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Development, Chemical Composition and Antioxidant Activity of *Dosa* Prepared Using *Bengal* Gram Seed Coat

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Abstract A popular fermented product, *dosa* was prepared by incorporating *bengal* gram seed coat, a by-product of legume milling industry at 5, 10 and 15% levels. On the basis of sensory evaluation, the 5% *bengal* gram seed coat substituted *dosa* was analyzed for its chemical composition and antioxidant activity against control *dosa*. Incorporation of seed coat in *dosa* resulted in a significant increase in crude and total fibre content of *dosa*. Crude fat, ash, total soluble sugar except non-reducing sugar content decreased significantly in seed coat supplemented *dosa* compared to control *dosa*. Antioxidant activity was also increased in *bengal* gram seed coat incorporated *dosa*.

Keywords *Dosa; Bengal Gram Seed Coat; Sensory Evaluation; Chemical Composition; Antioxidant Activity*

1. Introduction

Dosa is a thin, crispy textured and desirably sour flavour fermented product (Sekar and Mariappan, 2007). The fermentation process causes enrichment and improvement of food through flavour, aroma and change in texture, preservation by producing organic acids, nutritional enrichment, reduction of endogenous toxins and reduction in the duration of cooking and thereby fuel requirement. Normally, *dosa* is prepared from wet ground batter of rice and black gram (Sulochana and Bakiyalakshmi, 2011). In India, *dhal* (dehulled split pulse) milling is the third largest food grain processing industry after rice and wheat milling. The average yield of *dhal* in the commercial mills is about 75 % and the rest material (about 25 %) is obtained in the form of various types of by-products (Kurien and Parpia, 1968). These by-products comprises of seed coat/husk, powder, large and small brokens, shriveled and under-processed grains. Presently, these are disposed of only as feed grade material, fetching low remunerative prices (Ramakrishnaiah, et al., 2004). Most of these by-products are rich in protein, calcium, iron, zinc and fibre, so these can be utilized for making health foods for different age groups (Yadav, et al., 2007). So far, fewer attempts have been made to utilize these by-products in value-addition of food products for human consumption.

In the present study attempts has been made to develop fibre rich *dosa* by incorporating *bengal* gram seed coat. The incorporated *dosa* was then analyzed for its sensory evaluation, chemical composition and antioxidant activity.

2. Materials and Methods

2.1. Procurement and Processing of Materials

Bengal gram seed coat, were collected in a single lot from legume milling industries. They were washed in water to remove dirt, dipped in boiled water for 10 min, dried and ground to fine powder for further use. Other ingredients for preparation of dosa were procured from local market.

2.2. Preparation and Sensory Evaluation of *dosa*

Using different combination of raw material different types of *dosa* were developed (Table 1) and its preparation method is presented in Figure 1. For sensory evaluation control and by-products incorporated *dosa* samples were evaluated by ten semi-trained panelists. Sensory attributes like colour, appearance, flavour, texture, taste and overall acceptability for all samples were assessed using a nine-point Hedonic Scale (1=dislike extremely, 5=neither like nor dislike, 9=like extremely). On the basis of sensory evaluation, *dosa* exhibited higher scores for sensory characteristics were selected for further analysis.

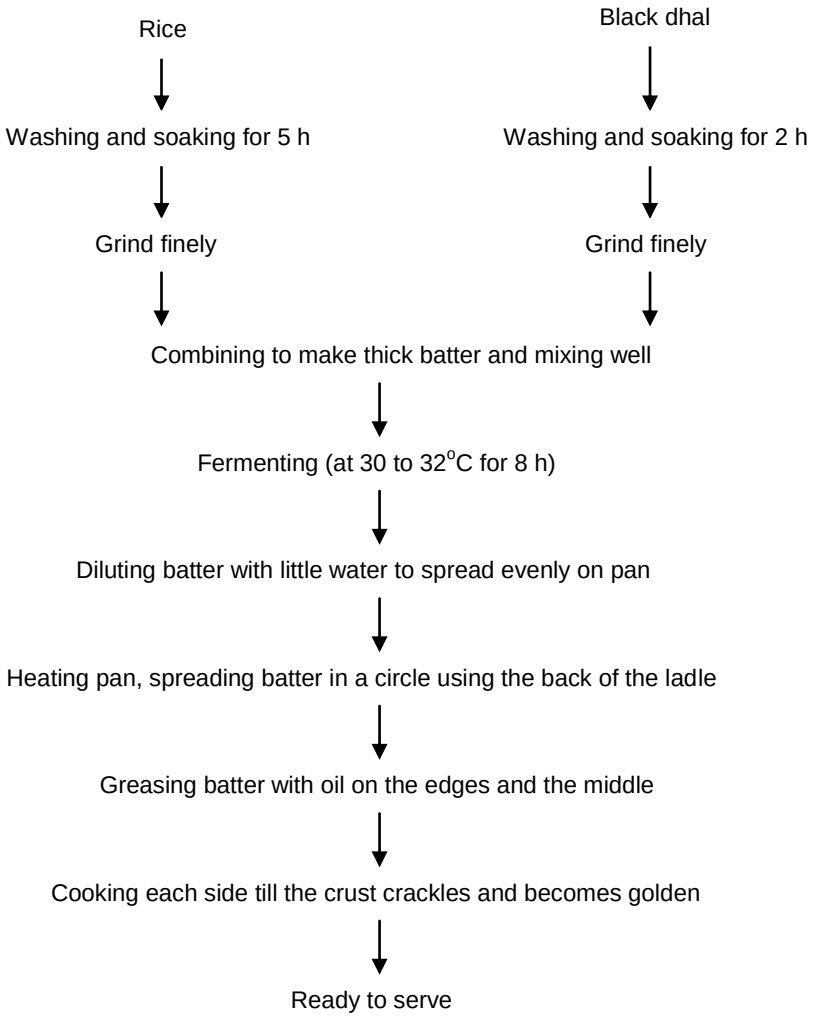

Figure 1: *Flow Diagram for dosa Preparation*

Table 1: *Recipe Formulation for dosa*

Ingredients	***Dosa* C** (g)	***Dosa* 10** (g)	***Dosa* 20** (g)	***Dosa* 30** (g)
Rice	85	80	75	70
Black gram dhal	15	15	15	15
Bengal gram brokens	-	5	10	15

2.3. Chemical Analysis

For chemical analysis, control and most acceptable *bengal* gram seed coat supplemented *dosa*, were dried at 50-60^{o}C for 8 h. The dried samples were milled to fine powder. Moisture, crude protein, crude fat, crude fibre and ash were analyzed using standard methods of Association of Official Analytical Chemists (AOAC, 2000). Total carbohydrates were calculated by difference. Total soluble sugars were extracted by refluxing in 80 per cent ethanol (Cerning and Guilhot, 1973). Starch from sugar free pallet was extracted in 52 per cent perchloric acid at room temperature (Clegg, 1956). Quantification determinations of total soluble sugar and starch were carried out accordingly to colorimetric method (Yemm and Willis, 1954). Reducing sugars were estimated by Somogyi's modified method (Somogyi, 1945). Non-reducing sugars were determined by calculating the difference between total soluble sugars and reducing sugars. Total dietary fibre was analyzed enzymatically, according to the method of Furda (1981). For antioxidant activity, sample was extracted by the method of Xu, et al. (2007). Total phenolic contents were estimated by the method of Singleton and Rossi (1965) and DPPH radical scavenging activity was evaluated by the DPPH method of Hudec, et al. (2007).

2.4. Statistical Analysis

All assays were carried out in triplicates. Appropriate statistical analyses were carried out as per the methods described by Sheoran and Pannu (1999).

3. Results and Discussion

3.1. Sensory Evaluation

The sensory profile of *dosa* is presented in Table 2. Although mean sensory scores for overall acceptability was slightly lower for *dosa* with *bengal* gram seed coat as compared to control *dosa*. And, with the increase of substitution level of *bengal* gram seed coat from 5 to 15 per cent the mean scores for overall acceptability decreased. The 5 % *bengal* gram seed coat incorporated *dosa* was rated from 'liked moderately' for overall acceptability and was further studied for chemical composition. While, 10 and 15 % of bengal gram seed coat substituted dosa were rated as 'liked slightly' and 'neither liked not disliked', respectively.

