers in India and other developing countries. The swine industry in India, currently in its infancy, i.e. in the hands of people having little or no awareness about pig farming. Pig mortality is an important factor affecting the economic viability and profitability of swine industry. The profitability of swine farm largely depends on the survival of piglets up to the weaning age. Immunity for the piglet is not obtained through placental transfer of antibodies during gestation and therefore it is born with very limited immune protection. Piglet born with low energy reserves and without immune protection therefore early and adequate intake of colostrum is major determinant of piglet survival during the early suckling period. New born piglets are highly dependent upon the sow for food and protection from disease, cold and predators. The death of suckling piglets adversely affects the productivity of farms; therefore, implementing an effective management regime until 3 d after birth could decrease the occurrence of piglet deaths. The first and foremost target of an ideal farm is to reduce the morbidity and mortality rate. Several managemental interventions are adopted to reduce the pre-weaning mortality like selection of animals having good mothering ability, modification of farrowing pen, provision of guard rail, farrowing crate, crush reducing device, ensure colostrum intake, measures to prevent hypothermia, cross-fostering, supplementation of iron, provision of creep feeding etc.

Keyword: Farrowing Pen; Colostrum Intake; Supplementation of Iron; Creep Feeding.

Introduction

Pig rearing is one of the most important occupations of rural society, especially the tribal masses of India. Majority of the pig population is maintained by marginal and small farmers, who rear pigs under nomadic or scavenging system or both as a source of income and a choice of meat for consumption. They are important for farmers as a major source of family income or as a 'savings bank' (Steinfeld 1998). According to 19th Livestock census, India's pig population is 10.29 million and it constitute 1.47% of world pig population. In Uttar Pradesh its population is 0.193 million and highest pig meat (0.173 MT) producing state.

Mortality pattern in organized swine herd serves as a useful indicator for assessing the status of herd health and management programme and their efficacy. The first and foremost target of an ideal farm is to reduce the morbidity and mortality rate. Often, there is considerable loss due to the seasonal and routine changes in management, which could be avoided by adopting standard

management practices and avoiding unnecessary and abrupt changes in the routine management activities. The farrowing crate is predicated on reducing sow mobility and reduce the number of piglet that killed by crushing treading on or overlying by sow. It also reduce the amount of disturbance, completion and fighting between the sow for feed and nest sites. With less restriction in loose housing, the maternal behaviour of the sow is likely to have a greater impact on piglet survival.

Managemental Practices to Reduce Pre-weaning Mortality

1. Selection of animals having good mothering ability
2. Modification of farrowing pen
   i. Provision of Guard rail
   ii. Provision of farrowing crate at pen
   iii. Provision of crush-reducing device
3. Ensure colostrum intake
4. Measures to prevent hypothermia
   i. Farrowing mat
   ii. Heat mat
5. Provision of heated creep area
6. Cross-fostering
7. Supplementation of iron
8. Provision of creep feeding

Selection of Animals having Good Mothering Ability

Patterns of maternal behaviour are strongly related to reproductive abilities in sows. Prenatal behaviour of sows is mainly characterised by nest-building activities, resulting in a nest that provides shelter for the piglets. In the course of domestication, sows have not lost their instinctive behaviour to nest-build, but perform at least elements of it when appropriate space and materials are available. Within 24 hours of farrowing, sows in farrowing pens and crates are highly motivated, even without nesting material, to perform nest-building behaviour such as rooting, nosing, and pawing (Jensen, 1986). However, sow behaviour can be negatively affected when there is no nesting material available compared with sows with access to bedding; more oral-nasal stereotypes, greater heart rate (Damm et al., 2003), greater concentrations of cortisol before farrowing (Lawrence et al., 1994), longer duration of parturition (Cronin *et al*., 1993), shorter nursing duration (Herskin *et al*., 1999), and more postural changes the first 24 hours post-farrowing. The onset and performance of nest-building is both stimulated internally via hormones and externally via feedback from the environment. With this environmental influence, the possibilities to perform nest-building can be restricted to different extents in commercially farmed pigs.

Modification of Farrowing Pen

• *Guard rail*

A guard rail around the farrowed pen is an effective means of preventing sows from crushing their pigs. The importance of this simple protective measure may be best emphasised by pointing out that approximately one-half of young pig losses are accounted for by those pigs that are laid on by their mothers. The rail should be raised 8 to 10 inches from the floor and should be 8 to 12 inches from the wall.

• *Farrowing crate*

The farrowing crate was introduced in the 1960s to decrease piglet mortality, especially the crushing of piglets by the sow, to make routine sow and piglet management easier for the stockperson, and to allow a greater number of animals to be kept per unit (Edwards, 2002). They are designed to restrict gross body movements of the sow and to make the floor area outside the crate safe for the piglets.

• *Crush reducing device*

Crushing occurs most frequently when sows lie down from a standing position therefore, the crush-reducing device was developed to obstruct the access of suckling piglets to the sows. This was done by ejecting compressed air beneath the sows' bellies when the sows were standing or sitting (Fig. 1). The photo sensor, which is fixed to the upper shoulder of the sow, detects behaviour such as standing and sitting that may crush piglets, and sends a signal to the controller. The controller then turns on the solenoid valve, and air from the compressor is released through the air rejection hose. The air prevents suckling piglets, which are sensitive to wind velocity, from remaining underneath the sow's belly and prevents sows from breeching, thereby decreasing the incidence of crushing.

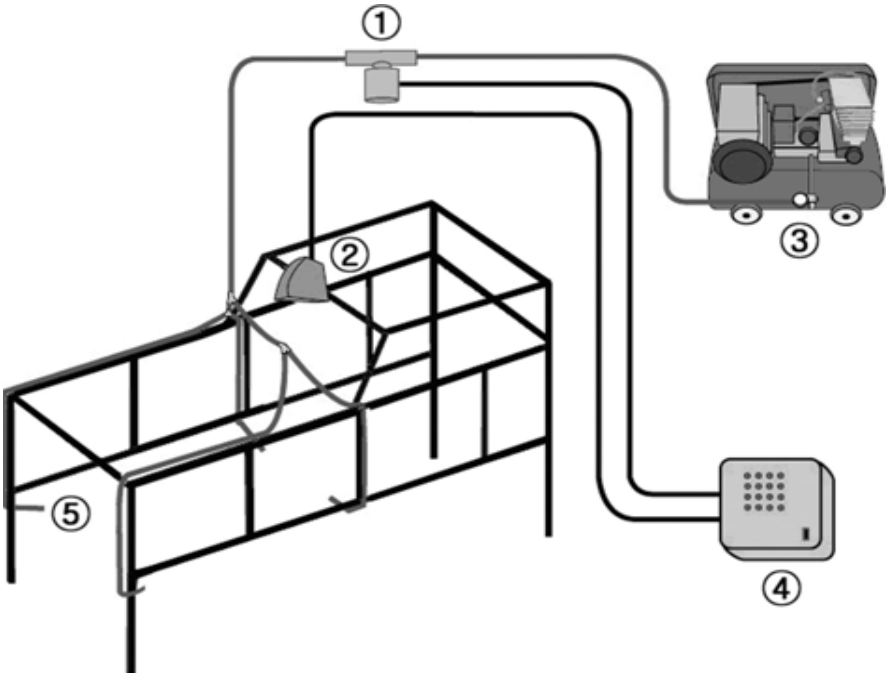


Fig. 1: Overall schematic of the crush-reducing device. The 1) photo sensor, which is fixed to the shoulder of the sow, detects behavior that may crush piglets (such as standing and sitting) and sends a signal to the 2) controller. The controller then turns on the 3) solenoid valve, and air from the 4) compressor is released through the 5) air ejection hose in back-and-forth and right-to-left directions.

Ensure Colostrum Intake

Sow have epitheliochorial placenta which does not allow maternal antibody to cross, therefore piglets are not provided with passive immunity and prone to get sick or die. The main causes of early piglet mortality include reduced vitality due to hypoxia during farrowing, hypothermia and lack of adequate colostrum intake (Malmkvist et al. 2006).

Therefore, an early and adequate intake of colostrum is a major determinant of piglet survival during the early suckling period. The most critical period for the survival of piglets is during the first two days of life. The piglet is born with low energy reserves and without immune protection and relies strictly on the sow's colostrum to obtain them in the defence against bacteria and viruses.

To ensure adequate colostrum intake, collect colostrum from the sow or obtain cow colostrum and give it to piglets via a stomach tube or a syringe. In newborn piglets, cow colostrum and infant formula differ from sow colostrum feeding regarding some intestinal functions (enzyme activities, nutrient absorption) but both formula and colostrum diets are well tolerated and induce normal intestinal mucosal growth with absence of intestinal atrophy or inflammation.

Measures to Prevent Hypothermia

• *Farrowing Mats*

The mat is biodegradable, eliminating the labour issue of cleaning up and bacterial contamination with rubber mats. The advantage with these mats is that it does not require to wash and clean, the disadvantage is the high cost of the mat. Pigs break up the mats by 10-14 days of age, by which time they no longer need them to keep warm and dry. When pigs have scours from *E. coli* or clostridium infections, or strep or staph infections, biodegradable mats become very attractive because of their one-time use.

