Perception and Attitude of Parents Towards Aflatoxins Contamination in Complementary Foods and Its Management in Central Tanzania

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Abstract: Complementary foods in Tanzania are contaminated with aflatoxins (AF), a group of highly toxic metabolites produced mostly by the fungi *Aspergillus flavus* and *Aspergillus parasiticus*. Although intake of aflatoxins contaminated food may cause cancer of the liver, very few parents perceive aflatoxins exposure as a public health threat. This study was cross-sectional designed and used both quantitative and qualitative approaches to assess perception and attitude towards aflatoxins contamination in child foods and its management among 364 parents with children aged between 6-23 months in central Tanzania. Health Belief Model (HBM) was used to determine parents' perception and attitude of aflatoxins. Exploratory Factor Analysis identified the underlying constructs of the Health Belief Model (HBM). The multivariate analysis indicated that mean perception score for parents aged above 34 years was significantly higher ($\beta=0.3666$, $p<0.05$) compared to those aged below or equal 34 years. The mean perception score for parents with primary education was significantly higher ($\beta=0.3730$, $p<0.05$) in comparison to mean score of those that had never been to school. The estimated mean attitude towards aflatoxins score for parents in union was significantly higher ($\beta=0.2639$, $p<0.05$) compared to those not in union. Parents with primary education and those with secondary education ($\beta=0.3405$, $p<0.05$) and ($\beta=0.5528$, $p<0.05$), respectively, were significantly important predictors of attitude for actions towards aflatoxins reduction. There was strong association between perception and attitude scores towards aflatoxin contamination and reduction to the foods. The findings were complemented by results of the focus group discussions (FGDs) which showed that people were not provided with education about aflatoxin contamination in complementary foods, although few of them were using their experience to control fungi. Health professionals and public extension officers should work together to advise the people about the problem of aflatoxins and means to prevent its occurrence in complementary foods.

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1. Introduction:

Aflatoxins, are among the most potent carcinogenic compounds found in human and animal foods (IARC, 1993). These are fungal toxin that commonly contaminates maize, nuts, and other types of cereals are notorious not only for the destruction they cause to crops but also the health effects they inflict on humans and animals (Wild and Gong, 2010). In developing countries, many people depend on consumption of largely cereal-based diets (Wu et al., 2011) that in addition to being deficient in essential nutrients contain aflatoxins. Feeding on aflatoxin contaminated food may contribute to nutritional deficiency and lead to growth failure (Gong et al., 2008). In 2004, 317 people including children became ill and 125 of them died in the central provinces of Kenya by consuming contaminated food (CDC, 2004; Azziz-Baumgartner et al., 2005; Strosnider et al., 2006). Williams et al., 2004 have indicated that over 5 billion people in developing countries worldwide are at risk of chronic exposure to aflatoxins through contaminated foods. The effects of this exposure include liver cirrhosis, intestinal dysfunction, immune suppression, and increased susceptibility to some infectious diseases including HIV-AIDS, and maternal and child health problems such as anaemia, malnutrition, stunting and wasting (Turner et al., 2007).

Infection of crops with aflatoxins producing fungi is most common in the tropical regions in which humidity and temperature are high (IARC, 1993; Schmale and Munkvold, 2012). The mould is capable of attacking crops during production, harvest, storage, and even during processing and is now recognized as one of the biggest challenges to food and nutrition security, health and trade across the African continent (Cotty and Bhatnagar, 1994; Cotty and Jaime-Garcia, 2007; Cotty et al., 2008). Contamination during storage of the crop can occur if moisture and relative humidity, oxygen availability, damaged or broken grain kernels are allowed to go beyond critical values (Lanyasunya et al., 2005). Crops grown in warm climates conditions have greater chances of being infected by aflatoxin and in some areas, infection occurs when temperatures rise in connection with drought and influences not only the amount ofaflatoxins, but also the types of aflatoxin to be produced (Cotty and Jaime-Garcia, 2007). The most critical environmental factors that determine whether or not a substrate will support mould growth are moisture content, temperature and time (FAO, 1998; FAO, 2004; Ncube et al., 2010). Thus, drying, proper storage and suitable transportation are of prime importance in prevention (Williams et al., 2004).

The wide range of food products which are contaminated by aflatoxins include cereals like maize, sorghum, pearl millet, other crops as well as milk and milk products (Lopez-Garcia and Park, 1998; CAST, 2003; Jolly et al., 2009). Maize is probably one of the major staple food in many countries and therefore of major concern, because it is grown in climates that are likely to have perennial contamination with aflatoxins (Marechera and Ndwiga, 2014). Most of the people living in rural areas use local products in preparation of complementary foods, mainly cereals like maize, and groundnuts, which come with an added risk of exposure to aflatoxins (WHO, 2006).

Many people in Tanzania and other East African countries produce and consume food crops which are at risk of aflatoxin contamination. The same crops are also traded directly and through networks of middle men in rural and urban markets that are not regulated for aflatoxins (Azziz-Baumgartner et al., 2005; Kimanya et al., 2008). There is strong agreement that aflatoxin contamination of important crops such as maize and groundnut poses a significant threat to public health, trade and livelihoods in Tanzania (Abt Associates, 2012; Abt Associates, 2013; Kimanya, 2014). Aflatoxin contamination is a public health threat since its contamination and exposure in complementary foods has been reported to be very high (Shirima et al., 2013; Kimanya et al., 2014; Kamala et al., 2016). Therefore, it is important to know how people perceive its effects and build an attitude to seek knowledge on its contamination and management in complementary foods and its health effects to the community. It is clear that most people are not aware of the aflatoxin issue, and so do not perceive aflatoxin contamination as a problem in their production systems. They also do not have enough information on health risks associated with the consumption of aflatoxin contaminated products including crops used in preparation of complementary foods. The study employed the Health Belief Model (HBM) to address parents' perceptions and attitude of susceptibility to aflatoxin induced diseases, seriousness of the aflatoxin problems, perception of the barriers that hinder alleviation of the problem, perception of benefits derived from reducing aflatoxin levels in foods and perceived actions necessary to reduce aflatoxin contamination in complementary foods. The HBM was chosen as the basis of the theoretical framework for this study because of its proven ability to successfully foresee the adoption of health behaviours (Hanson and Benedict, 2002). Despite the recognition that HBM is a psychosocial model and can account for those aspects of behaviour that can be explained by attitudes and beliefs, it has provided a useful theoretical framework for over thirty years and has been applied to a wide range of health-related behaviours (Nutbeam and Harris, 2004).

