Peertechz

LIFE SCIENCES GROUP

JOURNAL OF
Food Science and Nutrition Therapy
OPEN ACCESS JOURNAL

ISSN: 2641-3043 DOI: https://dx.doi.org/10.17352/jfsnt

Research Article

Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region

Tashome Urge Jiru[1]* and Ibsa Aliyi Usmane[2]

[1]Oromia Agricultural Research Institute, Fedis Agricultural Research Centre, Agricultural Engineering Research Process, Harar, Ethiopia

[2]School of Rural Development and Agricultural Innovation, Haramaya University, Dire Dawa, P. O. Box 138, Ethiopia

Received: 12 March, 2021
Accepted: 23 March, 2021
Published: 24 March, 2021

***Corresponding author:** Tashome Urge Jiru, Oromia Agricultural Research Institute, Fedis Agricultural Research Centre, Agricultural Engineering Research Process, Harar, Ethiopia, Tel: 256667549; Fax: 0256667551; E-mail: urgetash123@gmail.com

Keywords: Curing effect; Physiological breakdown; Storage; Chemical composition

https://www.peertechz.com

Abstract

The quality of potato and its storage life is reduced by the loss of moisture loss, decay and physiological breakdown. These deteriorations are directly related to storage temperature, relative humidity, air circulation and gas composition Curing process which is hardening the skin of potatoes and Bruise prevention is an important part of keeping quality of potatoes with minimum weight loss and storage diseases. The process was facilitated by dark, dry and warm location for six (6), and eight (8) days, at temperature ranges of 17°C -20°C and relative's humidity of 74-85 % to healing wound. In addition, curing tubers, the storage has been constructed by integrating the application storage techniques, design factors and management fundamentals into storage systems to minimize the storage losses. As a result of storage good management of the storage temperature observed as 12-16˚C inside and 25-30˚C outside, relative humidity of 77-85 % inside and 40-50 % outside. The observations of weight changes were recorded till end of storage over a 10-14 week throughout storing period with the total physiological loss of 18-24% with loss of (Gudanne < Shantama < Tulema) resulted under six day curing. Total losses include sprouting, greening moisture loss and rotting. Among these (sprouted (%) of lowest mean values loss was resulted as 2.0, 2.01 and 2.5, moisture losses (%) 0.58, 0.56 and 0.63, for variety of gudane, shantama and tulama respectively out of 18 kg before storage, in addition six day curing had significance effect among treatment, on moisture losses, and sprouted, but non significance for rotten and color change at (P< 0.05). As well as the laboratory result of chemical composition of stored tubers were match with that of scientific findings. Since curing and storing of the potato tubers results shows minimal tuber weight loss and chemical composition quality via 10th to 14 week in storage, we recommend farmers to cure before storing the potato tubers under good storage management to slow down deterioration.

Introduction

The potato (Solanum tuberosum L.) is the most important food crop in the world after wheat, rice and maize as well as ranks 4th in the world with respect to food production (Eltawil, et al. 2006). It is a semi-perishable commodity. Potatoes have important food value and cash crop in Ethiopia, especially in the high and mid altitude areas. According to [1], of Ethiopia shown that potential production of East Hararghe zone was 194,247.72 quintal and numbers of holders 34,732.00, among potential producers worade Haramaya, Kombolcha and Dadar were most potato producing area during Meher and Balg season. Potatoes production area mainly practices by peasant farmer and both home and market supply. Though the land in the zone has high production potential both for rain fed and irrigated potato cultivation, but lack of prolonging condition with improved storages among the major factors limiting the production and productivity of farmers in all potato growing areas [2].

Potato storage should have adequate insulation, outside waterproofing, inside vapor proofing, ventilation, air distribution, adequate humidification, and properly designed controls for precisely maintaining the storage atmosphere. The room must be completely dark or the potato tubers must be covered. Darkness is important in preventing light from reaching the tubers and causing their skin to turn green [3]. Temperature, light, humidity, and air movement are the most important environmental factors affecting storability. Good

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027

storage should prevent excessive dehydration, decay, sprouting and high sugar concentrations, which result in dark colored fried products [4]. Appropriate and efficient post-harvest technology and marketing are critical to the entire production-consumption system of potato because of its bulkiness and perishability [5].