Table 2: *Mean Scores of Sensory Evaluation of Dosa*

Products	Colour	Appearance	Aroma	Texture	Taste	Over All Acceptability
***Dosa* Control**	8.750.13	7.650.09	8.450.14	7.450.12	7.900.12	8.040.24
***Dosa* 5 % seed coat**	7.850.17	7.450.13	7.250.16	7.350.16	7.180.14	7.410.41
***Dosa* 10% seed coat**	6.450.15	6.250.17	6.150.11	6.850.15	6.650.16	6.470.37
***Dosa* 15% seed coat**	6.150.14	5.140.16	5.100.14	5.650.19	6.250.19	5.660.31
CD (P<0.05)	0.16	0.12	0.15	0.17	0.15	0.32

Values are mean ± SD of ten independent determinations

3.2. Proximate Analysis

The proximate composition of control and 5 per cent *bengal* gram seed coat supplemented *dosa* samples are given in Table 3. The values for crude protein (5.99 %) and crude fat (15.15 %) decreased significantly while the values for moisture (42.37 %), crude fibre (2.34 %) and ash (2.33 %) were found to be higher in *bengal* gram seed coat incorporated *dosa* sample as compared to control *dosa* sample. Crude fibre is mainly concentrated in the seed coat (Emami and Tabil, 2002), because of which replacement of rice with *bengal* gram seed coat increased the fibre and ash amount in supplemented *dosa.*

Table 3: *Proximate Composition of Dosa*

Parameters	*Dosa Control*	*Dosa 5 % Seed Coat*
Moisture*	40.61±0.36	42.37±0.20
Crude protein	7.76±0.68	5.99±0.57
Crude fat	15.99±0.15	15.15±0.24
Crude fibre	0.32±0.22	2.34±0.27
Ash	2.08±0.14	2.33±0.12
Total carbohydrates	73.85±1.19	74.19±1.97

Values are mean ± SD of three independent determinations
*Moisture content on fresh weight basis

3.3. Carbohydrates

Total soluble and reducing sugar content was decreased in *bengal* gram seed coat supplemented *dosa* sample (8.77 and 2.27 g/100g) than in control *dosa* sample (9.37 and 3.49 g/100g). On the other hand, non-reducing sugar was observed to be increased in supplemented *dosa* sample. Control and *bengal* gram seed coat incorporated *dosa* sample provided an amount of 53.72 and 51.05 g starch per 100g, respectively. As the endosperm portion of the legume which consists mainly of starch had been removed completely from seed coat the starch and sugar content of bengal gram seed coat supplemented product decreased as compared to control product. These results are in agreement with the earlier results reported by Sihag (2000) and Dhaka (2001) in legumes seed coat**.**

Incorporation of *bengal* gram seed coat in *dosa* increased total, soluble and insoluble dietary fibre content manifold as compared to control *dosa* sample. As fibre content is mainly located in outer layer of cereals or legumes and most of it is reduced during milling. Amount of dietary fibre is also affected by thicker hulls or seed coat of bengal gram (Jukantil, et al., 2012). The results of present study on dietary fibre content were found to be in concordance with the findings of earlier coworkers (Mamata, et al., 2012; and Sihag and Kwatra, et al., 2003).

Table 4: *Carbohydrate Content of Dosa*

Parameters	*Dosa Control*	*Dosa 5 % Seed Coat*
Total soluble sugar	9.37±0.25	8.77±0.57
Reducing sugar	3.49±0.57	2.27±0.65
Non-reducing sugar	5.88±0.96	6.50±0.80
Starch	53.72±1.34	51.05±1.08
Total dietary fibre	1.85±0.39	7.34±0.47
Soluble dietary fibre	1.23±1.12	3.42±1.14
Insoluble dietary fibre	0.62±0.33	3.92±0.24

Values are mean ± SD of three independent determinations

3.4. Antioxidant Activity

Antioxidants neutralize the plethora of free radicals generated continuously within the human body (Wang, et al., 2007). A number of synthetic antioxidants added nowadays to foodstuffs are being questioned for their probable toxic and carcinogenic effects, and replaced with natural alternatives (Dewato, et al., 2002). Keeping this in mind, antioxidant activity of control and *bengal* gram seed coat supplemented *dosa* samples were evaluated. The results presented in Table 5 showed that the extracts of *dosa* sample prepared from supplementation of *bengal* gram seed coat showed significantly different antioxidant activity as compared to control *dosa*. Maximum amount of total phenolic content (27.17 mg GAE/g) and DPPH radical scavenging activity (28.49%) were observed in 5 per cent *bengal* gram seed coat incorporated *dosa* and minimum in control *dosa* (24.42 mg GAE/g and 27.24 %, respectively). These values showed that *bengal* gram seed coat can be added effectively to food products to increase their antioxidant activity. This is because; during milling antioxidant activity of cereals/legumes decreased as these are mainly present in bran layer (Vaher, et al., 2010). So, addition of seed coat in dosa increased the antioxidant activity.

Table 5: *Antioxidant Activity of Dosa*

Parameters	*Dosa Control*	*Dosa 5 % Seed Coat*
Total phenolic content (mg GAE/g)	24.42±1.10	27.17±3.92
DPPH free radical scavenging activity (%)	27.24±1.06	28.49±1.20

Values are mean ± SD of three independent determinations

4. Conclusion

The shortage and sharp rise in prices of the conventional foodstuff have forced nutritionists to investigate alternative ones. By-products of food processing industries represent one such class of alternatives. Legume milling industries in India run at a very marginal profit and variation in market or crop failure immediately affects the financial status of the legume milling industries. So, any additional income to a legume miller will be of great help. From the present study it can be observed that, *dosa* prepared using *bengal* gram seed coat, a by-product after milling of *bengal* gram have higher nutritional value in terms of fibre and antioxidant activity as compared to the control *dosa*. They can be served as functional ingredients to combat degenerative disorders. Thus, it can be concluded that *bengal* gram seed coat can be utilized as unconventional sources of nutrients because they are often discarded as waste or used as animal feed, which will provide them an economical importance also.

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Factors Associated with Stunting among Children Aged 6-23 Months in Zambian: Evidence from the 2007 Zambia Demographic and Health Survey

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Abstract The reduction of child stunting requires an understanding of the major factors that are associated with it most especially before and during infancy of the child. This is because, the velocity of linear growth is highest during first months of life for most infants, and especially in less developed countries like Zambia. Children aged 6–23 months are usually vulnerable to stunting because of various factors such as lack of complementary foods containing the necessary nutrients during the early stages of life which leaves them vulnerable to opportunistic infections resulting in poor health outcomes and outmately stuntedness. The aim of this study was to determine factors associated with stunting among children aged 6–23 months in Zambia. The study used the 2007 Zambia Demographic and Health Survey data, which had data on anthropometric measurements for both children (6–23 months) and women of child bearing age (15–49 years); and various bio-demographic and socio-economic variables. Prevalence of stunting among children 6–23 months was very high 44.5 percent p<0.001. The study further revealed that stunting was associated with various factors. Mothers age was also associated child stunting (AOR=1.756, 95%CI: 1.168, 2.641; p=0.007 and AOR=2.568, 95%CI: 1.268, 5.200; p=0.009). Children whose birth weight was small or average (AOR=1.919, 95%CI: 1.350, 2.727; p<0.001 and AOR=1.365, 95%CI: 1.090, 1.710; p=0.007) were 91.9 percent and 36.5 percent more likely to be stunted compared with children whose birth weight was large at birth. Children whose mothers had not taken iron tablets whilst pregnant (AOR=0.600, 95%CI: 0.405, 0.890; p=0.011) more likely to be stunted than those whose mothers had taken the tablets. Mother and child's IDDS were also significant predictors of stunting (AOR=1.101, 95%CI: 1.021, 1.186; p=0.012 and AOR=1.101, 95%CI: 1.021, 1.186; p<0.001). Children (6–23 months) who were not being breastfed at the time of the survey were more likely to be stunted compared to those who reported being breastfed at

the time of the survey (AOR=1.384, 95%CI: 1.067, 1.796; p=0.014). In Zambia, stunting in children aged 6–23 months is high. Stunting is significantly associated with mothers' age, Childs' birth weight, mothers taking iron tablets whilst pregnant and breastfeeding. These findings implies that, measures targeted at reducing child stunting should not be taken in isolation but should include a multifaceted approaching looking at both the mother and the children aged 6–23 months at all societal levels in the country as once this window of opportunity is lost then the problem of stunting shall continue to be a public health problem for unforeseeable future.
Keywords *Children (6–23 Months); Determinants; Stunting; Zambia*

1. Introduction

Stunting or low Height-for-Age z-score (HAZ) is a worldwide phenomenon affecting growth potential in children. Globally, nearly one in four children under the age 5 (165 million or 26 percent in 2011) are stunted. This problem is in fact more pronounced in sub-Saharan Africa and South Asia which is home to three quarters of the world stunted children below the age of 5. In sub-Saharan Africa, 40 percent of the children under 5 are stunted of which Zambia is part of (UNICEF, 2013). At national level stunting prevalence has persistently remained above 45 percent among children below the age of 5 (CSO, et al., 2009).

Beyond regional and national averages, there are disparities by wealth and area of residence. Globally, one third of rural children under the age of 5 are stunted, compared to one quarter in urban areas. Similarly, children under 5 in the poorest communities are more than twice as likely to be stunted as children in the richest communities (UNICEF, 2013).

