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Organoleptic and Consumer Evaluation Studies of Jaggery Incorporated Millet-based Cakes

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ABSTRACT: Value-added products hold a lot of potential in the market. In the present research, an attempt has been made to develop value-added cakes by using minor millets like little millet (*Panicum sumatrense*) and foxtail millet (*Setaria italica*) by enhancing their nutrient content by replacing sugar with jaggery. The developed cakes were analyzed for their organoleptic qualities to check their acceptance rate over the regular maida (refined flour) cakes. The sensory analysis results showed that all the prepared millet cakes were approved by the semi-trained panel members, also the acceptance rate of the cakes increased with the addition of jaggery. Millet cakes containing 100% jaggery were highly accepted by the panelists and were selected as final formulations for further studies. The final cakes were subjected to consumer evaluation. The results showed a positive attitude of the consumers towards the developed cakes. Little millet jaggery cake was preferred over foxtail millet cake by most consumers. About 54% of the consumers wanted to purchase the cake daily. Almost two-thirds of the consumers (69%) reported that the major reason for preferring jaggery over sugar was health consciousness. Consumers appreciated the development of such products as these products are abundant in nutrients and also have functional benefits. The consumption of these millet based products on a regular basis can help in providing optimal nutrition and mitigating many diseases.

Keywords: Cakes, foxtail millet, jaggery, little millet, sensory evaluation.

INTRODUCTION

Millets are the powerhouse of many nutrients. These are found to be more nutritious and can be used as a replacement for regular cereals like wheat, rice and maize. Regular consumption of millets can be helpful to maintain good health. Millets are grown in several parts of the world. These low-maintenance crops require fewer inputs and are adapted to adverse conditions like extreme weather, alkaline soil, drought, etc., thus making them environment-friendly (Saxena *et al.*, 2018; Asrani *et al.*, 2021). Millets are widely grown in the Asian and African continents and India is the largest producer of millet crops across the world (Banerjee and Maitra 2020). The storage time of millet crops is also higher. Thus, these crops can be effectively used during emergencies like famines and can help to mitigate the problem of food scarcity (Amadou *et al.*, 2013).

Millets are highly abundant in nutrient content, especially micro-nutrients. On the basis of grain size, millets can be classified into major and minor millets. When compared to major millets, minor millets are used in a less frequent basis. Little millet (*Panicum sumatrense*) and foxtail millet (*Setaria italica*) are two such important minor millet crops that are cultivated by humankind from time immemorial. Both millets belong to the Poaceae family. Due to the corresponding warming and cooling effects that both millets have on the body, foxtail millet is referred to as "warm food" and little millet as "cool food" (Pradeep and Sreerama 2018).

Foxtail millet, also called as Italian millet, is largely cultivated in Asian countries like India and China. In India, it is known by various names in various languages, such as *Kakum* in Hindi, *Korra* in Telugu and *Tenai* in Tamil (Sunil *et al.*, 2016). Foxtail millet contains a sufficiently good amount of protein (11.13 to 18.75%) and fiber (210 g/kg) content. As compared to other cereals, the carbohydrate content of foxtail millet is generally low (Sachdev *et al.*, 2021). Additionally, foxtail millet contains a high amount of thiamine (0.59 mg/100 g), vitamin E (31 mg/100 g) and phosphorous (422 mg/100 g). It also contains other minerals like zinc and iron (Bandyopadhyay *et al.*, 2017). Foxtail millet contains certain phytochemicals and exhibits antioxidant and antiproliferative activity. The millet grain phenolics contain ferulic acid, chlorogenic acid, xanthophylls,

etc., which deactivates free radicals and thus, protects the body from cellular damage (Zhang and Liu 2015). Little millet is known as 'kutki' in Hindi and 'samalu' in Telugu (Patel *et al.*, 2020). It has an excellent nutrient profile which includes about 7.7 g of protein, 7.6 g of crude fibre, 4.7 g of fat and 1.5 g of minerals. The micronutrients like iron and calcium are also present in good percentages in the little millet, *i.e.*, 9.3 mg and 17 mg respectively (Gopalan *et al.*, 2010). Apart from these, other micronutrients like phosphorous (220 mg), zinc (116 mg), magnesium (2.97 g/kg), carotenoids (78 µg/100 g), tocopherol (1.3 mg/100 g) and niacin (3.2 mg) are present as well in the millet. The fat content of little millet is rich in PUFA (Polyunsaturated fatty acid) and the starch content is comparatively lower than other cereals (Bhat *et al.*, 2018; Chauhan *et al.*, 2018; Pasha *et al.*, 2018; Dey *et al.*, 2022).