According to trials of potatoes tubers treated for two weeks by above ground pit-curing method showed only 40% total loss of tubers after 4 months of storage, compared to 100% of untreated tubers [6]. Despite precautions taken to prevent injury to the potato tuber, some damage is likely and a curing process is necessary for any wounds to heal. The healing process is facilitated by curing, which refers to putting potato tubers in a place conducive to encourage the skin to harden and heal bruises that happen during digging [7]. The curing process prevents rotting of harvested tubers. It should be done in a dark, dry and warm location. Potato tubers should be placed at temperature of between 15ºC and 25ºC for 4 to 15 days to cure. If the potato tubers are harvested wet, they should be drayed-off before storage [8,9].

However, there is potential production of potatoes in study districts all the product was supplying to the market during on-season and saturated the market supply which exceeding the existing demand by far. As a result, the selling price in the local market falls extremely, mostly to the extent that it cannot cover the production cost invested by farmers. So ever falling in price the farmers obliged to sell at any market value, this is due to lack of alternative means to extend its shelf life of the products toward waiting for reasonable selling price [10]. In order to prolong the shelf life of potatoes tubers, the study was aimed to test the effect of curing condition on fresh potatoes products [11,12]. The process was facilitated by dark, dry and warm location to healing wound to minimize loss, and the study was aimed to facilitate good ware storage management to control the losses due to storage relative humidity and temperature. As usually naturally ventilated air was used to regulate the inside room temperature and relative humidity. Hence the aim of this study was to evaluate effect of curing conditions on shelf life of different potato varieties and to evaluate the optimum storage period and calibrate curing factors for major potato varieties produced in the area [13].

Materials and methods

Description of the study area

The project was conducted on station in the compound of FARC, which is located in East Hararghe zone of Oromia National Regional State of 1885 m above sea level, eastern Ethiopia and 522 km far from Finfinne. The district is lying between 09°18'9''N latitudes and 42°07`3'' longitudes.

Materials

Materials used during implementation were Digital weight balance, thermo-hygrometer, small water tank and other laboratory materials were collected from Haramaya University, Food chemistry laboratory.

Storage structures

The construction site of storage was selected considering free air movement area. The basic functions of storage buildings of stored tuber were protected the commodity against weather, and provided storage temperature, air circulation, relative humidity and atmospheric condition were maintained naturally. A good ceiling was provided for insulation in order to block direct sun light and absorbed heat emitted from outside environments. Three bottom and above wall window which was covered by wire mesh to protected entrance of insect and rodent. It was opened at night to remove heat generated due to respiration and to regulate the stored tubers moisture content by carrying humidify air that come from bottom windows small tank water edible potatoes Storage was constructed from locally available material like wooden, pole and mud. The dimensions of warehouse were 1.9 m wide, 4.80 m length and 2.70 m height, and internally classified into nine shelves (9) and had classified into twenty-seven shelf (27) box. The wall of storage was covered inside and outside by mud up to 10 cm thicknesses. As figure below external and internal potato storage was attempted to describe.

Sample preparation

Removal of excess field moisture: The samples were collected from the potato producers at their edible maturity stage a few hours before curing time to avoid the possibility of moisture losses, as well as damage that might occur due to contamination of environmental factors prior to storage bruises and signs of infection were discarded from the sample before curing and storing. The stored potatoes were drayed off by natural air for removal excess moisture from the outer layer and other foreign materials were removed. As showed in figure.

Curing process and storage period: Potatoes tubers of different size was obtained from each variety to undergo curing process. Curing was carried out under shade and covered by wetted grass immediately after harvest, the sample had classified as zero (0), six (6), and eight (8) days and at temperature ranges of 17-20ºC and relatives' humidity of 74-85 %. An amount of 490 kg, for testing were prepared and applied cure with zero (0), six (6), and eight (8) days, which was referred to put potato tubers in a place conducive to encouraged the skin to harden and healed minor bruises that happen during digging. According to trials of potatoes tubers treated for two weeks by above ground pit-curing method showed only 40% total loss of tubers after 4 months of storage, compared to 100% of untreated tubers [14,15].

