Nigerian Journal of Engineering Science Research (NIJESR).
Department of Mechanical Engineering, Gen. Abdusalami Abubakar College of Engineering, Igbinedion University, Okada, Edo State, Nigeria.

ISSN: 2636-7114
Journal Homepage: https://nijesr.iuokada.edu.ng/

Assessment of Performance and Ergonomics Analysis for Cassava Sieving Machine

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Manuscript History
Received: 25/12/2024
Revised: 20/03/2025
Accepted: 01/04/2025
Published: 08/04/2025
https://doi.org/10.5281/zenodo.15173493

Abstract: *The study is focused on assessment of performance and ergonomic analysis for cassava sieving machine. To achieve this, determination of level of exposure of musculoskeletal discomfort using questionnaire analysis, performance evaluation of the existing and improved cassava sieving machine, determination of anthropometric characteristics of cassava processors, establishment of design dimensions were obtained and factored into the development of the improved sieving machine. ResultsofdatacollectedandanalysedrevealedthatadjustableSeatheightrangeof 37-47cm, machine height of 80cm, and width of 48cm obtained from anthropometric body analysis of cassava processors was adopted. Also, the result obtained for the existing sieve showed 69% efficiency, 0.42kg/min sieve capacity, while the improved sieve showed 2.1kg/min sieve capacity and 89% efficiency. Questionnaire analysis indicated that 80% of users preferred the improved sieve based on comfortability criterion while 20% preferred the existing sieve. Energy expenditure result of users obtained showed 3.87KJ/min and 2.8KJ/min for existing and improved sieve respectively.*

Keywords: *Ergonomics, Anthropometry, Cassava, Energy expenditure, Performance evaluation*

INTRODUCTION

Research has indicated that different cassava processing phases expose workers to a variety of ergonomically derived occupational illnesses and disorders. For example, those who use traditional sieves and manual dewatering tools are at risk of developing a variety of illnesses, including awkward sitting positions during manual sifting and backaches from standing and bending (Igbeka, 2003). Ndaliman (2008) proposed that the following processes, depending on the desired end products, are typically involved in turning cassava into finished or semi-finished products: peeling, washing, grating, dewatering, fermentation, sieving, drying, or frying.

Hand labour still performs most of these tasks, which are typically labour-intensive, dangerous, time-consuming, and unsuitable for large-scale production due to their limited output capacity (Quaye *et al.,* 2009), among other drawbacks. Similarly, Cassava has recently given rise to several processing options, including garri, fufu, starch, flour, tapioca, and chips. Regardless of these alternatives, edible starch, a by-product of drying the grated tubers and garri, or roasted granules, have continued to play a significant role in many Nigerians' diets (Airaodion, 2019). The lack of effective machinery, processing technologies, and tools is a barrier to cassava processing (Ajagba, 2018). These are frequently out of reach and occasionally unavailable at the farm level. The ones that are currently on the market were simply manufactured without extensive engineering study. Bamiro (2007). Numerous efforts have been made by engineers both domestically and internationally to develop methods for harvesting and processing cassava. Among these are manual and semi-mechanized/mechanized techniques used in labs and on farms (Agbetoye, 2003). The quality of the products is often very low due to handling and processing conditions. Processing conditions are typically unhygienic and unwholesome, in addition to the high labour intensity and drudgery. Better ergonomically designed equipment can prevent the loss of some vitamin and mineral value that occurs during processing by women in rural areas (Kolawole *et al.,* 2007).