The world over, under-5 nutritional status is usually used as a good indicator for any given countries health and nutritional status of the population at large (Sumonkanti, et al., 2008). Nonetheless, among all the nutritional indicators of child malnutrition, HAZ is a useful anthropometric measure for child health (Rayman and Khan, 2006). Data shows that, Zambia has chronic malnutrition among children under the age 5. According to the 2007 Zambia Demographic Health Survey, about five in every ten children aged below the age of five are stunted (CSO, et al., 2009).

In addition, Stunting (reflects failure to receive adequate nutrition over a long period of time and may also be caused by recurrent illness (Chen, et al., 1980). Stunting is an important public health problem in developing countries because of its association with poor functional outcomes such as impaired cognitive development (UNDP, 2011; Wamani, et al., 2007; and Pollitt, et al., 1995), increased susceptibility to infection (Rayman and Khan, 2006; and Brown and Pollitt, 1996), and increased risk of mortality (Rayman and Kahn, 2006; Tomkins, 1988; and Bairagi, 1985). Other long term consequences of childhood stunting include poor work capacity, elevated risk of poor productive outcomes, and chronic diseases (Rayman and Khan, 2006).

It is also argued that, the most crucial time to meet a child's nutritional requirements is during the 1,000 days beginning from pregnancy to the child's second birthday. Evidence from 54 low- and middle-income countries indicates that growth deficiencies begin during pregnancy and continue until about 24 months of age. Catch-up growth later in childhood is minimal as the damage caused is largely irreversible (UNICEF, 2013).

Scientific evidence suggests that stunting is associated and caused by quite a number of factors. In general, and for Zambia specifically, demographic and socio-economic variables put certain groups of the population at greater risk of being poor and consequently resulting into experiences of malnutrition which is known to be one of the fundamental causes of child morbidity and mortality (UNDP, 2011). Presently, stunting accounts for up to 52 percent of under-5 deaths in Zambia. In

the same vein, Low Birth Weight, poverty, food insecurity, rural urban differentials, sub-optional infant feeding practices among others are some of the factors associated with stunting in children.

While the foregoing issues contribute a great deal to child stunting, there is significant evidence suggesting that failure to provide adequate complementary foods containing the necessary nutrients and minerals besides breast milk during the early stages of life leaves children vulnerable to opportunistic infections resulting in poor health and outmately stuntedness. Studies also indicate that, the velocity of linear growth is highest during the first months of life for most infants; hence this is the period of particularly increased susceptibility. However, exclusive breastfeeding, in the absence of supplements in societies such as those in Zambia protects early post-natal stunting (WHO, 1995).

Presently, Zambia has embarked on addressing other forms of malnutrition such as underweight and wasting which have reduced from 21 to 15 percent and 6 percent to 5 percent respectively. However, stunting still remains quite substantial among children aged 6–23 months. Given this situation, there seems to be little information on what is driving high stunting levels among children aged between 6–23 months. In this view therefore, this paper was aimed at studying factors associated with stunting in this age group using data from the 2007 ZDHS.

1.1. Study Objective

The main objective of this study was to determine factors associated with stunting among children aged 6–23 months in Zambia. The question this study aimed at answering was: what bio-demographic and socio-economic factors contribute significantly to stunting in children aged between 6–23 months in Zambia?

2. Methods and Materials

The study utilized data from the 2007 Zambia Demographic and Health Survey. The dataset provided data on child anthropometric measurements, socio-economic variables, food types and other variables. These variables were selected based on United Nations Children's Emergency Fund (UNICEF) framework of the factors that determine nutritional status. The factors usually include immediate (dietary intake and health status), underlying (quantity and quality of foods, feeding practices, knowledge on quality of care and health services), basic factors which looks at (resources potentially available to a household).

2.1. Statistical Analysis

Analysis of data was done using the Statistical Package for Social Sciences (SPSS). Chi-Square tests were used to explore relationships between the prevalence of stunting and explanatory variables already stated. Independent Samples tests were performed to compare differences in the means for HAZ and sex, type of place of residence etc. Both bivariate and multivariate analyses were used to determine correlates between mother's Body Mass Index (BMI) and stunting in children aged 6–23 months (low height-for-age). Statistical significance was considered as follows: *P < 0.05, **P-value < 0.01 and ***P < 0.001.

In addition, binary unconditional logistic regression models were built to predict the likelihood of height-for-age Z-scores. Analysis of the HAZ z-scores relied on the World Health Organization (WHO) recommendations, which define limits for acceptable Height-for-age to be between: <-5.0 and >+3.0. Z-scores. In this paper, fixed exclusion range was used because the mean z-score for HAZ was above -1.5. This limit has been used in analyses of anthropometric data worldwide because it is always necessary to identify outlier observations, or observations that are considered

to be “biologically implausible values (BIVs)” which are beyond what you expect to find in a population.

2.2. Limitations

The ZDHS data of 2007 is quite old currently and the hope is to carry out the same study using the 2013 ZDHS for comparison and latest data. Secondly, some of the variables especially the basic determinants were not available in the data set us such we only used what was available.

2.3. Study Results

The dataset had 1,855 children aged 6–23 months; 11 cases were deleted because they had no data on height. Of the remaining 1,844 184 cases were disqualified or deleted from the analysis because they were outside the 1977 NCHS/WHO HAZ condition of <-5 and >+3 (86 cases had greater than 3 z-scores while 98 had less than -5 Z-scores respectively). In the final analysis, this study had a sample of 1, 660 children age 6–23 months.

2.4. Stunting among Children aged 6–23 Months of Age

Table 1 shows that, overall, 44.5 percent of children aged 6–23 months in Zambia are stunted ($p < 0.001$). Prevalence increased with age. The mean HAZ score was 1.69±1.59 with the corresponding confidence interval and range of ±0.08 and (1.61-1.77) respectively. Disaggregation of this data by sex brings specific differentials. About five in every ten boys were likely to be stunted compared to four in every ten girls ($p< 0.001$). Further, stunting increases with decreasing reported size at birth: 53.2 percent of children born small (very small/smaller than average) were likely to be stunted compared to those born with average and large size (very large/larger than average) 45.9 and 38.6 percent respectively (p=0.002).

Table 1: *Percentage distribution of Stunting by Age, Sex and Reported Size of the Child at Birth*

Explanatory Variables	Height-for-Age				p-value
	<-2SD		≥2 SD		
	n	Percent	n	Percent	
Age in Months					
6 - 11	168	30.7	380	69.3	
12 - 17	246	45.1	299	54.9	0.001***
18 - 23	325	57.3	242	42.5	
Overall	739	44.5	921	55.5	
Sex of children					
Male	399	49.8	402	50.2	0.001***
Female	340	39.6	519	60.4	
Total	**1660**				
Childs Size at Birth					
Large	203	38.6	323	61.4	
Average	428	45.9	505	54.1	0.002***
Small	99	53.2	87	46.8	
Don’t Know	7	53.8	6	46.2	
Total	**1658**				

2.5. Stunting in Children Aged 6 - 23 Months by Mother's Demographic and Socio-Economic Characteristics

Table 2 shows that stunting in children was high among mother's aged 20–24 and 40–44 years (49.7 percent and 56.9 percent respectively p=0.007). Children in rural areas were likely to be more stunted (46 percent) compared to children in urban areas (41.1 percent; p=0.063). Disaggregation by province shows that, Luapula had the highest percentage of children stunted (55.2 percent p=0.006).

Children whose mothers have attained higher education are less likely to be stunted (about three in every ten compared to about five in every ten with primary education; p=0.058). In the same way, children in households with wealth quintiles described as poorest, poorer or middle are more likely to be stunted compared to those whose households are or were classified as belonging to the richer quintile (four in every ten p=0.046).

Further, children whose mothers had a moderate BMI were likely to be stunted compared to other BMI measures. In addition, children living in households where mother's reported their marital status as " living together" and "never been married" were less likely to be stunted (27.3 percent and 29.9 percent) compared to those mother's reporting either as widowed or divorced (74.2 percent and 57.4 percent) respectively (p<0.001). By parity, stunting was more pronounced in mother's reporting to have had 8 or more children ever born about (48 percent than those with about 4–7 children 43.1 percent). Stunting was also evident in mothers whose ages at first marriage were 15–19 years and 25 years or more (47.1 percent and 50 percent respectively).

