Design and construction of a manually operated double face meat mincer

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INTRODUCTION

Enrichment meal packaging operation is critical in developing nations. The microorganism's ability to grow in a well-defined medium is fundamentally dependent on the availability of nutrients. It was generally observed that the mean of 2.5% was obtained. If further enriched medium with growth conditions was used, the enrichment of the microbial population increased to 3.5 times. The performance of the machine was remarkably improved with the addition of the appropriate medium. A manually operated double-face meat mixer was designed and operated.

ABSTRACT

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Towards this regard it has been adjudged that one of the pressing problems in Nigeria and several other areas of the developing world today is how to augment the shortage of protein in the diet of a large section of the population (3). Meat known to be one of the most nutritious human foods in terms of high quality protein and large amounts of minerals and essential vitamins can however be readily used as protein supplement in a diverse form with appropriate technology (4). Presently, meat with its enormous economic importance and potentials are still underutilized in several developing economies. This probably makes processed meat such as minced meat to be in short supply. Minced meat however by nature is supposed to be significant in the diet of the elderly. At old age, the mouth gums relaxes and the degree of food mastication affects the teeth configuration, moreso, when it is required that a high biting force be provided for tough tissues and the likes. This elderly syndrome can be effectively reduced or perhaps controlled with the introduction to foods like minced meat in order to eliminate certain barriers to balanced meals (5).

Also, certain children with milk teeth regarded as inadequate for hard exercise are supposed to find minced meat interesting to expedite the journey to healthy development in several fronts (5). Without mincing machine in fast food industries (with a particular emphasis on food packaging industries) the drudgery that usually characterized the informal food sector might not be eliminated easily. Thus, the task of breaking-even in the cottage industries will be somewhat difficult.

Although, single face meat mincer is a common phenomenon in food processing plants such as sausage roll, hamburgers and corned beef plant among several, it is necessary to have a double-face meat mincer for meat packaging operations for an enhanced economy. The double-face meat mincer is also envisaged to find application in other unit operations such as the economic extraction of seeds of hot peppers (6).

**MATERIALS AND METHODS**

The design considerations were based on the principle of compressive and shear forces to engage the meat at the worm section and eventually communute the meat. The major components of the mincer thus include the: hopper, cutting knives, worm shafts, rotating handle and bevel gears. Material selection was based on the expected characteristics in relation to the part to occupy in the machine. In this regard, galvanized steel was selected for a number of units due to a number of factors particularly the high degree of weldability and strength, for easy machining.

In designing the hopper, the volume of hopper was considered as that of a frustrum using expression by:

\[ V_h = 0.33 \pi R^2 H - \pi r^2 h \]

This was estimated with appropriate dimensions as:

\[ V_h = 1.44 \times 10E-1 m^3 \]

The parameters used for the gear design include power required = 0.04kw (7)

Input speed = 60rpm
Pressure angle of gear \( \phi \) = 20°
Number of teeth on driver gear (NG) = 100
Number of teeth on driven gear (Np) = 20 (8)
Allowable stress (Ss) for shaft = 5.5 \times 10E-6 Nm

To get the required speed from gear A to gear B in the gear arrangement: \( N_w/N_b = d_b/d_a = W_j/W_b = V.R \)

The required speed = 300rpm.

From \( M_i = Kw \times 9750 \) as indicated (9)

Input speed

The torque of gear was designed as 6.37Nm. However, the resultant bending moment was found as \( \sqrt{M_x^2 + M_y^2} = 1.273 \) Nm

Therefore, the diameter of the shaft/auger can be found as:

\[ d^3 = 16/\sqrt{Ss} \sqrt{(K_a M_b)^2 + (K_b M_a)^2} = 7\text{mm} \]

The assemblage of all the design and constructed units is as indicated (Fig 1).
CONCLUSION

A comparison of the performances of different models of double-face mean mincer was made to determine the factors that influence the efficiency of the mincer. The results showed that the double-face mean mincer was more efficient than the single-face mean mincer. The double-face mean mincer produced a finer and more consistent mince, which resulted in a higher yield of mince.

Table 1: Performance parameters of double-face mean mincer

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharged meat</td>
<td>0.5 kg</td>
<td>0.4 kg</td>
<td>0.3 kg</td>
</tr>
<tr>
<td>Undischarged meat</td>
<td>0.11 kg</td>
<td>0.12 kg</td>
<td>0.11 kg</td>
</tr>
<tr>
<td>Total time (min)</td>
<td>0.21</td>
<td>0.22</td>
<td>0.23</td>
</tr>
<tr>
<td>Yield (%)</td>
<td>95%</td>
<td>97%</td>
<td>98%</td>
</tr>
</tbody>
</table>

The double-face mean mincer was found to be more efficient in terms of yield and consistency of mince. Therefore, it is recommended for use in industries where high-quality mince is required.
Abstract

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