Treatment and experimental design

The experiment was arranged in Randomized Complete Block Design (RCBD). Variety and curing duration were factors. Each treatment was replicated three times, accordingly the experiment 27 total combination of treatments which contained 18 kg sample for curing treatments. Not cured, after six (6) and eight days (8) were conducted for the experiments under constant storage managements. The treatment was prepared under two curing period and control non-cured accordingly zero (0), six (6), and eight (8) days, for three different varieties as shown in Table 1.

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027

Data collected

Data were collected over a 10-14 week depending on variety and curing periods throughout storing period. Parameters include, relative humidity, temperature, carbohydrate composition, weight loss, moisture loss, and quality measurement (sensory test) were gathered as following method below. All observations were recorded as means of three replications. The data pertaining moisture contents and sprouting were statistically analyzed to determine the significant difference.

Temperature and relative humidity

The storage air temperature and relative humidity was recorded two times weekly three times in days at 4-hrs intervals during the day-time using digital electronic Thermo-hygrometer model ETHG 913 R placed inside and outside storage. The average both temperature and relatives humidity difference between the inside storage and outside was calculated by using the following relationship.

Temperature

Since the study area was not able to given the temperature (cold) that favourable for storing the product. It's necessarily needed to maintained as much as possible by naturally ventilated method using water aeration system

$$\Delta T\ (℃) = \frac{T_{out} - T_{in}}{n} \quad [1]$$

Where; ΔT = average residual temperature between air in the storage and ambient air

T_{in} = inside storage temperature

T_{out} = outside storage temperature

n= number of records

Relative humidity

Since the study area was not able to given the humidity (moist environment) that favourable for storing the product. It's necessarily needed to maintained as much as possible by natural ventilated method using water aeration system.

Table 1: Treatments of the experiment.

Treatment	Varieties	Curing period in (days)	Treatment combination		
			Varieties	with	curing period
T_1	Gudane	0	Gudanne	with	Not cured
T_2		6	Gudanne	with	6-days cured
T_3		8	Gudanne	with	8 days cured
T_4	Shantama	0	Shantama	with	Not cured
T_5		6	Shantama	with	6-days cured
T_6		8	Shantama	with	8-days cured
T_7	Tulema	0	Tulema	with	Not cured
T_8		6	Tulema	with	6- days cured
T_9		8	Tulema	with	8- days cured

$$RH\ (\%) = \frac{R_{in} - R_{out}}{n} \quad [2]$$

Where, RH=average residual relative humidity between inside and outside of storage

R_{in} = inside storage relative

R_{out} = outside storage relative

n= number of record

Weight loss of potatoes (%)

Weight losses were taken from the sum of sprouted, rotten, color changed, and moisture loss of cured sample. The measurement was done by digital electronic balance having precision of 0.01gm, in the monthly interval and the difference between initial weight and final weight gave the total weight loss percentages.

$$W\ (\%) = \frac{Wi - Wf}{Wi} x100 \quad [3]$$

Where, W_i = initial weight

W_f=final weight

W = weight losses

Number of potatoes sprouted

The sprouted of potato was determined by counting the number of sprouted potato at monthly intervals during the storage period. The sprouted potatoes were discarded after each count to avoid double counting.

Number of rotten potatoes (%)

The incidence of rotting was determined by counting the numbers of rotten potatoes were discarded after each observing to avoid double counting.

Moisture loss (%)

Moisture content has a direct economic importance and a significant influence on the shelf life of potato tubers [5,16]. Potato tubers generally contain 63 – 80 % moisture resulting in an ambient relative humidity. On the other hand [5], stated that the moisture content of potato tubers variation leads to shrinking when lost and deterioration at above internal saturation state, calculated as follows.

$$\text{Percent moisture} = \frac{\text{Loss of sample weight x}}{\text{Weight of sample}} x100 \quad [4]$$

Palatability of potatoes

The quality measurements method of stored potato was tested according to [17]. Within every month of stored period the stored potato tubers were cooked & tested by untrained panelists. During palatability evaluation, panelists were

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027

instructed to drink water or wash mouth after each evaluation. Sensory evaluation was done on the daytimes.

Visual quality assessment

Visual quality was examined in accordance with the sensory evaluation standards [17]. Untrained panelist was scored on a scale of 9 points (1-9). In which 1. Dislike extremely, 2. Dislike very much, 3. Dislike moderately, 4. Dislike slightly, 5. Neither like nor dislike, 6. Like slightly, 7. Like moderately, 8. Like very much, 9. Like extremely. With this regarded every one month of stored period potatoes were cooked & tested by panelist and gave score as above rating scale Picture 1.

