BIOLOGICAL SCIENCES

UDC 579

THE INFLUENCE OF DIETARY FIBER IN DEFATTED SESAME FLOUR ON KEFIR

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Abstract: Defatted sesame flour (DSF) is a kind of by-products of agricultural processing, they are rich in dietary fiber and other nutrients. In modern society, dietary fibre is increasingly being paid attention for its health benefits. Kefir is a functional beverage and little known to consumers. This study aimed to study the influence of dietary fiber in rice bran on the physical properties of kefir, including water holding capacity and viscosity. Kefir supplemented with 0, 2%, 4%, 6%, 8% amount of DSF were studied. Samples were stored for 28 days at 4±1°C. Results showed that the introduction of defatted sesame flour could significantly improve the water holding capacity and viscosity of kefir because of the fiber in rice bran. To get a better quality of kefir, defatted sesame flour should be pretreated: crushing, decolorization, deodorization and other pretreatment. And more adding amount of introduction lead to bad taste, so the urgent problem needs to resolve is decrease the adverse effect of DSF on kefir.

Key words: defatted sesame flour, kefir, water holding capacity, viscosity

1 Introduction

DSF is a kind of by-product commonly discarded or utilized as animal food. The process of sesame oil extraction leads to the production of defatted sesame flour (DSF), which containing 50% protein, high calcium (1.5 g/100 g), and crude fiber (10.8 g/100 g), DSF also contains phenolic compounds which possess antioxidant, antimutagenic and antimicrobial activities [1, p. 10, 2, p. 718]. Other nutraceutical compounds present in DSF are lignans [3, p. 902] and several minerals, like potassium (4.6–5.3 g/kg), phosphorus (1.7–2.3 g/kg) and magnesium (0.018-0.052 g/kg).

The noteworthy trend in recent times is the addition of dietary fiber with health effects, such as preventing constipations, colonrectal diseases, diabetes and obesity [4, p. 487, 5, p. 555, 6, p. 766, 7, p.1]. Several studies involving the addition of dietary fiber to dairy products have reported a positive effect, both on the growth of probiotic bacteria and on the sensory, rheological and physicochemical properties [8, p. 280, 9, p. 1]. There is great economic interest in finding new dietary fiber -rich food matrices. These dietary fiber masked the sour taste of yogurt, thus enhance acceptability [10, p. 5369]. In the study on drivers of liking for fermented milk concluded that a more viscous product which has neither a very sour nor too sweet profile is mostly liked by consumers and such a combination is possible only by the incorporation of probiotics and dietary fiber in the drink. In synbiotic skim milk where Lactobacillus were incorporated with dietary fiber, the doubling time decreased considerably.

Hence it was concluded that the addition of dietary fiber had positive effects on both fermentation times and the viability of the probiotic strain during storage periods [11, p. 319].

In this study, the effects of DSF on kefir were studied, aiming to study the influence of dietary fiber in DSF on kefir.

2 Research methodology

Kefir was used as start culture at a ratio of 10% (V/V). Five raw materials formula were investigated: cow milk added with 0 (control), 2% (A), 4% (B), 6%

(C), 8% (D) amount of DSF. All kinds of mixture were fermented at 28°Cfor 22h until pH reached to 4.7, kefir samples were stored at 4 °C for 28 days.

The water-holding capacity and apparent viscosity of kefir were studied for all samples. All the indexes were studied every 7 days for 28 days.

The apparent viscosity of the samples was measured with a digital viscometer (NDJ-8S, Shanghai, China).

WHC of kefir was determined using a centrifuge.

10g of kefir (X) samples were weighed into 50mL test tube and centrifuged at 3000 rpm for 20 min at 4°C. The separated whey (Y) was removed and weighed. The water-holding capacity was calculated as

WHC (%) = [(X-Y)/X] x100)

3 Results

3.1 WHC

Water holding capacity (WHC) is the tendency to retain water or resistance towards phase separation of the product.

