

Assessment of Good Manufacturing Practices (GMP) in Selected Food Industries of Bangladesh.

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Abstract:

The study was done to assess Good Manufacturing Practices (GMP) in selected food industries of Bangladesh. Three food Industries were randomly selected for the work according to the convenience of time schedule and financial support. The industries were S-NB, S-HF and S-IF. The study involved the combination of collection of information from factory through extensive visits and proximate analysis of their products in the Institute of Nutrition and Food Science (INFS) laboratory.

Glucose biscuit, macaroni and potato chips were selected for proximate analysis from the factories. The study showed that moisture content of different types of snacks foods ranged between 2.4-9.39 g/100g. Protein content of same foods varies from 1.8-7.66 g/100g. Crude fat content of the products range was between 0.26-16.13g/100g. Carbohydrate content of considered foods ranged between 71.69-82.03g/100g. Ash content of such snacks foods lied between 0.31-0.81g/100g. Dietary fiber content of the products ranged between 0.05-0.11g/100g. Potato chips yield the highest amount of energy which was 462.65 kcal per 100g. Glucose biscuits had 461.15 kcal per 100g and finally macaroni had the energy of 361.22 kcal per 100g.

Two of the observed factories showed fair housing infrastructure. Toilet facilities of the pragmatic factories were dynamic as three factories represent each of the three different categories poor, fair, and good conditions. First aid boxes and safety measures (fire prevention etc.) were available in all of the factories. Diseased personnel were not permitted to work in all the selected factories. S-NB, S-HF and S-IF had their wastage ratio (%) 1.00, 0.50 and 2.00 respectively. One factory practiced only physical parameters for quality control. Others practiced combination of physical, biological and chemical parameters. One factory used Polypropylene (PP), High Density Polyethylene (HDP), Low Density Polyethylene (LDP), another used metalized films and finally the last one used combination of

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glass and tetra pack for packaging. All the studied factories had separate storage for non food items from products and definite place for storage of toxic substances. All the factories appointed Science graduate as a Quality Control Executive. S-NB had 25% of market share. S-HF and S-IF had 20% and 40% of market share respectively.

Key Words: GMP, Proximate Analysis, Physical Environment, Hygienic Practices.

Introduction:

GMP refers to the Good Manufacturing Practice regulations promulgated by the US Food and Drug Administration under the authority of the Federal Food, Drug, and Cosmetic Act. GMP regulations address issues including record keeping, personnel qualifications, sanitation, cleanliness, equipment verification, process validation, and complaint handling. Most GMP requirements are very general and open-ended, allowing each manufacturer to decide individually how to best implement the necessary controls. This provides much flexibility, but also requires that the manufacturer interpret the requirements in a manner which makes sense for each individual business. GMP is also sometimes referred to as "cGMP". The "c" stands for "current," reminding manufacturers that they must employ technologies and systems which are up-to-date in order to comply with the regulation.

Food safety has been regulated since the mid-1800s and was mostly the responsibility of local and state regulators. However, the Pure Food and Drugs Act, passed by Congress in 1906, marked the first major federal consumer protection law with respect to food processing. In 1938, after a battle about USDA jurisdictions with respect to the Act's enforcement, the Food Drug, and Cosmetic Act (FDCA) replaced the 1906 Act. The GMP regulations were finalized in April of 1969 and published as Part 128 of the Code of Federal Regulations (CFR). In 1977, Part 128 was recodified and published as Part 110 of the CFR¹.

The cGMP regulation in Part 110 is necessarily general in nature, so as to be broadly applicable to all food processing establishments and to allow for flexibility in its implementation, yet it is absolutely critical to the assurance of a safe food supply.

In order to overview the present GMP implementation in Bangladesh, an extensive investigation is planned for three randomly selected food industries in Bangladesh with selected laboratory observation in terms of food quality.

Materials and methods:

1. Study location: Factory location of S- NB, S-HF and S-IF are Tejgaon, Dhaka; Vulta, Narayanganj and Konabari, Gazipur respectively.

2. Study period: Study period in terms of data collection of the research was between January- October 2007.

3. Proximate Analysis:

In the laboratory, three snacks food items such as Biscuit, Macaroni and Potato chips were collected from each of the factories for determination of moisture, fat, protein, carbohydrate, ash, crude fiber, and calorie contents. The protein content was determined by micro Kjeldahl method of Association of Official Analytical Chemist (AOAC) and crude fat was analyzed by solvent extraction². Anhydrous chloroform-methanol mixture in the ratio of 2:1 was used to extract the fat from the dry samples. The estimation of moisture was done by constant weight methods and ash was determined by method described by Gopalan (1971)³. Crude fiber, carbohydrate and calorie content were also determined by appropriate laboratory methods described by Gopalan (1971).

