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Effect of Processing Temperature and Ingredients in the Preparation of *Gundpak* – A *Khoa* Based Dairy Product

Pushpa Prasad Acharya[1] and Prabin Sapkota[2]
[1]Central Campus of Technology, Dharan
[2] Former student, Central Campus of Technology, Dharan
e-mail: acharyapp@hotmail.com

Abstract

'Gundpak', an indigenous *khoa* based milk product is prepared especially in Kathmandu valley. It is prepared by using locally available raw materials like *khoa*, sugar, gudh, ghee, edible seeds, dried fruits, etc. In this study, the temperature for cooking and the raw materials used were optimized. The chemical composition of *khoa* showed that, 26.2 % moisture, 28.3 % fat, 20.2 % protein, 3.6 % ash, 21.7 % carbohydrate and 73.8 % total solid. The final product *'gundpak'* was analyzed chemically. It contained 24.57 % moisture, 31.53 % fat, 18 % protein, 3.9 % ash, 23 % carbohydrate and 73.43 % total solids. According to sensory evaluation *'gundpak'* prepared by the incorporation of 20 % sugar, 2.5 % gudh, 10 % ghee and cooked at temperature of 120 ^{o}C was selected as the best product.

Key words: Gundpak, Khoa sensory and chemical analysis

Introduction

There are different indigenous milk products sold in the Nepalese market. Among them the popular milk products are *paneer, khoa, rasogolla, peda, burfi, kalakand, pustakari, gundpak,* etc. *Gundpak* may be defined as a *khoa* based Nepalese indigenous dairy product made by suitable blending and frying of *khoa,* edible gum, dry fruits (cashew nut, almond, date, palm, coconut powder and pistachio), small cardamum, rice flake flour (optional), *battisa* powder on melted sugar syrup and with the development of characteristics caramel flavor and browning and decorative toppings with ash gourd and/or cucumber seeds and dry grapes (Sharma 2007). The Maillard reactions results from reactions between reducing sugars and amino acids are responsible for the development of color in the product (Baltes 1982).

Around 1933, Panna Lal Maske (1912-2000), born at Assan of Kathmandu, started the production of a dessert named *Gunpak* (Shakya 2006). Literally, *Gundpak* was originated from the two words (i.e. Nepali word '*Gund*' plus Newari word 'Pakh' means Methai in Nepali. Late Panna Lal Maske was first generated the idea of making Gundpak. He was inspired from his maternal uncle Baidhya, who used ayurvedic medicine for lactating women by using herbal products only. Later Panna Lal Maske use these herbal products (e.g. Battisa) in making *Gundpak* in combination with khoa, ghee, sugar, edible gum powder and different types of dry fruits. This is more nutritious products and especially used by lactating women as medicinal purpose (Shakya 2006).

Gundpak is an indigenous dairy product of Nepal which is produced mostly in Kathmandu valley. It is a *khoa* based product and is prepared by cooking *khoa* an other locally available ingredients such as sugar, ghee, *gundh,* and finally edible seeds are spread on top of the product. It is a sweet meat product brown in color with caramel flavor.

Gundpak is easy to manufacture, has a good market value and being a concentrated product it is easy to pack and transport. It does not require electricity and sophisticated machineries for production. So it can be prepared even in rural areas. Hence, *gundpak* could be the best alternative to minimize the milk losses and could also help to improve the living standards of the rural people by eliminating the poverty level.

However, *gundpak prepared* by the local people and available in the market vary widely and differ in quality. Being a traditional product, there is no any specific recipe and process for making it. Selection of ingredients and production process vary from place to place and family to family. They have their own logic for good and bad quality. The product quality is not consistent and varies from batch to batch or locality to locality. There hasn't been any scientific study of the product and no written documents are available for this popular indigenous product of our country. Scientific study could help to improve the quality of the product so that it could compete with different confectionery products, which are being imported in our country.

The indigenous method of preparation of *gundpak* is varies from place to place. According to Shakya (2006), *gundpak* is manufactured with the following method.