• *Heat Mats*

Heat mats, i.e., solid or flexible boards with embedded heating elements, have been considered by the swine industry in North America and Europe as a means of localized surface heating. Heat lamps have been commonly used as creep heat source while electrical heat mats are increasingly promoted as an energy-efficient alternative. From the viewpoint of heat transfer, overhead radiant heating with lamps is more effective in providing heat to piglets than underneath conductive heating with mat. This is because heat loss by convection and radiation

modes account for the majority of the sensible heat loss of the piglets. However, heating with heat lamps has several drawbacks such as higher energy use and limited area of thermal comfort zone for the piglets, as compared with heating with heat mats. Xin and Zhang (1999) examined the preference of lamp heat vs. mat heat by piglets. They found that the preference of mat or lamp heat for small piglets (< 1.7 kg or 3.7 lb.) was influenced by the original heat source the piglets had been exposed to, except for drafty conditions where lamp heat was preferred. As piglets grew (2.4 to 5.3 kg or 5.3 to 11.7 lb.), they showed a similar preference for lamp and mat heat. Further increase in body size (7.1 kg or 15.6 lb.) shifted the preference to mat heat. The study by Xin and Zhang (1999) used two pigs kept in a small environment-controlled wind tunnel for a relatively short time period.

Xin and Zhang (1999) examined the preference of heat lamp or heat mat by piglets (birth to weaning) under various environmental conditions and revealed that heat mat was generally preferred by larger piglets. The thermal performance of heat mats, as measured by uniformity and controllability of the mat temperature, can vary considerably depending on the mat design. When operated without adequate temperature controllers, mats may produce excessively hot regions around the heating elements that prevent piglets from using the mats. Furthermore, when piglets are resting on a mat, heat balance between the mat and the ambient environment changes. Consequently, mat temperature changes with the pig-resting behaviour. These dynamic characteristics of heat mats have not been considered in the design of most, if not all, commercial mats because of the lack of information in the literature.

Provision of Heated Creep Area

Preweaning mortality can be reduced by providing a heated creep area for the baby pig. This supplementary source of heat encourages the piglets to lie away from the sow and therefore reduces their chances of being crushed when the sow moves. Unfortunately, the new born pig tends to lie against the sow's udder for the first 2 to 3 days of life even when heated creep areas are provided (Petherick, 1983) and it is during these first 3 days that the majority of mortalities occurs.

Cross-fostering

It is common to find a sow having difficulty rearing a large litter, while nearby another sow is suckling only a few pigs. If this occurs, the litters can be balanced by taking a few pigs from the large litter and placing them on the sow with the small litter. Piglets of low birth weight have a low chance of survival when their littermates are much larger. But these small piglets have a good chance to survive and grow rapidly when their littermates are of similar size.

Cross-fostering is a standard management practice to minimise the variation in piglet birth weights within a litter in order to decrease piglet mortality. Pigs can be moved from large to smaller litters to equalize litter numbers, and pigs can also be transferred between litters to improve uniformity of body size (Gardner *et al*., 1990).

Supplementation of Iron

There are numerous ways in which supplemental iron may be administered to baby pigs either orally or parenterally to meet their needs for iron (Cutler *et al.,* 2006). The chemical form of the iron used in an oral iron source is very important. Ferric oxide and ferrous carbonate have frequently been used in commercial trace mineral mixes for young pigs, but they are very poorly available forms of iron. Ferrous sulphate is the most frequently used form because it is quite available and economical. The monohydrate form of ferrous sulfate ($FeSO_4.H_20$) has physical properties which make it suitable for mixing with other dietary ingredients, and the iron is equally as available to the pig for hemoglobin formation as that from the heptahydrate form ($FeSO_4.7H_20$). Cost of iron from either commercial source is similar. Indirectly from feed and feces of sows fed high levels of iron. Supplemental iron may be administered orally through (a) placing soil in the farrowing pen, (b) swabbing the sow's udder with an iron solution, (c) dosing the pig with iron pills, paste or liquids, (d) placing liquid, moss, meal, pellet or block preparations in the creep area, or (e) feeding high levels of iron in the sow's diet and allowing pigs access to sow's feed and faeces.

Parenteral administration is the most commonly used method and to be effective, must use a proper form (Iron-dextran and iron-dextrin), amount and method. Iron injections may be given intramuscularly, intra-peritoneally or subcutaneously, the preferred method is intramuscularly. Iron injections may be made any time within the first 3 to 4 days of life. Neck or ham is the better site for

iron injection and it may leave a permanent stain in the muscle. Intramuscular injection into gluteal muscles (thigh) can cause damage to nervous fibularis and nervous tibialis resulting in transient lameness of piglets. The most common method is associated with some side effects like acute toxicosis in antioxidant deficient piglets, myopathy in piglets deficient in vitamin E, etc. the required dose is 100 mg, in case weaning is done before 3 weeks and 150 to 200 mg, in case weaning is done after 3 weeks.

Provision of Creep Feeding

Creep feeding tended to improve litter weaning weights due to improved survivability. Creep feed consumption was related to piglet maturity rather than the induction of creep feeding. Creep feeding that focuses in encouraging more suckling piglets to eat is beneficial in producing weanling pigs that are better adapted to weaning, which improves post-weaning performance. Providing dry diets to piglets during lactation or 'creep feeding' continues to be one the most popular methods. This is especially true in pig producing countries where weaning is performed at older ages (4 weeks or older).

One of the major reasons for providing creep feed is to augment sow milk production, which often becomes limiting during early- to mid-lactation (Le Dividich and Sève, 2001). Boyd *et al*. (1995) estimated that lactating sows need to produce at least 18 kg of milk per day to meet the energy requirements of a 10-pig litter at 21 d, which is greater than the typical production of 10 to 12 kg of milk produced in modern sows. Thus, milk production may limit piglet growth as lactation advances, especially in large litters. In addition, Le Dividich and Seve (2001) contend that the protein content of sow milk may also be a limiting factor. Noblet and Etienne (1987) suggested that the protein to energy ratio in sow milk is lower than the level that is needed to maximize neonatal pig growth. Therefore, creep feeding may help supplement the deficiencies in sow milk supply and composition to positively impact preweaning growth.

Creep feeding was also thought to reduce the nutritional load in lactating sows especially those with large litters, which may have corollary effects in reducing lactation weight loss and weaning-to-estrus interval. The impact of creep feeding in reducing nutritional requirements of the sow may potentially be greater with older weaning ages, it does not appear to have any effects in a 21-d lactation period.

Creep feed consumption is also thought to help initiate and promote gut and digestive enzyme development that may help pigs to utilize alternative food sources once milk is removed (Nabuurs et al., 1993). These physiological factors including familiarity with solid food is speculated to stimulate postweaning feed intake, which may help maintain villus integrity and digestive function (Pluske and Williams, 1996) and reduce occurrence of postweaning disorders (Carstensen et al., 2005). Eventually, these benefits may lead to a reduction in postweaning growth check and potential improvements in overall nursery performance. Dried bread waste can be supplemented to the piglet ration without affecting feed intake and feed utilisation up to 50 per cent level in growing crossbred pigs ration (Ajay et al., 2016). Feeding of bread waste significantly reduce the cost of feeding in rearing of growing crossbred pigs.

Conclusion

During the past decades, considerable number of research papers has been conducted to reduce mortality of piglets. These have been mainly directed towards (i) provision of an adequate thermal environment to the litter based on the thermoregulatory ability of piglets and (or) providing the weak piglets with an energy source because of the high energy requirement during the first days of life, (ii) management practices to reduce competition among siblings, and (iii) studies of the behaviour of the sow (a component of the maternal quality of the sow) and her litter around parturition. The pig industry has been constantly developing more prolific genotypes with the ensuing increased proportion of larger litter sizes along with provision of protective mechanism to reduce the piglets mortality.

References

1. Annual report. Government of India ministry of agriculture, department of animal husbandry dairying & fisheries, krishi bhawan, new delhi. 2011-12.
2. BAHS. Basic animal husbandry & fisheries statistics. Government of India ministry of agriculture, department of animal husbandry dairying & fisheries, krishi bhawan new delhi. 2014.

3. Banerjee G.C. A text book of Animal Husbandary, 8th edn., Oxford and I.B.H. publ., New Delhi. 1998.p.792.

4. Basumatary R., S. Naskar A., Kumaresan G. Khargharia G. Kadirvel and R.K. Bardoloi. Mortality in pigs under subtropical hill conditions of Meghalaya. Ind. Vet. J., 2010;87:824-25.

5. Boyd R.D., R.S. Kensinger, R.J. Harrell and D.E. Bauman. Nutrient uptake and endocrine regulation of milk synthesis by mammary tissue of lactating sows. J. Anim. Sci., 1995;73(Suppl. 2):36.

6. Carstensen L., A.K. Ersboll K.H. Jensen, and J.P. Nielsen. Escherichia coli post-weaning diarrhea occurrence in piglets with monitored exposure to creep feed. Vet. Micro. Biol., 2005;110:113-123.