The health belief model was adopted being one of the models of behaviour change, usually used for studying health behaviours, and promoting the preventive health behaviours. The HBM was first developed in the 1950s by three social psychologists; Irwin Rosenstock, Godfrey Hochbaum and Stephen Kegels, working in the U.S. public health services to explain why medical screening programmes were not always successful (Steckler et al., 2010). Since then, the model has been adapted to explore a variety of long and short-term health behaviours. The HBM is based on the assumptions that, a person will take a health-related action if that person feels that a negative health condition can be avoided, has a positive expectation that by taking a recommended action, he/she will avoid a negative health condition, and believes that he/she can successfully take a recommended health action

The model holds that perceptions about a disease and strategies available to decrease its occurrence determine health behaviour (Hochbaum, 1958). The model consists of four constructs representing the perceived threat and net benefits, namely: perceived susceptibility, perceived severity (seriousness), perceived benefits, and perceived barriers. These concepts were proposed as accounting for people's "readiness to act." Subsequent amendments to the model were made whereby the concept of cues to action was added so as to activate that readiness and stimulate explicit behaviour. Another addition to the model is the concept of self-efficacy or one's confidence in the ability to successfully perform an action. This concept was added by Rosenstock and colleagues in 1988 to help the HBM better fit the challenges of changing habitual unhealthy behaviours, such as being sedentary, smoking, or overeating. The model that was found suitable as a framework for this study was Health Belief Model (HBM) which was initially developed, adopted and used to examine the structure of awareness and perceptions of groundnut aflatoxin among Ghanaian health and agricultural professionals and its influence on their actions (Jolly et al., 2009; Steckler et al., 2010). It has been used to assess hand hygiene knowledge, perceptions, and practices (Khateeb, 2011), breast cancer screening for female college students (Frankenfield, 2009), and influences on exercise behaviour among medical centre employees (Cychosz, 1994). Oral health education among 12 years old children was studied by Solhi et al., 2010 using the HBM. Promote behaviour change among Nigerian single youth by using HBM (Oyekale et al., 2010). In agriculture, a study of farmers to understand pesticide use decisions employed HBM (Khan, 2010). The modified Health Belief Model (HBM) was used in this study. The HBM is based on the perceived risks associated with the ingestion of the contaminated food. Therefore, the study aims to assess parents' perception and attitude towards aflatoxins contamination in child foods and its managements in Central Tanzania.

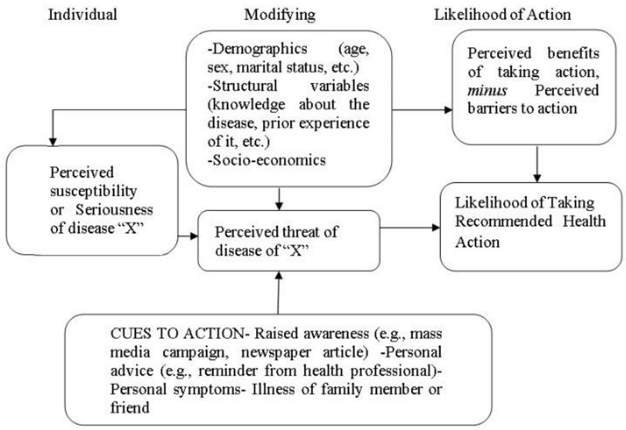

Figure 1. The Health Belief Model (Glanz et al., 2002).

2. Materials and Methods:

2.1. Description of the Study Areas:

A study was carried out in four districts that are Chamwino and Bahi in Dodoma region and Manyoni and Ikungi in Singida region, which are all located in central part of Tanzania. These regions experience low rainfall and short rainy seasons which are often erratic with long periods of drought. The regions were selected because of the semi-arid condition which is characterized by high temperature during the day (up to 35°C) and cool (to 10°C) during the night. Both temperature and humidity favour the growth of fungi, thus signaling the possibility of aflatoxins production in improperly stored crops (Turner et al., 2007). Descriptions of the study areas are in Ngoma et al., 2016.

2.2. Sample size:

Sample size (n) of parents/caregivers in this study was determined by applying the single proportional formula by Magnani, (1997) used in the Statcalc programme of Epi Info Version 6 as follows: $n = (t^2)\, p\, (1-p)/ m^2$

Where: n = the desired total sample.

t = standard normal deviate value (set at 1.96 which corresponded to the 95%confidence interval level).

m= margin error, the degree of accuracy (taken to be 5% in this study).

p= the proportion of parents/caregivers who have been aware of aflatoxin taken to be 33%) from Jolly et al., (2009).

When these figures in the above formula, are substituted, it gives a minimum sample size of 340. Then the figure was rounded up to 364 so as to accommodate the unforeseen problems such as non-response to some or all questions. This sample size assumes that a household has one child aged between 6-23 months. In case a household has more than one child aged between 6-23 months, one child was randomly selected to avoid clustering of information.

2.3. Study Methodology:

A multistage sampling technique was used to select a total of 364 parents/caregivers with children aged between 6-23 months. The process involved simple random sampling at district, division, ward, village/street and sub-ward up to household level.

A descriptive cross-sectional study design was employed. Both quantitative and qualitative approaches to data collection with pre-tested questionnaires and structured interviews were used. All the 364 parents/caregivers were interviewed using Likert scale statements to obtain their views, perceptions and attitudes about aflatoxin contamination in complementary foods and its health effects.

2.4. Data Collection Procedure

Six research assistants were selected by the principal researcher (PR) to assistin data collection. Research assistants were selected based on their previous experience in research work in communities and ability to understand and write Kiswahili and English languages. They were trained by the PR to understand the objectives of the study, the purpose and the procedure of the interview process; in order to have a common understanding of the questions in the interview schedule, and also to ask the questions to ensure that participants understood them. The questions were translated from English to Kiswahili by the PR and were explained to the participants.

Quantitative data were collected by administering an interview to the 364 parents/caregivers. The interview contained both open and close-ended questions developed and used together basic information on respondents' demographics, perception, and attitude on aflatoxin contamination in complementary foods and its actions to control in the community.

Qualitative data were collected by using the Krueger and Casey, (2015) methodology for conducting focus group discussions (FGDs). Aquestionnaire was developed and used after pre-testing through conducting a focused group discussion and an interview involving parents or caregivers. The Focus Group Discussions were carried out after setting appointments with stakeholders (parents or caregivers) to be interviewed. The FGDs were conducted by using a checklist of the semi-structured, open-ended questions to allow the researcher guide the sessions and obtain the participants' views. Participants (including parents or caregivers with children aged between 6 to 23 months) in Focus Group Discussion (FGD) were purposefully selected from the four randomly selected districts. These were the criteria that were used in inclusion and exclusion of participants. The research assistants had been trained on how to probe for specific issues when running FGDs. One pair of assistants (male and female) facilitated the FGDs by using a discussion guide and the principal researcher (PR) served as the assistant moderator. Another pair took notes during the FGDs. Information was collected by research assistants through 17 Focus Group Discussions (FGDs) with 121 participants (105 females and 16 males). The composition of all 17 FGDs was six (6) participants except six groups which had nine participants each and one group which had seven participants. The discussions were held nearby primary school class rooms,the office of village leaders or office of ward executive officer. The information collected was on community actions to prevent aflatoxins contamination in complementary foods and also personal experiences about aflatoxin contaminations in complementary foods. The interview lasted for approximately 40 minutes for each session. All the interviews were audio recorded, after obtaining the consent from participants and then the tapes were transcribed and translated into English by the principal researcher.