Little millet is also found to exhibit positive effects in the body. It contains a good amount of dietary fiber, which in turn is beneficial for gut health. The composition of dietary fiber was reported as 29.48% of insoluble and 1.33% of soluble dietary fiber (Chauhan *et al.*, 2018). Little millet also contains many phytonutrients like gallic acid, vanillic acid, caffeic acid, ferulic acid, *etc.* and it also possesses radical scavenging activity (Saleh *et al.*, 2013).

The products made by incorporating foxtail and little millet hold a lot of potential in the market. Due to the increasing awareness of the benefits of consuming millets among people, their attitude towards millets is changing. Now more and more people know about the benefits of consuming millets. Owing to this, it is necessary to know the perception of the common mass in order to decide the success rate of any product. In this regard, evaluation techniques like sensory evaluation, consumer acceptance studies, etc., are conducted which provide the base to approve or deny any product. Thus, the current research is focused on the "Organoleptic and consumer evaluation studies of jaggery incorporated millet-based cakes".

MATERIALS AND METHODS

The present research was conducted at Millet Processing and Incubation Center (MPIC) and Post Graduate and Research Center (PGRC), Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad.

Development of cake. For the preparation of cake, the ingredients used were refined wheat flour, little millet flour, foxtail millet flour, sugar, sunflower oil, curd, milk, baking soda, baking powder and vanilla essence. Refined wheat flour was replaced in the proportions of 25%, 50%, 75% and 100% by each millet (separately), as mentioned in Table 1, while keeping other ingredients constant. One-one formulation of each millet was selected by sensory analysis for further studies. For the preparation of cakes, the steps followed are mentioned in Fig. 1.

Development of jaggery cake. In the selected formulations of millet cakes, sugar was replaced with jaggery in the proportions of 25%, 50%, 75% and 100%, as mentioned in Table 2, while other ingredients were kept constant.

Table 1: Proportions of maida replaced with millet flour for various formulations.

Formulation	Maida %	Foxtail millet flour %	Little millet flour %
CTL	100%	-	-
FCS1	75%	25%	-
FCS2	50%	50%	-
FCS3	25%	75%	-
FCS4	-	100%	-
LCS1	75%	-	25%
LCS2	50%	-	50%
LCS3	25%	-	75%
LCS4	-	-	100%

Table 2: Proportions for replacement of sugar with jiggery.

Formulation	Sugar %	Jaggery %
FCS3	100%	-
FCJ1	75%	25%
FCJ2	50%	50%
FCJ3	25%	75%
FCJ4	-	100%
LCS3	100%	-
LCJ1	75%	25%
LCJ2	50%	50%
LCJ3	25%	75%
LCJ4	-	100%

Similar steps were followed for the preparation of jaggery cakes as mentioned in Fig. 1. The final formulations of jaggery cakes were selected by sensory evaluation.

Sensory analysis. Sensory analysis was done by a semi-trained panel of 15 members using a 9-point hedonic scale (Meilgaard *et al.*, 1999). They compared all the formulated cakes and gave scores according to their perception. Statistical analysis was performed for the obtained responses and one cake formulation of each millet was selected for further research.

Consumer evaluation studies. The final selected formulations were subjected to consumer evaluation studies. A structured questionnaire was developed in Google forms and the link was sent to the consumers after providing the cakes for evaluation. The questionnaire consisted of general information about the consumers and questions related to their perception and attitude towards the developed cakes. A total of 75 consumers were selected at random for the study (Chambers, 1994).