7. Cronin,G.M., B.N. Schirmer, T.H. McCallum, J.A. Smith and K.L. Butler. The effects of providing sawdust to preparturient sows in farrowing crates on sow behavior, the duration of parturition and the occurrence of intra-partum stillborn piglets. Appl. Anim. Behav. Sci., 1993;36:301–15.

8. Cutler R.S., A.F. Fahy, G. M. Cronin, and E.M. Spicer. Preweaning mortality. 2006.p.993-1009.

9. Damm B.I., L. Lisborg, K.S. Vestergaard and J. Vanicek. Nest-building, behavioral disturbances and heart rate in farrowing sows kept in crates and Schmid pens. Livest. Prod. Sci., 2003;80:175–87.

10. Edwards, S.A. Peri-natal mortality in the pig: environmental or physiological solution. Livest. Prod. Sci., 2002;78:3-12.

11. Gardner I.A., D.W. Hird, N.M. Sullivan and R.J. Pierce. Clinical, pathologic and microbiologic findings of foot abscesses in neonatal pigs. J. Amer. Vet. Med. Assoc., 1990;196:1791–94.

12. Gaskins H.R. Immunological development and mucosal defence in the pig intestine. Progress in Pig Science. J. Wiseman, M. A. Varley, and J. P. Chadwick, ed. Nottingham Univ. Press, Nottingham, 1998.pp.81–102.

13. Herskin M.S., K.H. Jensen and K. Thodberg. Influence of environmental stimuli on nursing and suckling behaviour in domestic sows and piglets. Anim. Sci., 1999;68:27–34.

14. Jensen A.R, J. Elnif D.G. Burrin and P.T. Sangild. Development of intestinal immunoglobulin absorption and enzyme activities in neonatal pigs is diet dependent. J. Nutri., 2001;131:3259–65.

15. Jensen, P. Observations on the maternal behaviour of freeranging domestic pigs. Appl. Anim. Behav. Sci., 1986;16:131–42.

16. Kumar A.R., Biswajit R., Sirohi Y., Singh D.N. Effect of bread waste feeding on growth performance and carcass traitsof crossbred pigs. J. Anim Res., 2016;6:117-120.

17. Lawrence A.B., Petherick J.C., McLean K.A., Deans L.A., Chirnside J.A., Vaughan E. Clutton and E.M.C. Terlouw. The effect of environment on behavior, plasma-cortisol and prolactin in parturient sows. Appl. Anim. Behav. Sci., 1994;39:313–30.

18. Le Dividich, J. and B. Sève. Energy requirements of the young pig. In: M. Varley and J. Wiseman (eds.) The Weaner Pig: Nutrition and Management. CAB International, Wallingford, UK. 2001.p.17-44.

19. Malmkvist, J., L.J. Pedersen, B.M. Damgaard, K.T. Thodberg, E.J. Jorgensen and R. Labouriau. Does floor heating around parturition affect the vitality of piglets born to loose housed sows. Appl. Anim. Behav. Sci., 2006;99:88-105.

20. Nabuurs M.J., Hoogendoorn A., Vander Molen E.J., Van Osta A.L. Villus height and crypt depth in weaned and unweaned pigs, reared under various circumstances in The Netherlands. Res. Vet. Sci., 1993;55:78–84.

21. Noblet J. and Etienne M. Body composition, metabolic rate and utilization of milk nutrients in suckling piglets. Reprod. Nutr. Dev., 1987;27:829-839.

22. Petherick J.C. [I] A note on nursing termination and resting behaviour of suckling piglets. [II] A note on the space use for excretory behaviour of suckling piglets. Appl. Anim. Etho., 1983;9:359–71.

23. Pluske J.R. and I.H. Williams. Split weaning increases the growth of light piglets during lactation. Aust. J. Agric. Res., 1996;47:513-23.

24. Spicer E. M., Driesen S.J., Fahy V.A., Horton B. J., Sims L.D., Jones R.T., Cutler R.S. and Prime R.W. Causes of preweaning mortality on a large intensive piggery. Aust. Vet. J. 1986;63:71-75.

25. Steinfeld H. Livestock Production in the Asia and Pacific Region - Current Status, Issues and Trends. In B.S. Hursey, ed., World Animal Review, 1998;90:1.

26. Svendsen J., Bengtsson A.C. and Svendsen L.S. Occurrence and causes of traumatic injuries in neonatal pigs. Pig News Inf. 1986;7:159-170.

27. Vieuille C., Berger F., Le Pape G., Bellanger D. . Sow behaviour involved in the crushing of piglets in outdoor farrowing huts - a brief report. Appl. Anim. Prod. Sci., 2003;80:109-115.

28. Weary D.M., Pajor E.A., Fraser D., Honkanen A.M.. Sow body movements that crush piglets: a comparison between two types of farrowing accommodation. Appl. Anim. Behav. Sci., 1996;49:149-58.

29. Weary D.M., Phillips P.A., Pajor E.A., Fraser D. and B.K. Thompson. Crushing of piglets by sows: Effects of litter features, pen features and sow behaviour. Appl. Anim. Behav. Sci., 1998;61:103–11.

30. Wechsler B. and Hegglin. Individual differences in the behaviour of sows at the nestsiteand the crushing of piglets. Appl. Anim. Behav. Sci., 1997;51:39-49.

31. Wechsler B., and Weber R. Loose farrowing systems: challenges and solutions. Anim. Welf. 2007;16:295-307.

32. Xin H., and Zhang Q. Preference of heat lamp or heat mat by neonatal pigs at cool and warm ambient temperatures with low to high drafts. App. Eng. Agri., 1999;15(5):547-51.

33. Xin H., Zhou H., Bundy D.S. Comparison of energy use and piglet performance between the conventional and an energy-efficient heat lamp. App. Eng. Agri. 1997;13(1):95-99.

Indian Journal of Agriculture Business

Library Recommendation Form

If you would like to recommend this journal to your library, simply complete the form below and return it to us. Please type or print the information clearly. We will forward a sample copy to your library, along with this recommendation card.

Please send a sample copy to:

Name of Librarian

Name of Library

Address of Library

Recommended by:

Your Name/ Title

Department

Address

Dear Librarian,

I would like to recommend that your library subscribe to the **Indian Journal of Agriculture Business**. I believe the major future uses of the journal for your library would provide:

1. useful information for members of my specialty.
2. an excellent research aid.
3. an invaluable student resource.

I have a personal subscription and understand and appreciate the value an institutional subscription would mean to our staff.

Should the journal you're reading right now be a part of your University or institution's library? To have a free sample sent to your librarian, simply fill out and mail this today!

Stock Manager

Red Flower Publication Pvt. Ltd.

48/41-42, DSIDC, Pocket-II

Mayur Vihar Phase-I

Delhi - 110 091(India)

Phone: Phone: 91-11-45796900, 22754205, 22756995, Cell: +91-9821671871

E-mail: sales@rfppl.co.in

Indian Journal of Agriculture Business
Volume 4 Number 1, January - June 2018
DOI: http://dx.doi.org/10.21088/ijab.2454.7964.4118.4

Review Article

Role of Animal By-Products Utilization in Doubling the Farmers Income

D.N. Singh[1], R. Sirohi[2], Y. Singh[3], Ajay Kumar[4], P.K. Shukla[5]

Author's Affiliation
[1,2,3,& 4]Assistant Professor, Department of LPM [5] Professor & Head, Department of Poultry Science, College of Veterinary Science & Animal Husbandry, U.P. Pandit Deen Dayal Upadhayaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan (DUVASU), Mathura, Uttar Pradesh 281001, India.

Reprint Request
D.N. Singh,
Assistant Professor, Department of LPM, College of Veterinary Science & Animal Husbandry, U.P. Pandit Deen Dayal Upadhayaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan (DUVASU), Mathura, Uttar Pradesh 281001, India.
E-mail: drdeep25@gmail.com

Received on 07.05.2018
Accepted on 09.06.2018

Abstract

Animal husbandry is the most important component of Indian agriculture supporting livelihood of more than two-thirds of the rural population especially marginal, small & landless farmers of our country. Animals provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin, and are a regular source of cash income for rural households. The growth of livestock wealth in India at the rate of approximate 6% per annum. Animals provide nutrient-rich food products, draught power, dung as organic manure and domestic fuel, hides & skin, and are a regular source of cash income for rural households Animal Husbandry and Dairying play an important role in development of India's economy. Livestock by-products, such as processed animal proteins, animal fats, milk and egg products, and former food products represent a potentially valuable resource for feeding livestock. Proper utilization of by-product has direct impact on the economy and environmental pollution of country as well as for improvement of socio-economic condition of the farmers. Non-utilization of animal by-products in a proper way may create major aesthetic and catastrophic health problems. Judicious and efficient utilization of animal by-product has direct impact on the income generation and to reduce environmental pollution of the country as well as for the betterment of socio-economic status of the farmers. In recent years there has been tremendous work has been done for wide spread and increasing interest among the people for proper and judicious utilization of the animal byproduct of the dairy, meat and skin industry along with dung & urine for preparation of valuable product such as Panchgavya, Jeevamrit and Gau-mutra ark etc for betterment of socio-economic status of farmers as well as for healthy environmental issues.