4. Design of Good Manufacturing Practices:

GMP related information is collected and classified through a preset questionnaire which was developed on the basis of the regulations described in the Code of Federal Regulations, Title 21, Volume 2⁴ and International Organization for Standardization (ISO) guidelines (2004)⁵. The questionnaire consisted of both open ended and closed ended questions and information were obtained from the following segments- Environment of the factory, Health and Hygiene Practices, Production and Wastage, Quality Control, Packaging and Product Evaluation, Storage, Administration and Human Resource Development, Good Manufacturing Practices (GMP), and finally Documentation by observation, interviewing and sometime checking the records.

5. Data Analysis:

Results were analyzed by Microsoft Excel, Statistical Package for Social Science (SPSS) program version 12 and values were expressed as both in frequency and percentage.

Results:

Proximate composition of Glucose Biscuit (S-NB), Macaroni (S-HF) and Potato Chips (S-IF) is shown in the Table-1. The moisture, protein, fat, carbohydrate, ash, dietary fiber and energy contents of Glucose Biscuit were 3.95, 7.305, 16.13, 71.69, 0.81, 0.115 and 461.15 respectively. The moisture, protein, fat, carbohydrate, ash, dietary fiber and energy contents of Macaroni were 9.39, 7.669, 0.267, 82.03, 0.54,

0.09 and 361.22 respectively. Whereas the same values for Potato Chips were 2.42, 1.83, 14.77, 80.59, 0.31, 0.05 and 462.65 respectively. All the values were reported as g per 100g and in case of energy it was kcal per 100g.

Figure-1 shows that two of the observed factories showed fair housing infrastructure and one had poor status. Again two of the observed factories showed fair doors, windows and campus condition and one showed poor condition. The condition of approach roads and surroundings of two factories were fair and one had good condition. The results of ventilation and lighting conditions also represented the same condition as approach roads and surroundings. Toilet facilities of the sensible factories were dynamic as three factories represented each of the three different categories poor, fair, and good conditions.

In the Figure-2, two of the observed factories showed that there were no awareness about hygiene and consciousness about food production process. There was no monitoring system about hygienic practices among all the factories. Only the workers of one of the factories were aware about environmental sanitation.

Wastage ratio of the studied factories was specified in the Figure-3. S-NB, S-HF and S-IF had their wastage ratio (%) 1.00, 0.50 and 2.00 respectively.

In Figure-4 showed that, two factories had space between the stock and the floor and walls and other don't. On the other hand, one factory had acceptable limits (max. 8-10 layers) of stock height but the other two don't.

Figure-5 showed that no organization had any Food Scientist as a QC Executive. All the factories appointed Science graduate as a QC Executive.

Discussion:

Glucose Biscuit and Potato Chips are rich in energy values (461.15 and 462.65 Kcal per 100g). Macaroni contained the lowest amount of energy, 361 kcal per 100 g. But its moisture and protein content were higher than remaining snacks foods. The high amount of fat is present in Glucose biscuits (16.130g/100g). It is a delicious food item and loved by all consumer groups. Carbohydrate was the predominant energy source of macaroni. The amount of fat was very low but when it would be cooked with cooking oil, the value would be enriched. High moisture content of macaroni some time responsible for pest attack. Finally, Macaroni when cooked with appropriate ingredients it could be a good, nutritious and palatable snacks item for all people. Potato chips contribute the highest energy value because of containing relatively high carbohydrates (80.596g/100g) and fat (14.77g/100g). It is a popular snacks item especially for children.

Physical environment of the observed factories were very dynamic. Conditions of housing infrastructure, doors and windows, campus, approach roads and surroundings directly affect product quality. Ventilation and lighting arrangement are important for ensuring fresh environment. Finally toilet facility is the very significant part of factory which unswervingly influences the microbial load in the products. The conditions of housing infrastructure, doors and windows, campus, approach roads and surroundings and ventilation and lighting arrangements of the observed factories were satisfactory as maximum contained fair conditions. But one of the observed factory represented poor toilet facility which should be improved for the sake of public health importance. Awareness regarding this sector can ensure a lucrative, healthy factory premises.

Healthy and hygienic practices should be the prerequisite of food factory. Thousands of lives of people depend on hygienic practices. From the study, information of this segment represented by poor situation. Maximum factories didn't have any provision for awareness about hygiene, consciousness raising regarding production process, monitoring system for hygiene practices and environmental sanitation.