Furthermore, ergonomics, according to Mark (2008), is the study of people in the workplace. Makhbul *et al.* (2012) defined ergonomics as the process of designing a workspace, tools, environment, product, and personnel policies with the biomechanical, physical, and psychological needs of workers in mind. It has been widely used in the business sector in Italy (Capodaglio, 2022). These days, more focus is being placed on how well a job fits the worker. To help employees perform their jobs to the best of their abilities, workplaces are designed around their personalities or skills (Soares, 2006). Ergonomics has changed a lot over the years. Some of these were at the level of debate, such as psychological ergonomics in the 1990s, organizational ergonomics in the 1970s, positive ergonomics in the 1980s, cognitive ergonomics in the 1960s, and spiritual ergonomics in the new millennium (Wilson, 2000). The study of emotional ergonomics examines the interaction between a person's emotions and those of a machine. Employee success and well-being are significantly impacted by their passions, according to the theory behind spiritual ergonomics (Mokdad and Abdel-Moniem, 2017). Findings from various researchers stated that there are strategies that are formulated to evaluate the exposure of workers to occupational discomfort. Among all the assessment methods, the quick ergonomic checklist (QEC) offers an advantage of promptly assessing and evaluating the exposure of workers to the risks of work-related musculoskeletal discomfort (WMSDs), as reported by Anas *et al.* (2012). QEC primarily concentrates on the needs and investigations of major WMSD risk factors by practitioners. QEC features a high degree of usability and exceptional observer reliability, as proven by Samuel *et al.* (2010). Video footage or direct observation can be used for the assessment. The "worker's Assessment Checklist," as described by Neville *et al.* (2005) must be filled out by the employee being observed. Like the traditional sieving process, assessments of employees exposed to work-related musculoskeletal disorders (WMSD) have been conducted in other fields where employees' energy, time, and awkward posture were factors. Simonson and Rwamamara (2009) investigated the ergonomic risks associated with self-compacting and conventional concrete. Oladele (2012) conducted research on the degree of discomfort associated with four different working postures used when frying gari. Further research showed that to measure postural comfort objectively, Kölshy *et al.* (2020), stated that postural comfort assessment is possible with the suggested approach. Mahendra and Awadhesh (2010) designed, developed, and evaluated the ergonomics of a hand-operated spade. According to Princess and Micah (2021), employees in the production department feel uncomfortable due to repetitive motions and extended awkward postures at work. Comparably, the process of determining a machine's productivity and efficiency in reaching a goal is known as performance assessment.

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The performance test of a cassava processing machine is usually conducted by evaluating several factors, including capacity, efficiency, output quality, ease of operation, and energy expenditure, to guarantee effectiveness, efficiency, and suitability for needs (Akinfonye, 2020).

Additionally, in relation to the ergonomic study of the cassava processing machine, ergonomics uses anthropometry to assess a machine's suitability for a human operator. This increases the efficiency and productivity of the work system while ensuring the worker's safety, health, and comfort. It entails measuring various human body parts to assess variations among user groups and account for those variations to create an appropriate design (Dawal *et al.,* 2012). When designing ergonomic cassava processing machines, factors such as operator comfort and safety, material handling, lifting and accessibility should all be considered. In summary, some researchers have carried out related study on ergonomics evaluation in different study areas such as the work of Ojolo (2016). However, the challenge in ergonomic design includes the need to strike a balance between human-machine fitness, machine performance evaluation and operator comfort. Furthermore, examples of how anthropometry is used in ergonomics include the planning and arrangement of living and working environments, with special attention to anthropometric factors like grasping and using controls, knobs, buttons, and switches. (Lin *et al.,* 2016), clearance (e.g., sufficient leg, elbow, and head space, among other things which keep the body away from potential dangers like nearby equipment. (Ghaderi *et al.,* 2014), posture (e.g., relationship between the dimensions of the workstation and the body) (Kushwaha *et al.,* 2016), as well as power (e.g., applying and analyzing torque and forces when operating controls or performing other physical tasks) (Dianat *et al.,* 2017), as well as the description of the variations in anthropometric traits between various ethnic and occupational groups (Stewart *et al.,* 2017), as well as variations in body measurements over time (Tomkinson *et al.,* 2017). The application of ergonomics into the design of agricultural machines is an important aspect of ensuring optimal performance of machines, sustainability and comfortability of operators which contributes to the overall success of post-harvest operations. Hence, the work addressed the challenges by making use of anthropometric data for human-machine fitness for sieving machines. The motivation behind the study is driven by passion, interest, personal experience, and potential impact it will make.). Inappropriate equipment design has also been linked to a high rate of occupational injuries, to increase safety and reduce workplace injuries, anthropometric characteristic analysis has been suggested (Sutalaksana *et al.,* 2016). Anthropometric studies can therefore offer crucial information for creating ergonomic tools, goods, or spaces, which could greatly enhance productivity, fit, comfort, and safety at work (Hanson et al., 2009).