Keywords: Byproduct; Bovine; GDP; Gaumutra Ark; Livestock; Pollution & Panchgavya.

Introduction

Animal Husbandry is an economic enterprise & considered as "Survival enterprise" for millions of people in India, especially in the Arid & Semi-Arid regions. In India, 85% livestock keepers are small & marginal farmers having less than 2 hectare of land, operating 44% of land for crop cultivation & contributing more than 69% in country milk production. Future of sustainable agriculture growth & food security in India depends on the performance of small & marginal farmers. Livestock is an engine for economic diversification and sustainable rural development.

It serves as a lifeline since it provides livelihood to two-third of rural community giving

employment to large population of unskilled youth. Livestock contributes 16 per cent to the income of small farm households as against the national average of 14 per cent for all rural households. Not only this, livestock sector provides employment to 8.8 per cent of population which largely comprises of landless and unskilled population. In the livestock sector, the dairy sub-sector has always played an important role.

This is quite evident from the words of Nanda Kumar, Chairman National Dairy Development Board (NDDB) that "Doubling farmers' income by 2022 is impossible without dairy farming which has a CAGR of 19.6 per cent. 85 per cent of the farmers in India who are marginal and small own 45 per cent of the land, but 75 per cent of the bovine. So probably for a landless person, dairying is one of the best occupations".

Moreover no one is left untouched from the commendable position of India in the world in milk production accounting for 18.5 per cent of world production (789 million tons). The monetary value of this is more than the current combined value of rice and wheat, and this was achieved without subsidy and incentives.

Dairy by-products viz. skim milk, butter milk, whey and ghee residues have a very useful value for human nutrition, which have a good medicinal values. These by-products are further used for manufacturing of different products by using different processing methods such as pasteurization, sterilization, fermentation, coagulation & drying processes.

Animal by-products (ABPs), such as processed animal proteins, animal fats, milk and egg products, and former food products represent a potentially valuable resource for feeding livestock. Thus the use of different by-product of livestock such as dairy, dung, urine and meat industries by-product & their importance should be promoted extensively by organizing regular awareness program & educating the farmers to improve their income as well as to improve socio-economic status.

The growth of a country is directly related with energy, renewable as well as non-renewable resources. Animal by-products (ABPs), such as processed animal proteins, animal fats, milk and egg products, and former food products represent a potentially valuable resource for feeding livestock.

Using animal manure as fuel offers a number of advantages for large livestock and poultry operations. Wastes are either inexpensive or cheaper than propane, electricity and most natural gas. In fact, there are costs associated with disposing of manure which can be minimized through use as a fuel. In addition, using manure as a fuel minimizes odor, run off (non-point source pollution) and other nuisances.

Dairy Industry Byproduct

A dairy by-product can be defined as a product of commercial value produced during the manufacture of a main dairy product such as paneer, cheese, chhana, butter milk and ghee. The major dairy industry by-products are skim milk, butter milk, ghee residue and whey. Utilization of dairy by-products improves plant economy, makes valuable nutrients available for humans and reduces environmental pollution originating from dairy waste. It is a true fact that proper and judicious disposal of dairy by-products is an essential parameters for profitable dairy industry as well as for betterment of farmer and environmental hygiene.

In our country, skim milk the major by-product of dairy industry is mostly utilized either for standardization purposes or preserved in spray dried form and some time it is used for economic ration formulation of calves in milk replacer. Skim milk powder is major component of milk replacer. In milk replacer the quantity of skim milk powder should not be less than 50% of the milk replacer. Due to huge demands for chhana, paneer & cheese in india, there is more production of whey, which can be judiciously used for feeding of calf or for preparation of whey beverage, plain and sweetened condensed whey, whey protein concentrate, dried whey & ricotta cheese by different processing methods. Butter milk is the major by-product obtained during the manufacture of butter from curd while ghee residues are the major by-products of ghee industry which is generally used for making toffee & sweet meat.

By-Products of Indian Dairy Industry

The dairy byproduct utilization also provides source of income by different value addition methods.

Dung & Urine

Cow dung is a very good source for maintaining the production capacity of soil and enhances the

Table 1:

Main Product	By Product	Processing method	Products Made
1. Cream	Skim milk	Pasteurization	Flavoured milk
		Sterilization	Sterilized flavoured milk
		Fermentation	Cultured Butter milk
		Fermentation and Concentration	Concentrated sour skim milk
		Concentration	Plain and Sweetened Condensed skim milk
		Drying	Dried skim milk or Skim milk powder or Non Fat Dry Milk NFDM)
2. Butter	Butter Milk	Coagulation	Cottage cheese & edible casein
		Fermentation and Concentration	Condensed butter milk
		Concentration and drying	Dried butter milk
		Coagulation	Soft cheese
3. Cheese, Paneer & Chhana	Whey	Fermentation	Whey beverage, Yeast whey
		Concentration	Plain and sweetened condensed whey, whey protein concentrate, whey paste, lactose
		Drying	Dried whey
		Coagulation	Ricotta cheese
4. Ghee	Ghee residue	Processing	Sweet meat, Toffee, Sweet paste

microbial population. Cow dung has been considered as a Gold Mine due its wide applications in the field of agriculture, energy resource, environmental protection and therapeutic applications It is also used as a co-product in agriculture, such as manure, bio-fertiliser, bio-pesticides and pest-repellent. Several Products has been launched by the manufacturing companies such as soap, toothpaste, floor cleaners, hair oil, incense, shaving cream and face wash from the cow dung to earn money.

The soap contains dried and pulverised cow dung, orange peel, lavender powder, and gooseberries, the company says. The toothpaste is made of dung, ghee, and urine. It is now readying a line of cosmetic products and medicines as well. Using animal manure as fuel can improve the financial bottom line of the farm operation. Generally, anaerobic digestion is the most flexible biomass conversion option for a farm operation. It produces biogas which has a heating value of approximately 600-800 Btu/cubic foot, 60 to 80% of the energy value of natural gas. The gas can be used to generate electricity, as a boiler or furnace fuel or to run refrigeration equipment. Biogas is one of the more important sources of energy in terms of cooking, electricity generation & mechanical energy generation. Biogas is a clean and efficient fuel. It is a mixture of methane (CH_4), carbon dioxide (CO_2), hydrogen (H_2) and hydrogen sulphide (H_2S). The chief constituent of biogas is methane (65%). The green-house gas emissions from the livestock farms can be reduced following anaerobic digestion approach of converting cattle dung into bio-energy. Thus, this process can be widely applied for the production of the biogas on a large scale. Moreover, the resulting methane can be utilized for electricity generation, lighting, heating and cooking. The cow's urine, cow's horn and a dead body of a cow can be used for preparing effective bio-fertilizer. Cow's urine have various medicinal uses for preparation of various medicines, fly & mosquito repellent etc.

Panchgavya

Maharshi Dhanvantari offered to mankind a wonder medicine "Panchgavya" (a combination of cow urine, milk, dung, ghee and curd). In Sanskrit, all these five products are individually called "Gavya" and collectively termed as "Panchgavya". An organic product has the potential to play the role of promoting growth and providing immunity in plant system. Panchagavya consists of five products viz. cow dung, cow urine, milk, curd (yogurt), and ghee. When suitably mixed and used, it has miraculous effects. Ancient Ayurvedic scriptures such as Bhela Samhita, Kashyapa Samhita, Charaka Samhita, Sushrutu Samhita, Gada Nigraha, Rasa Tantra Sara all speak highly about the divinity and significance of Panchagavya in human life. It is stated that consumption of Panchagavya results in removal of physical and mental disorders and is an

enhancer of prana, physical strength, and life span. Regular consumption results in the removal of poisons from the body, healing of food addictions, cure from side effects of alcohol, tobacco, and atmospheric pollutants, and it strengthens the immune system.

Biogas and Composting

It mainly comprises of hydro-carbon which is combustible and can produce heat and energy when burnt. Bio-gas is produced through a bio-chemical process in which certain types of bacteria convert the biological wastes into useful bio-gas. Since the useful gas originates from biological process, it has been termed as bio-gas. Dung has also been successfully used to produce bio-gas (methane) and generate electricity for consumer use. Biogas is used in cooking, for lighting in homes and streets.

It can be used for driving self-combustion engines for various uses like running a generator to produce electricity. The slurry (residue) could also be used for production of manure, which when spread on crops acts as an excellent fertilizer. Dung for Bio-gas and its slurry for manure is providing renewable cooking energy and slurry for compost. Proper manure disposal at a dairy farm has always been a concern. Small, integrated farming operations generally use the manures as fertilizers and apply the collected manure on soil surface of a crop land. There are limits to how much manure can be spread. Putting too much manure on fields can reduce yields. Additionally, spreading more manure than the requirement of crops can result in groundwater and surface water pollution.

Livestock Slaughter by-Product

Animal by-products include almost all parts of a live animal that are not part of the dressed carcass or edible part of meat. The by-products provide many of the raw materials used to make various products. Hides and skins are tanned and processed into leather for shoes, purses, clothing, car seats, and other items preparations while intestines can be used for preparations of sausage or casings.