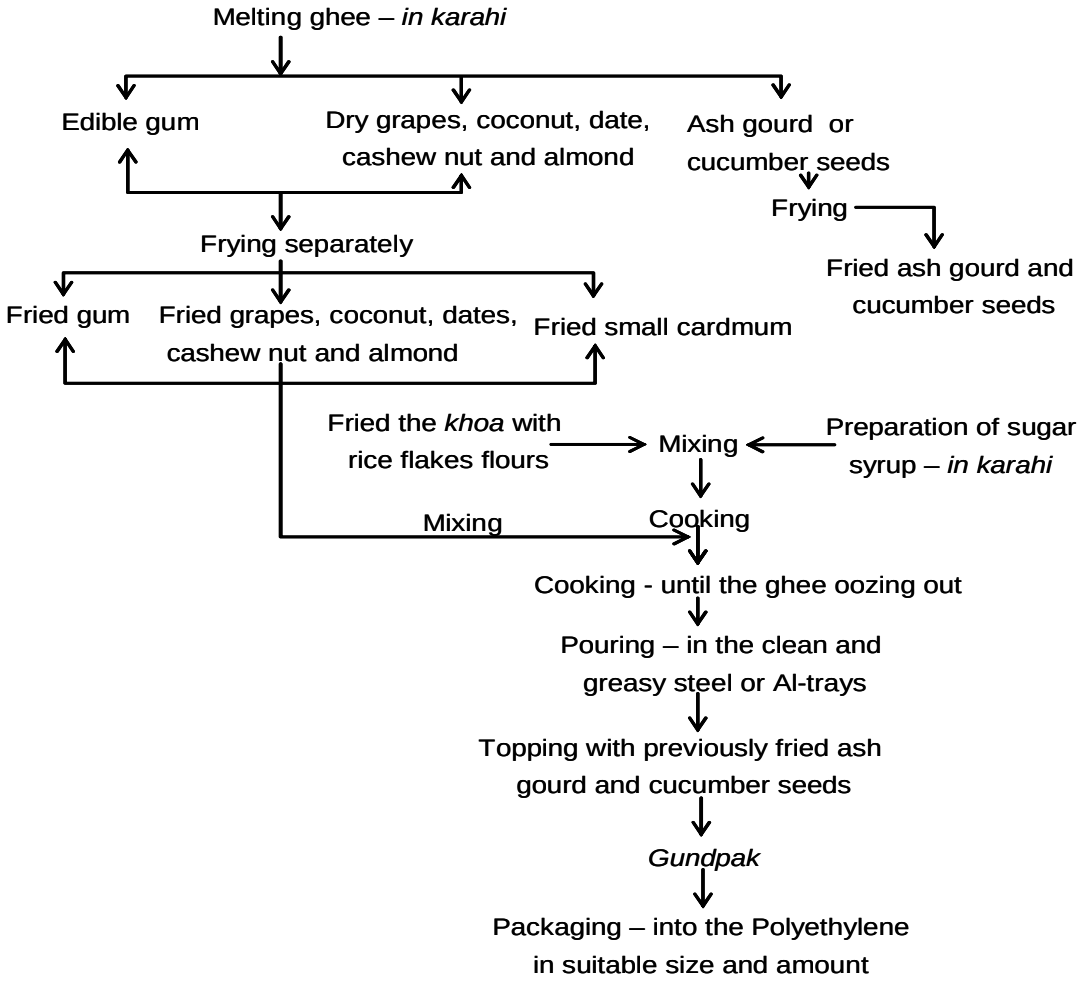

Fig. 1. Flow diagram for the traditional manufacture of *gundpak*

The overall objective of this work is to know the effect of cooking temperature and different ingredients in the sensory quality of *gundpak*.

Materials and Methods

The *khoa* for the preparation of *gundpak* was bought from Nobel Dairy Pvt. Ltd., Biratnagar. The other materials viz. sugar, *gundh*, ghee, and edible seeds (gourds or cucumber) were collected from the local market.

For the optimization of *gundpak* preparation, different parameters such as cooking temperature, sugar, ghee, and *gundh*, the samples were evaluated for color, texture, taste, smell and overall acceptability on a 9-point Hedonic rating scale. The prepared samples were subjected for sensory evaluation to eight semi-trained panelist (lecturers and research students). The data obtained in each parameter were evaluated statistically and the optimum values were determined.

