

# Identification of Group Structure among Abattoirs Workers of Kano State Metropolitan, Nigeria based on their KAP Scores in Relation to Hygiene Practice: A Two-Step Cluster Analysis

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## Abstract

A cross sectional study was conducted to evaluate the level of knowledge, attitude and practice (KAP) of workers of abattoirs of Kano state Metropolitan area in Nigeria regarding hygiene practice to be followed during the processing of animal products for human consumption and group them based on their present status. A group of 170 workers were selected from three abattoirs using stratified random sampling and interviewed using a semi-structured questionnaire to assess their knowledge, attitude and practice in relation to hygiene practices during the period of July to August, 2014. The gap analysis indicates that these workers are generally rich in attitude but poor in knowledge. A Two-Step cluster analysis was used to group these abattoir workers based on their demographic factors like age, marital status, education status; working experience and the type of work they render during their work and also based on the average scores of knowledge, attitude and practice obtained by them. A four-cluster structure was obtained. It seems knowledge level does not differentiate the workers of four clusters where as attitude and practice do. Young and inexperienced workers possess good attitude and sincere in their practice than older and experienced workers. However, there is need to increase the level of knowledge on hygiene practices among abattoir workers in order to reduce the incidence of diseases and sickness in the state.

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## 1. Introduction

A KAP (Knowledge, Attitude and Practice) survey is a representative study of a specific community to collect information on what is known, believed and acted on in relation to a particular topic (WHO, 2008). These studies have been playing important role in Veterinary-Public Health research by taking up different applications based on the understanding that increasing knowledge will result in changing attitudes and practices to minimize disease burden of the community (Tornimbene *et al.*, 2014; Peter Musyoka Kioko, 2004 ). The applications of this survey-based study include influencing community on controlling epidemics, identifying knowledge gap, determining behavioral patterns and documenting cultural beliefs that may act as barriers to controlling infectious diseases, designing relevant public health awareness campaigns to reduce the disease burden and

provision of baseline data for planning, implementation and evaluation of national control programmes understanding of disease transmission, recognition of disease symptoms, perceptions of causes and treatment seeking behavior (Ehiri and Morris, 1996). Statistical analysis of the different levels of the three factors of the KAP studies provides a more efficient way of awareness creation as it will allow the program to be tailored more appropriately to the needs of the community and help us in the development of evidence-based disease prevention campaigns that can have an important impact on the occurrence of disease epidemics (Peter Musyoka Kioko, 2004).

## 2. KAP Studies in Veterinary-Public Health

Increased public awareness of food-borne disease has shown that food safety is an important issue

to producers, processors, distributors, regulatory authorities and consumers (WHO, 2002). Statistics say that one third of the human population especially in developed countries is affected by food-borne diseases every year and, the problem is likely to be even more widespread in developing countries (WHO, 2002). It is important to have an understanding of the interaction on prevailing food safety beliefs, knowledge and practices of food processors in order to reduce food-borne outbreaks (WHO 2000). Food processing centers are one of the sources for getting food-borne diseases and good knowledge of food processors towards food safety and the effective practices of such knowledge in food handling are imperative in ensuring the safe production of food in any abattoir operations (Chukwuocha *et al.*, 2009). Recently, many studies pinpoint that education on food safety and proper training on food processing should be given to all staff in food processing businesses so as to bring behavioral changes besides adoption of positive attitudes. Besides knowledge and attitude, the food handler's practice is also an important factor that ensures a reduction trend of food-borne diseases (Emanuel *et al.*, 2010).

As animal food is such a highly perishable food stuff and the abattoir is in such a labour-intensive working environment, the knowledge and level of training of the food processors regarding personal and general hygiene is of particular importance to ensure the health and safety of the consumers and hence, abattoir workers who process the animal food for human consumption play important roles in ensuring food safety (Haileselassie *et al.*, 2013). Good knowledge associated with positive attitudes towards processing procedures and sincere practice of food processors in the abattoirs are considered as a crucial line of defense in the prevention of most types of food-borne illnesses (Labib Sharif *et al.*, 2013).

Despite the fact that the international food management agencies have already provided guidelines to member countries about safe handling procedures such as HACCP and Good Manufacturing Practices, the knowledge and perceptions of meat handlers on safe food handling in most developing countries particularly in Nigeria remain largely unknown (Adesokan and Raji, 2014). But the recently held two studies in different regions of Nigeria on different communities have used multivariate logistic regression model to establish the association between different levels of KAP of workers abattoirs about safe meat-handling and socio-economic factors like age-group, gender and work experience (Adesokan and Raji, 2014; Alhaji and Baiwa, 2015). This study makes an attempt to group the workers of abattoirs of Kano metropolitan area of Nigeria State based on their KAP scores in relation to hygiene practices followed by them during

the food processing and different socioeconomic factors using Two-Step Cluster analysis.