Other animal by-products like bloods, glands and organs can be used for pharmaceutical, cosmetic, household, and industrial product manufacturing. In-edible animal byproducts include hide or skin, hair, horns, hooves, teeth, fats, bones, ligaments and cartilage, feet, glands, blood, and lungs are the primary raw materials used in the manufacture of a broad assortment of industrial, household, cosmetic, pharmaceutical, and medical suppliesas well as used for making products such as lubricants, plastics, soaps, glycerin, and gelatins (Alicia, 2012).

Meat sector in India plays an important role in providing livelihood to rural people, sustaining livestock production and contributes a valuable foreign exchange to the country. Livestock by-products include all parts of a live animal that are not part of the dressed carcass. The byproducts provide many of the raw materials used to make various products (Daniel et al., 2011). Meat sector in India plays an important role in providing livelihood to rural people in the country. Cosmetics, shoe polish and glue are common household products that are made, in part, from livestock by-products.

Gelatin is an edible by-product obtained from tissues rich in collagen such as pork skins, calf skins and bones which is extensively used in food industry, while Glue is made from skin or hides, cartilage and bones. The blood albumen, obtained from blood plasma, is used to make various types of adhesives material which are used in manufacturing of plywood and wood veneers. Animal fat has many edible and inedible applications. Rendered animal fat may be separated into glycerol and fatty acids. Glycerol is used in the production of pharmaceuticals, explosives, cosmetics, toothpastes, plastics , antifreeze and paints. Fatty acids are used in soaps, detergents, insecticides, herbicides, paints, lubricants, asphalt, car polishes and waxes, shaving cream, deodorants and perfumes.

Leather, produced from hides and skins, is used for shoes, clothing, luggage, furniture and automobile upholstery, sporting goods and many other products. Bone charcoal, derived from bones, is used to manufacture steel ball bearings. Hormones isolated from animal tissues and glands have been important for the production of pharmaceutical products. Heparin, obtained from lungs or liver, is used as an anticoagulant to prevent blood clots. Small intestines of sheep are generally used for preparation of surgical sutures.

The fats and extracted bone marrow were added into a measured quantity of water with appropriate quantity of caustic soda for soap preparation. The bone are also used for production of bone crafts i.e. ornamental items from bone.

Conclusion

The animal by-products and wastes are a good source of renewable energy for any country and plays a very significant role in development of nation, farmers & traders. In present scenario the utilization needs become significantly stronger due to competition. This is important because increasing profit and decreasing the cost is required in the future for the meat industry to remain viable. The use of different by-product of livestock such as dairy, dung & urine and meat industries by-product & their importance along with establishment of marketing strtegies should be promoted extensively by starting awareness program & educating the farmers to improve their income as well as to improve their socio-economic status.

References

1. 19th Livestock Census. All India Report, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India, Krishi Bhawan, New Delhi. 2012.
2. J.G. Alicia. The Effect of Internal Endpoint Temperature on Smoked Sausage Quality Stored under Light Emitting Diode and Fluorescent Lighting. 2012.
3. K. Jayathilakan & Khudsia Sultana & K. Radhakrishna & A. S. Bawa. Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review J Food Sci Technol 2012 May–June;49(3):278–93.
4. L. M. Daniel, J. J. Rachel and H. M. Kenneth. Where's the (Not) Meat? A text book on Byproducts from Beef and Pork Production. 2001.
5. Mishr, R. and Singh S. Sustainable energy plan for a village in Punjab for self-energy generation. International Journal of Renewable Energy Research, 2013;3(3):640-646.
6. Mohammad Rais and Sherin Kuruvilla (2016). Meat Processing in India: Science, Technology, Policy and Skill Development. Journal of meat science and technology, 2016;4(2):53-61.
7. Ramachandra T.V. and Shruthi B.V. Spatial mapping of renewable energy potential. Renewable and Sustainable Energy Reviews, 2007;11:1460-80.
8. Sharma BD. Modern abattoir practices and animal byproducts technology, Jaypee Brothers Med. Publ., (P) Ltd. 2003.
9. Sharma BD and Sharma K. Outlines of Meat Science and Technology, Jaypee Brothers Med. Publ., (p) Ltd. 2011.pp.360.
10. Singh M.P. Organic waste creates power and fertilizer. Journal of the International Association on Electricity Generation, Transmission and Distribution, 2008;19-20(1):18.
11. Suresh A, Kavita B and Chaudhary KR. India's meat export: Structure, composition and future prospects. Indian Journal of Animal Sciences, 2012;82(7): 749-756.
12. Shastry, N.S.R. & Thomas, C.K. Cattle & buffalo production. A text book of Livestock Production Management (5th Revised edn.). 2015.

SUBSCRIPTION FORM

I want to renew/subscribe international class journal **"Indian Journal of Agriculture Business"** of Red Flower Publication Pvt. Ltd.

Subscription Rates:
- Institutional: INR5500/USD413

Name and complete address (in capitals): _____

_____

Payment detail:
Online payment link: http://rfppl.co.in/payment.php?mid=15

Cheque/DD: Please send the US dollar check from outside India and INR check from India made payable to 'Red Flower Publication Private Limited'. Drawn on Delhi branch.

Wire transfer/NEFT/RTGS:
Complete Bank Account No. 604320110000467
Beneficiary Name: Red Flower Publication Pvt. Ltd.
Bank & Branch Name: Bank of India; Mayur Vihar
MICR Code: 110013045
Branch Code: 6043
IFSC Code: BKID0006043 (used for RTGS and NEFT transactions)
Swift Code: BKIDINBBDOS

Term and condition for supply of journals
1. Advance payment required by Demand Draft payable to Red Flower Publicaion Pvt. Ltd. payable at Delhi.
2. Cancellation not allowed except for duplicate payment.
3. Agents allowed 10% discount.
4. Claim must be made within six months from issue date.

Mail all orders to
Subscription and Marketing Manager
Red Flower Publication Pvt. Ltd.
48/41-42, DSIDC, Pocket-II
Mayur Vihar Phase-I
Delhi - 110 091(India)
Phone: 91-11-45796900, 22754205, 22756995, Cell: +91-9821671871
E-mail: sales@rfppl.co.in

Indian Journal of Agriculture Business
Volume 4 Number 1, January - June 2018
DOI: http://dx.doi.org/10.21088/ijab.2454.7964.4118.5

Review Article

Stressors and Their Biochemical Indicators in Poultry

P.K. Shukla[1], Ashish Kumar[2], Ambika Sharma[3]

Author's Affiliation
[1]Registrar, Dean Post Graduate Studies [3]Assistant Professor, Dept. of Biochemistry, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura, Uttar Pradesh 281001, India. [2]Senior Veterinary Officer, All India Institute of Medical Sciences (AIIMS), Rishikesh, Uttarakhand 249203, India.

Reprint Request
P.K. Shukla,
Registrar, Dean Post Graduate Studies, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura, Uttar Pradesh 281001, India.
E-mail: pksmathura@yahoo.co.in

Received on 28.05.2018
Accepted on 21.06.2018

Abstract

Stress is an important area for concern in poultry industry as it has direct impact on the production performance of poultry. There are various types of stressors that jeopardies the poultry health. We need to minimize these stress by adopting good management practices and also by analysing the various biochemical indicators that may get affected due to stress. A battery of biochemical indicators is required to be tested to assess the severity of stress in poultry. In this review we tried to pool together the various parameters that may be a good indicator to ascertain the stress conditions in poultry.

Keywords: Stressors; Stress; Poultry; Biochemical Indicator; Corticosterone.

Poultry are the birds namely chickens, ducks, quails, turkeys that are reared since ages for eggs, meat, feathers and various other products or bye-products. The word poultry originated from the French word 'Poule' which find its origin from the Latin word 'Pullus' meaning small animals.