2.5. Data Analysis

The Statistical Package for Social Sciences (SPSS) programme 21.0 version was used to analyze the data after cleaning. A 5% level of significance was used throughout the study and an independent variable with a p-value less than 0.05 was considered as statistically (significantly) associated with the outcome variable. For the qualitative part, coding was done using NVivo 7 software. The NVivo package has the ability to code and sort narrative data, interface with SPSS, and has good modelling facility and is user friendly (Hancock, 1998). It also combines best the NUD*IST computer software package with much more flexibility (Hancock, 1998). The FGDs were analysed by using Thematic Content Analysis method.

2.6. Inferential Statistics

In order to reach the conclusions that extend beyond the immediate sample, the inferential statistics were used in the data process. Inferential statistics are used to make an inference about a population from a sample (Tabachnick and Fidell, 2007; Meyers et al., 2010; Zikmund, 2003). In this regard, the major statistical operations performed under inferential statistics, were the multivariate analysis; specifically factor analysis, Pearson chi square test and Analysis of Variance (ANOVA).

2.6.1. Factor Analysis

Factor analysis is a group of analytical techniques used for different purposes such as data reduction, development and evaluation of tests and scales (Tabachnick and Fidell, 2007; Pallant, 2011). There are two main approaches to factor analysis that are commonly discussed in various literature; exploratory and confirmatory. An exploratory factor analysis is used to explore the interrelationship amongst a set of variables and reduce them into a small number of factors which can easily be managed, while the confirmatory factor analysis is used to test specific hypotheses or theories regarding the structure of the underlying latent variables (Pallant, 2011). This study adopted the exploratory factor analysis to explore the relationship among a set of variables that measures perception and attitude towards aflatoxins contamination, and reduce them into few components/factors that can easily be managed for further analysis.

The factors are inferred from the observed variables and estimated as linear combinations. The general estimation of jth factor Fj is as follows:

$$Fj=\Sigma\ Wji\ XIP= Wj1X1+Wj2X2+\cdots\cdots+WjpXP \quad (1)$$

i=1

Where,

Wj= factor score coefficients

P=number of variables reply

In addition, factor loading analysis was done and the higher factor loadings suggest that more of the variance in that observed variable is attributable to the latent variable. To ensure that the sample was suitable for factor analysis, the Measure of Sampling Adequacy (MSA) Test, Kaiser–Meyer–Olkin (KMO) test and the Bartlett test of sphericity was run. Next, the eigenvalue a criterion was used to represent the amount of variance accounted for by a factor. Besides, the communality was applied to find the total amount of variance an original variable shares with all other variables included in the analysis. Furthermore, variance explained and varimax normalization was used. An exploratory factor analysis was carried out to define the underlying structure in the data matrix. Principle component analysis was used to extract factors and produce one component for each variable. Although the analysis yielded as many factors as variables, the smaller factors, in terms of accounted variable variance were dropped if the value was less than or equal to 0.5. For factor analysis to produce meaningful result, communalities of each variable retained in the factors must be greater than 0.5 (University of Texas, 2003; Field, 2005). To avoid multicollinearity, determinant should be greater than 0.00001 (Field, 2005). In this study, the recommended acceptable values was greater than 0.5, value below this, it should lead to the researcher to collect more data, otherwise the researcher would be required to rethink which variables to include (Kaiser, 1974). Respondents were asked questions about their attitudes, perceptions, susceptibility and seriousness, barriers, benefits and actions toward aflatoxins contamination and its control.

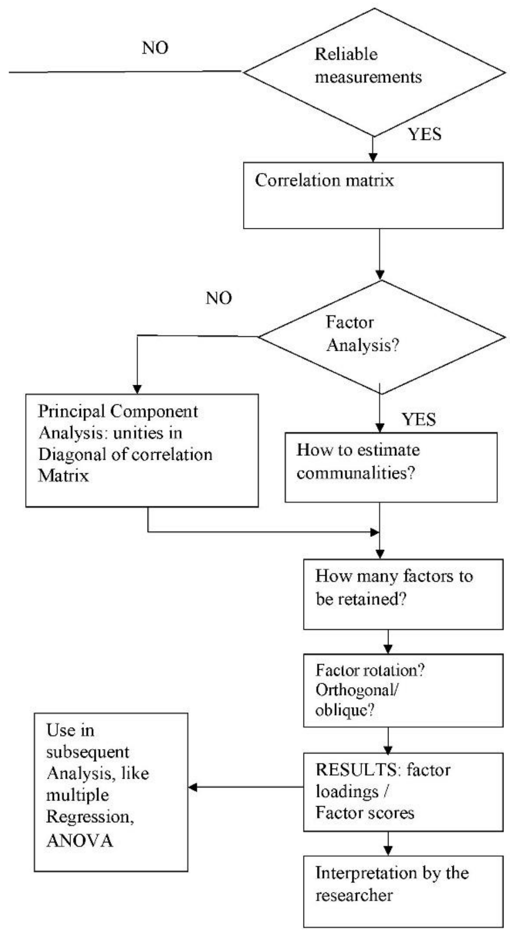

Figure 2. An overview of the steps in a factor analysis

2.6.2. Analysis of Variance (ANOVA)

Multi-way Analysis of Variance was performed to compare group means of the demographic variables, specifically the respondent's age, level of education, occupation, marital status and monthly household income which determined statistically significant difference in terms of the perception and attitude score toward aflatoxins. The perception and attitude scores were generated using factor analysis.

The general multi-way ANOVA model is given as:

$$E(Y_i) = \beta_0 + \beta_1 x_1 + ... + \beta_p x_p \qquad (2)$$

Where E (Yi) is estimated mean score for perception and attitude toward aflatoxins, x_i's are independent variables and β_i's are their respective parameters.

The R square (R2) or coefficient of multiple determinations is one of the useful statistics used to examine the amount of variance explained in the outcome variable by the predictors in the model (Field, 2009). The R square (R2) measures the amount of variance in the outcome variable, explained by the model relative to how much variation there was to explain in the first place (SST) (Pallant, 2011). Therefore, as a percentage, it presents the percentage of variation in the outcome variable that can be explained by the model (Field, 2009). It is easily computed by dividing the model sum of square (SSM) by the total sum of square (SST).

That is, $R^2 = \frac{SSM}{SST}$. (3)

2.7. Consent

We had had a clear and free consent of each patient before starting the study.

3. Results:

3.1 Socio-demographic Characteristics

Results in Table 1 show the distribution of parents/caregivers by socio-demographic characteristics. Generally, the majority of the respondents were aged below or equal to 34 years (74.3%); earned income less than or equal to US$ 22.8 (70.3%); had a primary education (56%); were farmers(78.8%), and in the marital union (74.7%).