MATERIALS AND METHODS

2.1 Materials

Materials used include measuring tape, digital stop watch, mechanical weighing balance,jute bag, dried cassava mash, and fabrication materials.

2.2 Methods

2.2.1 Performance Assessment

The research work was done in cassava processing centres in Ohaji, Obinze, and Naze in Owerri-West and Owerri-North Local Government Areas in Imo State, Nigeria, respectively. The map of the study areas is depicted in Fig 1. A sample of 40 cassava processors was selected randomly, with 20 females and 20 males. The data was analyzed using Statistical Package for Social Sciences (SPSS) and Excel software, and Design Expert Software version 11. In the performance evaluation method, dried cassava pulp was weighed at 5,10,15, 20, and 25kg loading rate each time. This was poured into the sieving unit and well spread out, it was done until the cassava mash was completely sieved.

The time taken was recorded, and the sample output from the sieve was weighed and recorded. The procedure was repeated thrice for each sample. Design-Expert® Application Software (version 11.1.0.1) was used to design the experiment using a Response Surface Central Composite design method. A total of 13 runs were designed for the existing sieve and 13 runs for the ergonomically improved sieve. Plate 1a and Plate 1b shows the performance assessment. Sifting efficiency was obtained using the Equation (Emmanuel, 2012) as expressed in Equation (1):

$$S_e(\%) = \frac{W2}{W1} x100 \quad (1)$$

Where;

S_e = Sifting efficiency (kg), W_2 = Weight of the sifted mash(kg),

W_1 = Initial weight of the cassava(kg)

The output capacity was obtained using the equation (Emmanuel, 2012) as expressed in Equation (2):

$$O_c = \frac{Ws}{T} \quad (2)$$

Where;

O_c = Output capacity (kg/hr), $W_{s\ =\text{Weight of sifted mass}}$(kg), T = Time of sifting. (hr).

2.2.2 Ergonomic Evaluation

During the time of measurement, the cassava processors were without shoes by procedure explained by Pheasant (2003). The Statistical Package for Social Science (SPSS) was used to analyze the data. The 5th, 50th, and 95th percentile values were calculated using SPSS.

2.2.3 Postural Discomfort

The identified areas of discomfort after the initial experimental trials by the processors are the buttocks, neck, shoulder, wrist, waist, upper back, thigh, and arm, as shown in Plate 1a.

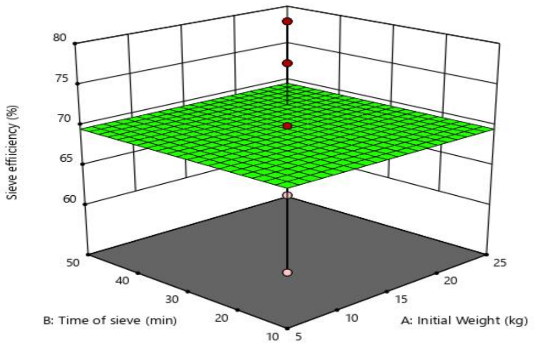
Plate 1a. performance assessment using the sieve

Plate 1b. Performance assessment using the improved improved sieve

RESULTS AND DISCUSSION

3.1 Performance Efficiency Result of the Existing Sieve

Result obtained from the performance efficiency of the existing sieve were analyzed and expressed in Figs. 1. and 2.