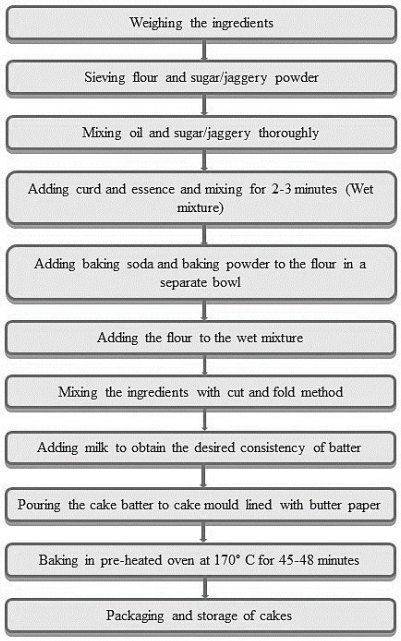


Fig. 1. Flow chart for preparation of cake.

RESULTS AND DISCUSSION

Sensory analysis of millet and jaggery cakes. The control cake with refined wheat flour (CTL) obtained the highest sensory scores amongst all the formulated cakes. As the incorporation of millet flour increased, the mean sensory score for each attribute decreased. FCS1 and LCS1 obtained the highest scores in all the parameters among foxtail millet and little millet cakes respectively. The least accepted formulations were FCS4 and LCS4. This can be due to the fact that higher millet incorporation brought about evident changes in the flavour and texture of the cakes. Moreover, due to the absence of gluten, the cakes became crumbly and couldn't hold their shapes properly. Based on the analysis data, the selected formulations of millet cake for further analysis were FCS3 and LCS3.

The addition of jaggery in the cakes brought about positive changes in the texture and taste of the cakes. The mean scores for the jaggery cakes were above 7 (liked moderately), for all the formulations. The mean sensory scores for the formulations containing 100% jaggery, *i.e.*, FCJ4 and LCJ4, ranged from 8.4 (appearance) to 7.73 (after taste) and 8.46 (appearance) to 7.4 (after taste) respectively. These formulations were more preferred by the panelists than other cakes for some parameters like texture, taste, etc. The differences in the mean sensory scores among the control and millet cakes are depicted in Fig. 2 and 3.

A similar study was conducted to develop biscuits, cake and cookies by adding foxtail millet flour at 10, 20 and 30 percent levels by replacing wheat flour. The sensory evaluation was performed on the developed products and the results reveal that at 20 and 30 percent incorporation of millet flour, the products received good sensory scores (Shadang and Jaganathan 2014). In another study, germinated millet flour was used along with rice flour in various proportions to make gluten-free cakes. The samples with 50% millet flour had highly acceptable and significantly different sensory scores among all the prepared products (Nada *et al.,* 2016).

Lamdande *et al.* (2018) reported that upon replacing sugar with jaggery in various proportions to develop muffins, the formulation containing 84% jaggery obtained acceptable quality parameters and were organoleptically more acceptable compared to other formulations.

Being good in texture, obtaining higher scores in sensory evaluation and taking the health point into consideration, the final selected cakes were FCJ4 and

LCJ4. Consumer evaluation studies were conducted for these cakes so as to find out the success rate of these products among the people.

Consumer evaluation. Consumer evaluation is necessary to know the attitude of the people about any product. It helps to ascertain whether a product will be approved in the market or not. The consumer acceptance study for the selected products was done including 75 participants, out of which 81% were females and the rest 19% were males, belonging to various age groups as mentioned in Fig. 4.

The participants tasted the products and rated them using a 5-point hedonic scale for various parameters including appearance, colour, flavour, taste, texture and overall acceptability. Both cakes received good scores for all the parameters. The average of the sensory scores for both cakes is presented in Fig. 5.

Among both the cakes, little millet cake (LCJ4) was preferred more by most of the consumers. It received higher scores for appearance (4.37), flavour (4.07), taste (4.19), texture (4.25) and overall acceptability (4.33), while the colour parameter of foxtail millet cake (FCJ4) obtained higher score (4.31) as compared to little millet cake (LCJ4) which obtained a score of 4.16.