### **3. Material and Method**

#### **3.1 Study Area**

The study was conducted in Kano State Metropolitan City in June to July, 2014. There are 2,163,225 people as 2006 national population census living within the metropolitan area which has a total area of 499kms (NPC, 2014). Kano state situated at 11<sup>0</sup> 30 North latitude and 8<sup>0</sup> 30 East longitude at an altitude of 2300 meters above the sea level (KSN, 2014). The predominant ethnic group of Kano State is Hausa Fulani and it consists of wooded savanna in the south and scrub vegetation in the north and is drained by the Kano-Chalawa-Hadejia river system. Majority of the people of this state are farmers producing crops such as millet, rice, cassava, date palms, fruits, vegetables, sorghum, wheat, sweet potato, sugarcane, groundnut, cotton etc. Kano state rainfall usually ranges from three to five months with a temperature of 26°C to 33°C (KSN, 2014). Kano State is the most populated region of the Nigerian federation, the current population of the state is more than 9,401,288 million. As most of the people consume animal origin food and there is an increased demand for such foods in this state (Junaidu *et al.*, 2015).

#### **3.2 Study Design**

This cross-sectional descriptive study was conducted mainly to evaluate the knowledge, attitude and practice in relation to hygiene practices among workers of abattoirs and group the workers based on the scores of these factors. A structured questionnaire was used to collect information from the workers of the three metropolitan abattoirs, namely, Kano main abattoir, Bachirawa abattoir and Yarakwa abattoir. Individual verbal consent was obtained from the respondents prior to data collection and permission for data collection was taken from Ministry of Agriculture and Natural Resources through the Director Veterinary Service of Kano State. The study was approved by the Institutional Review Board of the School of Public Health, SRM University, India.

#### **3.3 Data Collection**

A self administered questionnaire for this study was prepared which consists of four parts; the first part collects information about the socio demographic characteristics of the respondents such as; age, marital status, years of working experience, and educational level, the second part consists of question covering different aspects of hygiene practices to be followed

which include; hand washing, wearing of protective cloth, cleaning of protective cloth, method of pest control, method of meat preservation and storage, the third part deals with different aspects of knowledge about hygiene practices that involves; effect of training and frequency of the training and the last part consists of statements like Following hygiene practices is part of our responsibility, Improper storage will be harmful to health, Wearing protective cloth is important etc. and the responses to these statements are used to assess the attitude of the respondents towards hygiene practice. The questionnaire was designed in English. On an average 15minutes were spent to interview each respondent. Total sample size of 230 samples was calculated using  $n = z^2 (pq)/d^2$  but only 170 data was collected and analyzed. Stratified random sampling method was used to select the respondents based on the type of service they render in the abattoir; eviscerations, flaying, admin staff, public health duty, hide and skin, bleeders and sectioning. The number of samples drawn from each stratum were calculated and assigned using proportional allocation  $n_h = n/N * N_h$  where  $n_h$  is the stratum sample size,  $n$  is the sample size,  $N$  is the total population and  $n_h$  is the stratum size.

### **3.4 Two-Step Cluster Analysis**

The SPSS developed Two-Step clustering method is a scalable cluster technique meant for large data sets. This method groups the observations in two stages. In the first stage, this method scans the observations one by one and decides whether the observation can be added to one of the previously formed clusters or whether it can start a new cluster based on the some distance criterion. This procedure is continued till all the observations are accommodated in all the clusters. In the second stage treating each sub-cluster centre as an observation, they are grouped into desired number clusters. Euclidean distance and log-likelihood distance are used as distance measures. Euclidean distance is used when all the variables are of continuous type and Log-likelihood distance is used when are variables are of mixed type (SPSS Technical Report, 2001). In calculating log-likelihood, it assumes normal distributions for continuous variables and multinomial distributions for categorical variables and also assumes that the variables are independent of each other, as well as the observations (Banfield and Raftery, 1993).

If the desired number of clusters is unknown, this method will find the proper number of clusters automatically in such a way that objects in a group are homogeneous and objects between groups are heterogeneous. This method sees that generally the observations in one sub-cluster end up in one of the

final clusters so that the pre-cluster step may not affect the accuracy of the final clustering. In general, inaccuracy from the pre-cluster step decreases as the number of sub-clusters from the pre-cluster step increases. However, too many sub-clusters will slow down the second stage clustering. This method chooses the number of sub-clusters carefully in such a way that the number is large enough to produce accurate results and small enough to not inhibit performance in the later clustering procedure (Banfield and Raftery, 1993). In order to determine the optimal number of clusters, this method uses automatic clustering function like Schwarz's Bayesian Criterion (BIC) for each potential number of clusters, the change in BIC from the prior to the current number of clusters, the ratio of BIC changes, and the subsequent ratio of those distance measures. The optimal number of clusters is usually associated with the lowest of BIC and the largest ratio of distance measures. The face-validity of the cluster solution is obtained using Chi-square test and student's t-test (SPSS Technical Report, 2001).