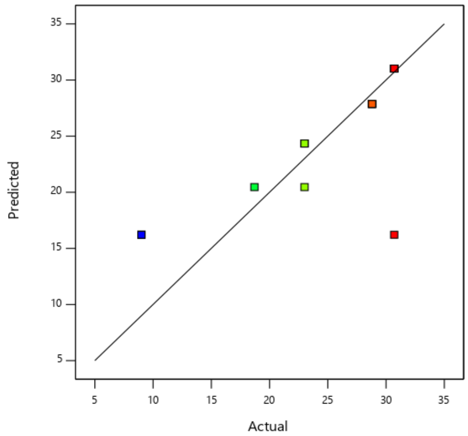


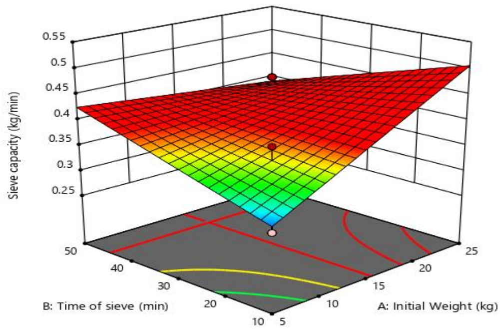
Fig. 1. Performance efficiency plot

Fig. 2. Predicted vs Actual plot

Fig. 1 shows the dependency of sieve efficiency on weight of dewatered cassava mash and time of sieve. As can be seen from Fig. 1, sieve efficiency is linearly proportional to time of sieve and weight of dewatered cassava pulp. This can be attributed to the constant rate at which dewatered cassava is fed into the sieve without getting clogged during the process. Also, the traditional sieve may not experience significant wear and tear that could affect efficiency. The maximum efficiency obtained from the existing sieve was 69%. This can be compared to the result of Azeez *et al.,* (2020) who got an efficiency of 77%. The predicted and actual graph as shown in Fig. 2 showed that the predicted values are correlated with the actual values as some points fall along and close to 45degree line (y=x) indicating that the predicted values are precise.

3.2 Sieve Capacity Result for the Existing Sieve

Data obtained from the performance capacity of the existing sieve were analyzed and expressed in Figs. 3 and 4.



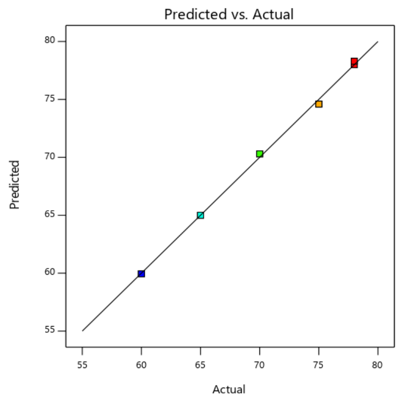


Fig. 3. Sieve capacity for the existing sieve.

Fig. 4. Predicted vs Actual plot

Fig. 3 shows that sieving capacity varies inversely with the initial weight of the cassava roots samples and the sieving time. This could be because of material compaction or sieve blockage. The maximum sieve capacity obtained from the existing traditional sieve was 0.42kg/mi. This can be compared to the result of Azeez et al, (2020) who got sieve capacity of 0.043kg/s. The predicted and actual graph as shown in Fig. 4 showed that the predicted values are not closely in alignment with the actual values as some points falls within 45degree line (y=x) indicating that the predicted values are correlated.

Table-1 ANOVA for Quadratic Model of Existing Sieve Efficiency

Source	Sum of Squares	Df	Mean Square	F-value	p-value	
Model	625.36	2	312.68	153.72	<0.0001	Significant
A-Initial Weight	619.49	1	619.49	304.54	<0.0001	
B-Time of sieve	0.0000	0				
AB	32.63	1	32.63	16.04	0.0039	
A^2	0.0000	0				
B^2	0.0000	0				
Residual	16.27	8	2.03			
Lack of Fit	16.27	2	8.14			
Pure Error	0.0000	6	0.0000			

The expression for the sieving efficiency of the existing sieve is presented in terms of the coded factor as Equation (3).