The results of WHC of samples were showed in table 1 and figure 2. The WHC of kefir supplemented with DSF was significantly increased compared with blank one ($p<0.05$), which was due to the high WHC of dietary fiber and protein in DSF. Fiber may act as a stabilizer due to its capacity for binding water [12, p. 1]. The amino acid composition of the proteins, the structures of the proteins and the ratio of surface polarity/hydrophobicity of the proteins are the major effects that influence water holding capacity of foods [13, p. 28]. There was no significant change in WHC among kefir added with 2%, 4%, 6%, 8% amount of DSF, which might be caused by the lack of free water, most molecules of water were combined in samples added with 2% DSF, let alone kefir added with 4%, 6%, 8% amount of DSF.

Storage period made no difference on the WHC of control samples, but significant decrease of WHC occurred during storage period, which might be caused by the slow coagulation of DSF.

Table 1

WHC of kefir in 28 days (n=3, ±SD)

Indicato-rs	Samples	Day 0	Day 7	Day 14	Day 21	Day 28
WHC (%)	K	$54.57\pm4.91^{b, X}$	$56.31\pm1.30^{d, X}$	$55.49\pm1.90^{c, X}$	$59.69\pm1.423^{d,X}$	$60.97\pm0.93^{d, X}$
	A	$67.76\pm0.85^{a, X}$	$64.4\pm1.28^{c, Y}$	$62.07\pm0.45^{b,YZ}$	$62.56\pm1.198^{c, YZ}$	$61.21\pm1.36^{cd,Z}$
	B	$67.49\pm2.26^{a,XY}$	$68.44\pm0.41^{b,X}$	$66.73\pm1.23^{a, XY}$	$64.49\pm0.28^{bc,YY}$	$64.30\pm0.79^{bc, YY}$
	C	$71.60\pm1.02^{a,X}$	$70.44\pm0.46^{ab,XY}$	$68.35\pm1.06^{a,YZ}$	$65.99\pm0.52^{ab, ZW}$	$64.87\pm1.35^{ab,W}$
	D	$70.17\pm0.97^{a,XY}$	$72.27\pm0.08^{a, X}$	$67.94\pm1.01^{a,YZ}$	$67.58\pm0.63^{a,YZ}$	$67.84\pm1.33^{a, Z}$

$^{a, b, c, d}$ Means in the same column with different superscripts significantly differ (P<0.05)

$^{X, Y, Z, W}$ Means in the same row with different superscripts among fermented milk drink samples significantly differ (P<0.05)

SD (Standard deviation): K= control sample, A= fermented milk drink with 2 % DSF, B= fermented milk drink with 4 % DSF, C= fermented milk drink with 6 % DSF, D= fermented milk drink with 8 % DSF.