Four samples of *gundpak* were prepared for optimization of temperature. These are cooked at different temperatures, 105, 110, 115, 120 °C and samples were coded as A, B, C and D respectively. Six samples of were prepared by the incorporation of 0, 5, 10, 15, 20 and 25 % of sugar for its optimization and these coded as A, B, C ,D, E and F, respectively. The six samples of *gundpak* were prepared for optimization of *gundh* by the incorporation of 0, 2.5, 5, 7.5, 10 and 12.5 % and coded as A, B, C, D, E and F respectively. These samples were prepared by the incorporation of 0, 5, 10, 15, 20 and 25 % of ghee for its optimization and were coded as A, B, C ,D, E and F respectively.

Method of preparation

The preparation of *Gundpak* was carried out as follows. Calculated amount of ghee was taken in a pan (*karahi*) and heated to about 60 °C, which was the frying temperature of *gundh*. The *gundh* was then fried for 5 minutes and taken out separately with the help of a spoon. Other ingredients like edible seeds and cashew nuts were fried separately in ghee till their slight color changes. Then the calculated amount of *khoa* was added in excess of ghee remaining after the cooking of *gundh*. The *khoa* was roasted with continuous stirring and scrapping till golden color and lump formation was observed. At this condition, the cooked *khoa* leaved the bottom and side of the pan, which facilitate stirring and scrapping process. Supersaturated sugar syrup was made and strained for removing undissolved particles present in it. It was cooked for some time to make it viscous mass. If pure and refined sugar is available it can be used directly. Finally, sugar syrup and *gundh* were added and the mixture was cooked at the optimum temperature till desired color and texture was attained. The mass was then poured into trays and cooled for 1 hour. It was then packed into high density polythene.

Analytical procedure

Chemical analysis of *khoa*

Moisture, fat and protein (% N × 6.38) content in the *khoa* were determined by hot air oven method, Roese-Gottieb method, and micro Kjeldahl method respectively (Egan *et al.* 1981). Ash content and the total solids contents were determined by following the standard procedure as mentioned in AOAC (1980). Carbohydrate was determined by difference method. Total carbohydrate (%) = 100- (% moisture + % protein + % fat + % ash).

Chemical analysis of *gundpak*

Moisture, fat and protein, carbohydrate analyses were done as described above. Acid and peroxide values were determined by the standard procedure as mentioned in Egan *et al.* (1981).

Sensory evaluation and statistical analysis

The laboratory prepared samples of *gundpak* were evaluated for texture, flavor, taste, smell and overall acceptability on a 9-point Hedonic rating test (Ranganna 1994) by semi-trained panelist (those who were trained first about the characteristics of the products) of Central Campus of Technology, Dharan. The data were subjected to statistical analysis and the scores given by the panelist were analyzed by one-way analysis of variance (ANOVA) at 5% level of significance to determine whether the samples were significantly different from each other and also to determine which one was superior among them.

Results and Discussion

Chemical composition of *khoa*

Chemical analysis of *khoa* showed the following composition: moisture, fat, protein, carbohydrate, total solids and ash were found to be 26.2, 28.3, 20.2, 21.7, 73.8 and 3.6 %, respectively.

According to Gopalan (1993), in comparison this product the *khoa* sample had low moisture and ash, whereas, little higher in fat and total solids was observed. However, the percentage of carbohydrate was found to be within this range. The higher values of protein, fat and total solids might be due to lower moisture content. The composition of *khoa* depends mainly on the initial composition of milk and the degree of concentration of the milk solids.

Chemical composition of *Gundpak*

The moisture, fat, proteins, ash, carbohydrate, total solid of gundpak prepared by the optimized process were found to be 24.57, 31.53, 18.0, 23.0, 75.43 and 3.9 % respectively.

Sensory evaluation

For optimization of cooking temperature

The effect of variation in the cooking temperature viz.105, 110, 115 and 120°C on mean sensory score of *gundpak* samples are presented in Table 1.
Statistical analysis showed that the products cooked at different temperature were significantly different (P>0.05) from one another on mean sensory score in terms of texture, color, taste, smell and overall acceptance. This showed that higher temperature can markedly alter the sensory quality of the product.