Table 1: *Distribution of Parents/caregivers by Socio-demographic Characteristics*

Characteristics	**Number**	**(%)**
Age Group (Years)		
≤ 34	270	(74.2)
> 34	94	(25.8)
Monthly income (US$)		
≤ 22.8	256	(70.3)
> 22.8	108	(29.7)
Level of education	**Number**	**(%)**
Never been to school	64	(17.6)

Partial primary	49	(13.5)
Primary	204	(56)
Partial secondary	18	(4.9)
Secondary	29	(7.9)
Respondent's occupation status		
Farmer	287	(78.8)
House wife	32	(8.8)
Employee	10	(2.7)
Petty trader	35	(9.6)
Marital status		
In Union	272	(74.7%)
Not in Union	92	(25.3%)

3.2. Perception towards Aflatoxins Contamination

Perception is the process of acquiring, interpreting, selecting and organizing sensory information on a given item. The frequency analysis results of the respondent's perceptions toward aflatoxin contamination are presented in Table 2. The results show that 32.1% of the respondents strongly agreed that sorting of grains/nuts reduces aflatoxins (mouldy) contamination and were aware that washing grains/nuts reduce aflatoxins (mouldy) contamination (29.7%). While the majority of the respondents (43.7%) were not sure that washing of grains/nuts reduces aflatoxins (mouldy) contamination before milling. About 36% of the respondents strongly agreed that discoloured grains/nuts indicate the presence of aflatoxins (mouldy) but 31.9% of them were not sure that discoloured grains/nuts indicate the presence of aflatoxins (mouldy). Besides, 39.3% of the respondents strongly agreed that eating contaminated foods with aflatoxins (mouldy) can cause diseases, while 33.8% were not sure that eating contaminated foods with aflatoxins (mouldy) can cause diseases. Almost half of the respondents (46.4%) were not sure that aflatoxins (mouldy) contamination can occur any time in foods. Furthermore, most of them (37.9%) were not sure that eating contaminated foods with aflatoxins (mouldy) will cause death while (30.5%) strongly agreed.

3.3. Factors influensing Perception toward Aflatoxins Contamination

Factor Analysis was carried out for different responses on questions to the respondents relating to perception toward aflatoxins contamination. After carrying out the factor analysis, information about respondents' perception toward aflatoxins' contamination was represented by one factor of perception toward threat and reducing aflatoxins contamination with the following items; Sorting of fungal infected seeds may reduce levels of aflatoxins (fungus); Washing of fungal infected seeds may reduce levels of aflatoxins (fungus); Rotten seeds indicate the presence of fungus; Foods containing fungus may cause diseases; People may die by consuming foods that have been infected with fungus; and Fungal growth may occur at any time in foods.

Table 2: *Perception toward Aflatoxins*

S/N	Perception statements	5 (n/%)	4 (n/%)	3 (n/%)	2 (n/%)	1 (n/%)
1	Sorting of grains/nuts reduces aflatoxins (mouldy) contamination	117 (32.1	85 (23.4)	124 (34.1)	19 (5.2)	19 (5.2)
2	Washing grains/nuts reduces aflatoxins (mouldy)contamination	108 (29.7	63 (17.3)	159 (43.7)	19 (5.2)	15 (4.1)
3	Discoloured grains/nuts indicate the presence of aflatoxins (mouldy)	133 (36.5	96 (26.4)	116 (31.9)	9 (2.5)	10 (2.7)
4	Eating contaminated foods with aflatoxins (mouldy) can cause diseases	143 (39.3	74 (20.3)	123 (33.8)	13 (3.6)	11 (3.0)
5	Eating contaminated foods with aflatoxins (mouldy) can cause death	111 (30.5	86 (23.6)	138 (37.9)	16 (4.4)	13 (3.6)
6	Aflatoxins (mouldy) contamination can occur any time in foods	83 (22.8)	67 (18.4)	169 (46.4)	29 (8.0)	16 (4.4)

5= Strongly agree, 4=Agree, 3=Undecided, 2=Disagree and 1= Strongly disagree.

Table 3: *Components Extracted from Factor Reduction Analysis on Five Items of Perception towards Aflatoxin Contamination*

S/N	Variable	Component 1
1	Sorting of grains/nuts reduces aflatoxins (mouldy) contamination	0.798
2	Washing grains/nuts reduces aflatoxins (mouldy) contamination	0.806
3	Discoloured grains/nuts indicate the presence of aflatoxins (mouldy)	0.855
4	Eating contaminated foods with aflatoxins (mouldy) can cause diseases	0.835
5	Eating contaminated foods with aflatoxins (mouldy) can cause death	0.800

3.3.1. Factors Analysis for Perception toward Aflatoxins Contamination

Screening of the data was done, so as to make the remaining factors have to mean. The factors which remained measured the same dimensions i.e. correlated to each other. Therefore the variable "Fungal growth may occur at any time in foods" had a communality of 0.384. This variable was removed from the next iteration of the factor analysis since it was less than 0.5. In the second iteration, all variables were greater than 0.5 showing that they highly correlated to each other as there was no any variable with communality less than 0.5. There was only one factor retained which explain 67.2% of total variance (see Table 4).

Table 4: *Factor Reduction Analysis on Five Indicator Variables to obtain a Single Variable*

Total Variance Explained						
	Initial Eigen values			Extraction Sums of Squared Loadings		
Component	**Total**	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	3.358	67.153	67.153	3.358	67.153	67.153
2	0.755	15.104	82.257			
3	0.380	7.609	89.866			
4	0.257	5.148	95.015			
5	0.249	4.985	100.000			

Since there was only a single factor, there was no complex structure existence. On the other hand, checking for multicollinearity was done which could be detected by looking at the determinant of the R-matrix. The determinant for the factor formed was 0.062 (i.e. greater than 0.00001), this implies there is no multicollinearity.

3.3.2. Kaiser-Meyer-Olkin (KMO)

The KMO statistic measures of sampling adequacy vary between 0 and 1. A value of 0 indicates that the sum of partial correlations is large relative to the sum of correlations, indicating diffusion in the pattern of correlations hence factor analysis is likely to be inappropriate. The value close to 1 indicates that patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable components. For these data, the value was 0.810, which fell within an acceptable value that is greater than 0.5. This shows that factor analysis was appropriate for this data (see Table 5).

Table 5: *KMO and Bartlett's Test for Perception toward Aflatoxins Examination*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.810
Bartlett's Test of Sphericity	Approx. Chi-Square	1002.965
	Df	10
	Sig.	0.000

3.3.3. Bartlett's Measure

For factor analysis to work there should be some relationships between variables and if the R-matrix were an identity matrix, then all correlation coefficients would be zero. Therefore, the test needs to be significant. If the test is significant, then R-matrix is not an identity matrix. The probability associated with the Bartlett test was <0.000, which satisfies the requirement, thus Bartlett's measure was highly significant since <0.001 (see Table 5) and therefore factor analysis was appropriate for perception toward aflatoxins examination.

3.3.4. Factor Loadings and Eigen value for Perception toward Aflatoxins Examination

The Eigen value associated with perception toward Aflatoxins Examination has represented the variance explained by that particular linear factor. The Eigen values were displayed in terms of the percentage of variance explained. Factor loadings for each variable which were based on the common variance are presented in Table 6, where all were greater than 0.5.