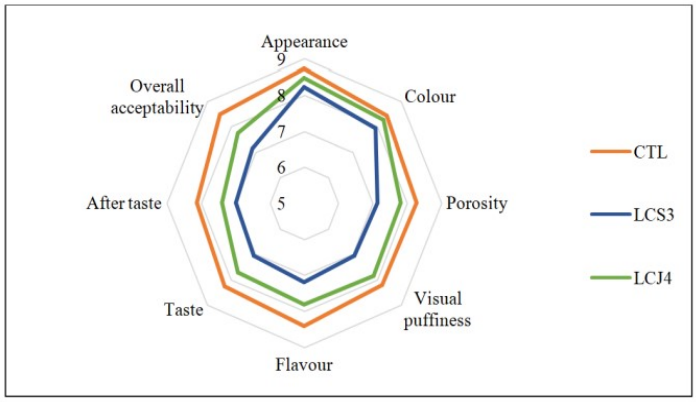
A study conducted by Mahalaxmi and Hemlatha (2018) to develop little millet based cookies by incorporating jaggery revealed similar results. The millet based cookies with organic jaggery replacing sugar in the ratio of 100:0 showed highly acceptable results in the sensory and consumer evaluation.

Consumer's responses towards likeness, cost, acceptance and benefits of the products. The consumers preferred the given cakes over the ones which are generally available in the market. The major reasons to prefer jaggery over sugar, as mentioned by the participants, are displayed in Figure 6. The majority of the consumers (69.3%) hailed health consciousness as the major factor followed by its nutritive value to replace sugar with jaggery.

The consumers further mentioned their frequency of buying the millet-based cakes. As mentioned in Fig. 7, about 54% of the participants wanted to buy the cakes once a week, whereas 13% and 28% of them wanted to buy them twice a week and monthly, respectively.

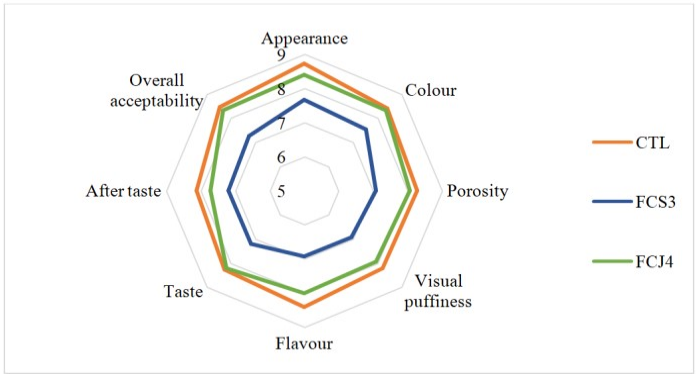
Participants agreed that the production of such products will be a healthy initiative as these products are nutrient-rich and suitable for all age groups. The consumers had an overall positive attitude towards the developed cakes.

Azzizah and Handayani (2021) developed millet coffee cake by substituting regular flour with millet flour. The results showed that the consumers highly accepted the cake containing 50% millet flour.



Note: CTL: Control cake with 100% maida and sugar; LCS3: Cake with 75% little millet (with sugar); LCJ4: Cake with 75% little millet and 100% jiggery

Fig. 2. Mean sensory scores of selected formulations of little millet cakes.



Note: CTL: Control cake with 100% maida and sugar; FCS3: Cake with 75% foxtail millet (with sugar); FCJ4: Cake with 75% foxtail millet and 100% jaggery

Fig. 3. Mean sensory scores of selected formulations of foxtail millet cakes.

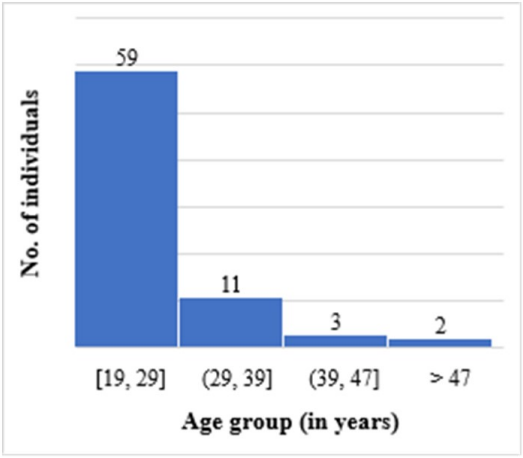
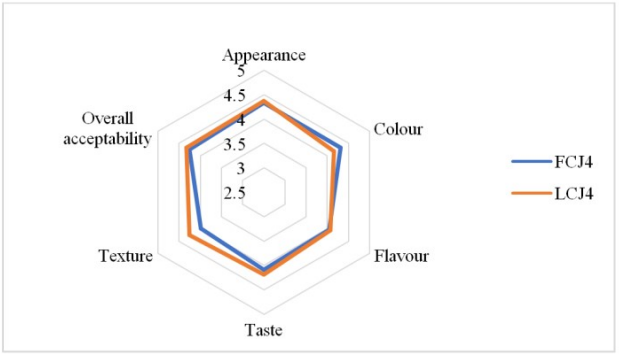


Fig. 4. Age group of the respondents.