### **3.5 Data Analysis**

Data are analyzed through Statistical Package for Social Sciences version 17.0. Descriptive statistics such as means and frequencies were used to present the level of knowledge, attitude and practice of about hygiene practice among workers and two step cluster analysis was used to group the worker based on their KAP score.

## **4. Result**

Out of 170 respondents interviewed, majority of the workers (62%) are in the age group of 21-40, almost all the respondents (97%) received training regarding hygiene in the abattoir itself by the public health personnel within the abattoir when the need arose. Majority of the respondents are married (67%). About 43% and 32% attended secondary school and primary school respectively, 17% completed tertiary education and only 7% with no formal education. Out of 170 respondents involved in this study 62% of the respondents have working experience less than 10 years, 10% have just 15 years, and 15% have working experience more than 20 years and all of them are male workers. Details of auto-clustering from the result shows that BIC coefficient is lowest (1584.536) and the ratio of distances is the largest (1.795) for four clusters, which establishes that the optimal number of clusters is four for this dataset. The cluster distribution is that the first cluster consists of 38 workers, the first cluster (Cluster I) workers are, on the average, 25 years of age, all of them are unmarried and have completed secondary level education, on the average, 4 years of service, 19 of them do flying job.

Table 1: Demographic characteristics of the respondents

Characteristic	Demographic characteristics	Number (%)
Age	<=20	9(5.3)
	21-30	48(28.2)
	31-40	58(34.2)
	41-50	32(18.8)
	>50	23(13.5)
Marital status	Married	114(67)
	Single	56(33)
Educational level	Primary	55(32.4)
	Secondary	71(41.8)
	Tertiary	29(17.1)
	No formal education	13(7.6)
Working experience	1-5	67(39.4)
	6-10	38(22.4)
	11-15	18(10.6)
	16-20	21(12.4)
	21-25	20(11.8)
	>25	6(3.4)
Service	Admin staff	18(10.6)
	Bleeders	35(20.6)
	Flaying	53(31.2)
	Public health duty	15(8.8)
	Evisceration	31(18.2)
	Splitting	7(4.1)
	Hide and skin	11(6.5)
Training	Yes	165(97.1)
	No	5(2.9)

Table 2: Detail of auto clustering

Number of Clusters	Schwarz's Bayesian Criterion (BIC)	BIC Change <sup>a</sup>	Ratio of BIC Changes <sup>b</sup>	Ratio of Distance Measures <sup>c</sup>
1	1921.475			
2	1697.988	-223.487	1.000	1.794
3	1618.882	-79.106	.354	1.327
4	1584.536	-34.346	.154	1.795
5	1606.853	22.317	-1.100	1.105
6	1636.826	29.973	-.134	1.200
7	1678.934	42.108	-.188	1.051
8	1723.971	45.037	-.202	1.051
9	1771.788	47.817	-.214	1.060
10	1822.734	50.946	-.228	1.224
11	1883.145	60.411	-.270	1.183
12	1950.098	66.953	-.300	1.005

The second cluster consists of 35 workers, they have more than five (5) years of working experience and majority of them (35) conduct evisceration as their work. The third cluster (Cluster III) consists of again 38 workers, they have the highest score of knowledge and having more than 37 years, they have been working in the abattoir for more 13 years, about 36 of them completed secondary school and participate more in flaying work. The last cluster (Cluster IV) consists of 59 workers, majority of the worker in this cluster are

more than 43 years and completed only primary school, and they involved more in evisceration worker. The multivariate analysis of variance test establishes that the knowledge factor does not statistically differentiate four clusters from one another ( $p>0.05$ ) but the other two factors do (Attitude and Practice). That is, the workers of the four clusters possess the same level of knowledge about hygiene but their attitude and practice are at different levels.