Table 2: *Prevalence of Stunting of Children Aged 6 - 23 Months by Mother's Age, Residence Province, Education, and Wealth quintile, BMI, Total Children Ever Born and Age at 1st Marriage*

Explanatory Variables	Height-for-Age				p-value
	<-2SD		≥2 SD		
	n	Percent	n	Percent	
Age Group					
15 - 19	61	35.3	112	64.7	
20 - 24	237	49.7	240	50.3	
25 - 29	191	42.7	256	57.3	
30 - 34	131	43.7	169	56.3	0.007**
35 - 39	74	41.3	105	58.7	
40 - 44	41	56.9	31	43.1	
45 - 49	4	33.3	8	66.7	
Residence					
Urban	211	41.1	302	58.9	0.063*
Rural	528	46.0	619	54.0	
Province					
Central	68	48.2	73	51.8	
Copperbelt	78	46.4	90	53.6	
Eastern	99	47.6	109	52.4	
Luapula	96	55.2	78	44.8	
Lusaka	70	43.2	92	56.8	0.006**
Northern	96	43.8	123	56.2	
North-Western	82	44.6	102	55.4	
Southern	74	33.6	146	66.4	
Western	76	41.3	108	58.7	
Educational Attainment					
No Education	90	42.1	124	57.9	
Primary	488	47.0	551	53.9	0.058*

Secondary	150	40.0	225	60.0	
Higher	11	34.4	21	65.6	
Wealth Quintile					
Poorest	168	46.4	194	53.6	
Poorer	172	46.7	196	53.3	0.046*
Middle	188	48.1	203	51.9	
Richer	129	38.5	206	61.5	
Richest	82	40.2	122	59.8	
Body Mass Index					
Severely underweight <16.0	3	37.5	5	62.5	
Moderately underweight 16.0-18.4	66	48.2	71	51.8	0.849
Normal 18.5 – 24.9	571	44.4	716	55.6	
Overweight 25.0 – 29.9	79	42.5	107	57.5	
Obese ≥ 30	19	47.5	21	52.5	
Total	**1,658**				
Marital Status					
Never Married	41	29.9	96	70.1	
Married	616	44.8	758	55.2	
Living Together	3	27.3	8	72.1	0.001***
Widowed	23	74.2	8	25.8	
Divorced	39	57.4	29	42.6	
Not Living Together	17	43.6	22	56.4	
Total number of children ever-born					
0 - 3	391	45.0	478	55.0	0.550
4 - 7	276	43.1	364	56.9	
8 or more	72	47.7	79	52.3	
Total	**1660**				
Age at first Marriage of mother's					
less than 15	74	42.3	101	57.7	
15 - 19	476	47.1	534	52.9	0.397
20 - 24	125	42.8	167	57.2	
25 or more	23	50.0	23	50.0	
Total	**1523**				

2.6. Stunting in Children Aged 6 - 23 Months by Household Size and Sex of Household Head

Table 3 shows that stunting in children was high among households with less than 5 members (47.9 percent) compared to those with five or more (45.0 percent and 42.8 percent). Four in every ten children residing in male headed households were stunted compared to about five in every ten children in female headed households (p=0.101).

Table 3: *Prevalence of Stunting of Children Aged 6 - 23 months by Household Size and Sex of Household Head*

Explanatory Variables	Height-for-Age				p-value
	<-2 SD		≥2 SD		
	n	Percent	n	Percent	
Household Size					
Less than 5 members	213	47.9	232	52.1	0.202
5 members	130	45.0	159	55.1	
More than 5 members	396	42.8	530	57.2	
Sex of household head					
Male	607	43.6	784	56.4	0.101
Female	132	49.1	137	50.9	
Total	**1660**				

2.7. Stunting in Children Aged 6-23 Months by Mothers Receipt of Supplements and Place of Delivery, Number of Antenatal Visits, Birth Order and Preceding Birth Intervals

Table 4 shows that children whose mothers were given or bought iron tablets, took anti-malarial drugs, took de-worming tablets and also were given Vitamin A post-partum were less likely to be stunted (43.0 percent, 43.8 percent, 41.7 percent and 41.5 percent) compared to those whose mothers reported that they never took these supplements (55.8 percent p=0.006, 45.8 percent p=0.683, 45.3 percent p=0.158 and 46.4 percent p =0.058 respectively).

The findings further shows that, four in every ten children whose mothers delivered at a health facility were likely to be stunted than those whose mothers delivered at home five in every ten p=0.038. About six and five in every children whose mothers did not go for antenatal or went for less than four visits were likely to be stunted compared to only four in every ten among those whose mothers went for four or more times for antenatal (p=0.024). About 47.2 percent of the children whose mothers previous birth interval is less than 24 months are stunted compared with 45.0 percent whose mothers previous birth interval is 24 or more (p=0.297).

Table 4: *Prevalence of Stunting of Children Aged 6 - 23 Months by Mothers Receipt of Supplements, Number of Antenatal Visits, Birth Order and Preceding Birth Interval*

Explanatory Variable	Height-for-Age				p-value
	<-2SD		≥2 SD		
	n	Percent	n	Percent	
Given or bought Iron tablets					
Yes	639	43.0	847	57	**0.006 ****
No	100	57.5	74	42.5	
Took any anti-malaria drugs					
Yes	631	43.8	810	56.2	**0.683**
No	75	45.5	90	54.5	
De-worming tablets					
Yes	258	41.7	360	58.3	**0.158**
No/Don't Know	448	45.3	540	54.7	
Vitamin A 2 Months Post-Partum					
Yes	325	41.5	458	58.5	**0.058 ***
No/Don't Know	381	46.4	440	53.6	
Place of delivery					
Health Facility	331	41.3	470	58.7	**0.038****
Home	404	47.6	445	52.4	
Other	4	44.4	5	55.6	
Number of antenatal visits					
Less than 4 visits	276	45.6	329	54.4	**0.024****
4 or more visits	404	42.1	555	57.9	
No Visit	26	61.9	16	38.1	
Birth Order					
First	126	40.8	183	59.2	**0.303**
2^{nd} – 4^{th}	380	45.9	448	54.1	
5^{th} or more	233	44.6	290	55.4	
Previous Birth Interval					
No previous/Missing	127	40.8	184	59.2	**0.297**
< 24 months	94	47.2	105	52.8	
≥24 months	518	45			

2.8. Stunting in Children Aged 6 - 23 Months by Mother and Child's 24 hour Individual Diet Diversity Score (DDS)

One of the commonly used index for assessing food availability and access at both individual and household level is the Dietary Diversity Score (DDS). This index measures the number of different food groups that are consumed over a given period (Savy, 2006; Swindale, 2006; WFP; 2008; NFNC; 2009). DDS may be calculated as individual dietary diversity score (IDDS) or household dietary diversity (HDD). IDDS has been used as a proxy measure of individuals' food availability and access (ability to acquire sufficient quality and quantity of food to meet all household members' nutritional requirements for productive lives) and overall dietary quality (Savy, 2006; NFNC, 2009). The scores for the food items that were eaten by women in the past 24 hours prior the survey were categorised into three categories so as to assess the diversification and quality of the food items eaten. These groups consist of Poor (less than 4 food items), Moderate (4–6 food items) and Good (More than 6 food items) (ibid, 2006).

Table 5 shows stunting among children who are aged 6–23 months by mother and child's 24 hour IDDS. The IDDS ranged between 0 and 11 food items, with the mean IDDS of mothers' 4.37±2.12 and children -5 3.99±2.02 food items in the 24 hours prior to the survey respectively. Children in households with mother's who had a good DDS were less likely to be stunted (39.5 percent) compared to those who had a poor DDS (48.2 percent (P=0.036)). In addition, about five in every ten children in who had poor or moderate diet were stunted compared to about four among those who had a good IDDS 24 hours prior the survey p=0.267.

Table 5: *Prevalence of Stunting by Mother's and Childs's 24 Hour Diet Diversity Score (DDS)*

Explanatory Variable	Height-for-Age				p-value
	<-2SD		≥2 SD		
	n	Percent	n	Percent	
Mother's Diet Diversity Score					
Poor	305	48.2	328	51.8	
Moderate	331	43.2	435	56.8	0.036**
Good	103	39.5	158	60.5	
Childs Diet Diversity Score					
Poor	325	45.9	383	54.1	
Moderate	341	44.5	425	55.5	0.267
Good	73	39.2	113	60.8	
Total	**739**	**44.5**	**921**	**55.5**	

2.9. Current Breastfeeding Status and Initiation of Breastfeeding

This chapter presents information on initiation of breastfeeding. Early initiation of breastfeeding has benefits for survival and beyond. Breastfeeding promotes child survival, health, brain and motor development (Edmond, et al., 2006; Horta, et al., 2007 and Mullany et al, 2008). Early initiation of breastfeeding prevents neonatal and infant deaths by reducing the risk of infectious diseases. This is because: colostrum, contain a large number of protective factors that provide passive and active protection to a wide variety of known pathogens. It is rich in these protective factors and its ingestion within the first hour of life prevents neonatal mortality, and exclusive breastfeeding or feeding only breast-milk eliminates the ingestion of pathogenic micro-organisms through contaminated water, other fluids etc.

Table 6 below shows that, among the children who are stunted, 43.2 percent were currently being breastfed compared with 50.3 percent who were not (p=0.024). In addition, of the stunted children,

only 43.8 percent were initiated to the breast within one hour after birth compared with 56.2 percent with normal HAZ (p=0.217).