Wastage ratio is the outcome of the efficiency of a food plant to produce consistently evenhanded products in terms of both quality and quantity. The observed factories represented almost satisfactory results. But S-IF should need to lower wastage ratio.

Storage of products is another important section of food plant to ensure fresh, unchanged products to the consumers. Many competent food products loose their excellence only for inappropriate storage. According to GMP regulations, there should be a space between stock and floor and walls. Height of stocks should also maintain in acceptable limit that is maximum 8-10 layers.⁶ Information of the studied factories provides reasonable results as maximum plants have acceptable level of stock height and space between stock and floors and walls.

Food that can support the rapid growth of undesirable microorganisms, particularly those of public health significance, shall be held in a manner that prevents the food from becoming adulterated.⁷ From the studied factories, it was found that they didn't afford any Food Scientist as a QC executive. As a result they were deprived from good quality products at the same time innovation of new cost effective, publicly acceptable food products. They had science graduate as QC executive. Food Scientist should be appointed prompt in this segment to discover the new era of qualified, nutritious food products.

Table-1: Distribution of Proximate Composition of Glucose Biscuit (S-NB), Macaroni (S-HF) and Potato Chips (S-IF)

Items	Moisture (g/100g)	Protein (g/100g)	Fat (g/100g)	Carbohydrate (g/100g)	Ash (g/100g)	Dietary Fiber (g/100g)	Energy (Kcal/100 g)
Glucose Biscuits	3.95	7.305	16.13	71.69	0.81	0.115	461.15
Macaroni	9.39	7.669	0.267	82.038	0.545	0.09	361.228
Potato Chips	2.425	1.835	14.77	80.596	0.316	0.055	462.65

Figure-1: Distribution of the conditions of the factories by physical environment

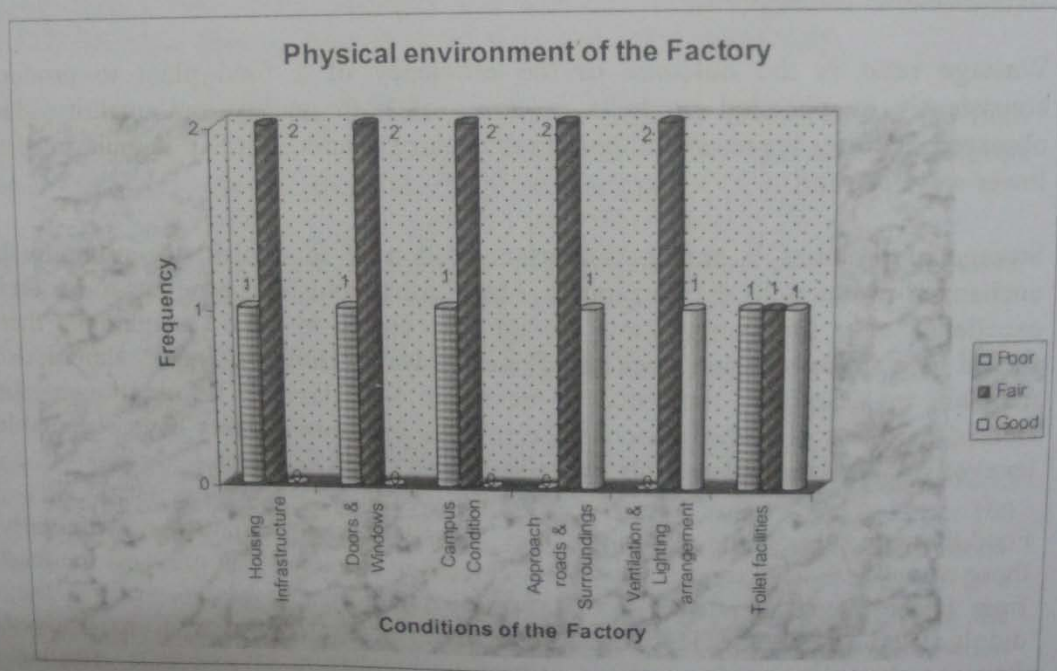


Figure-2: Distribution of Knowledge, attitude and practice about Hygienic practices.