Note: FCJ4: Foxtail millet cake with 100% jiggery; LCJ4: Little millet cake with 100% jaggery

Fig. 5. Mean sensory scores given by the consumers for the final formulations of millet cakes.

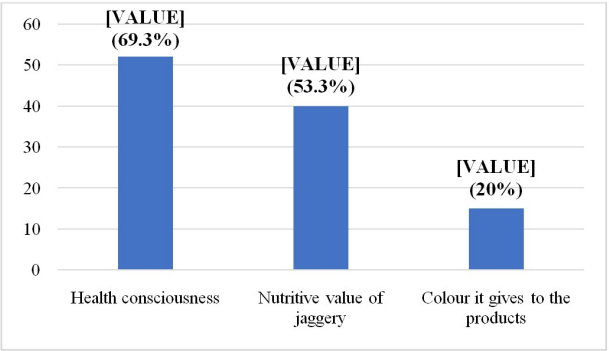


Fig. 6. Major reasons to replace sugar with jiggery.

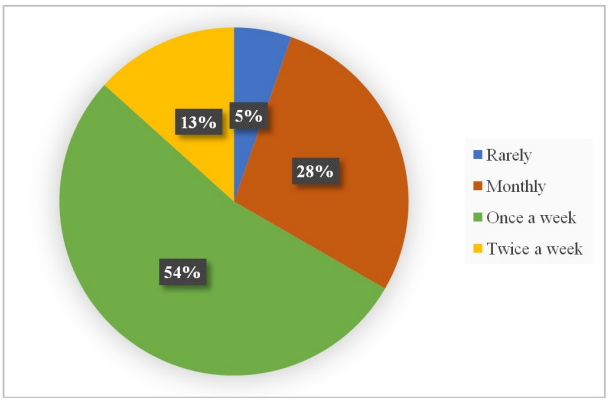


Fig. 7. Frequency of purchasing the millet cakes.

CONCLUSION

The present study was conducted to know about the perception of the consumers towards the developed cakes, and to generalize whether the developed cakes were accepted among the people or not. In view of that, sensory evaluation and consumer acceptance studies were conducted which showed a positive attitude of the people towards the developed products. Thus, it can be concluded that the development of millet-based products can be beneficial from the consumer's point of view as well. These products are healthy, attractive and capable of attracting a huge percentage of consumers. With the increasing risk of malnutrition and lifestyle diseases, the development of millet-based products is a healthy initiative.

FUTURE SCOPE

Because of the high acceptability of the developed products among the consumers, this study can serve as a base and prove to be useful in developing more millet-based products. Furthermore, such type of products also has the capability to perform well in the market.

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Conflict of Interest. None.

REFERENCES

Amadou, I., Gounga, M. E. and Le, G. W. (2013). Millets: Nutritional composition, some health benefits and processing-A review. *Emirates Journal of Food and Agriculture*, *25*(7): 501-508.

Asrani, P., Ali, A. and Tiwari, K. (2021). Millets as an alternative diet for gluten-sensitive individuals: A critical review on nutritional components, sensitivities and popularity of wheat and millets among consumers. *Food Reviews International, 37*: 1-30.

Azzizah, P. S. N. and Handayani, T. H. W. (2021). March. Utilization of millet flour as the basic material to make millcoff cake (millet coffee cake). In *Journal of Physics: Conference Series*, *1833*(1): 012052.

Banerjee, P. and Maitra, S. (2020). The role of small millets as functional food to combat malnutrition in developing countries. *Indian Journal of Natural Sciences, 10*(60): 20412-20417.

Bandyopadhyay, T., Jaiswal, V. and Prasad, M. (2017). Nutrition potential of foxtail millet in comparison to other millets and major cereals. In *The Foxtail Millet Genome.* Compendium of Plant Genomes. Springer, Cham, 123-135.