Table 6: *Prevalence of Stunting by Current Status of Breastfeeding and Initiation of Breastfeeding among children aged 6 – 23 months in Zambia*

Explanatory Variable	Height-for-Age				p-value
	<-2SD		≥2 SD		
	n	Percent	n	Percent	
Currently Breastfeeding					
No	153	50.3	151	49.7	0.024*
Yes	586	43.2	770	56.8	
Initiation of breastfeeding					
Within 1 hour of birth	359	43.8	460	56.2	
within a day after 1 hour	279	42.7	375	57.3	0.217
After a day	62	51.2	59	48.8	
Total	**700**	**43.9**	**894**	**56.1**	

3. Multivariate Analysis

3.1. Factors Associated with Stunting Among Children

Table 7 shows the binary logistic regression Adjusted Odds Ratios (AORs), corresponding p-values and confidence intervals for the association between stunting by immediate, underlying, basic and other factors of children aged 6–23 months of age in Zambia. Among the immediate factors of stunting, the major factors associated with a child being stunted are: mothers receiving iron tablets whilst pregnant, child's and mothers individual dietary diversity scores (IDDS). Mothers receipt of anti-malaria tablets, de-worming drugs and vitamin A post-partum did not contribute significantly to the model. Children reported to have been breastfeeding at the time of the survey, mothers having attended antenatal clinics during the previous pregnancy and place of delivery were some of the underlying factors of child stunting. Furthermore, maternal education, mother's age, wealth index and mothers earning more or same as partner were also basic factors. The model further reveals that, sex, age in months and size at birth are some of the other determinants of stunting.

Children whose mothers had not taken iron tablets whilst pregnant (AOR=0.600, 95%CI: 0.405, 0.890; p=0.011) more likely to be stunted than those whose mothers had taken the tablets. Mother and child's IDDS were also significant predictors of stunting (AOR=1.101, 95%CI: 1.021, 1.186; p=0.012 and AOR=1.101, 95%CI: 1.021, 1.186; p<0.001).

Children (6–23 months) who were not being breastfed at the time of the survey were more likely to be stunted compared to those who reported being breastfed at the time of the survey (AOR=1.384, 95%CI: 1.067, 1.796; p=0.014). Children whose mothers had attended antenatal clinics less than three times and four or more times had reduced odds of being stunted (AOR=0.562, 95%CI: 0.294, 1.074; p=0.081 and AOR=0.483, 95%CI: 0.255, 0.917; p=0.026) compared to those whose mothers did not attend. The model further shows that, children (aged 6–23 months) who were delivered at a healthy facility (AOR=0.771, 95%CI: 0.630, 0.944; p=0.012) were less likely to be stunted compared to those who reported to have been delivered at home or other places.

Education, age of the mother and wealth are also important markers on child stunting. Children whose mothers had no education were more likely to be stunted compared with those whose mothers had primary education (AOR=1.306, 95%CI: 0.961, 1.775; p=0.088). In the same way, mothers age was also associated child stunting (AOR=1.756, 95%CI: 1.168, 2.641; p=0.007 and

AOR=2.568, 95%CI: 1.268, 5.200; p=0.009). Children (aged 6–23 months) from richer households (AOR=0.682, 95%CI: 0.454, 1.022; p=0.064) were less likely to be stunted compared with those from poorest households. Child stunting was also associated with household earnings (AOR=1.710, 95%CI: 1.103, 2.651; p=0.016).

The data also shows that sex of a child is associated with stunting. Female children (AOR=0.649, 95%CI: 0.531, 0.795; P<0.001) were less likely to be stunted compared with male children within the same age group (6–23 months). Age of the child is also associated with stunting. Data in table 6 shows that for each increase in age by a month, there is a 9.8 percent increase in the odds of a child being stunted (AOR=1.098, 95%CI: 1.077, 1.120; p<0.001). Children whose birth weight was small or average (AOR=1.919, 95%CI: 1.350, 2.727; p<0.001 and AOR=1.365, 95%CI: 1.090, 1.710; p=0.007) were 91.9 percent and 36.5 percent more likely to be stunted compared with children whose birth weight was large at birth.

Table 7: *Immediate, Underlying, Basic and Other Factors Associated With Stunting among Children Aged 6 - 23 Months in Zambia In 2007*

Explanatory Variable	Stunting			
	Sig.	Adjusted Odds Ratios	95.0% C.I. for EXP(B)	
			Lower	Upper
Immediate Factors				
Mothers received Iron				
Yes[RC]				
No	0.011**	0.600	0.405	0.890
Mothers received malaria drugs				
Yes[RC]				
No	0.405	1.159	0.819	1.641
Mothers received De-worming drugs				
Yes[RC]				
No	0.651	0.952	0.769	1.179
Mothers received Vitamin A Post-Partum				
Yes[RC]				
No	0.198	0.874	0.711	1.073
Childs Individual Dietary Diversity Score (IDDS)	0.012**	1.101	1.021	1.186
Mothers' Individual Dietary Diversity Score (IDDS)	0.000***	0.860	0.800	0.924
Underlying Factors				
Currently Breastfeeding				
Yes[RC]		1		
No	0.014**	1.384	1.067	1.796
Initiation of breastfeeding				
Within 1 hour of birth	0.849	1.020	0.835	1.245
After 1 hour of birth[RC]		1		
Quantity of food items consumed by child				
Less than 4 food items[RC]		1		
4 or more food items	0.434	0.922	0.753	1.129
Number of Antenatal Visits				
No Visits/ Don't Know[RC]		1.000		
Less than 3 Visits	0.081*	0.562	0.294	1.074
4 or more visits	0.026**	0.483	0.255	0.917
Place of Delivery				

Home or other place[RC]		1		
Health facility	0.012**	0.771	0.630	0.944
Basic Factors				
Maternal education				
No education[RC]		1		
Primary	0.088*	1.306	0.961	1.775
Secondary	0.816	1.045	0.719	1.521
Higher	0.701	0.846	0.36	1.99
Mothers age				
15 – 19[RC]		1		
20 - 24	0.007**	1.756	1.168	2.641
25 - 29	0.162	1.383	0.878	2.178
30 - 34	0.184	1.421	0.846	2.386
35 - 39	0.367	1.311	0.727	2.364
40 - 44	0.009**	2.568	1.268	5.200
45 - 49	0.867	0.894	0.239	3.341
Place of residence				
Urban[RC]		1		
Rural	0.629	0.918	0.65	1.297
Wealth index				
Poorest[RC]		1		
Poorer	0.922	0.985	0.733	1.325
Middle	0.758	1.048	0.778	1.41
Richer	0.064*	0.682	0.454	1.022
Richest	0.405	0.809	0.491	1.333
Earnings				
Less or Don't Know[RC]		1		
Earns more than partner	0.016**	1.710	1.103	2.651
Decision making on how to spend more				
Respondent/Husband/Partner	0.357	1.135	0.867	1.484
Husband/Partner/Others	0.960	1.010	0.672	1.520
Don't Know/Missing[RC]		1		
Household Size				
< 5 members	0.134	1.222	0.940	1.587
5 members	0.735	1.050	0.791	1.394
> 5 members[RC]		1		
Sex of household head				
Male[RC]		1		
Female	0.128	1.234	0.941	1.616
Birth Order				
First born[RC]		1		
2nd - 4th	0.862	1.285	0.076	21.580
5 or more	0.873	1.261	0.074	21.567
Preceding birth interval				
No previous birth[RC]		1		
< 24 months	0.943	0.902	0.054	15.199
> 24 months	0.895	0.827	0.05	13.775
			Lower	Upper
Other Factors				
Sex of the child				
Male[RC]		1		
Female	0.000***	0.649	0.531	0.795
Childs age in months	0.000***	1.098	1.077	1.120
Childs size at birth				
Don't Know	0.410	1.626	0.512	5.163

Small	0.000***	1.919	1.350	2.727
Average	0.007**	1.365	1.090	1.710
Large[RC]		1		
Mothers body mass index				
Underweight[RC]		1.000		
Normal	0.650	0.920	0.643	1.317
Overweight	0.518	0.866	0.559	1.340

RC= Reference Category

4. Discussion of Results

The main objective of this study was to determine factors associated with stunting among children aged 6–23 months in Zambia. Researchers suggest that, bio-demographic and socio-economic factors contribute significantly to stunting in children. Our study reveals that, stunting among children 6–23 months of age is quite high in Zambia (44.5 percent) and comparatively, much higher than what is obtaining in other developing countries (Tiwari, et al., 2014). Stunting increases as the age of a child (in months) increases; this is similar to what Adeladza (2009, Kenya) and Alemayehu (2014, Ethiopia) found in their studies. This could be due to extended periods of inadequate food intake and increased morbidity among children 6–23 months in the past years or months prior the survey which could account for why stunting increases with age in the area.