Chemicals composition of potatoes

The results of moisture, ash, fibre, carbohydrates, and some minerals contents were comparable to the results achieved by [18] as well as by [4].

Chemical combustion of stored potato was tested in laboratory throughout storing period.The potato tubers contain 35 % moisture, 25 %vitamin C, 16 % dietary fibre, 12.5 % Carbohydrates, 10 % calcium and other. The composition of potato tubers, however, varies considerably according to the class of potato, its variety of origin and the proportion of outer parts removal by particular milling process [19,20].

Methods of data analysis

All measured variables were subjected to Genstat 15th edition software for analysis of variance. When the treatment effects were found significant, the mean difference was tested using least significant difference at 5% level of probability.

Picture 1: During sensory test.

Result and discussion

Physiological weight loss

All the physiological losses mentioned below were depend on the storage conditions and perishability of tubers, therefore it could be limited by maintaining favorable conditions in the storage as well as hardening the skin of the tubers was observed to minimize the losses. ANOVA indicated that curing effect on Gudane, Shantama and Tulema variety was significance difference among treatment, of moisture losses, sprouted, colour change, but non significance for rotten and colour change (P< 0.05) as shown in Table 2.

Losses due to sprout

ANOVA indicated that loses due to sprout significantly affected by curing period. Sprouted in potato was not seen in first part of the storage period. The highest mean values lost in gudane, shantama and tulama variety was 4.8, 5 and 5.4 respectively, this was due to untreated by curing condition as well as the lowest mean values loss was resulted as 2.0, 2.01 and 2.5 respectively, with six-day curing, this was due to medium curing condition on the treatment applied. So that for those varieties under study curing had positive impact on shelf life of potatoes at six days curing duration, beyond this level it had negative impact which speed up the rate of moisture loss.

Moisture lose

The highest mean values loss of moisture was recorded in gudane variety, 1.86 this was due to over curing. shantama and tulama variety was, 1.76 and 1.49 respectively, this was due to untreated under curing condition as and the lowest mean values loss was resulted as 0.58, 0.56 and 0.63 respectively, with six day curing this was due to medium curing condition on the treatment applied. So that for those varieties under study curing had positive impact on shelf life of potatoes at six days curing duration, beyond this level it had negative impact which speed up the rate of sprouting.

From the result Curing effect had significantly (P<0.05) influenced tubers weight loss throughout storage period.

Table 2: Analyzed data of potato weight loss.

Variety	Treatment	Sprouted (kg)	Color change(kg)	Rotten(kg)	Moisture loss(kg)
Gudane	Not cured	4.83^{ab}	0.91^{ab}	0.2^{a}	1.83^{a}
	After six days cured	2.00^{e}	0.65^{abc}	0.2867^{a}	0.58^{c}
	After eight days cured	3.52^{bcd}	1.04^{a}	0.126^{7a}	1.86^{a}
Shantama	Not cured	5.00^{ab}	0.55^{bc}	0.1167^{a}	1.76^{ab}
	After six days cured	2.01^{de}	0.4533^{c}	0.1967^{a}	0.56^{c}
	After eight days cured	4.33^{ab}	0.3667^{c}	0.1933^{a}	1.73^{ab}
Tulama	Not cured	5.40^{a}	0.46^{c}	0.1567^{a}	1.03^{bc}
	After six days cured	2.50^{de}	0.6633^{abc}	0.1333^{a}	0.63^{c}
	After eight days cured	3.00^{cde}	0.4767^{c}	0.1^{a}	1.49^{ab}
	CV (%)	24.20	37.70	28.90	34.30
	L.S.D (%)	1.52^{*}	0.40^{NS}	0.32^{NS}	0.75^{*}

LSD: Least Significance Difference; CV: Coefficient of Variation; Note: Mean followed by the same letters are not significant different NS stand foe non significance

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027

However, it did not significant differences for some variety among treatments in storage periods. In other way, increased curing days linearly increase physiological (total weight loss) tubers. Accordingly, six days curing condition shown good performance which result of weight loss was less as compared with that of rest treatment. Total losses throughout storage period of potatoes were recorded as 18 – 24 %. Result was lower than that of reported the Losses from tuber color greening, rotten, excessive sprouting, and other causes average about 20-30%, although losses of up to 70% have been reported [22].

