

THE MOISTURE CONTENT, VISCOSITY, SOLUBILITY, SWELLING AND MICROBIAL ANALYSIS OF A PRESCHOOL CHILDREN'S HOMEMADE FOOD AT VARIOUS STORAGE PERIODS

A. M. Zangina¹, M. L. Umoru² and U. B. Buhari³

¹Department of Home Science and Management, Federal University, Gashua, Yobe State, ²Department of Vocational Education, Modibo Adama University, Yolo

³Department of Home Economics, Sa'adatu Remi University of Education, Kumbotso, Kano, Kano State

ABSTRACT

This study investigated the attributes dynamics of preschool children's homemade food by analyzing its moisture content, viscosity, solubility, swelling behaviour, and microbial composition across different storage periods. This is important as it helps to determine the shelf life and rheological properties of food in order to ensure safety, nutrition, and quality because preschool children rely on nutritious and safe meals to support their growth and development, making it essential to understand how homemade food changes during storage. When children's food is left out for too long, it may contain harmful microorganisms that can cause food poisoning. The Rheological characteristics of the homemade food over three storage periods were analyzed for moisture content, viscosity, solubility, swelling, microbial levels and coefficient of variation using standard laboratory method. The findings revealed % moisture content (4.51, 4.41, 3.83, 3.83, 4.12 and 7.27), % viscosity (45.34, 45.44, 45.32, 45.29 and 0.14), % solubility (85.02, 85.16, 84.98, 85.37, and 0.21), % swelling (50.24, 50.01, 51.26, 51.49 and 1.45) % coefficient of variation respectively. Microbial analysis of the preschoolers' homemade food over three storage periods indicated nil for most parameters except for Coliform and Yeast/mould counts which showed 0.20×10^2 with 0.00 % coefficient of variation for all the stages. These findings showed consistent rheological properties of the food over three storage periods, with low percentage variation coefficients indicating reliability. The microbial analysis indicated minimal coliform and yeast/mold counts. Based on the results, it was concluded that the food is safe for preschooler to consume within a 9-month period. Therefore, storing the homemade food for preschoolers for up to 9 months is recommended.

Keywords: *Preschooler, homemade food, rheological properties, shelf life and microorganisms*

INTRODUCTION

The need for adequate nutritional and safety food for Preschool children is to support their growth and development. Due to the freshness nature of homemade food that is often cherished by mothers due to its nutritional content, and the shelf life of these foods may undergo a series of changes during storage and this might impact its overall quality (UNICEF, 2020). Moisture content is a critical determinant of food quality and influences its taste, texture and the spoilage susceptibility (Moore, 2020). Viscosity is the measure of a fluid's resistance to flow and plays a strong role in examining the ease of food swallowing or consumption and digestion, most especially as it affects preschoolers who are young and trying to develop their feeding arts and skills. Transformation in viscosity over storage time and periods can significantly impact the nutritional and acceptability delivery of foods (Moriconi et al., 2023). More so, solubility according to Moore (2020) enhances substance dissolvability in a solvent and impacts nutrients accessibility of homemade food absorption of young digestive systems like preschool children thereby contributing to their nutritional needs.

Swelling of food is the expansion of food particles upon hydration and is a characteristic that directly impacts sensory quality and attributes that support digestive properties of individual. Examining the swelling property phenomena across various storage periods is to offers valuable understanding into

the compositional changes and also hydration movements of homemade food, thereby providing optimization guidelines for palatability and texture. Microbial analysis is for food safety assessment and is an integral component most especially as it concerns preschool children's immune systems. Assessing microbial viability and composition throughout storage periods is to enable the identification of serious potential hazards that can inform and provide appropriate storage practices that can mitigate risks associated with food borne diseases (Yousefi & Abbasi, 2022). When food intended for children is left out for too long, it can become a breeding ground for harmful microorganisms like bacteria, molds, and yeast (Jay et al., 2021; American Academy of Pediatrics, 2021). These microorganisms can cause food poisoning if consumed and may thrive in warm, moist environments (Doyle & Buchanan, 2013). It is crucial to determine the shelf life of children's food to ensure safety, maintain nutritional value, reduce waste, and promote good food safety practices. Determining the rheological properties of food, which include viscosity, elasticity, and thixotropy, plays a key role in determining texture and quality (Food and Drug Administration, 2021). Understanding these properties of food at various periods of time is essential for developing products that meet the needs and preferences of consumers. Swelling capacity is another important factor to consider in children's foods as it helps prevent choking hazards and ensures adequate nutrition (United States Department of Agriculture, 2021).

Comprehensively assessing these quality attributes or parameters is to aim at enhancing the understanding of the various changes that occur in homemade diet for preschool children during the storage period. Insights provided from this study is to provide good information to caregivers and children food producers or practitioners on the need to follow optimized storage conditions in order to uphold nutritional quality that is safety, sensory appeal, promoting the health and well-being of preschool-aged children which is the ultimately goal of eating.

METHODOLOGY

To prevent moisture and contamination, three food samples were stored in an airtight container.

Solubility

Solubility rate refers to how well a substance dissolves in a liquid, helping the baby's body absorb essential nutrients. The food sample was mixed with a specific amount of water and stirred until it was completely dissolved. The solubility of the food was then determined by measuring the amount of undissolved particles left in the solution (FDA, 2017; World Health Organization, 2003).

Viscosity

Viscosity, which measures a food's flow resistance, can impact mouthfeel and pourability and was measured using viscometers (WHO, 2018).