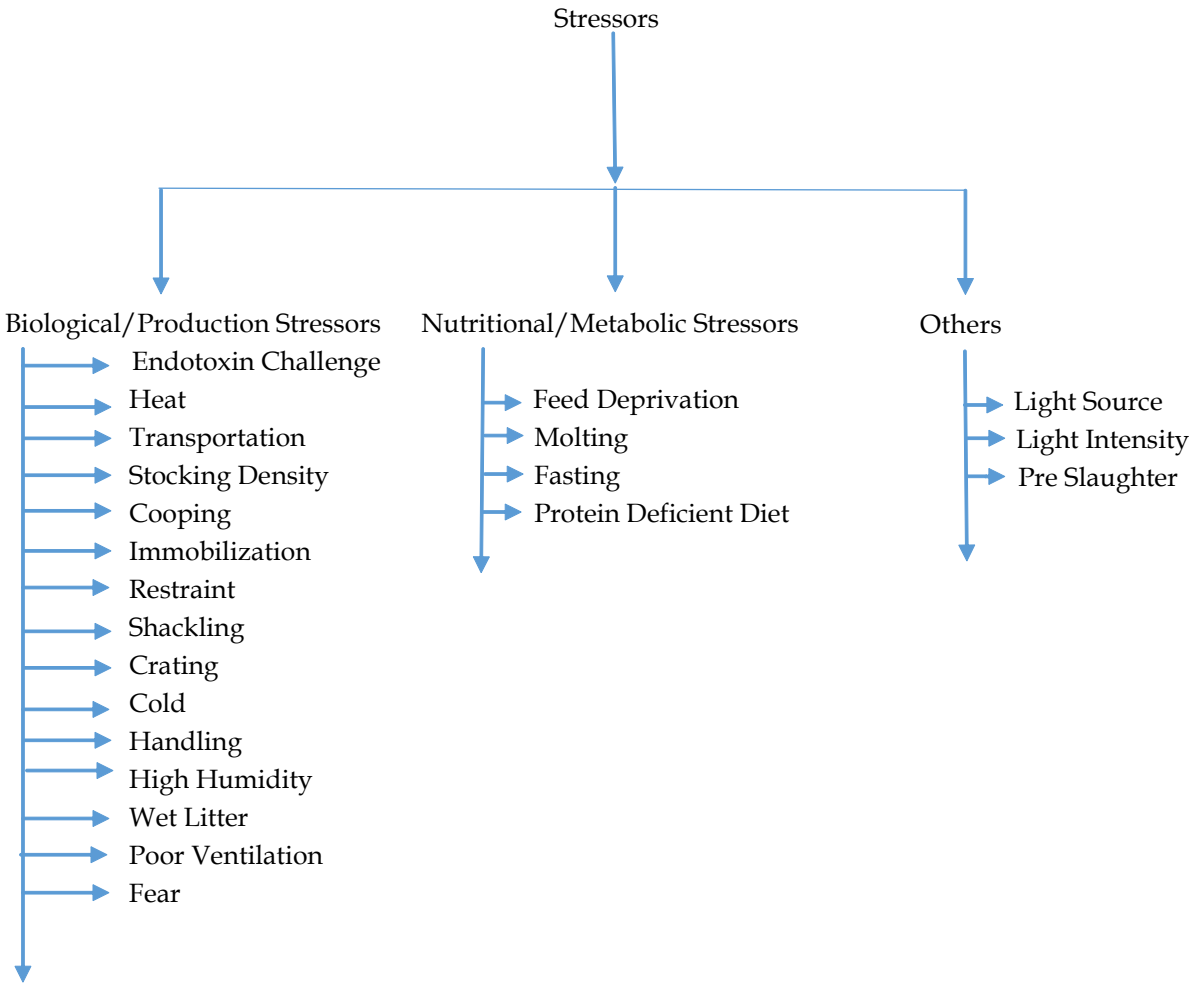
In India, poultry industry is growing at aphenomenal rate (8-10% per annum), much faster than the agricultural crops production (1.5-2% per annum). India is placed at position 3rd and 5th in the world list of largest egg and broiler producers respectively. India is emerging as the second largest market for poultry industry. The poultry industry is turning into a major backbone for the Indian economy and contribute almost 26,000 crores to the national GDP.

However, there are factors which on and often not only inflict losses to the farmers but also compromises our national economy and the most important are the stressors, that may be biological, nutritional and various others. These stressors directly affect the production capacity of the poultry. To reduce the losses due to these stressors we need to device a mechanism so as to minimize the impact of these stressors on the production output of the poultry.

If we go into the definition the "stressors are the agents that produces stress at any time" and the phenomenon is called Stress, which according to the Selye (1973) "Stress is the nonspecific response of the body to any demand". Love et al. (2013) identified four major system response to mitigate the effects of these stressors namely the Autonomic Nervous System (ANS) response, immune response, endocrine response and the behavioural response.

During the stress, there are changes in the normal levels of the various biochemical and physiological parameters, which helps us to assess the severity of stress at a given point of time.

The objective of this review is to group various stressors and to compile various biochemical parameters that may need to be studied while describing the stress conditions in the poultry.



Biochemical Indicators of Stress

Corticosterone

In poultry, the major adrenal glucocorticoid is corticosterone.There is an activation of Hypothalamic-Pituitary-Adrenal (HPA) axis due to the alteration in the activity of the neuroendocrine system of poultry caused by high environmental temperatures, cold, overcrowding, restraint, cooping, and shackling. These stressors cause an elevation in the plasma concentrations of corticosterone due to increased secretion of adrenocorticotropic hormone (ACTH) and corticotrophin releasing hormone (CRH).

There are literatures reporting different basal level of corticosterone in unstressed chickens as well as different levels during stress conditions, thereby requiring a validation of the corticosterone assays (Scanes et al. 2016). The basal concentration of corticosterone should be less than 0.3 ng/ml but as it is evident from the different studies that it may vary anywhere between 0.3 to 20 ng/ml. During stress, it may go up to the level of 150 ng/ml (Huang et al. 2014).

Adrenal Gland Ascorbic Acid Content

The adrenal glands contain large quantity of vitamin C. However, it secretes Vitamin C locally in response to stress and when ACTH is released from the pituitary leading to high concentrations. There is a significant depletion of adrenal gland ascorbic acid content in young chickens suffering from stress. Freeman, 1967 stated that the bird responds to stress in a way similar to the mammal but the response, as measured by adrenal ascorbic acid depletion, is considerably more rapid in bird.

Lipid Peroxidation/Free Radical Scavenging Activity (MDA Assay)

Pre-slaughter stress can lead to increase of oxidative activity and production of superoxides

free radicals in the muscle of poultry (Shanthaand Decker, 1994). Estimation of superoxide free radicals production in poultry muscle could be a sensitive indicator of pre-slaughter stress related to stunning (Serena et al. 2017). Heat stress elevates malondialdehyde (MDA), an indicator for lipid peroxidation (Altan et al. 2010)

Acid-Base Balance

Birds suffering from heat stress have increased panting or increased respiration rate leading to a reduction in blood partial pressure of CO_2, HCO_3 and an increase in blood pH, resulting in respiratory alkalosis. A significant difference was observed in pCO2 and HCO_3 level in heat stress (Zdenekand Slama, 2011). Acid-base parameters of laying hens are affected by heat stress.

Heterophils: Lymphocytes Ratio

The H: L ratio can be used as an index of stress in chickens. Stress causes a significant shift in the H: L ratio in poultry due to reduced numbers of circulating lymphocytes and higher numbers of heterophils. Maxwell (1993) reported an elevation in H:L ratio during heat and transportation stress.The increase of H:L ratio is a reliable and steady parameter reflecting stress. Corticosterone also influence the H:L ratio. However, in a meta-analysis report by Scanes and Christensen (2014), did not find any shift in H:L between commercial chickens and indigenous broilers suggesting commercial chickens are not stressed.

Hypocalcaemia

According to Marderand Arad (1989), heat stress hampers blood bicarbonate availability for egg shell mineralization, induces increased organic acid availability and decreases free calcium levels in the blood.

Thyroid Profile

Thyroid Hormones (T3 and T4) plays an important role in maintaining the body temperature and metabolic activity. Geraert et al (1996) and Elnagar et al. (2010) reported that triiodothyronine (T3) concentrations consistently decreased in high atmospheric temperature whereas changes in thyroxine (T4) levels are inconsistent with studies reporting decrease (Bobek et al. 1980), increase (Cogburnand Freeman, 1987) and no alteration (Mack et al., 2013).

Immune System and Antibodies

Heat stress causes an immunosuppressing effect on broilers and laying hens.The relative weights of thymus, bursaand spleen has been found to be lowered in laying hens and broilers subjected to heat stress as reported by Ghazi et al. (2012). Bartlett et al. (2003) observed lower levels of total circulating antibodies, as well as lower specific IgM and IgG levels in broilers subjected to heat stress.

Heat Shock Protein (HSP)

To maintain its thermal homeostasis, increased numbers of reactive oxygen species (ROS) are formed leading to oxidative stress with the production and release of heat shock proteins (HSP). High concentrations of HSP70 are found in broilers and laying hens exposed to heat stress (Gu et al. 2012).

Uric Acid

Plasma uric acid (UA) is a major antioxidant and it is an indicator of oxidative stress. A significant increase in plasma uric acid concentration was reported by Huff et al. (2008) in turkeys suffering from transport stress.

Glucose and Non Esterified Fatty Acid (NEFA)

An increase in glucose level for short duration transport occurs due to supply of liver glycogen whereas a decrease in glucose level was observed in three hours transport due to exhaustion of liver glycogen (Zhang et al. 2009). When glycogen reserve is exhausted to make up the shortage of glucose, the birds start utilizing fat and protein leading to the increase in NEFA. NEFA is a good indicator of lipolysis. Nijdam et al. (2005) reported a rise in blood NEFA levels in broilers suffering from transport stress with feed withheld. Stocking density, overcrowding also increases NEFA levels.

However, Geraert et al. (1996) reported that endocrinological changes caused by chronic heat stress in broilers stimulate lipid accumulation through increased de novo lipogenesis, reduced lipolysis, and enhanced amino acid catabolism.

Creatine Kinase (CK)

It is an intracellular enzyme and its elevation is indicative of damage to muscle membrane integrity due to transportation stress (Huff et al. 2008).

Total Protein and Albumin

Total protein and albumin levels increases following different duration of transport in ducklings (Erisir et al. 2008).

Triglyceride

A lowering in plasma triglyceride level were noticed when broilers were transported under high stocking densities due to more energy consumption by the birds (Delezie et al. 2007).