$E_{ff=75.11+10.33A+0.0000B-4.10AB+0.0000A^2+0.0000B^2}$ [R^2= 0.9583] (3)

Where E_{ff} is the response variable and A-B are the coded values of the independent variables. Equation (3) represents the quantitative effect of the factors (A and B) upon the response (E_{ff}). Coefficients with one factor represent the effect of that factor while the coefficients with more than one factor represent the interaction between those factors. Positive sign in front of the terms indicates synergistic effect while negative sign indicates antagonistic effect of the factor. Equation (3) in terms of coded factors can be used to make predictions about the response variables. The adequacy of the above proposed model was tested using the Design Expert sequential model sum of squares and the model test statistics. P-values help determine the statistical significance of each source, P-values less than 0.0500 indicate model terms are significant. In this case A, AB are significant model terms as expressed in Table 1. The lack of fit shows that the model adequately fits the data. The Predicted R^2-value of 0.9583 is in reasonable agreement with the Adjusted R^2-value of 0.9683 which indicates a good model prediction between the observed variables and predicted variables. The Model F-value of 153.72 implies the model is significant as illustrated in Table-1.

Table-2 ANOVA for Quadratic Model for Existing Sieve Capacity.

Source	Sum of Squares	Df	Mean Square	F-value	p-value	
Model	0.0137	2	0.0069	21.00	0.0011	Significant
A-Initial Weight	0.0080	1	0.0080	24.50	0.0017	
B-Time of sieve	0.0000	0				
AB	0.0057	1	0.0057	17.50	0.0041	
A^2	0.0000	0				
B^2	0.0000	0				
Residual	0.0023	7	0.0003			
Lack of Fit	0.0023	2	0.0011			
Pure Error	0.0000	5	0.0000			
Cor Total	0.0160	9				

The expression for the sieve capacity of the existing sieve is presented in terms of the coded factor as Equation (4):

$S_{c=0.4086+0.0400A+0.0000B-0.0571AB+0.0000A^2+0.0000B^2}$ [R^2=0.7387] (4)

Where S_c is the response variable and A-B are the coded values of the independent variables. Equation (4) represents the quantitative effect of the factors (A and B) upon the response (S_c). Coefficients with one factor represent the effect of that factor while the coefficients with more than one factor represent the interaction between those factors. Positive sign in front of the terms indicates synergistic effect while negative sign indicates antagonistic effect of the factor.

Equation (4) in terms of coded factors can be used to make predictions about the response variables. The adequacy of the above proposed model was tested using the Design Expert sequential model sum of squares and the model test statistics. P-values help determine the statistical significance of each source, P-valuesless than 0.0500 indicate model terms are significant. In this case A, AB are significant model terms, the lack of fit showed that the model adequately fits the data as expressed in Table-2. The Predicted R^2-value of 0.7387 is in reasonable agreement with the Adjusted R^2-value of 0.8163 which indicates a good model prediction between the observed variables and predicted variables.

3.3 Anthropometric Body Measurements Result of the Cassava Processors

Table-3 shows the result of the anthropometric measurement of the body parts of the twenty (20) female and twenty (20) male cassava processors obtained from the study area.

Table-3 Anthropometric Data of Cassava Processors

Women (n = 20)					Men (n = 20)				
Parameters	Tag	5^{th}	50th	95th	5^{th}	50^{th}	95^{th}	Min	Max
Age (years)	Ag	21.0	30.50	38.00	20	37	45	21	45
Elbow to finger (cm)	El	37.0	42.5	48	30	33	47	30	48
Knee height sitting (cm)	Kh	24.0	30.0	37.0	43	50	60	24	60
Hip to knee (cm)	Hk	35	39	46	38	41	47	35	47
Hip breadth (cm)	Hb	28	36	40	26	32	36	26	40
Height (cm)	Ht	158	168	184.9	169	181	190	158	190
Lower leg length (cm)	Ll	37	42	55	40	45	47	37	47
Thigh clearance (cm)	Tc	9	11.5	10	12	16	17	9	17
Hip -to- head (cm)	Hh	20	25	30	25	30	35	20	35