Chemicals composition of potatoes tubers

Accordingly, the results of moisture, ash, fibre, carbohydrates, and some minerals contents were illustrated in above table Fresh potatoes consist of average 60 – 83% moisture, 45-60% carbohydrates, 0.7 - 5% protein, 3% ash. The laboratory result of chemical composition of Total soluble solid, carbohydrate, proteins, fibre, ash, Moisture contents (%) and vitamin C in average result of treatment that cured after six days was failed between ranges of the in potato tubers were comparable to the results achieved by [6,23-27] as well as by [4].

The conducted experiments revealed that the carbohydrate and vitamin c concentrations in the studied potato curing effect did shown difference with that of not cured potato which stored under the same storage condition but different curing time on each variety. within the range of permissible values for this component in potato tubers not cured shown more qualitative loss for all three varieties majorly next to that of after eight days which affect sugar contents of tubers, so that after six-day curing shown that good performance Table 3.

This due to undergo optimum curing days means, it was not too long day's not too short day. Accordingly, the result had indicated that the existing differences in chemical composition of tubers were comparable with these findings.

Temperature and relative humidity

From the plotted graph between number of record versus temperature or humidity plotted the first two column shown temperature and the second column shown humidity accordingly the inside temperature of storage was varied between 12-16ºC against ambient temperature variations between 25-30ºC, and Relatives Humidity inside the structure was 77-85% against that of outside 40-50%. As shown from the graph the inside average temperature was much less than ambient temperature, which was regulated by cool air entrance, this indicated that keep coldness and moistness of internal storage was critical to maintained the internal storage, similarly for humidity Figure 1.

Visual quality assessment

Visual quality was examined in accordance with the sensory evaluation standards [17] and [23] Table 4.

From above table the sensory average result shown that for three varieties under not cured treatment had lowest value overall acceptance of scored as 5 (Neither like nor dislike), as the panelist stated that not cured treatment taste was bitter, appearance and texture of not cured was not attractive when compared with that of cured treatments. In addition, curing for six days was scored highest value of (7 and 8) like moderately and like very much respectively which was preferred than eight days curing. This revealed that for three varieties (Gudane, Shantama, and Tulema) curing condition had positive effect on six-day curing time shown good performance in case of sensory analysis.

Conclusion and recommendation

Conclusion

The result taken from analyses of three potato varieties indicated that curing effect after six days had positive effect for major variety. The curing condition and good storage management was serve producers by preventing the spoilage of potatoes tubers which make them available at off-season in places they were harvested. Curing effect had positive impact on potato tuber storage regarding the level of the storage of fresh potato to prolong the shelf life of potato from 14 days to 10 and 14 weeks, with the total loss of 18 to 24% at the end of storage period. The result of loss was lower than trials which potato tubers treated for two weeks by above ground pit-curing method showed only 40% lost tubers after 3 months of storage (FAO 2000). The inside storage temperature range

Table 3: Chemical composition of the stored tubers laboratory result.

Collected Parameters chemical composition	Varieties with Treatment								
	Gudane			Shantama			Tulem		
	Not cured	After 6th day	After 8th day	Not cured	After 6th day	After 8th day	Not cured	after 6th day	after 8th day
sample (g)	3	3	3	3	3	3	3	3	3
TSS (%)	5.0	4.5	5.0	4.0	3.0	4.5	4.0	3.0	3.0
Vitamin C	13.0	15.0	15.0	15.0	13.0	15.0	14.0	14.0	14.0
Sample (100ml)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
CH_2O (%)	57.7	48.3	39.7	47.7	48.3	46.0	60.2	48.7	57.6
Moisture contents (%)	34.3	44.7	54.3	35.3	42.7	43.7	33.3	43.3	34.7
Ash (%	5.0	4.7	6.0	4.7	6.7	5.3	4.9	5.7	5.0
Protein contents (%)	3.0	2.3	2.0	2.3	2.3	2.4	1.5	2.4	2.8
Fiber (%)	1.1	0.7	0.6	0.7	0.7	0.7	1.2	0.7	1.2
Potassium (g)	196.8	122.8	126.4	153.2	102.5	151.0	150.2	176.5	173.8
Iron (g)	6.0	7.2	12.1	9.6	5.5	13.8	14.7	7.0	14.9
Calcium(g)	12.0	41.3	44.7	18.9	37.8	26.4	31.5	40.1	25.2