Conclusion

Corticosterone, Adrenal Glands Ascorbic Acid content and MDA levels are the established biochemical indicators for stress. Likewise, HSP, HL ratio, Acid base balance, organ weights of immunological interest are other criteria to assess the stress conditions in poultry. However different findings have been reported by different investigators while assessing these parameters in stress conditions of poultry probably due to different conditions of studies. Therefore, a uniform criteria need to be adopted while assessing these biochemical stress parameters in poultry. Still, these biochemical indicators give some excellent insights into the stress levels of poultry.

References

1. Altan O., Pabuccuoglu A., Altan A., Konyalioglu S., Bayraktar H. Effect of heat stress on oxidative stress, lipid peroxidation and some stress parameters in broilers. Br Poult Sci. 2010;44(4):545-50 DOI: 10.1080/00071660310001618334.
2. B.M. Freeman. Effect of stress on the ascorbic acid content of the adrenal gland of *Gallus domesticus*. Comparative Biochemistry and Physiology. 1967;23(1):303-305. https://doi.org/10.1016/0010-406X(67)90496-3.
3. Bartlett J.R., Smith M.O. Effects of different levels of zinc on the performance and immunocompetence of broilers under heat stress. Poult. Sci. 2003;82: 1580–88.
4. Bobek S., Niezgoda J., Pietras M., Kacinska M., Ewy Z. The effect of acute cold and warm ambient temperatures on the thyroid hormone concentration in blood plasma, blood supply, and oxygen consumption in Japanese quail. Gen. Comp. Endocrinol. 1980;40:201–10.
5. Cogburn L.A., Freeman R.M. Response surface of daily thyroid hormone rhythms in young chickens exposed to constant ambient temperature. Gen. Comp. Endocrinol. 1987;68:113–23. https://doi.org/10.1016/0016-6480(87)90066-9.
6. Colin G. Scanes. Biology of stress in poultry with emphasis on glucocorticoids and the heterophil to lymphocyte ratio. Poultry Science 2016;95:2208–215. http://dx.doi.org/10.3382/ps/pew137.
7. Delezie E., Swennen Q., Buyse J., Decuypere E. The effect of feed withdrawal and crating density in transit on metabolism and meat quality of broilers at slaughter weight. PoultSci 2007;86:1414-23. DOI: 10.1093/ps/86.7.1414.
8. Elnagar S.A., Scheideler S.E., Beck M.M. Reproductive hormones, hepatic deiodinase messenger ribonucleic acid, and vasoactive intestinal polypeptide-immunoreactive cells in hypothalamus in the heat stress-induced or chemically induced hypothyroid laying hen. Poult. Sci. 2010'89:2001–9. DOI: 10.3382/ps.2010-00728.
9. Erisir Z., Poyraz O., Erisir M., Onbasilar E.E., Erdem E. The changes of the body weight and some blood parameters of Pekin ducklings dependent on transportation duration. Journal of Animal and Veterinary Advances 2008;7:1190-95. http://medwelljournals.com/abstract/?doi=javaa.2008.1190.1195.
10. Geraert P.A., Padilha J.C.F., Guillaumin S. Metabolic and endocrine changes induced by chronic heat exposure in broiler chickens: biological and endocrinological variables. Br. J. Nutr. 1996;75: 205–16. https://doi.org/10.1017/BJN19960125.
11. Ghazi S.H., Habibian M., Moeini M.M., Abdolmohammadi A.R. Effects of different levels of organic and inorganic chromium on growth performance and immunocompetence of broilers under heat stress. Biol. Trace Elem. Res. 2012;146:309–17. DOI: 10.1007/s12011-011-9260-1.
12. Gu X.H., Hao Y., Wang X.L. Overexpression of heat shock protein 70 and its relationship to intestine under acute heat stress in broilers: 2. Intestinal oxidative stress. Poult. Sci. 2012;91:790–99. DOI: 10.3382/ps.2011-01628.
13. Huang J. C., Huang M., Wang P., Zhao L., Xu X.L., Zhou G.H., Sun J.X. Effects of physical restraint and electrical stunning on plasma corticosterone, post-mortem metabolism, and quality of broiler breast muscle. J. Anim. Sci. 2014;92:5749–56. DOI: 10.2527/jas.2014-8195.
14. Huff G.R., Huff W.E.,Rath N.C., Anthony N.B., Nestor K.E. Effects of Escherichia coli challenge and transport stress on hematology and serum chemistry values of three genetic lines of turkeys. Poult Sci 2008;87:2234-41. DOI: 10.3382/ps.2008-00128
15. Love O.P., McGowan P.O., Sheriff M.J. Maternal adversity and ecological stressors in natural populations: The role of stress axis programming in

individuals, with implications for populations and communities. Funct. Ecol. 2013;27:81-92.

16. Mack, L.A.; Felver-Gant, J.N.; Dennis, R.L.; Cheng, H.W.2013. Genetic variation alters production and behavioral responses following heat stress in 2 strains of laying hens. Poult. Sci. 2013;92:285–94. DOI: 10.3382 /ps.2012-02589.
17. Marder J. and Arad Z. Panting and acid-base regulation in heat stressed birds. Comparative Biochemistry and Physiology Part A: Molecular and Integrative Physiology, 1989;94:395–400.
18. Maxwell M. H. Avian blood leukocyte responses to stress. World's Poult. Sci. J. 1993;49:34–43 https://doi.org/10.1079/WPS19930004.
19. Nijdam E., Delezie E., Lambooij E., Nabuurs M.J.A., Decuypere E.Feed withdrawal of broilers before transport changes plasma hormone and metabolite concentrations. Poult Sci 2005;84:1146-52.
20. Scanes C.G., Christensen K. Comparison of meta-analysis of the hematological parameters of commercial and indigenous poultry to wild birds: implications to domestication and development of commercial breeds/lines. J. Vet. Sci. Anim. Health 2014;1(1):1-12.
21. Selye H. The Evolution of the Stress Concept: The originator of the concept traces its development from the discovery in 1936 of the alarm reaction to modern therapeutic applications of syntoxic and catatoxic hormones. Am. Sci. 1973;61:692-99.
22. Serena S., Maria Francesca P., Mariagrazia G., Nicoletta M., Maria L.C., Raffaelina M. Preliminary study on physicochemical and biochemical stress markers at poultry slaughterhouse Italian Journal of Food Safety 2017;6(6346):57-60.
23. Shantha N.C., Decker E.A. Rapid, sensitive, iron-based spectrophotometric methods for determination of peroxide values of food lipids. J AOAC Int 1994;77:421-4.
24. Zdenek H., SlamaP. Effect of Heat Stress on Biochemical Parameters of Hens. Proceedings of ECO pole 2011;5(1):57-60.
25. Zhang L., Yue H.Y., Zhang H.J., Xu L., Wu S.G. Transport stress in broilers: I. Blood metabolism, glycolytic potential and meat quality. Poult Sci 2009;88:2033-41. doi: 10.3382/ps.2009-00128.

Instructions to Authors

Submission to the journal must comply with the Guidelines for Authors.

Non-compliant submission will be returned to the author for correction.

To access the online submission system and for the most up-to-date version of the Guide for Authors please visit:

http://www.rfppl.co.in

Technical problems or general questions on publishing with IJAB are supported by Red Flower Publication Pvt. Ltd's Author Support team (http://rfppl.co.in/article_submission_system.php?mid=5#)

Alternatively, please contact the Journal's Editorial Office for further assistance.

Editorial Manager

Red Flower Publication Pvt. Ltd.

48/41-42, DSIDC, Pocket-II

Mayur Vihar Phase-I

Delhi - 110 091(India)

Phone: 91-11-22754205, 45796900, 22756995, Cell: +91-9821671871

E-mail: author@rfppl.co.in

Guidelines for Authors

Manuscripts must be prepared in accordance with "Uniform requirements for Manuscripts submitted to Biomedical Journal" developed by international committee of medical Journal Editors.

Types of Manuscripts and Limits

Original articles: Up to 3000 words excluding references and abstract and up to 10 references.

Review articles: Up to 2500 words excluding references and abstract and up to 10 references.

Case reports: Up to 1000 words excluding references and abstract and up to 10 references.

Online Submission of the Manuscripts

Articles can also be submitted online from http://rfppl.co.in/customer_index.php.

I) First Page File: Prepare the title page, covering letter, acknowledgement, etc. using a word processor program. All information which can reveal your identity should be here. use text/rtf/doc/PDF files. Do not zip the files.

2) Article file: The main text of the article, beginning from Abstract till References (including tables) should be in this file. Do not include any information (such as acknowledgement, your name in page headers, etc.) in this file. Use text/rtf/doc/PDF files. Do not zip the files. Limit the file size to 400 Kb. Do not incorporate images in the file. If file size is large, graphs can be submitted as images separately without incorporating them in the article file to reduce the size of the file.

3) Images: Submit good quality color images. Each image should be less than 100 Kb in size. Size of the image can be reduced by decreasing the actual height and width of the images (keep up to 400 pixels or 3 inches). All image formats (jpeg, tiff, gif, bmp, png, eps etc.) are acceptable; jpeg is most suitable.