Stunting is also clearly associated with both the sex and the birth weight of a child. In this study, this aspect has also been amplified. Similarly, research conducted elsewhere shows that, male children are slightly more likely to be stunted compared to female children (Alemayehu, et al., 2014, Adeladza, 2009, Bwalya, 2013 and Wolde, et al., 2014). These findings further show that, Children whose birth weight was recorded as “small or average” were likely to be stunted compared with children whose birth weight was recorded as “large” at birth. This fact was also found by Ajao and Girmay (2010, Nigeria). Similarly, Tiwari (2014) found that Nepalese children perceived to have been small had a higher risk of being stunted compared to those perceived to be average or large.

Other prominent findings in this study are that maternal age and education play a significant role in determining stunting in children. (Intuition and studies confirm that higher educated mothers understand and, generally, act more responsively to the nutrition of their children, seek disease prevention and treatment, and maintain sanitary living conditions (Panjsheri, 2007; and Bwalya, 2013)). Results in this study indicate that, children whose mothers had no education were likely to be stunted compared to those whose mothers had primary education. Maternal education generally has an inverse relationship with stunting levels and has consistently shown to be critical for child health, nutrition and survival (Alemayehu, et al., 2014 and Bwalya, 2013). Evidence from various studies indicates that knowledge and practices are key pathways. Educated women are likely to be more aware of nutrition, hygiene and health care; and they can easily introduce new feeding practices which can improve the nutritional status of children (Ajao, et al., 2010 and Sumonkati and Islam, 2008). Similarly, it is also one of the most important resource that enable women to provide appropriate care for their children, which is an important determinant of children’s growth and development (Engle and Menon, 1996). In the same vein, maternal age plays a significant role in determining stunting in children. In this study, results show that children born to mothers aged 20– 24 and 40–44 years were more likely to be stunted compared to those born to mothers aged 15– 19 years. This finding is consistent with a study conducted in Nepal by Tiwari et al. in 2014 where, children 0–23 months born to mothers <20 years were less likely to be stunted as compared to those born to older women > 20 years. However, it is really not clear how children born to younger mothers in Zambia and Nepal could exhibit positive outcomes. This may require more research since under normal circumstances, mothers who are less than 20 years are not only physically immature, but also socially and economically unstable. At this age, most of

these mothers could still be potentially attending school and most likely unemployed or not in any income generating venture. Linked to this argument is also the effect wealth has on stunting. This study shows that children from richer households were less likely to be stunted compared to those in poorer households. In the same way, this study shows that stunting is a function of household earning (AOR=1.710, 95%CI: 1.103, 2651; p=0.016). The fact that only the richer and households with better earnings were statistically significant means that there is some threshold level of income and socio-economic status above which families have access to a number of important socioeconomic factors such as education, employment, and healthcare which considerably impact the health of their children (Odunayo and Oyewole, 2006 and Panjsheri, 2007).

This study also found that, children (6–23 months) who were not being breastfed at the time of the survey were more likely to be stunted compared to those who reported being breastfed (AOR=1.384, 95%CI: 1.067, 1.796; p=0.014). This finding can be attributed to the fact that, breastfeeding in general promotes child survival, health, brain and motor development (Edmond, et al., 2006; Horta, et al., 2007 and Mullany, 2008). Early initiation of breastfeeding prevents neonatal and infant deaths by reducing the risk of infectious diseases.

Another aspect pertinent to stunting is antenatal care. Studies have found that antenatal care contributes significantly and positively to the child's nutrition (IFPRI, 2009). In the same way, this study found that, children whose mothers had attended antenatal clinics less than three times and four or more times had reduced odds of being stunted compared to those whose mothers did not attend. In the same way, a study conducted by Kanjilal (2010), found that, institutional births were less likely to be stunted compared to non-institutional births ($p<0.001$). This finding is similar to findings under this study. This may be due to the quality of service received when antenatal visits and deliveries are made at health facilities defined by the calibre of qualified healthcare providers attending to expectant mothers amongst other factors.

This study has also shown that iron supplement is a deterministic aspect affecting stunting in children. Children born to mothers who had not taken iron tablets whilst pregnant were more likely to be stunted compared to those whose mothers had taken the iron tablets. This finding further compounded by the result showing that mother and child's IDDS were also significant predictors of stunting ($p<0.05$ and $p<0.001$). Siimens and Perheenpupa (1984) and Dallman (1986) also found that iron in breast milk (though present in low concentration) (0.06-0.09 mg/100ml) is uniquely well absorbed and utilised, although reasons for this aspect are unclear. Ideally, absorption of about 0.8 mg or iron per day from the diet is required, of which 0.6 mg is needed for growth, and 0.2 mg to replace loses (Dallman 1986). The reference nutrient intake for iron (mg/day) is 7.8 for children aged 7–10 months (Department of Health, 1991). Meaning therefore, that increased additional sources of iron is required to maintain haemoglobin concentration during the rapid phase of growth between 4 and 12 months of a child.

5. Conclusion

From this study, it is clear that stunting among children 6–23 months is a major challenge and that there are several bio-demographic and socio-economic factors associated with stunting in Zambia. Among them being, mother and child's Dietary Diversity Score, Mothers non-receipt of iron tablets whilst pregnant, increased age in months of a child's, non-attendance of antenatal clinics, home deliveries, mothers not being educated and increased aged, household wealth (poorest), household earnings, sex of the child, and child's size at birth. Therefore, it implies that measures targeted at reducing child stunting should not be taken in isolation but should include a multifaceted approaching looking at both the mother and the children aged 6–23 months at all societal levels in the country as once this window of opportunity is lost then the problem of stunting shall continue to be a public health problem for unforeseeable future. As a forward, this study

proposes more detailed and focussed research to investigate for example how results in Zambia and Nepal seem to suggest low prevalence of stunting in very young mothers (<20 years) compared to those aged 20–29 years

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Research Article | Open Access

Quality Assessment of Different Milk Brands Available in Kottayam District, Kerala

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Abstract Milk is a perishable commodity; its low acidity and high nutrient content make it the perfect breeding ground for bacteria. Milk quality control tests are designed to ensure that milk products meet accepted standards for chemical composition and purity as well as levels of different micro-organisms. To assess the quality of the different milk brands available in Kottayam district, Kerala. Using questionnaire, information was elicited among the local people, to know the highly preferred milk sample; three more samples of varied brands were selected for the present study. Microbial, organoleptic and chemical parameters tests were carried out in all the 4 samples. Government owned milk brand had the overall quality with its highest ranking of preference and absence of coliform, < 2000cfu, 0.14 level of acidity, fat content and SNF being 3.5 and 8.5 respectively. By and large, certified farms/dairy must meet provincial standards for quality milk production, adequate processing and clean premises.
Keywords *Acidity; Coliform; Microbial; Organoleptic; Solid Not Fat*

1. Introduction

Milk is a complete food which invariably improves the food and nutrition security of the country. Of the total world population, 6 billion consumes milk and milk products. More than 750 million people live within dairy farming households (Haytowitz, 2006). There are numerous dependent factors which includes geographic and climatic conditions, availability and cost of milk, food taboos, and religious restrictions (Deborah, 2007).

Milk is highly perishable and spoils very easily, if not properly processed. It's the low acid and high nutrient content which are favorable for the growth of the microbial activity (McGee, 2004). Especially the high nutrient load causes the rapid multiplication of bacteria in an unhygienic condition stored at ambient temperature (Wiley, 2008). Milk has to be thoroughly processed inorder to make the consumers safe from milk borne diseases.

Good-quality raw milk is required to make good-quality dairy products. The degree to which milk consumption and processing occurs will differ from region to region. Therefore, it is important that raw milk of varied quality be produced and handled from farm to plant under suitable conditions. So the present study was planned to assess the quality of most commonly consumed milk brands in Kottayam District.

2. Materials and Methods

The present study was conducted at Nattakom Panchayath in the Kottayam district of Kerala. Among the 500 house in the Panchayath every 11th house were selected for the study survey. Questionnaires were issued to the home makers to elicit the information on the preference of milk they use. As per their response, the consumer preference of various milk brands was determined.

Highly preferred four milk samples coded AA1, AA2, AA3 and AA4 were selected for the present study on the basis of the result of the questionnaire conducted in the Panchayath. Among the milk samples three of them were branded sachet milk and the remaining one was the milk from the households. Commercially available milk sachets and the fresh natural milk were purchased from local markets in Nattakom Panchayath Kottayam, Kerala. The fresh animal milk samples were collected in thoroughly washed and cleaned steel containers. The other milk samples were collected in the same form as marketed. All milk samples were brought to the laboratory for conducting various physicochemical and microbial analyses**.**

2.1. Assessment of Consumer Preference for Different Milk Brands Available in Kottayam District

Consumer Preference using the questionnaire was conducted at house hold level for different milk brands available in Kottayam District.