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027

was observed as 12-16ºC with inside Relatives humidity of 77-85%, when the outside temperature and Relatives humidity were recorded as 25-30ºC and 40-50% respectively. From the experimental result observed that moisture loss and sprouting had great importance in order to decide shelf life of stored potato. Therefore, curing was undertaken prior to storage in order to minimize the loss occurred due to moisture loss by conserving moisture and good storage management minimize loss in case of sprouting by maintaining storage atmosphere to extend shelf life of stored tubers.

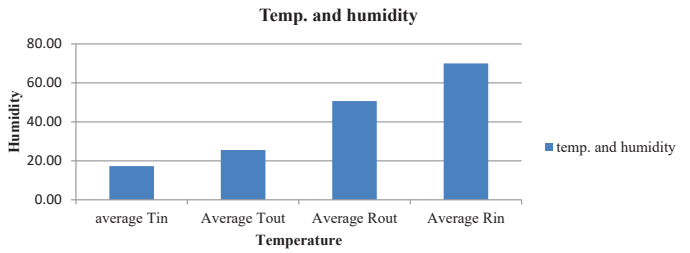

Figure 1: Temperature and Humidity.

Recommendation

The of curing potato tubers was prolonging shelf life of potato thereby sustainable availability of potato over the market and makes gain of additional money for farmers. In general, the structure of the storage required important care during construction totally the sun light should be blocked as much as possible from entering into the storage and time of ventilation have to be seriously applied unless there might be great losses or cause total damage on potato tubers. It would also be beneficial to select a longer period of storage and more potato variety to test potatoes to understand the chemical and physical changes which occur during prolonged storage.

Table 4: Summary of average sensory result.

Testing parameters	Varieties with Treatments								
	Gudane			Shantama			Tulema		
	Not cured	After 6th day	After 8th day	Not cured	After 6th day	After 8th day	Not cured	After 6th day	After 8th day
Taste	6.2	8.0	6.3	5.6	7.5	7.4	5.0	8.6	5.7
Color	6.0	7.3	7.0	4.5	6.7	5.5	4.6	7.4	5.3
appearance	4.5	7.0	7.5	7.3	7.0	4.6	3.7	7.8	4.3
texture	3.7	6.0	4.0	4.2	8.4	5.3	5.0	8.6	5.8
Overall acceptance	5.0	7.0	6.0	5.0	7.0	6.0	5.0	8.0	5.0