Table 6: *Factor Loadings and Eigen value for Respondents' Perception toward Aflatoxins Contamination*

S/N	Variable	Factor Loadings	Eigen Value
1	Sorting of grains/nuts reduces aflatoxins (mouldy) contamination	0.798	
2	Washing grains/nuts reduces aflatoxins (mouldy) contamination	0.806	
3	Discoloured grains/nuts indicate the presence of aflatoxins (mouldy)	0.855	
4	Eating contaminated foods with aflatoxins (mouldy) can cause diseases	0.835	
5	Eating contaminated foods with aflatoxins (mouldy) can cause death	0.800	3.358

3.4. Analysis of Variance (ANOVA) Model for Perception toward the Aflatoxins Contamination

The multi- way analysis of variance was also employed to find out how the perception scores from factor analysis vary with respect to demographic characteristics. The results of the fitted ANOVA model for perception revealed that the estimated mean perception score for respondents aged above 34 years was significantly higher by 0.3666 compared to subjects aged below or equal to 34 years (p<0.05). The mean perception score for respondents with primary education was significantly higher by 0.3730 in comparison to mean score of the respondents that had never been to school (p<0.05).

Though not statistically significant, participants with partial primary education ($\beta = 0.3283, p = 0.0814$), partial secondary education ($\beta = 0.4843, p = 0.0734$), and secondary or higher education ($\beta = 0.3583, p = 0.1746$) were also found to have higher mean perception score than that of the participants with no education. Other independent variables, namely monthly income, occupation and marital status were significantly important predictors of perception toward aflatoxins contamination. The R2 of this model was 0.0573, which implies that about 6% of the variability in perception toward the aflatoxins contamination can be explained by the independent variable included in the model.

Table 7: *Parameter Estimates of Fitted ANOVA Model for Perception toward Aflatoxins Contamination (n=364, R^2=0.0573)*

Variable	Parameter Estimates(*B*)	Standard Error	T-Value	P-Value
Age (Years)				
≤ 34	Reference	Reference	Reference	Reference
> 34	0.3666	0.1211	3.03	0.0026
Monthly Income (US$)				
=<22.8	Reference	Reference	Reference	Reference
>22.8	-0.0522	0.1234	-0.42	0.6725
Education Level				
Never been to School	Reference	Reference	Reference	Reference
Partial Primary	0.3283	0.1879	1.75	0.0814
Primary	0.3730	0.1426	2.62	0.0093
Partial Secondary	0.4843	0.2697	1.8	0.0734
Secondary	0.3583	0.2634	1.36	0.1746
Occupation				
Peasant	Reference	Reference	Reference	Reference
House wife	0.3232	0.1857	1.74	0.0827
Petty trade	0.1978	0.1931	1.02	0.3064
Employed	0.6805	0.3932	1.73	0.0844
Marital Status				
Not in Union	Reference	Reference	Reference	Reference
In Union	-0.0386	0.1250	-0.31	0.7576

3.5. Attitude toward Aflatoxins Contamination factors

Results on respondents' attitudes towards aflatoxins are presented in Table 8. The results show that the majority of the respondents (37.1%) strongly agreed that good agricultural practices would minimize aflatoxins (fungus) in crops and were aware that sorting of discoloured (mouldy) crops reduces contamination of aflatoxins (fungus) in the child's foods (27.5%).

However, about 36.3 percent of them were not sure that sorting of discoloured (mouldy) crops reducescontamination of aflatoxins. Half of the respondents (50.0%) stated that clean grains/nuts always sell faster. Moreover, most of them (51.1%) strongly believed that sorting of grains/nuts is hygienic. Around 39.3 percent were not sure that washing of grains/ nuts before milling can reduce aflatoxins (mouldy) contamination. Nearly 47.5 percent of the respondents indicated that clean grains/nuts attract better prices. However, 28.0% of them revealed that sorting of damaged grains/nuts is too costly and also 33.5% of them showed that sorting of damaged grains/nuts is time consuming. Large proportions (43.7%) of the respondents were not sure that aflatoxins could be removed during cooking of child's foods. These were very true because aflatoxins can be minimally reducedduring cooking

Table 8: *Attitude toward Aflatoxins*

S/N	Attitudinal statements	5 n (%)	4 n (%)	3 n (%)	2 n (%)	1 n (%)
1	Good agricultural practices will minimize aflatoxins in crops	135 (37.1)	89 (24.5)	117 (32.1)	14 (3.8)	9 (2.5)
2	Sorting of discoloured (mouldy) crops will minimize contamination of aflatoxins in the child's foods	100 (27.5)	97 (26.6)	132 (36.3)	24 (6.6)	11 (3.0)
3	Washing of grains/ nuts before milling can reduce aflatoxins (mouldy) contamination	90 (24.7)	88 (24.2)	143 (39.3)	27 (7.4)	16 (4.4)
4	Aflatoxins can be removed during milling of child's foods	65 (17.9)	44 (12.1)	169 (46.4)	29 (8.0)	57 (15.7)
5	Sorting of damaged grains/nuts is time consuming	68 (18.7)	63 (17.3)	122 (33.5)	37 (10.2)	74 (20.3)
6	Aflatoxins can be removed during cooking of child's foods	53 (14.6)	43 (11.8)	159 (43.7)	30 (8.2)	79 (21.7)
7	Sorting of damaged grains/nuts is too costly	102 (28.0)	62 (17.0)	81 (22.3)	42 (11.5)	77 (21.2)
8	Sorting of grains/nuts is hygienic	186 (51.1)	65 (17.9)	88 (24.2)	14 (3.8)	11 (3.0)
9	Clean grains/nuts attract better prices	173 (47.5)	71 (19.5)	66 (18.1)	25 (6.9)	29 (8.0)
10	Clean grains/nuts always sell faster	182 (50.0)	52 (14.3)	78 (21.4)	17 (4.7)	35 (9.6)

5= Strongly agree, 4=Agree, 3=Undecided, 2=Disagree and 1= Strongly disagree.

3.6. FactorsAnalysis for Attitude toward Aflatoxins Contamination and Management

The first iteration in this case, revealed that communalities for each variable were greater than 0.5. There was also no complex structure for the formed factors hence no any variable dropped. Checking for multicollinearity was done which could be detected by looking at the determinant of the R-matrix. The determinant for the factor formed was 0.009 (i.e. greater than 0.00001), this implies that there is no multicollinearity.

3.6.1. Factors Analysis for Attitude toward Aflatoxins

The factor analysis of the 10 attitudinal statements was conducted and the factors are ranked according to the proportion of variance explained and are named to reflect the latent stimuli underlying parents' attitude about aflatoxin contamination and its management in foods. The analysis identifies three latent factors influencing parents' opinions about aflatoxin contamination and its management in foods. After carrying out the factor analysis, information about respondent's attitude toward aflatoxins was represented in three factors here under:

Factor I (Barriers versus Benefits)

Items/Variables: Fungal may be removed by milling the child's food; Sorting of spoiled seeds is time wasting activity; Fungus/aflatoxins may be removed during cooking of child's food, and Sorting of spoiled seeds is costly in terms of money.

Factor II (Benefits)

Items/Variables: Sorting of spoiled seeds is a good hygienic practice; Clean seeds offer a better price, and Clean seeds are marketable

Factor III (Actions to Reduce Aflatoxins)

Good agricultural practices will minimize problems associated with aflatoxins in crops; Sorting of discoloured (mouldy) crops will minimize contamination of aflatoxins in the child's foods and Washing of seeds before milling helps to reduce the chance of having fungal/aflatoxin in foods fed to children.