2.2. Assessment of Initial Quality of Selected Samples

Wholesome quality of a food is an essential requirement of food processing, as any form of contamination during the manufacturing process are highly susceptible to consumers. It is obvious that the consumers are aware and totally rely on the manufacturing and processing standards

Quality Assurance (QA) is applied to verify the products in pre-production phase to overcome the defects and to meet the specifications and requirements of the finished products with overall quality (Jeffy, 2010)

2.2.1. Microbial Quality

The microbial quality of the selected samples were analysed to check the bacterial activity. Methylene Blue Reduction Test (MBRT), Standard Plate Count (SPC), Coliform Count and the Yeast and Mold Count were carried out.

2.2.2 Chemical Quality

Using a standard procedure, the acidity of the selected milk samples was determined by using the titratable acidity, the fat content by using the Electronic Milk Tester and the Gerber method, the Solid Not Fat (SNF) by standard equation (Babulal, 2003 and Cyriac, 2008) and Clot On boiling test was carried out to determine the acceptability of milk.

2.2.3 Organoleptic Quality

Organoleptic Assessment was done for the selected samples on the basis of Appearance, Taste, Odour and the Texture to check out whether the samples are of good quality condition.

3. Results and Discussion

Consumer preferences of various milk brands were determined and presented in the Table 1, it is understood that AA2 sample have an increasing rate of preference of 50% and secondly, sample AA3 have 30%. So it is clear that the AA2 sample which is of government owned milk producer, have highest preference of percentage amongst the subjects.

Table 1: *Consumer Preference for Different Milk Brands Available in Kottayam District*

Milk Samples	% of Preference
AA1	10
AA2	50
AA3	30
AA4	10

Sample AA1- unprocessed milk, AA2-Milma, AA3 -Malanadu Milk, AA4- Sakthi Milk

Milk is extremely susceptible to spoilage by microorganisms and the microbiologist plays a major role in the dairy industry in quality control of milk. Good production and herd management practices help ensure low bacteria counts and reduce the risk of the presence of pathogens in the raw milk (Stradley, 2003). The details regarding the Microbial Quality Assessment of selected samples for Standard Plate Count are given in the Table 2. The MBRT time taken for the samples AA2 is 6 hrs, AA1 and AA4 took 4 hrs and AA3 nearly 3 hrs. It is obvious from the table, the samples AA2 and AA4 are in good quality compared to the samples AA2 and AA3 which are of low quality; it can also be noted from the table, that the standard plate count of sample AA1 and AA4 are less than 2500cfu and 2300cfu respectively. Sample AA2 and AA3 have a similar coliform count less than 2000cfu. Sample AA1 have high count of colonies because it is an unprocessed one. Colony count of the other samples had less than that of normal count. The normal limit of SPC in milk is < 2500. While the legal limit for total bacteria in farm raw milk is 100,000/ml, milk with counts of 10,000 or less is considered desirable and achievable by most farms (Reay, 2007). It is clear from the table, that Coliform Count or Coliform Bacteria in the selected milk samples are not present except for the sample AA1. Bacteria produce enzymes that degrade proteins, fats, and other components, resulting in reduced product quality when counts are high (Tannahill, 2009). This indicates the proper maintenance of quality parameters during processing of milk samples. E. coli is an important food-borne disease organism and enteropathogenic type which can cause diarrhea; even cause complications resulting in fatalities (Merrill, 2009). Coliform bacteria include the organisms Escherichia coli (E. coli) and Enterobacter aerogenes, both of which are normal inhabitants of the large. The presence of these organisms in milk therefore indicates fecal contamination by unsanitary handling after the completion of the pasteurization process (Stephanie, 2012). The presence of coliform in the milk sample AA1 is due to the lack of processing, the improper handling of the milk and must have been contaminated through water or any other means. So it requires adequate heating for its total destruction. None of the samples are contaminated with the Yeast and Mold, which signifies the proper quality treatments of the milk samples during the processing.

***Table 2**: MBRT Time, Standard Plate, Coli Form Count, Yeast/Mold of Selected Samples*

Milk Samples	MBRT Time	Standard Plate Count	Coliform Count	Yeast and Mold
AA1	<4	**< 2500 CFU**	**< 10 CFU**	**Nil**
AA2	>6	**<2000 CFU**	**Nil**	**Nil**
AA3	>5	**<2000 CFU**	**Nil**	**Nil**
AA4	<6	**<2300 CFU**	**Nil**	**Nil**

Sample AA1- unprocessed milk, AA2- brand 1, AA3– brand 2, AA4- brand 3

Acidity measures the lactic acid in the milk. Bacteria that normally develop in raw milk produce more or less of lactic acid. Acid forming bacteria will cause a sour taste in milk and will lead to a pH drop in milk from 6.6 to a pH of 4.6. In the acidity test the acid is neutralised with 0.1 N Sodium hydroxide and the amount of alkaline is measured (NDC, 2010). Table 3 presents the details regarding Acidity level, fat and solid not fat (SNF) content. The 0.15 was the Acidity level in the samples AA1 and AA4; 0.14 in the samples AA2 and AA3 respectively. This proves that all the samples are in the normal range of acidity level. If the acidity is higher than 0.19%, it need not to be processed. If the lactic acid content is lower than the normal range (0.10%), then it may be of two reasons; 1. Either the milk is of poor quality and 2. Sodium hydroxide/bicarbonate might have been added (Pak Milk Info, 2012) due to lactic acid, formed as a result of growth of Lactic Acid Bacteria in milk. Action of them on lactose is responsible for lactic acid production in milk. Produced Lactic acid contributes a major part of the milk acidity and it can be measured by simple titration method. It is expressed as per cent Lactic acid (BC Diary, 2010).

***Table 3:** Acidity, Fat and Solid Not Fat Content of Selected Samples*

Milk Samples	Acidity	Fat Content	Solid Not Fat
AA 1	0.15	3.01	8.2
AA 2	0.14	3.5	8.50
AA 3	0.14	3.8	8.55
AA 4	0.15	3.02	8.05

Sample AA1- unprocessed milk, AA2- Milma, AA3- Malanadu Milk, AA4- Sakthi Milk

Organoleptic assessment should always be the first screening of the milk, since it is cheap, quick and does not require any equipment. These tests are also called 'organoleptic tests' (Mother Diary, 2010).

The organoleptic evaluation of quality parameters and standards set for milk is outmost importance because there are no laboratory methods which can replace human senses in judging the parameters like appearance, colour, aromas, taste, quality of a package etc., (BC Diary, 2010). The organoleptic testing of raw milk and milk products uses normal senses of sight, smell and taste in order to observe and record the overall quality. The result of this test (Table 4) is obtained immediately on the spot where and when it is carried out. This method is of minimum cost but when correctly used it is very useful and, e.g. permits rapid screening out of poorest quality milk at reception. It is applicable on farms, during milk collection, at milk reception and at the milk processing plant (NDC, 2010).

From the result of organoleptic assessment of the sample it is seen that the quality parameters of the sample AA1, AA2 and AA3 are in the category of good and the sample AA4 in satisfactory because its appearance was cloggy, taste was not appealing, texture was granular and the odour was also not as like of fresh milk.

Table 4: *Organoleptic Assessment Test of Selected Samples*

Parameters	AA1	AA2	AA3	AA4
Appearance	Good	Good	Good	Satisfactory
Taste				
Texture				
Odour				

Sample AA1- unprocessed milk, AA2- Milma, AA3- Malanadu Milk, AA4- Sakthi Milk

Perusal of Table 5 indicates the details regarding the Chemical Quality Assessment of selected samples for Corrected Lactometer Reading. Corrected Lactometer Reading of the sample AA1 is 27, sample AA2 and AA3 are 28, and for sample 4 is 29.5. This result shows the adulteration of milk with water, among these milk samples, sample AA4 is extremely adulterated with water. In continuation with the Chemical Quality Assessment for Fat Content, it is obvious from the table, that the sample AA3 has an appreciable content of the fat i.e., 3.8, sample AA2 is 3.5 followed by the samples AA4 and AA1 is 3.02 and 3.01 respectively. Invariably milk contains approximately 3.4% total fat. Some of the fatty acids are found in very small amounts but contribute to the unique and desirable flavour of milk fat and butter (NDC, 2010). From the table it is also depicted that Solid Non Fat content of sample AA1 is comparatively low (8.2) than the sample AA2 which is 8.5 and sample AA3 with 8.55 of SNF indicates mineral content in them. Corrected Lactometer Reading of the sample AA1 is 27, 28 for the sample AA2 and AA3, and for sample 4, it is 29.5; shows the adulteration of milk with water, among these, sample AA4 is extremely adulterated with water. The specific gravity of milk does not give a conclusive indication of its composition since milk contains a variety of substances that are either heavier or lighter than water (Mother Dairy, 2010).