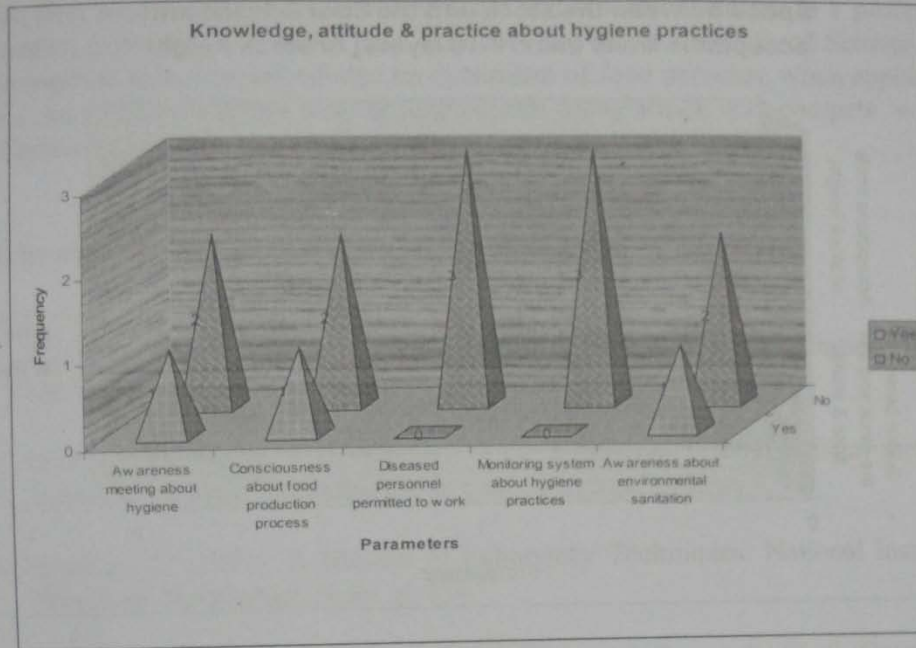


Figure-3: Distribution of Wastage ratio of the factories

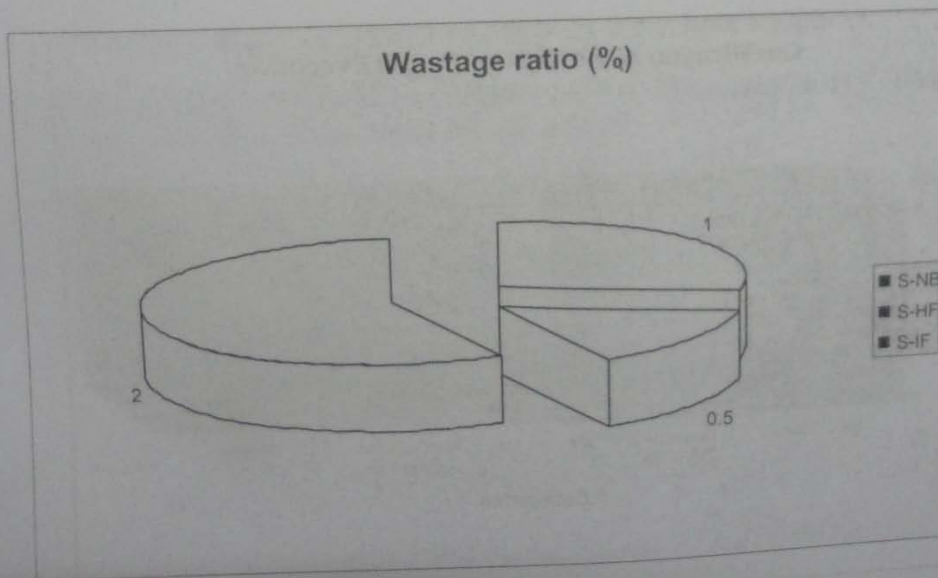


Figure-4: Distribution of frequencies of factories on Space between the stock and the floor and walls and acceptable limits of stock height