Table 9: *Factor Reduction Analysis on Ten Indicator Variables to obtain a Single Variable*

Total Variance Explained									
Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.602	36.022	36.022	3.602	36.022	36.022	2.609	26.094	26.094
2	2.458	24.580	60.602	2.458	24.580	60.602	2.450	24.497	50.591
3	1.177	11.773	72.375	1.177	11.773	72.375	2.178	21.784	72.375
4	.604	6.036	78.411						
5	.497	4.975	83.386						
6	.478	4.776	88.161						
7	.371	3.714	91.875						
8	.352	3.522	95.397						
9	.300	3.005	98.402						
10	.160	1.598	100.000						

Extraction Method: Principal Component Analysis.

For test attitude toward aflatoxins, Kaiser-Meyer-Olkin (KMO) value was 0.782, which fell within the acceptable value. Likewise, the probability associated with the Bartlett test was <0.000, which satisfies the requirement, thus Bartlett's measure was highly significant since P<0.001. Therefore, factor analysis was appropriate (Table 10).

Table 10: *KMO and Bartlett's Test Attitude toward Aflatoxins*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.782
Bartlett's Test of Sphericity	Approx. Chi-Square	1675.096
	Df	45
	Sig.	0.000

3.6.2. Factor Loadings and Eigen values for Attitude toward Aflatoxins

From factor extraction, the Eigen values associated with each linear component before extraction, after extraction, and after rotation were computed usingSPSS software. Before extraction, finding indicated ten factors were identified. The Eigen values associated with each factor represented the variance explained by that particular factor. The Eigen values were displayed in terms of the percentage of variance explained. The first factor explained 36.02% of the total variance whereas thesecond factor explained 24.58% of the total variance.

The third factor explained 11.77% of the total variance. The rotation has the effect of optimizing the factor structure and it tends to make the three factors with equal relative importance. Therefore, after rotation, the first component accounted for 26.09%, the second accounted for 24.5% and the third accounted for 21.78% of the total variance. All three factors retained were able to explain 72.4% of the total variance (see Table 10).

Table 11: *Factor Loadings and Eigen value for Respondent's Attitude toward Aflatoxins*

S/N	Variable	Factor Loadings	Eigen Value
1	Aflatoxins can be removed during milling of child's foods	0.781	
2	Sorting of damaged grains/nuts is time consuming	0.825	
3	Aflatoxins can be removed during cooking of child's foods	0.800	
4	Sorting of damaged grains/nuts is too costly	0.766	3.602
5	Sorting of grains/nuts is hygienic	0.781	
6	Clean grains/nuts attract better prices	0.903	
7	Clean grains/nuts always sell faster	0.915	2.458
8	Good agricultural practices will minimize aflatoxins in crops	0.794	
9	Sorting of discoloured (mouldy) crops will minimize contamination of aflatoxins in the child's foods	0.829	
10	Washing of grains/ nuts before milling can reduce aflatoxins (mouldy) contamination	0.755	1.177

The results of the fitted ANOVA model for barriers and benefits to reduce aflatoxins contamination reveal that the estimated mean attitude score for respondents in the union was significantly higher by 0.2639 compared to those not in unions (p<0.05). Although not statistically significant, respondents aged above 34 years $(\beta = -0.0732, p = 0.5512)$, were having a low estimated mean score to attitude toward aflatoxins compared to the respondents aged below or equal to 34 years. On another hand, although not significant, respondents with partial primary education $(\beta = 0.1610, p = 0.3984)$, Primary education $(\beta = 0.1987, p = 0.17)$ and secondary education or higher $(\beta = 0.0333, p = 0.9007)$ were having higher estimated mean score attitude toward aflatoxins compared to the respondents who had never been to school. Also, respondents with partial secondary education $(\beta = 0.0299, p = 0.9129)$ were having a higher mean score of attitude toward aflatoxins contamination compared to those who had never been to school. Likewise, occupations of the respondents were having different impacts to the estimated mean score of attitude toward aflatoxins. Attitude towards aflatoxins for Housewife $(\beta = 0.0894, p = 0.6349)$ and employed $(\beta = 0.3061, p = 0.4429)$ being higher compared to peasant respondents whereas that of petty traders was lower compared to that of peasants although all occupation categories were not statistically significant.

Table 12: *Parameter Estimates of Fitted ANOVA Model for Attitude Factor 1 (Barriers and Benefits) toward Aflatoxins Contamination (n=364, R2=0.0321)*

Variable	Parameter Estimates	Standard Error	T Value	P-Value
Age (Years)				
≤ 34	Reference	Reference	Reference	Reference
> 34	-0.0732	0.1227	-0.60	0.5512
Monthly Income (US$)				
≤ 22.8	Reference	Reference	Reference	Reference
> 22.8	0.0556	0.1250	0.45	0.6565
Education Level				
Never been to School	Reference	Reference	Reference	Reference
Partial Primary	0.1610	0.1904	0.85	0.3984
Primary	0.1987	0.1445	1.37	0.1700
Partial Secondary	0.0299	0.2733	0.11	0.9129
Secondary	0.0333	0.2669	0.12	0.9007
Occupation				
Peasant	Reference	Reference	Reference	Reference
House wife	0.0894	0.1882	0.48	0.6349
Petty trade	-0.2283	0.1957	-1.17	0.2441
Employed	0.3061	0.3984	0.77	0.4429
Marital Status				
Not in Union	Reference	Reference	Reference	Reference
In Union	0.2639	0.1199	2.20	0.0284

Table 13 presents the parameter estimate, standard error and p-value for the predictors towards the factors III (actions to reduce aflatoxins) attitude to aflatoxins contamination. Respondents with primary education and those with secondary education or higher (p<0.05) were significantly important predictors of attitude for actions to reduce aflatoxins contamination. Although not significant, respondents with partial primary education $(\beta = 0.0579,\ p = 0.7595)$ and partial secondary education $(\beta = 0.4584,\ p = 0.0922)$ were having higher estimated mean score of factor III (actions to reduce aflatoxins) attitude toward aflatoxins contamination compared to the respondents who had never been to school.

The results of the fitted ANOVA model for actions to reduce aflatoxins reveals that the estimated mean attitude score for the respondents aged above 34 years was significantly higher by 0.2124 compared to subjects aged below or equal to 34 years. However, estimated mean of factor III attitude score for subjects having a monthly household income of US$ above 22.8 was lower by 0.1154 compared to the respondents with monthly income less or equal to US$ 22.8 although not significant.

Although not significant, housewives $(\beta = 0.1439, p = 0.4417)$, petty traders $(\beta = 0.1563,\ p = 0.4218)$ and employed respondents $(\beta = 0.053,\ p = 0.8935)$ had higher estimated mean attitude for factor III score compared to peasants. However, although not significant, respondents in theunion $(\beta = -0.0933,\ p = 0.4585)$ had a lower mean score of estimated factor III attitude towards aflatoxins contamination compared to those not in unions.