Table 3: The cluster distribution of all the variables

Variable	Cluster I	Cluster II	Cluster III	Cluster IV
Number	38	35	38	59
Knowledge Score	1.6447	1.6857	1.7763	1.6695
Attitude Score	1.9737	1.9529	1.9474	1.9237
Practice Score	2.1556	2.1603	2.0803	2.0471
Age in years	25.18	30.54	36.66	43.85
Years working of Experience	4.84	5.28	13.82	18.11
Educational Status	Primary	0	8	0
	Second	37	0	36
	Tertiary	0	27	2
	No Educ.	1	0	0
	Administration	5	5	7
	Bleeder	3	5	10
Type of Work	Flaying	19	4	11
	PH Duty	0	13	1
	Avis creation	7	2	3
	Splitting	1	6	0
	Hide and Skin	3	0	6
				2

Table 4: Manova Tests of Between-Subjects Effects

Source	Dependent Variable	F	Sig.
Corrected Model	Mean score for practice	9.574	.000
	Mean score for knowledge	.773	.511
	Mean score for attitude	4.669	.004
	Actual age	40.082	.000
	How many years have you been working in abattoir	28.954	.000
Intercept	Mean score for practice	49485.941	.000
	Mean score for knowledge	2808.562	.000
	Mean score for attitude	71113.777	.000
	Actual age	2509.350	.000
	How many years have you been working in abattoir	268.841	.000
Cluster	Mean score for practice	9.574	.000
	Mean score for knowledge	.773	.511
	Mean score for attitude	4.669	.004
	Actual age	40.082	.000
	How many years have you been working in abattoir	28.954	.000

## 5. Discussion

The aims of the study are to identify the group structures among abattoir workers of Kano State metropolitan Nigeria using two step cluster analysis. Knowledge score, attitude score, practice score, age of the workers, years of working experience, educational qualification and types of the work render by the worker were used to classify the workers using two step cluster analysis. In Kano state abattoir, there is no clear division of slaughtering section, stunning, skinning, evisceration, chilling/hanging, cutting/deboning, frozen section as well as no mechanism installed for rodents and insects control. According to Roberts and de Jager, abattoir is one of the food industries that contribute to the problem of possible food-borne diseases and potential health

hazards associated with food unless the principles of food hygiene are implemented (Robert *et al.*, 2014). The finding from this study revealed that majority of the workers (62%) are in the age group of 21-40 but according to Abbate *et al.* (2006), the average age of the workers were found to be 40 years among poultry workers. About 43% and 32% attended secondary school and primary school respectively, 17% completed tertiary education and only 7% with no formal education. Out of 170 respondents involved in this study 62% of the respondents have working experience less than 10 years, 10% have just 15 years, and 15% have working experience more than 20 years and all of them are male workers. Two step cluster analysis shows that four important cluster were identify base on BIC coefficient and ratio distance. The first cluster consist of 38 worker and they are in average 25

years of age, all of them are unmarried and have completed secondary level education, on the average, 4 years of service, 19 of them do flying job. The second cluster members completed their third level of education, they are in their thirty's, have put in 5 years of experience and they do either public health duty or splitting job. Their attitude and practice towards their processing job is the best and they are commendable. All the above mentioned factors are important in differentiating this cluster from the rest. The members of this cluster are known for their higher education level and also for their appreciable attitude and practice towards their processing job. The management of any organization will be benefited if it retains this type of workers and provide them training periodically to update their knowledge about their job.

The workers who are accommodated in the third cluster are also in their thirty's, are all married, educated up to secondary level, have about eight years of working experience and do work as bleeders, flayers and hide skinning job. Education level and marital status of workers of this cluster differentiate this cluster from other clusters. The attitude and practice scores of workers of third cluster are not up to mark when comparing with the scores of workers of first two clusters. The workers of third cluster should not only be educated about hygiene process but also should be motivated to do a good job in appreciable manner. The fourth cluster is the largest one. The workers of this cluster are the oldest in age, highly experienced, educated up to primary level only and do multiple jobs like bleeders, flayers and evisceration. The attitude and practice scores of workers of this cluster are the lowest

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in order. This type of workers will always be burden for any organization. In the future, to conduct training programmes successfully to enrich their worker's knowledge, attitude and practice, any organization should design these programmes differently in terms of periodicity, intensity and methods for different groups of workers based on their present status. The multivariate analysis of variance test establishes that the knowledge factor does not statistically differentiate four clusters from one another ( $p > 0.05$ ) but the other two factors do (Attitude and Practice scores). That is, the workers of the four clusters possess the same level of knowledge about hygiene but their attitude and practice are at different levels.

## 6. Conclusion

Hygiene practices are under increased consumer and regulatory pressures to improve the safety of animal food prepared for human consumption. The gap analysis indicates that generally these workers possess good attitude but poor in knowledge regarding the hygiene practice. The Two-Step cluster analysis indicates that young and inexperienced workers possess good attitude and sincere in their practice than old and experience workers. Basic hygiene practices are needed to be optimized in order to be more effective. It is therefore advisable to provide hands on training to workers of abattoirs pertaining to personal and general hygiene which gives individuals the knowledge and skills to be followed during the food processing within abattoirs.

*Yakubu et al...Identification of Group Structure among Abattoirs Workers of Kano State Metropolitan, Nigeria based on their KAP Scores in Relation to Hygiene Practice: A Two-Step Cluster Analysis*

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