Table 1. Effect of variation of cooking temperature on sensory scores of *gundpak*

Temperature(°C)	Texture	Color	Taste	Smell	OA*
(A) 105	6.37^{a}	6.25^{a}	6.75^{a}	6.62^{a}	6.25^{a}
(B) 110	7.25^{a}	7.0^{ab}	7.12^{a}	7.25^{a}	7.37^{a}
(C) 115	7.12^{a}	7.12^{abc}	7.75^{a}	7.50^{a}	7.62^{a}
(D) 120	7.75^{a}	7.87^{bd}	7.87^{a}	8.00^{a}	8.00^{c}
LSD(p<0.05)	1.189	1.047	1.001	1.304	1.047

*OA = Overall acceptability

The values are the mean of eight panelist score. The values having same superscript in a column did not differ significantly by LSD (p<0.05).

The samples A and B, C; B and C, D, and C and D were not significantly different in terms of color while the rest of other combination, i.e., A and D are significantly different (p>0.05). Among them sample D showed highest mean score. It was found that as the cooking temperature is increased, Maillard reaction is also increased and the compounds like melanoidins are formed which are responsible for the development of color. Higher the temperature, development of more color which will result in darker the product. Also, the caramelization of sugar helps for color development (Table 1).

The samples B and C, and C and D were not significantly different in terms of overall acceptance while the other combinations were significantly different (p>0.05). The samples C and D had highest mean score. The texture, color, taste and smell, as expected, had a strong association with the overall acceptance.

Sample cooked at 120 °C had scored the highest sensory score for all the parameters. So, this temperature was selected as the optimum cooking temperature for *gundpak* production.

Optimization of sugar

The effect of varying percentages of sugar on mean sensory score of *gundpak* samples has been presented in the Fig 2.

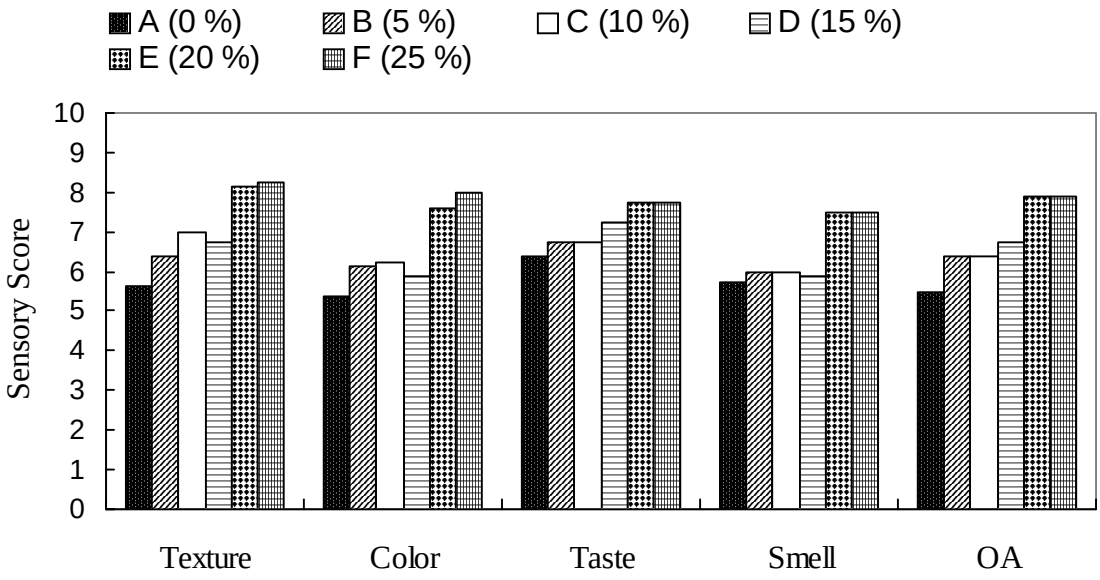

Fig. 2. Effect of variation of sugar on sensory score of *gundpak*.

Statistical analysis showed that the samples did not differ significantly ($P<0.05$) from one another on mean sensory scores in terms of taste. But it showed significant differences ($p>0.05$) on texture, color, smell and overall acceptance. It might be due to a small increase in sugar that could markedly alter the sensory quality of this product.

The samples A and B, C, D; B and C, D; C and D; E and F were not significantly different ($p<0.05$) from each other on sensory score. Here, the sample F had the highest mean value. It was found that the textural properties of the product increased with increased content of sugar. This is due to the decreased proportion of milk solids and increased proportion of sugar. The low score of sample A might be due to only milk solids (without the incorporation of sugar).