Legends: Legends for the figures/images should be included at the end of the article file.

If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks from submission. Hard copies of the images (3 sets), for articles submitted online, should be sent to the journal office at the time of submission of a revised manuscript. Editorial office: Red Flower Publication Pvt. Ltd., 48/41-42, DSIDC, Pocket-II, Mayur Vihar Phase-I, Delhi – 110 091, India, Phone: 91-11-22754205, 45796900, 22756995. E-mail: author@rfppl.co.in. Submission page: http://rfppl.co.in/article_submission_system.php?mid=5.

Preparation of the Manuscript

The text of observational and experimental articles should be divided into sections with the headings: Introduction, Methods, Results, Discussion, References, Tables, Figures, Figure legends, and Acknowledgment. Do not make subheadings in these sections.

Title Page

The title page should carry

1) Type of manuscript (e.g. Original article, Review article, Case Report)
2) The title of the article, should be concise and informative;
3) Running title or short title not more than 50 characters;
4) The name by which each contributor is known (Last name, First name and initials of middle name), with his or her highest academic degree(s) and institutional affiliation;
5) The name of the department(s) and institution(s) to which the work should be attributed;
6) The name, address, phone numbers, facsimile numbers and e-mail address of the contributor responsible for correspondence about the manuscript; should be mentoined.
7) The total number of pages, total number of photographs and word counts separately for abstract and for the text (excluding the references and abstract);
8) Source(s) of support in the form of grants, equipment, drugs, or all of these;
9) Acknowledgement, if any; and
10) If the manuscript was presented as part at a meeting, the organization, place, and exact date on which it was read.

Abstract Page

The second page should carry the full title of the manuscript and an abstract (of no more than 150 words for case reports, brief reports and 250 words for original articles). The abstract should be structured and state the Context (Background), Aims, Settings and Design, Methods and Materials, Statistical analysis used, Results and Conclusions. Below the abstract should provide 3 to 10 keywords.

Introduction

State the background of the study and purpose of the study and summarize the rationale for the study or observation.

Methods

The methods section should include only information that was available at the time the plan or protocol for the study was written such as study approach, design, type of sample, sample size, sampling technique, setting of the study, description of data collection tools and methods; all information obtained during the conduct of the study belongs in the Results section.

Reports of randomized clinical trials should be based on the CONSORT Statement (http://www. consort-statement. org). When reporting experiments on human subjects, indicate whether the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional or regional) and with the Helsinki Declaration of 1975, as revised in 2000 (available at http:// www.wma.net/e/policy/l 7-c_e.html).

Results

Present your results in logical sequence in the text, tables, and illustrations, giving the main or most important findings first. Do not repeat in the text all the data in the tables or illustrations; emphasize or summarize only important observations. Extra or supplementary materials and technical details can be placed in an appendix where it will be accessible but will not interrupt the flow of the text; alternatively, it can be published only in the electronic version of the journal.

Discussion

Include summary of key findings (primary outcome measures, secondary outcome measures, results as they relate to a prior hypothesis); Strengths and limitations of the study (study question, study design, data collection, analysis and interpretation); Interpretation and implications in the context of the totality of evidence (is there a systematic review to refer to, if not, could one be reasonably done here and now?, What this study adds to the available evidence, effects on patient care and health policy, possible mechanisms)? Controversies raised by this study; and Future research directions (for this particular research collaboration, underlying mechanisms, clinical research). Do not repeat in detail data or other material given in the Introduction or the Results section.

References

List references in alphabetical order. Each listed reference should be cited in text (not in alphabetic order), and each text citation should be listed in the References section. Identify references in text, tables, and legends by Arabic numerals in square bracket (e.g. [10]). Please refer to ICMJE Guidelines (http://www.nlm.nih.gov/bsd/uniform_ requirements.html) for more examples.

Standard journal article

[1] Flink H, Tegelberg Å, Thörn M, Lagerlöf F. Effect of oral iron supplementation on unstimulated salivary flow rate: A randomized, double-blind, placebo-controlled trial. J Oral Pathol Med 2006; 35: 540-7.

[2] Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

[3] Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

[4] American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

[5] Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

[6] Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

[7] Nauntofte B, Tenovuo J, Lagerlöf F. Secretion

and composition of saliva. In: Fejerskov O, Kidd EAM, editors. Dental caries: The disease and its clinical management. Oxford: Blackwell Munksgaard; 2003. p. 7-27.

No author given

[8] World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

[9] National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ 20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.

More information about other reference types is available at www.nlm.nih.gov/bsd/uniform_requirements.html, but observes some minor deviations (no full stop after journal title, no issue or date after volume, etc).

Tables

Tables should be self-explanatory and should not duplicate textual material.

Tables with more than 10 columns and 25 rows are not acceptable.

Table numbers should be in Arabic numerals, consecutively in the order of their first citation in the text and supply a brief title for each.

Explain in footnotes all non-standard abbreviations that are used in each table.

For footnotes use the following symbols, in this sequence: *, ¶, †, ‡‡,

Illustrations (Figures)

Graphics files are welcome if supplied as Tiff, EPS, or PowerPoint files of minimum 1200x1600 pixel size. The minimum line weight for line art is 0.5 point for optimal printing.

When possible, please place symbol legends below the figure instead of to the side.

Original color figures can be printed in color at the editor's and publisher's discretion provided the author agrees to pay.

Type or print out legends (maximum 40 words, excluding the credit line) for illustrations using double spacing, with Arabic numerals corresponding to the illustrations.

Sending a revised manuscript

While submitting a revised manuscript, contributors are requested to include, along with single copy of the final revised manuscript, a photocopy of the revised manuscript with the changes underlined in red and copy of the comments with the point to point clarification to each comment. The manuscript number should be written on each of these documents. If the manuscript is submitted online, the contributors' form and copyright transfer form has to be submitted in original with the signatures of all the contributors within two weeks of submission. Hard copies of images should be sent to the office of the journal. There is no need to send printed manuscript for articles submitted online.

Reprints

Journal provides no free printed reprints, however a author copy is sent to the main author and additional copies are available on payment (ask to the journal office).

Copyrights

The whole of the literary matter in the journal is copyright and cannot be reproduced without the written permission.

Declaration

A declaration should be submitted stating that the manuscript represents valid work and that neither this manuscript nor one with substantially similar content under the present authorship has been published or is being considered for publication elsewhere and the authorship of this article will not be contested by any one whose name (s) is/are not listed here, and that the order of authorship as placed in the manuscript is final and accepted by the co-authors. Declarations should be signed by all the authors in the order in which they are mentioned in the original manuscript. Matters appearing in the Journal are covered by copyright but no objection will be made to their reproduction provided permission is obtained from the Editor prior to publication and due acknowledgment of the source is made.

Approval of Ethics Committee

We need the Ethics committee approval letter from an Institutional ethical committee (IEC) or an institutional review board (IRB) to publish your Research article or author should submit a statement that the study does not require ethics approval along with evidence. The evidence could either be consent from patients is available and there are no ethics issues in the paper or a letter from an IRB stating that the study in question does not require ethics approval.

Abbreviations

Standard abbreviations should be used and be spelt out when first used in the text. Abbreviations should not be used in the title or abstract.

Checklist

- Manuscript Title
- Covering letter: Signed by all contributors
- Previous publication/ presentations mentioned, Source of funding mentioned
- Conflicts of interest disclosed

Authors

- Middle name initials provided.
- Author for correspondence, with e-mail address provided.
- Number of contributors restricted as per the instructions.
- Identity not revealed in paper except title page (e.g. name of the institute in Methods, citing previous study as 'our study')

Presentation and Format

- Double spacing
- Margins 2.5 cm from all four sides
- Title page contains all the desired information. Running title provided (not more than 50 characters)
- Abstract page contains the full title of the manuscript
- Abstract provided: Structured abstract provided for an original article.
- Key words provided (three or more)
- Introduction of 75-100 words
- Headings in title case (not ALL CAPITALS). References cited in square brackets
- References according to the journal's instructions

Language and grammar

- Uniformly American English
- Abbreviations spelt out in full for the first time. Numerals from 1 to l0 spelt out
- Numerals at the beginning of the sentence spelt out

Tables and figures

- No repetition of data in tables and graphs and in text.
- Actual numbers from which graphs drawn, provided.
- Figures necessary and of good quality (color)
- Table and figure numbers in Arabic letters (not Roman).
- Labels pasted on back of the photographs (no names written)
- Figure legends provided (not more than 40 words)
- Patients' privacy maintained, (if not permission taken)
- Credit note for borrowed figures/tables provided
- Manuscript provided on a CDROM (with double spacing)

Submitting the Manuscript

- Is the journal editor's contact information current?
- Is the cover letter included with the manuscript? Does the letter:

1. Include the author's postal address, e-mail address, telephone number, and fax number for future correspondence?
2. State that the manuscript is original, not previously published, and not under concurrent consideration elsewhere?
3. Inform the journal editor of the existence of any similar published manuscripts written by the author?
4. Mention any supplemental material you are submitting for the online version of your article. Contributors' Form (to be modified as applicable and one signed copy attached with the manuscript)