From Table 3, the data obtained under the parameters measured for the males were different from those obtained for the female processors. This data was further analyzed using excel t-test to know if the difference observed were statistically significant with the results showing a t-stat values of 0.0067, 0.0049, and 0.0078 at 16 degree of freedom,5% significant level with a t-critical value of 2.23 for the 5th,50th, and 95th percentile respectively. The t-test values showed that there was no significant difference between the male and female parameters indicating that the values can be used for both genders. The 5^{th} percentiles are the minimum values obtained, the 50^{th} average values obtained while the 95^{th} percentile are the maximum values obtained. The anthropometric data obtained from the research area (Obinze, Ohaji and Naze) were closely related to that obtained by Samuel et al., (2016) who carried out anthropometric studies for designing to fit gari-frying workers in the Western States of Nigeria namely: Ogun, Ondo, Ekiti and Lagos state.

3.4 Design Dimensions and Criteria for the Improved Cassava Processing Machines

From Table-3, the dimensions for the improved cassava sieving machine, were developed.

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Table-4 Design Dimensions

Machine parts dimensioned	Single or combined processors measured parts	Designed dimension (cm)	Source of Dimension
Sitting height (Sw)	Lower leg length (Ll)	Adjustable sit of height range (37-47)	5th percentile and 95th percentile men
Machine width (Mw)	Elbow to finger (El)	48	95th percentile women
Machine length (Ml)	Hip breadth (Hb) x 2	80	95th percentile women x 2
Leg entrance	(Ll + Tc)	62	50th percentile of LL (men) + 95th percentile of Tc (men)
Machine height	(Hk+Hh)	82	95th percentile men

From the results as shown in Table-4, a seating adjustable height range of 37-47cm is favourable to accommodate users' variations. Machine length was obtained by multiplying the 95th percentile hip breadth of women processors by 2 which gave an ergonomic length of 80cm as shown in Table-4. Machine width is the maximum extent the arm can reach when the processors are performing a task such as sieving, pressing etc**.** Machine height is the height between the machine frame to ground. Leg entrance is the distance between the user when sitting.

3.5 Performance Efficiency of the Improved Sieve

Results of performance evaluation of the improved sieve are expressed in Figs. 5 and 6.

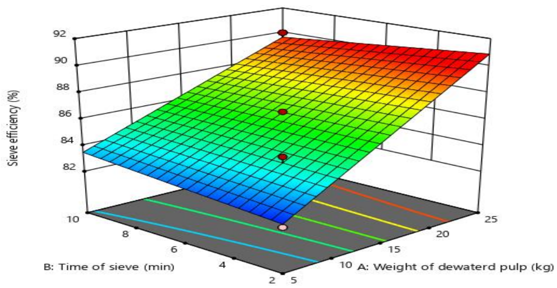

Fig. 5. Efficiency plot of the improved sieve

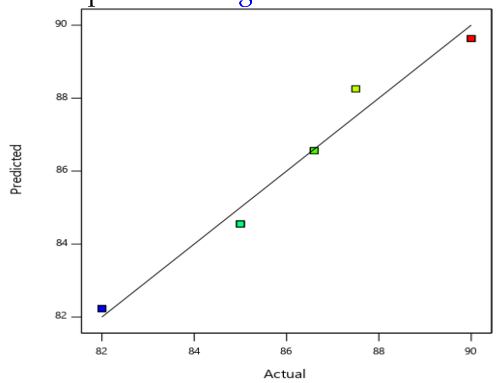

Fig. 6. Predicted vs Actual plot

Fig. 5 shows that sieving efficiency varies proportionally with the initial weight of the cassava roots samples and inversely with the sieving time. The proportional relationship with the initial weight could be because of optimal utilization of the sieve's capacity and effective separation dynamics, while the inverse relationship with sieving time could be because of clogging. The sieving efficiency obtained from the improved sieve was 89%. This result compares favourably with other garri sieving machine developed by Ovat and Odey, (2018) with an efficiency of 78%. The predicted and actual graph as shown in Fig 6 showed that the predicted values are in alignment with the actual values points fall along and 45degree line (y=x) indicating that the predicted values are correlated.