Bhat, S., Nandini, C. and Tippeswamy, V. (2018). Significance of small millets in nutrition and health-A review. *Asian Journal of Dairy and Food Research*, *37*(1): 35-40.

Chambers, E. (1994). Conducting Consumer Sensory Evaluation Studies. Reciprocal Meat Conference Proceedings. The Sensory Analysis Center, Justin Hall, Kansas State University Manhattan.

Chauhan, M., Sonawane, S. K. and Arya, S. S. (2018). Nutritional and nutraceutical properties of millets: a review. *Clinical Journal of Nutrition and Dietetics, 1*(1): 1-10.

Dey, S., Saxena, A., Kumar, Y., Maity, T. and Tarafdar, A. (2022). Understanding the Antinutritional Factors and Bioactive Compounds of Kodo Millet (*Paspalum scrobiculatum*) and Little Millet (*Panicum sumatrense*). *Journal of Food Quality,* 2022.

Gopalan, C., Ramashastri, B. V. and Balasubramaniam, S. C. (2010). Nutritive Value of Indian Foods, revised and updated by Rao BSN, Deosthale YG and Park KC. NIN, ICMR Hyderabad.

Lamdande, A. G., Khabeer, S. T., Kulathooran, R. and Dasappa, I. (2018). Effect of replacement of sugar with jaggery on pasting properties of wheat flour, physico-sensory and storage characteristics of muffins. *Journal of food science and technology*, *55*(8): 3144-3153.

Mahalaxmi, B.K. and Hemalatha, S. (2018). Functional and nutritional characteristics of organic jaggery millet cookies. *International Journal of Food Science and Nutrition*, *3*(5): 171-177.

Meilgaard, M., Civile, G. V. and Carr, B. T. (1999). Sensory Evaluation Technique. 3rd Edition. CRC press, Boca Raton.

Nada, F. A., El-Gindy, A. A. and Youssif, M. R. G. (2016). Utilization of millet flour in production of gluten free biscuits and cake. *Middle East Journal of Applied Sciences*, *6*(4): 1117-1127.

Pasha, K., Ratnavathi, C. V., Ajani, J., Raju, D., Kumar, M.S. and Beedu, S. R. (2018). Proximate, mineral composition and antioxidant activity of traditional small millets cultivated and consumed in Rayalaseema region of south India. *Journal of the Science of Food and Agriculture, 98*(2): 652-660.

Patel, V.,Sengar, S. S., Singh, R. K., Singh, A. K. and Kumar, R.(2020). Primary nutrient content and its uptake in little millet (*Panicum sumatrense*) as influenced by different nutrient management and seed priming. *Journal of Pharmacognosy and Phytochemistry, 9*(4): 1228-1233.

Pradeep, P. M. and Sreerama, Y. N. (2018). Phenolic antioxidants of foxtail and little millet cultivars and their inhibitory effects on α-amylase and α-glucosidase activities. *Food Chemistry, 247*: 46-55.

Sachdev, N., Goomer, S. and Singh, L. R. (2021). Foxtail millet: a potential crop to meet future demand scenario for alternative sustainable protein. *Journal of the Science of Food and Agriculture, 101*(3): 831-842.

Saleh, A. S., Zhang, Q., Chen, J. and Shen, Q. (2013). Millet grains: nutritional quality, processing, and potential health benefits. *Comprehensive reviews in food science and food safety, 12*(3): 281-295.

Saxena, R., Vanga, S. K., Wang, J., Orsat, V. and Raghavan, V. (2018). Millets for food security in the context of climate change: A review. *Sustainability, 10*(7): 2228.

Shadang, C. and Jaganathan, D. (2014). Development and standardisation of formulated baked products using millets. *Int. J. Res. Appl. Nat. Soc. Sci.*, *2*, 75-78.

Sunil, C. K., Venkatachalapathy, N., Shanmugasundaram, S. and Loganathan, M. (2016). Engineering properties of foxtail millet (*Setaria italic* L): Variety-HMT 1001. *International Journal of Science, Environment and Technology, 5*(2): 632-637.

Zhang, L. Z. and Liu, R. H. (2015). Phenolic and carotenoid profiles and antiproliferative activity of foxtail millet. *Food Chemistry, 174*: 495-501.

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