References

1. CSA (2016) G.C, (Schaupmeyer, 1992), (FAO, 1991), (FAO 1987).
2. Eltawil M, Samuel D, Singhal O (2006) Potato Storage Technology and Store Design Aspects. Agricultural Engineering International: the CIGR Ejournal. Invited overview 8. Link: https://bit.ly/3lKdPSy
3. Herbert H (2003) Harvesting potatoes. Fairbanks Daily Article. August 2003. Alaska, USA
4. Lefort JF, Durance TD, Upanhdyaya MK (2003) Effect of tuber storage and cultivar on the quality of vacuum-microwaved dried potato chips. J Food Sci 68: 690-696. Link: https://bit.ly/3vTaEg1
5. Alvarez MD, Fernandez C, Solas MT, Canet W (2011) Viscoelasticity and microstructure of inulin-enriched mashed potatoes: Influence of freezing and cryoprotectants. J Food Eng 102: 66-76. Link: https://bit.ly/2PhxMnL
6. Alvarez MD, Fernandez C, Canet W (2005) Effect of freezing/thawing conditions and long-term frozen storage on the quality of mashed potatoes. J Sci Food Agric 85: 2327-2340. Link: https://bit.ly/3tU6lQ1
7. Dogan H, Karwe MV (2003) Physicochemical properties of quinoa extrudates. Food Sci Technol Int 9: 101-114.
8. Schaupmeyer CA (1992) Potato Production Guide for Commercial Producers. Alberta Agriculture, Edmonton, Alberta. Canada (FAO, 1991), (Ma et al., 2010), (Herbert, 2003).
9. Schoch TJ (1964) Swelling power and solubility of granular starches. In: R.L.Wlistler (Ed.). Methods in carbohydrate chemistry. New York: Academic Press Inc. 106-108.
10. Kerdpiboon S, Devahastin S (2007) Fractal characterization of some physical properties of a food product under various drying conditions. Drying Technol 25: 135-146. Link: https://bit.ly/3tORlTj
11. Jaetzold R, Schmidt H (1983) Farm Management Handbook of Kenya Vol. 11/B. (Rift Valley and Central Provinces). Ministry of Agriculture, Kenya and GTZ. W. Germany. Link: https://bit.ly/31cGWEO
12. FAOAC (1998) Official methods of analysis of the association of official analytical Chemists. 16th ed. Gelthersburg. Maryland.
13. Gawroska H, Thornton M, Dwelle R (1992) Influence of heat stress on dry matter production Harvesting potatoes. Fairbanks Daily Article. Alaska, USA. Link: https://bit.ly/3vXgzky
14. Mclaughlin CP, Magee TRA (1998) The effect of shrinkage during drying of potato sheres and the effect of drying temperature on vitamin C retention. Food and Bioproducts Processing 76: 138-142. Link: https://bit.ly/39bS9d7
15. Kim HO, Lee SK (1993) Effects of curing and storage conditions on processing quality of potatoes. Acta Hortic 343: 73-76. Link: https://bit.ly/2PlcSEr
16. Beukema HP, Van Der Zaag DE (1990) Introduction to Potato Production. Pudoc, Wageningen, the Netherlands. CIP. (2000) CIP. In: C. Graves. (Ed.). The Potato, Treasure of the Andes²From Agriculture to Culture. CIP, Lima, Peru.
17. Devi AF, Fibrianto K, Torley PJ, Bhandari B (2009) Physical properties of cryomilled rice starch. J Cereal Sci 49: 278-284. Link: https://bit.ly/2NKgGym
18. Herbert H (2003) Harvesting potatoes. Fairbanks Daily Article. August 2003. Alaska, USA.
19. Anderson RC, Conway HF, Griffin EL, Pfeifer V, Anderson R, et al. (1969) Gelatinization of corn grits by roll and extrusion cooking. Cereal Sci Today 14: 4-11. Link: https://bit.ly/2NKuEQQ
20. Kabira JN (2002) Linking ware potato growers with processors of French-fries in Nakuru District, Kenya. Report of Food Net Processing Project. Link: https://bit.ly/3riPAMB
21. Subadra S, Monica J, Dhabhi D (1997) Retention and storage stability of beta

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027

carotene in dehydrated drumstick leaves (Moringa oleifera). Int J Food Sci Nut 48: 373-379. Link: https://bit.ly/3tNA9xr

22. Kerdpibon S, Devahastin S, Kerr WL (2007) Comparative fractal characterization of physical changes of different food products during drying. J Food Eng 83: 570-580. Link: https://bit.ly/39cUPai

23. Doymaz I (2007) Air drying characteristics of tomatoes. J Food Eng 78: 1291-1297. Link: https://bit.ly/3d5uRGS

24. Liu M, Chen RY, Tsai MJ (1990) Effect of lowtemperature storage, gamma irradiation and iso-propylN-(3-chlorophenyl carbamate) treatment on processing quality of potatoes. J Sci Food Agric 53: 1-13. Link: https://bit.ly/31cw1eh

25. Lung'aho B, Lemanga B, Nyangesa M, Gildemacher P, Kinyae Demo P, et al. (2000) Commercial seed potato production in Eastern and Central Africa. Kenya Agricultural Research Institute 140.

26. Muthoni J, Nyamongo DO (2009) A review of constraints to Irish potato in Kenya. J Hortic For 1: 98-102.

27. Nnodu EC, Harrison MD, Parke RV (1982) The effect of temperature and relative humidity on wound healing and infection of potato tubers byAlternaria solani 59: 297-311. Link: https://bit.ly/3tMsqji

Citation: Jiru TU, Usmane IA (2021) Effect of curing condition on shelf life of fresh potatoes storage in Easter Hararghe zone of Oromia region. J Food Sci Nutr The 7(1): 011-017. DOI: https://dx.doi.org/10.17352/jfsnt.000027