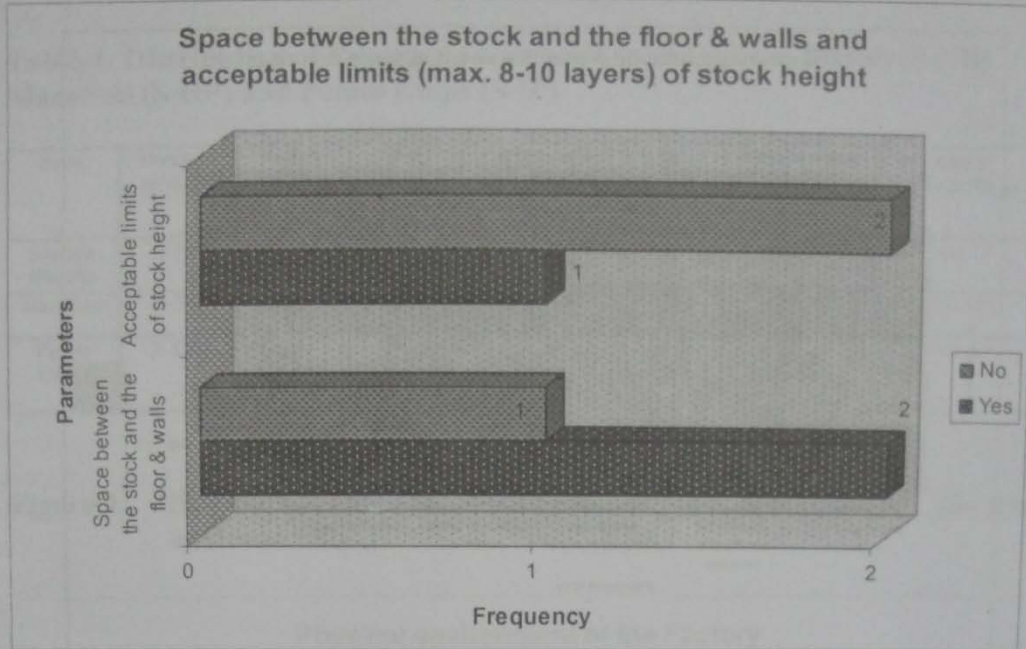
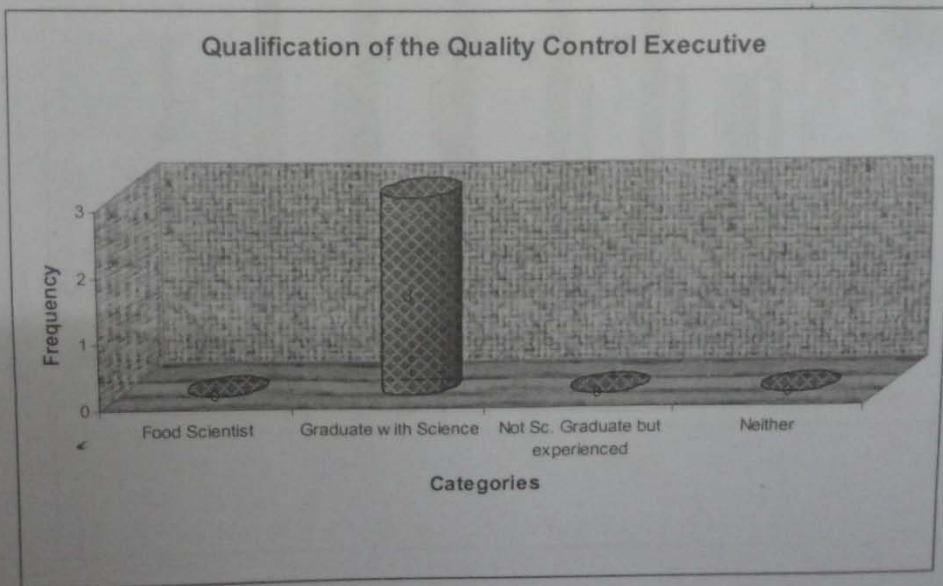


Figure-5: Distribution of categories of Quality Control Executive by qualification



From the above findings, the study will try to understand the real portrait of foods plants in Bangladesh. As a developing country, food plants didn't have resources like first world. But whatever resources it had would not utilize in a professional manner. Lots of potentialities have been lost due to ignorance. Food Scientists with appropriate technical knowledge on dynamism of food particles, when appointed in this sector, the change will be significant. Bangladesh can compete with the international food products.

References:

1. Food and Drug Administration (2004): Food GMP Modernization Working Group: Report Summarizing Food Recalls, 1999-2003.
2. AOAC (Association of Official Analytical Chemist, 1984). Official method of analysis, 14th ed. (Williams, S.sds.). Inc. Virginia, U.S.A.
3. Gopalan, C. (1971): A Manual of Laboratory Techniques. National Institute of Nutrition. Hyderabad, India. p. 434.
4. Code of Federal Regulations, Title 21, volume 2 (From the U. S. Government Printing Office via GPO Access, CITE: 21CFR110.3, Page 215-216.)
5. IAF Guidance on the Application of ISO 9001:2000, Issue 2 (2004)
6. Food and Drug Administration (FDA). (1999): Milestones in U.S. Food and Drug Law History. FDA Backgrounder. May 3.
7. Jouve, J. L. (2000): Good Manufacturing Practice, HACCP and quality systems, p.1627-1655 in Lund, B. M., Baird, P. T. C. and Goulg, G. W. (Ed.): The microbiological safety and quality of food, Aspen.