3.6 Performance Capacity of the Improved Sieve

The result of the performance capacity of the improved sieve is expressed in Figs. 7 and 8. Fig. 7 shows the dependency of sieve capacity on dewatered cassava mash and time of sieve. As can be seen from Figure 7, the sieve capacity is proportional to the time of sieve and to the weight of dewatered cassava pulp. This could be because of faster sieving rate of the improved sieve. The maximum sieving capacity obtained was 2.1kg/min compared to 0.033 kg/s that was obtained by Ovat and Odey, (2018). The predicted and actual graph as shown in Fig 8 showed that the predicted values are in alignment with the actual values as some points falls along 45degree line (y=x) indicating that the predicted values are correlated.

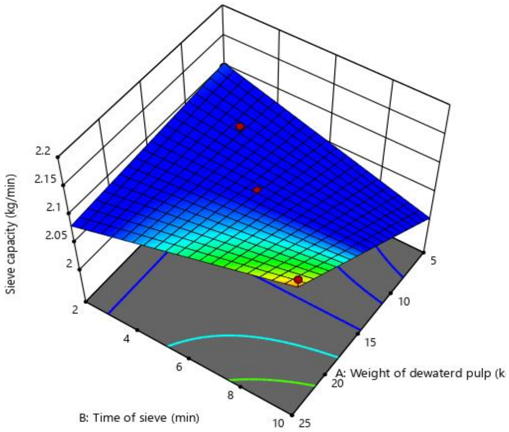

Fig. 7. Sieve capacity for the improved sieve.

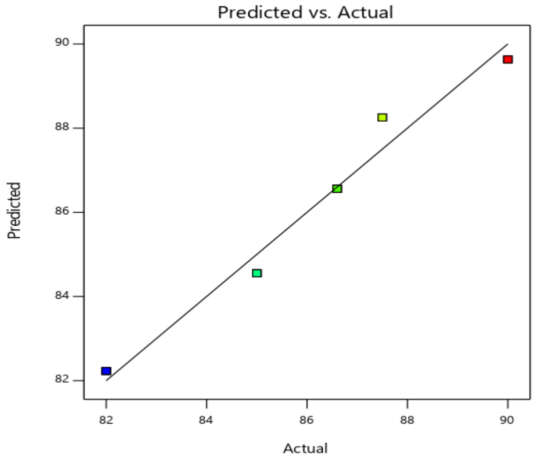

Fig. 8. Predicted vs Actual

Table-5 ANOVA for Quadratic Model Sieve Efficiency of Improved Sieve

Source	Sum of Squares	Df	Mean Square	F-value	p-value	
Model	86.04	2	43.02	198.19	<0.0001	Significant
A-Weight of dewatered pulp	82.29	1	82.29	379.10	<0.0001	
B-Time of sieve	0.0000	0				
AB	0.8974	1	0.8974	4.13	0.0694	
A^2	0.0000	0				
B^2	0.0000	0				
Residual	2.17	10	0.2171			
Lack of Fit	2.17	2	1.09			
Pure Error	0.0000	8	0.0000			
Cor Total	88.21	12				

The expression for the sieve efficiency of the improved sieve is presented in terms of the coded factor as Equation (5).

$$S_{eff}=86.56+3.70A+0.0000B-0.6274AB+0.0000A^2+0.0000B^2 \quad [R^2 = 0.9596] \tag{5}$$