Table 13: *Parameter Estimates of Fitted ANOVA Model for Attitude Factor III (Actions to Reduce Aflatoxins) toward Aflatoxins Contamination (n=364, R^2= 0.0452).*

Variable	Parameter Estimate	Standard Error	T-Value	P-Value
Age (Years)				
≤ 34	Reference	Reference	Reference	Reference
> 34	0.2124	0.1219	1.74	0.0823
Monthly Income (US$)				
≤ 22.8	Reference	Reference	Reference	Reference
> 22.8	-0.1154	0.1242	-0.93	0.3531
Education Level				
Never been to School	Reference	Reference	Reference	Reference
Partial Primary	0.0579	0.1891	-0.31	0.7595
Primary	0.3405	0.1435	-2.37	0.0182
Partial Secondary	0.4584	0.2714	-1.69	0.0922
Secondary	0.5528	0.2651	-2.09	0.0378
Occupation				
Farmer	Reference	Reference	Reference	Reference
House wife	0.1439	0.1869	0.77	0.4417
Petty trade	0.1563	0.1943	0.8	0.4218
Employed	0.0530	0.3957	0.13	0.8935
Marital Status				
Not in Union	Reference	Reference	Reference	Reference
In Union	-0.0933	0.1258	-0.74	0.4585

3.7. Socio-demographic Variables, Perception, and Attitude

The Pearson's correlations in Table 14 suggest that age of the respondents did not correlate with the education levels in a mouldy reduction or health effects. However,the age of the respondent correlated positively to the perception (p=0.005), and negatively to occupation (p=0.041). The analysis shows that monthly income positively correlated to occupation and education towards aflatoxin reduction (p=0.000). On the other hand, occupation negatively correlated to marital status (p=0.006). The correlations also show that there is an association between perception and attitude scores towards aflatoxin (mouldy) reduction and its health effects to the community (p=0.000).

Table 14: *Correlation Matrix of the Socio-demographic Variables, Perception, and Attitude*

	Age in Years	Monthly income	Education level	Occupation	Marital status	Perception score	Attitude score
Age in Years	1.000						
Monthly Income	0.043(0.416)	1.000					
Education Level	-0.001(0.980)	0.201**(0.000)	1.000				
Occupation	-0.107*(0.041)	0.305**(0.000)	0.379(0.000)	1.000			
Marital Status	-0.009(0.871)	-0.061(0.243)	-0.062(0.236)	-0.145**(0.006)	1.000		
Perception score	0.147**(0.005)	0.007(0.893)	-0.033(0.530)	0.089(0.091)	0.017(0.750)	1.000	
Attitude score	0.010(0.851)	-0.041(0.439)	-0.081(0.124)	0.010(0.849)	0.071(0.179)	0.597**(0.000)	1.000

**p<0.05, **p<0.01*

3.8. Qualitative Results

Several themes with supporting quotes were obtained from focus group discussions.

3.8.1. Community Actions to Prevent Aflatoxins Contamination in Complementary Foods

When asked about things which they were doing to prevent aflatoxins contamination in the complementary food, most people mentioned the same kind of precautions they were usually taking to prevent aflatoxins in general. Participants mentioned drying of crops before taking them inside for storage, use of treatments(traditional meterials) for example ash and mud sprayed on the crops before and during storage. It was noted that very few participants were buying and using fungicides/insecticides from the shops. Also, a minority of participants were taking grains/nuts outside regularly in between storage time and storing crops in the rooms which were well ventilated and sun rays normally got in and out daily and easily. Some participants mentioned that, storage inside or outside depended on the type of crop where with some crops, they never took them inside because even if they would take them while dry, they could easily get moisture so those kinds of crops were normally stored outside on the roofs during summer. Another challenge they were facing is a lack of money with which to buy storage materials.

3.8.2. Education about Aflatoxin Contamination and Control

When asked about perception or attitude on education which they had received about mouldy (aflatoxin) contamination and prevention in complementary food, almost all participants in four districts mentioned that there were no any formal or informal education provided about fungi contamination, and even control, rather they were generally preventing (mouldy) aflatoxins through experiences.

4. Discussion

Contamination of complementary foods by aflatoxin is a serious public health problem that requires attention to ensure that proper measures are taken to limit its health effects. This study has investigated the parents' perception and attitude towards aflatoxins contamination in complementary foods and its management in Central, Tanzania. The findings of the study indicate that parents who are responsible for preparation of complementary foods in central Tanzania do not fully perceive that aflatoxins are harmful to human and animals and their attitude towards their control was low, in general. They were, however, of a strong belief that sorting and washing of grains or nuts before milling may reduce the level of (mouldy) aflatoxins in foods. A similar study in Benin reported that most aflatoxins contamination occurs on relatively in a few grains or nuts; therefore sorting of damaged grains can reduce toxins loads in stored grains (Fandohan et al., 2005; Afolabi et al., 2006). These results are not similar to the study done by Shabani et al. (2015) in Handeni, Tanga which revealed that 67% of the farmers did not sort their defective maize. However, such study contrasts with the study done in Tabora, Kilimanjaro and Iringa in Tanzania, that more than 90% of the maize users were sorting their maize before use (Kimanya et al., 2008). Though there was disagreement that washing of grains or nuts would minimize the level of aflatoxins contamination, the parents strongly agreed that eating of contaminated foods could cause diseases. Almost half of the parents 46.4% were not sure that aflatoxins (mouldy) contamination could occur any time in foods. This result contrasts with the study done by Kumar et al., (2010) in India which revealed that farmers disagreed that the contamination could occur at any time during pre-harvest stages 55.5% and post-harvest stages 60%,

After carrying out the factor analysis, information about parent's perception toward aflatoxins contamination was represented as one factor of perception toward reducing aflatoxins and threat (seriousness and susceptibility) of contamination. All factor loadings were statistically significant and valid. The result of this factor suggests that parents pay attention to aflatoxin contamination and its threat from different aspects and they are generally positive towards aflatoxins reduction on foods if they will be provided with education. These results are almost similar to the study done by Jolly et al. (2009) in Ghana which showed that all factor loadings in seriousness and susceptibility towards aflatoxin contamination were statistically significant at the 95% confidence level which indicates that the variables are good indicators of their particular basic constructs and hence those constructs are valid.

The role of socio-demographic characteristic was also examined in the study. The results were obtained with regard to the effects on perception, attitude and actions towards aflatoxins contamination and its management. It was revealed that the parents aged above 34 years old were more likely to have higher perception towards aflatoxins threat and reduction compared to subjects aged below or equal to 34 years old. This may be due to the experience on crops which are used in the preparation of complementary foods and also which are susceptible to fungal infection. This result concurs with Bektas et al. (2011) in Turkey who revealed that the families with elderly people aged 50 years and above were more sensitive to food safety than others. The parents with primary education were more likely to have higher perception towards aflatoxins threat and its reduction in comparison to respondents that had never been to school. This may be due to the reason that majority of the participants in this study had a primary level of education. However, parents with partial primary education, partial secondary education and secondary or higher education were found to have no effects on perception towards aflatoxins contamination and its management than those participants who had never been to school. Meanwhile, participants in focus group discussion claimed that no any information or education was given to them about aflatoxin regardless of their education levels. These results are in contrast with the previous study done by Jolly et al. (2009) in Ghana and (Baker, 2003) that people with higher levels of education are likely to be better informed on some risks of food additives or pesticides in food than people with less education (Khan, 2010; Khan et al., 2013). Therefore, they are more likely to better understand aflatoxin and its threat to humans and animals. Furthermore, monthly income, occupation and marital status were significantly important predictors of perception toward aflatoxins contamination and managements though they did not affect the parents' perceptions. Hence, there were no significant differences in their perceptions on this aspect.