It was observed that samples A and B, C, D, B and C, D; C and D, and E and F did not significantly ($p<0.05$) differ to each other in terms of color while rest of the combinations differed significantly ($p>0.05$). Here sample F had the highest mean score. The reason for the highest score of this sample was due to the presence of milk solids which affected on color and flavor. The fat content also had a significant contribution to the color and flavor. During the cooking process, the milk proteins (especially lysine) and sugar undergo a chemical reaction called Maillard reaction and caramelization of sugar to form a complex compounds. The compounds that are formed affect both on color and flavor of the product (Baltes 1982).

The samples A and B, C, D, E; B and D, C and D, and E and F were not significantly different in terms of smell while rest of t]nt. Here, samples E and F had the highest mean values.

The samples A and D, E, F; D and B, C, and E and F, were not significantly different in terms of overall acceptance, while rest of the other sensory score were significantly ($p>0.05$) differed to each other. Here, samples E and F had the highest mean sensory score. It had shown that texture, color, taste and smell, as expected, had a strong association with the overall acceptance of the product.

Here, samples E and F had scored the highest mean values for all the sensory parameters. Both the samples did not differ significantly ($p<0.05$) in terms texture,

color, taste, smell and for overall acceptance. Since they did not differ ($p<0.05$) significantly, the choice may be based either on the average score or percentages of sugar input. Since sugar is expensive, it is wasteful to use 25 % instead of 20 %. So, sample E could be selected as the best sample.

Optimization of *gundh*

The effect of varying percentage of *gundh* on mean sensory score of *gundpak* samples A, B, C, D, E and F has been presented in the Fig 3.

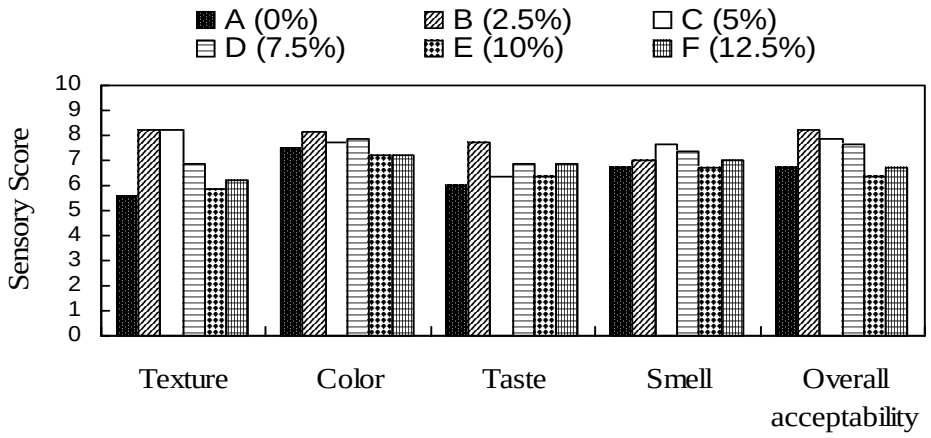

Fig. 3. Effect of variation of gundh on sensory score of gundpak.

The samples A, B, C, D, E and F represent the sample having *gundh* in varying proportion viz. 0, 2.5, 5, 7.5, 10 and 12.5 % respectively.

Statistical analysis showed that the samples were not significantly different ($p <0.05$) from one another on mean sensory scores in terms of texture and taste. But the other sensory parameters had a significant affect on color, smell and overall acceptance. This showed that even a small increase in percentage of *gundh* can markedly alter the sensory quality of this product.

The samples A and D, E, F; B and C, D; C and D; D and E, F, and E and F were not significantly different in terms of texture while rest of the combination were significantly different. Here, the samples B and C scored the highest mean score. It was found that the textural properties of the product increased with increase in the percentage of *gundh* up to 5 % it was decreased onwards. This might be due to the good binding ability of *gundh* to the fat in this percentage. The low score of sample A is due to the complete absence of *gundh*, which yielded oily and sticky product. But, the reason for the low score of sample E is due to too much incorporation of *gundh* which yield oily and gritty texture. This might be due to the binding of mass product by excess *gundh* remained after the binding of requisite amount of fat.

The samples A and D, E, F; B and C, D; D and C, E, F, and E and F were not were not significantly different in terms of overall acceptance while rest of the combinations were significantly different. Here sample B had scored the highest mean value. It had shown that texture, color, taste and smell as expected, have strong association with the overall acceptance.