Table 5: *Corrected Lactometer Reading of the Selected Samples*

Milk Samples	Corrected Lactometer Reading
AA1	27
AA2	28
AA3	28
AA4	29.5

Sample AA1- unprocessed milk, AA2- Milma, AA3- Malanadu Milk, AA4- Sakthi Milk

4. Conclusion

The tests for Quality assurance ensured that milk products meet the accepted standards and regulations in chemical composition, microbial load and overall quality. The selected four milk samples (two from private branded and the government owned) were assessed for the initial quality. The quality was assessed in terms of microbial, organoleptic, chemical parameters and adulterant tests. From our findings, the sample AA2 which was of Government owned milk brand was extensively considered to be the best quality milk as its purity, adequate processing and consumer preference were markedly significant.

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Research Article | Open Access

Work Deviance Effects on Job Performance and Health

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Abstract The study of deviant behavior among employees has always been of central interest to employers. Two types of behavior of employees: those targeting the organization and those targeting other persons in the organization are discussed. These deviant or discretionary work behaviors are harmful to the organization by directly affecting its functioning or property, or by hurting employees in a way that will reduce their effectiveness and develop physiological or biological stress indirectly. This article is an effort to arrive at a unifying framework for understanding work place deviance that incorporates constraints, conflict, justice perceptions, control (autonomy), emotional responses, mental stress and affective dispositions as antecedents of distinct categories of behavioral responses.
Keywords *Deviance; Stress; Behavior; Discretionary; Work Place*

1. Introduction

In the book 'The Courage to teach' written by Palmer (1999) says that 'the power of our mentors is in their capacity to awaken a truth within us, a truth we can reclaim years later by recalling their impact on our lives'. This special power of teachers to infect others with the virus of their own passion for learning often gives teachers more power than they either realize or want. This power is created in healthy atmosphere or work culture. For that teachers have to overcome all the work deviances and resulting developing stress. This deviance defining helps a society to convince itself of its own normalcy by condemning and controlling those who disagree. Technically, the term work place deviance is used for all those employee behavior that goes against the goals of an organization (Sackett et al., 2006).

According to Sockett and DeVore (2001) CWD, is any intentional behavior on the part of an organization member viewed by the organization as contrary to its legitimate interests. It can be divided into following categories:

a) Productive deviance also called organizational workplace deviance includes various forms of behavior that violate organizational norms regarding the minimal quantity and quality of work to be accomplished.
b) Property deviance is instances when employee acquires or damage the tangible property without authorization.
c) Political deviance is a social interaction that puts other individuals at personal or political disadvantage.
d) Personal Aggression is behavior such as verbal abuse, sexual harassment, which is displayed in a hostile, violent or aggressive manner.

Behaviors in the first two categories are directed against the organization or its systems while behaviors in the last two categories, referred to as interpersonal deviance, consist of acts that inflict harm upon individuals and develop physiological or biological stress.

Work place Deviance or Discretionary work Behavior can be explained under following forms:

1) Absenteeism

- Can be excused absences are those due to personal or family illness or physiological or biological stress.
- Unexcused absence include an employee who does not come to work in order to do another preferred activity or neglect to call into a supervisor.
- Frequent absence from the workplace may be indicative of poor morale or of sick building syndrome. Sometimes people choose not to show up for work and do not call in advance, which show unprofessional and inconsiderate attitude of teachers. The psychological model discusses it as with drawl & assurances that absenteeism represents individual withdrawal from dissatisfying working conditions. Problems absenteeism is typically measured by time lost measures and frequency.

- 2) Lateness is described as arriving late at work or leaving early. Problem associated with lateness include compromised organizational efficiency. Here, both employees and employer must understand that time coordination comes from structured thinking and proper planning. Chronic lateness often comes from confused thinking. People with Attention Deficit Disorder (ADD), on medication for mental disorder, physiological or biological stress or those who drink or do drugs may have problems coordinating time.

3) Employee job turnover we need to understand individual decisions to leave an organization.

- Contingencies for performance & better external job opportunities are the main cause. Turnover can be optional as when a poorly performing employee decides to leave an organization or by functional when high turnover rates increase the costs associated with recruitment & training of new employee or goal employee decide leave consistently.
- Avoidable turnover is when the organization could have prevented it and unavoidable turnover is when the employee decision to leave could not be prevented.

Problems due to Ineffective job performance can be measured by performance data that includes:-

- Personnel data (e.g., items such as absence, sick days or stress management, and tardiness disciplinary action and safety violations.
- Production data (e.g., an annual appraisal performed by an employee's immediate supervisor) and electronic performance monitoring (e.g., a call center manager monitoring an employee's telephone interactions with customers).

4) Social loafing may occur when individuals are working in groups. When working in groups, individuals often reduce their efforts and work outputs (Harkin, 1985). Individual outputs can be reduced by as much as 20% in group tasks (William et al., 1981).

5) Cyber loafing Lim (2002) defined it as surfing the web in any form of non job related tasks performed by the employee.

6) Anti Social Behavior includes

- Workplace incivility i.e. acting with disregard for other. The effects of incivility include increased competitiveness, increased sadistic behavior, and inattentiveness (Anderson & Pearson, 1999).
- Bullying or mobbing is a psychological mistreatment of one employee against another.
- It may include verbal abuse, gossiping, social exclusion or the spreading of rumors.
- Sexual harassment is unwired me sexual advances, requested for sexual favors, and other verbal or physical contact.
- Employee theft is defined as employee taking things not belonging to them from an organization. Many organizations use integrity tests during the initial screening process for new employee in an effort to eliminate those considered most likely to commit theft (Bolton et al., 2010)
- Employee sabotage is behavior that can damage or disrupt the organization and production damaging property, the destruction of relationship, or harming of employees or customer (Crino, 1994).
- Causes of Workplace Conflict: Workplace conflict is caused by poor communication, different values, differing interest, scarce resources, personality clashes and poor performance. Office romance can be another cause of workplace conflict. Public displays of affection can make coworkers uncomfortable and accusations of favoritism may occur, especially if it is a superior-subordinate relationship. If the relationship goes awry, one party may seek to exact revenge on the other.

2. Methods

How to Control Workplace Deviance

The primary method of controlling workplace deviance has been to increase managerial control of employees' time, efforts and access to organizational goods as well as reducing the physiological stress. It is often the case that there is a strong positive relationship between managerial acts to more perfectly control employees and increased levels of employee deviant behaviors.

For employee turnover, managers have to ask themselves if all turnovers are avoidable or if there are circumstances where it is unavoidable to retain employees. It would not make sense to invest money in retention if the chances to retain employees are rather small. In addition, it might be favourable for an organization if a low performer leaves the organization. Therefore, managers have to make distinction between functional and dysfunctional as well as avoidable and unavoidable turnovers in order to create strategies to retain people.

Evidence indicates that absence is generally viewed as 'mildly deviant workplace behavior'. For example, people tend to hold negative stereotype of absentees, under report their own absenteeism, and believe their own attendance record is better than that of their peers. Negative attributions about absence then bring about three outcomes: the behavior is open to social control, sensitive to social context, and is a potential source of workplace conflict.

3. Discussion

To control all the behavior deviances, Hirschi (1969) presented four social bonds which promote socialization and conformity. These include attachment, commitment, involvement, and belief. He claimed that the stronger these four bonds, the least likely one would become deviant. The second bond is that of commitment and it involves the support of and equal partaking in social activities tie an individual to the moral and ethical code of society. Hirschi's control theory holds that people who build an investment in life, property, and reputation are less likely to engage in criminal acts which will jeopardize their social position. The societal accumulations that one accrues throughout a lifetime represent assurance to society that this person is committed to conventional values. He has more to lose by violating laws. Not only can one be committed to conformity by what he has obtained, but the hope of acquiring goods through conventional means can reinforce one's commitment to social bonds. The third bond is involvement. This addresses a preoccupation in activities which stress the conventional interests of society. Hirschi argues that an individual's heavy involvement in conventional activities does not leave time to engage in delinquent or criminal acts. He believes that involvement in workplace, family, recreation, and so forth, insulates an employee from potential delinquent behavior that may be a result of idleness. Conflicts at workplace can be ended if the employee takes things professionally rather than personally.

Engrossment in conventional activities comprises the component of involvement. If the managers can enable employees to strengthen their bond with the employer through commitment and involvement activities, it is possible that instances of employee deviance will decrease.

Here I want to add that whoever adopts teaching as a profession assumes the obligation to conduct him/her in accordance with the ideal of the profession. A teacher is constantly under the scrutiny of his students and the society at large. Therefore, every teacher should see that there is no incompatibility between his precepts and practice. The national ideals of education which have already been set forth and which he/she should seek to inculcate among students must be his/her own ideals. The profession further requires that the teachers should be calm, patient and communicative by temperament and amiable in disposition. Further details of code of professional ethics are given in UGC revised regulations (2010).

Developing these strategies may lead to stable, yet creative organizations that are capable of adapting and remaining competitive over time.

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