On the other hand, parents' attitude towards aflatoxin contamination and its management showed that some of the parents strongly agree that good agricultural practices would minimize aflatoxins (fungus) in crops and also were aware that sorting of discoloured (mouldy) crops would minimize contamination of aflatoxins (fungus) in the child's foods. These findings correlate with the study done in Benin revealed that aflatoxins reduction was observed after sorting, winnowing and washing of the raw maize (Fandohan et al., 2005). However, about 36.3 percent of them were not sure that sorting of discoloured (mouldy) crops would minimize contamination of aflatoxins. Around 39.3 percent were not sure that washing of grains or nuts before milling can reduce aflatoxins (mouldy) contamination. However, 28.0% of the parents revealed that sorting of damaged grains or nuts are too costly and also 33.5% of them shows that sorting of damaged grains or nuts is time consuming. These findings contradict with the study done in Benin revealed that aflatoxins reduction was observed after sorting, winnowing and washing of the raw maize (Fandohan et al., 2005).

In this study, the socio-demographic factors were influenced by the attitude towards aflatoxin contamination. The study found that in factor one which includes barriers and benefits towards aflatoxin contamination, only marital status influenced parents' attitude towards aflatoxin contamination and its control to the foods. Respondents in the union were more likely to have a positive attitude on barriers and benefits of aflatoxin contamination compared to those not in a union. This finding was similar to the study done by Bektas et al. (2011) in Turkey who reported that married individuals were more sensitive to food safety than unmarried; this may be due to family responsibility. In factor two the benefits towards aflatoxins reduction showed that all age predictors monthly income, education level, occupation and respondents' marital status were not statistically significant with the attitude towards aflatoxins ($P > 0.05$).

Hence, there were no significant differences in their attitude on this aspect. However, parents aged above 34 years were likely to have a higher attitude toward aflatoxins compared to those aged below or equal to 34 years. Also, parents' attitude towards aflatoxins contamination was lower to the respondents' with higher income compared to the subjects having lower monthly income.

Education levels have different impacts to the attitude towards aflatoxins. Having partial primary education, primary education, partial secondary education and secondary education or higher made it more likely for the respondents to have a higher positive attitude toward aflatoxins contamination and its control compared to the parents who had never been to school. In the study done in Canada by Dosman et al. (2001) reported that people who have high educational level are more likely to give preference to the healthiness of food than those who have a lower level of education. Furthermore, with regard to occupation, the housewives, petty traders and employed had a higher positive attitude toward aflatoxins contamination compared to farmers. Parents who were in the union also were more likely to have a higher attitude towards aflatoxins contamination compared to those who were not in a union. This might be that most of the time they discuss issues of quality of food with their partners. While in the third factor of actions towards aflatoxin reduction, parents with primary education and those with secondary education or higher ($p<0.05$) were significantly important predictors of attitude toward aflatoxins contamination and control. Although not statistically significant, respondents with partial primary education and partial secondary education were having a higherattitude toward aflatoxins contamination compared to the respondents who had never been to school.

The respondents aged above 34 years were more likely to have higher positive attitude compared to subjects aged below or equal to 34 years old. However, the parents having higher monthly income had a lower attitude in action to reduce aflatoxin compared to the parents with lower monthly income. These results contrast with those of the study done by Sabran et al. (2012) in Malaysia which revealed that people with high income were more likely to take precaution about food and were willing to pay for food safety (Baker, 2003, Dosman et al., 2001) than those with lower income. Furthermore, housewives, petty traders, and the employed respondents were more likely to have a higher attitude towards reducing aflatoxin compared to farmers. However, respondents in the union had a lower attitude towards aflatoxins contamination compared to those not in a union.

Parents strongly agreed that sorting and washing of crops before milling would minimize aflatoxin contamination and believed that eating contaminated food could cause diseases and even death. This was similar to the study done by Fandohan et al. (2005) in Benin that sorting, washing, and winnowing minimize aflatoxin level in grains. Age,thelevel of education and marital status of the respondents were the most significant variables to the perception and attitude of aflatoxin contamination and control in this study area. The respondents' age and level of education were mostly determinants of participants' perception of aflatoxin contamination and control in the foods. However, in general, the parents had a low level of perception and attitude as it was reflected on the total scores of perception and attitude. Inequality of age, marital status, and level of education might be the reasons for the respondents to have a lack of attitude and perception about aflatoxin contamination and control.

The Pearson's correlations show that there was a strong association between perception and attitude scores towards aflatoxins contamination and control in the community. However,the age of the respondent correlated positively to the perception, and also monthly income was positively correlated with occupation and education towards aflatoxin reduction and its threat to the health of the people. Similar findings were obtained by Jolly et al. (2009) that income and education are highly correlated and people with high income are willing to pay for food safety (Baker, 2003). This study used standard methods. Therefore one must be very careful in the interpretation of the results. Again, further research is also needed to analyze the sub-constructs of constructs from exploratory factor analysis so as to be submitted to a confirmatory factor analysis to study each factor if it illustrates individual items.

5. Conclusion and Recommendations

Contamination of food by aflatoxin is a serious public health threat that requires attention to ensure that proper actions are taken to limit its health effects. The findings showed that socio-demographic variables had an effect on parents' perception and attitude on aflatoxin contamination and its management in the foods either directly or indirectly. This study focused on communities and its findings do not represent the whole populations including health and agricultural professionals on their levels of perception and attitude regarding aflatoxin contamination and control in the foods. Thus, when the communities are educated and perceived about the threat associated with aflatoxin, they will build an attitude on its actions to reduce contamination and that information will be easily diffused to the public.

Though the analysis revealed a number of factors that reflect the parents' attitude about aflatoxin risks, the study suggests that there is little variation in actions to reduce aflatoxin levels in complementary foods. The study observed perception and attitude divided into sub-constructs after using exploratory factor analysis, this is not the limitation of the study rather than those sub-constructs should be submitted to confirmatory factor analysis for further studies. The study team recommends public extension services to deliver information on aflatoxins and its control to the communities in a more timely and effective way. Such information can be disseminated through radio, existing system of government extension workers and communities groups which exist in the study areas where information can be distributed in an appropriate manner. Also, aflatoxin contamination and control should be taught in schools as special courses, not only in the medical schools but in all tertiary institutions. These may be important strategies to increase public attention on aflatoxins contamination and adoption methods of control towards health effects of human and animals.

6. Conflict of Interest

All the authors have declared that they do not have any potential conflicts of interest.

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