Here sample B scored the highest mean value for all the varieties in terms of texture, color, taste, smell and overall acceptance. So, sample E was selected as the best sample.

Optimization of ghee

The effect of varying percentage of ghee on mean sensory scored of *gundpak* samples A, B, C, D, E and F is presented in the Fig. 4.

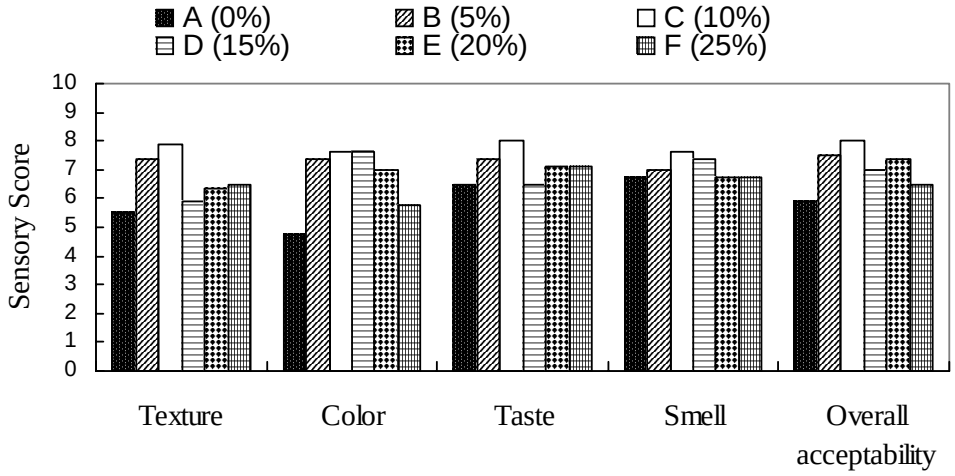

Fig. 4. Effect of variation of ghee on sensory scores of gundpak.

The samples A, B, C, D, E and F represents the samples of ghee in varying proportion viz. 0, 5, 10, 15, 20 and 25 % respectively.

Statistical analysis showed that the samples did not significantly ($p<0.05$) differ in terms of taste and smell, but it showed that they had a significant effect on color, texture and overall acceptance. This showed that even a small increase in percentage of ghee could markedly alter the sensory quality of this product.

The samples A and F, B and C, D, E; E and D, and C and E, were not significantly different in terms of texture while rest of the combinations were significantly different ($p>0.05$). Here, sample C had scored the highest mean value. It was found that the textural properties of the product increased with increased in the percentage of ghee and then decreased .The low score of sample A was due to low fat content which produced product which were sticky and difficult to chew. Here, the low scores of samples E and F were due to the too much incorporation of fat, which yielded oily and sticky product. This might be due to decreased binding ability of *gundh* to fat.

The samples A and D, B and C, D, E; C and D, E, and D and E were not significantly different in terms of color while rest of the combinations were significantly ($p>0.05$) different. Here, sample C had score the highest value. The sample F scored the lower mean value. According to James (1976), excess heating of milk fat components decompose to give a brown to black discoloration, heated, burnt or charred flavor and this might be the cause of low score for sample F.

The samples A and D, F; B and C, D, E, F; C and D, E, F, D and E, and E and F were not significantly different in terms of overall acceptance while rest of the combinations were significantly different. Here sample B and C scored the highest mean value. It had shown that texture, color, taste and smell, as expected, have strong association with the overall acceptance.

The sample B and C scored the highest mean value for all the sensory parameters. Both the samples did not differ significantly in terms of texture, color, taste, smell and for overall acceptance. Since they did not differ significantly the choice may be based either on the average numerical score or percentage of ghee input. It is wasteful to use 10% of ghee instead of 5 %. So, sample C had been selected as the best sample.

Gundpak is prepared from the locally available raw materials like *khoa*, sugar, ghee, and *gudh*. Sensory evaluation revealed that cooking temperature, sugar, ghee and *gundh* have a significant effect on the sensory quality of *gundpak. Gundpak* prepared by the incorporation of 20, 2.5 and 10 % of sugar, *gundh* and ghee, respectively, and cooking at 120° C was found best. *Gundpak* is a highly nutritious food having high-energy value.

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