Swelling

Measuring the swelling rate of infant food can determine the right cooking time for softer food suitable for a baby's consumption. Methods like water absorption and volume expansion were used to measure swelling rate accurately (Vandenplas et al., 2009).

Microbial contamination

Microbial contamination in food was detected through microbiological testing where samples are taken, cultured in a lab, and analyzed for the presence of bacteria, viruses, and other microbes to ensure food safety (Doyle & Buchanan, 2013; FDA, 2017; Jay et al., 2005).

RESULTS

Moisture, viscosity, solubility and swelling

Table 1 presents the rheological characteristics of the homemade food over three storage periods. The parameters remained stable regardless of the duration of storage, with lower percentage

variation coefficients indicating consistency. Viscosity and solubility exhibited the lowest percent coefficient of variation, while swelling and moisture showed slightly higher percent coefficient of variation.

Table 1: Rheological characteristics of the homemade food over three storage periods

Parameter	Initial	3 months	6 months	9 months	CV%
Moisture %	4.51	4.41	3.83	4.12	7.27
Viscosity (centipoise: cP)	45.34	45.44	45.32	45.29	0.14
Solubility [%]	85.02	85.16	84.98	85.37	0.21
Swelling (%)	50.24	50.01	51.26	51.49	1.45

Microbial analysis

In Table 2, the microbial analysis of the preschoolers' homemade food at the three storage periods is detailed. Coliform count and yeast/mould counts had minimal values with a CV of 0.0%, while the bacterial loads were negligible.

Table 2: Microbial analysis of the preschoolers' homemade food over three storage periods

Parameters	Initial	3 months	6 months	9 months	CV%
Coliform count	0.20x10 ²	0.20x10 ²	0.20x10 ²	0.20x10 ²	0.00
E. coli count	Nil	Nil	Nil	Nil	-
Total sal/shigella	Nil	Nil	Nil	Nil	-
Streptococci	Nil	Nil	Nil	Nil	-
Clostridium perfringenes	Nil	Nil	Nil	Nil	-
Chlorobacterium violacium	Nil	Nil	Nil	Nil	-
Klebiella aerogenes	Nil	Nil	Nil	Nil	-
Staphylococcus aureus	Nil	Nil	Nil	Nil	-
Yeast/mould counts	0.02x10 ²	0.02x10 ²	0.02x10 ²	0.02x10 ²	0.00

CV% = coefficient of variation [%].

DISCUSSION

Dry baby foods are safe to eat for a limited time if stored correctly (WHO, 2021); otherwise they can spoil and become unsafe for consumption due to microbial growth and changes in physical properties. A study on preschooler's homemade food found that after storage for 3, 6, and 9 months, the rheological properties and microbial loads remained consistent with the initial levels, indicating that the food was still of good quality even after 9 months. Our results are consistent with Ahmed and Anwar (2006) and Gokemen et al. (2010) who reported shelf life of infant foods stored from 3-9 months. This suggests that the food can potentially be stored for even longer than 9 months, possibly up to a year as recommended by AAP (2021). The prolonged shelf life may be due to the low moisture content and airtight packaging used.

Solubility

The lower solubility of the food within the 80-90% range (WHO, 2003) may make it easier for infants to digest and absorb the nutrients, promoting proper growth and nutrition.

Viscosity

In terms of viscosity, the formulated food had lower viscosity compared to previous studies, falling within the ideal range of 50-100 cP for infant foods as recommended by AAP (2021) and WHO

(2003). This appropriate viscosity ensures easy swallowing and digestion for infants, while avoiding potential choking hazards of foods that are too thin or too thick (Friedmann, 2007).

Swelling

The swelling rate of a food item indicates how much it expands when in contact with liquid like saliva or water. If food expands 50-100% in contact with liquid, it can pose a choking hazard for infants (AAP, 2021; Vandenplas et al., 2009). Parents should be cautious and choose foods with a lower swelling rate to avoid this risk as reported by Codex Alimentarius Commission (2008).

Microbes

Food safety is a critical concern for consumers, as the presence of harmful microbes in food can lead to foodborne illnesses. Microbes such as bacteria, viruses, and parasites can contaminate food at any stage of production, processing, or preparation. The rate at which food is declared to have a low or high load of microbes is determined by the level of contamination presents (USDA, 2021). The microbial analysis of the food showed that the food was free of microorganisms as evident of having nil for the individual bacteria and also having the coliform account and Yeast/mould counts below the threshold. This finding confirms the safe of the food over the 9 month storage period. This implies that the food was well dried and the container and where it was kept is adequate. The microbial load in food is measured in colony-forming units (CFU) per gram or milliliter of food. A low microbial load is typically considered to be less than 10^4 CFU/g, while a high microbial load is greater than 10^6 CFU/g (FDA, 2021). Coliforms test have been used to indicate fecal contamination and general sanitation in such matrices as raw ground meats, water, and spices (Buchanan & Oni, 2012).

CONCLUSION

The following findings were recorded:

1. The moisture content, solubility, viscosity and swelling rate of the food were not changed from the original over periods of storage
2. The microbes did not infest the food over the storage periods.

IMPLICATIONS

The microbial analysis showed that the food remained free of harmful microbes over the 9-month storage period, indicating its safety and longer shelf life.

RECOMMENDATIONS

It is recommended to consume the food within nine months to prevent bacterial contamination and ensure the quality of taste and texture for the child. Regulations for storing homemade food should be established.

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