Where S_{eff} is the response variable and A-B are the coded values of the independent variables. Equation (5) represents the quantitative effect of the factors (A and B) upon the response (S_{eff}). Coefficients with one factor represent the effect of that factor while the coefficients with more than one factor represent the interaction between those factors. Positive sign in front of the terms indicates synergistic effect while negative sign indicates antagonistic effect of the factor. Equation (5) in terms of coded factors can be used to make predictions about the response variables. The adequacy of the above proposed model was tested using the Design Expert sequential model sum of squares and the model test statistics P-values helps determine the statistical significance of each source, P-values less than 0.0500 indicate model terms are significant. In this case A is a significant model term as shown in Table 5. The lack of fit shows that the model adequately fits the data. The Predicted R^2-value of 0.9596 is in reasonable agreement with the Adjusted R^2-value of 0.9595 which indicates a good model prediction between the observed variables and predicted variables.

Table-6 ANOVA for Quadratic Model Capacity of the Improved Sieve

Source	Sum of Squares	Df	Mean Square	F-value	p-value	
Model	0.0144	2	0.0072	28.06	<0.0001	Significant
A-Weight of dewatered pulp	0.0097	1	0.0097	37.85	0.0001	
B-Time of sieve	0.0000	0				
AB	0.0062	1	0.0062	24.12	0.0006	
A^2	0.0000	0				
B^2	0.0000	0				
Residual	0.0026	10	0.0003			
Lack of Fit	0.0026	2	0.0013			
Pure Error	0.0000	8	0.0000			
Cor Total	0.0169	12				

The expression for the pressing efficiency of the improved sieve is presented in terms of the coded factor as Equation (6).

$$S_{c=2.10+0.0402A+0.0000B+0.0520AB+0.0000A^2+0.0000B^2} \quad [R^2 = 0.7508] \tag{6}$$

Where S_c is the response variable and A-B are the coded values of the independent variables. Equation (6) represents the quantitative effect of the factors (A and B) upon the response (S_c). Coefficients with one factor represent the effect of that factor while the coefficients with more than one factor represent the interaction between those factors. Positive sign in front of the terms indicates synergistic effect while negative sign indicates antagonistic effect of the factor. Equation (6) in terms of coded factors can be used to make predictions about the response variables. The adequacy of the above proposed model was tested using the Design Expert sequential model sum of squares and the model test statistics P-values helps determine the statistical significance of each source, P-values less than 0.0500 indicate model terms are significant. In this case A, AB are significant model terms. The lack of fit shows that the model adequately fits the data as shown in Table 6. The Predicted R^2-value of 0.7508 is in reasonable agreement with the Adjusted R^2-value of 0.8185 which indicates a good model prediction between the observed variables and predicted variables. The Model F-value of 28.06 implies the model is significant.

3.7 Comparative Analysis of the Existing and Improved Sieve

The result of different test samples according to the time taken for the sieving to be completed were recorded. From the results, the existing traditional sieve took more time due to the back-and-forth movement of the arm and the constant fatigue that comes with movement. Also, the pains experienced by bending the back contributes to delay in the sieve process. The improved sieve yielded an efficiency of 89% and maximum sieve capacity of 2.1kg/min while the existing sieve yielded an of 68% and maximum sieve capacity obtained from the existing traditional sieve was 0.42kg/min.

CONCLUSION

From this study, the following conclusions were made:

1. The traditional manual sieve used by the cassava processors did not fit the processors well because there was no ergonomics consideration in the development of the sieve, it therefore exposed users to work related musculoskeletal discomfort of 80% questionnaire analysis rating. There is a probability that those who have used this method are suffering from one form of musculoskeletal disorder (WMSD) or another. Also, the users of the existing sieve are exposed to muscular skeletal discomfort of 80% rating.

2. From the experiment, there was an increase of up to 2.1kg/min capacity and 89% efficiency for the sieve.

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There was no significant variation in the anthropometric data of male and female cassava processors from the study area.

CONFLICT OF INTEREST

The authors declare no comflict of interests.

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