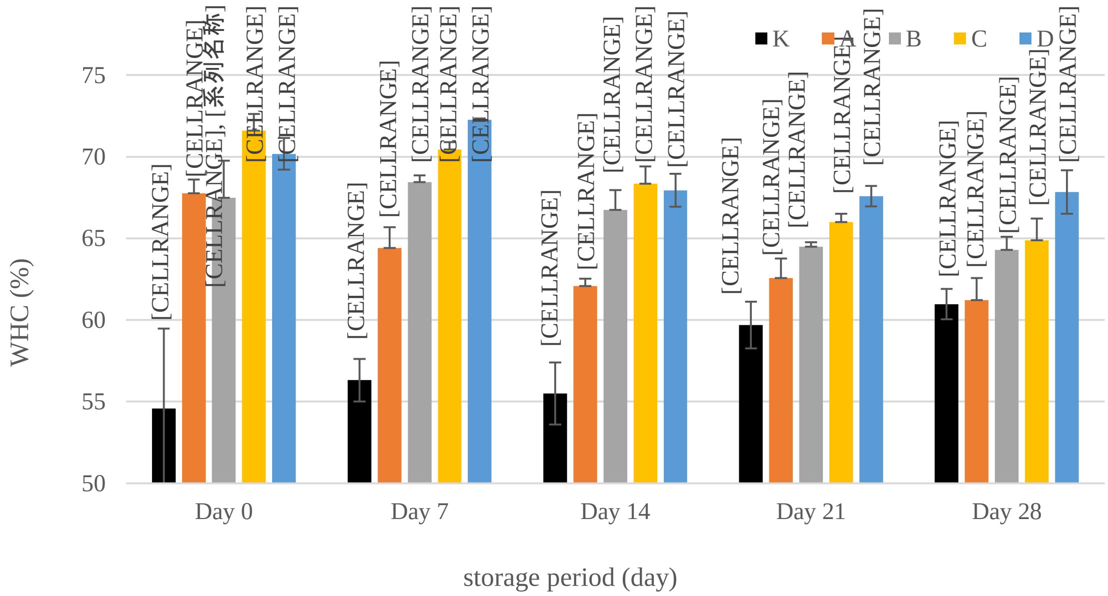

Fig. 1. WHC of kefir samples during storage for 28 days (n=3, ±SD)

* $^{a, b, c, d}$ Means different samples in the same day with different superscripts significantly differ (P<0.05)

* $^{X, Y, Z, W, M}$ Means in different day for the samples with different superscripts significantly differ (P<0.05)

* K= control sample, A= kefir with 2% DSF, B= kefir with 4% DSF, C= kefir with 6% DSF, D= kefir with 8% DSF.

3.2 Apparent viscosity

The results of apparent viscosity were shown in table 2 and figure 2. Compared with blank samples, even 2% amount of DSF significantly increased the apparent viscosity of kefir (p<0.05), let alone samples added with 4%, 6% and 8% amount of DSF, which was caused by the adding amount of dry matter and the hydrophilicity of protein and fiber in DSF [12, p. 1, 13, p. 28]. The apparent viscosity kept steady among samples added with 2%, 4%, 6% and 8% amount of DSF during storage period ($p > 0.05$), this might partly be explained by the balance of sedimentation and hydrophilic interaction of DSF. The storage period significantly influenced the apparent viscosity of control sample. The apparent viscosity of control sample improved during the storage period ($p<0.05$). Sharply contrasted, the apparent viscosity of samples added with DSF were in a fluctuant downward trend during the storage period, which could be explained by the sedimentation of DSF.

Table 2

Viscosity of kefir in 28 days (n=3, ±SD)

Indicat-ors	Samples	Day 0	Day 7	Day 14	Day 21	Day 28
Apparent viscosity (Pa*s)	K	$0.19{\pm}0.02^{c, Z}$	$0.23{\pm}0.02^{b, YZ}$	$0.27{\pm}0.05^{d, XY}$	$0.30{\pm}0.02^{b, XY}$	$0.35{\pm}0.03^{b, X}$
	A	$4.87{\pm}0.37^{b, Y}$	$6.01{\pm}1.47^{a, X}$	$3.26{\pm}0.34^{c, Z}$	$3.88{\pm}0.11^{a, Z}$	$5.06{\pm}0.64^{a, Y}$
	B	$7.53{\pm}0.92^{ab, X}$	$3.72{\pm}0.19^{a, Z}$	$6.52{\pm}0.09^{b, XY}$	$3.52{\pm}0.94^{a, Z}$	$5.72{\pm}0.67^{a, Y}$
	C	$7.33{\pm}1.12^{ab, X}$	$5.52{\pm}0.63^{a, XY}$	$5.88{\pm}0.29^{b, XY}$	$4.14{\pm}0.31^{a, Y}$	$5.95{\pm}1.31^{a, XY}$
	D	$9.33{\pm}1.69^{a, X}$	$5.52{\pm}1.11^{a, YZ}$	$8.45{\pm}1.31^{a, XY}$	$4.90{\pm}0.62^{a, Z}$	$5.68{\pm}0.60^{a, YZ}$
$^{a, b, c, d}$ Means in the same column with different superscripts significantly differ ($P<0.05$)						
$^{X, Y, Z, W}$ Means in the same row with different superscripts among fermented milk drink samples significantly differ ($P<0.05$)						
SD (Standard deviation): K= control sample, A= fermented milk drink with 2 % DSF, B= fermented milk drink with 4 % DSF, C= fermented milk drink with 6 % DSF, D= fermented milk drink with 8 % DSF.						

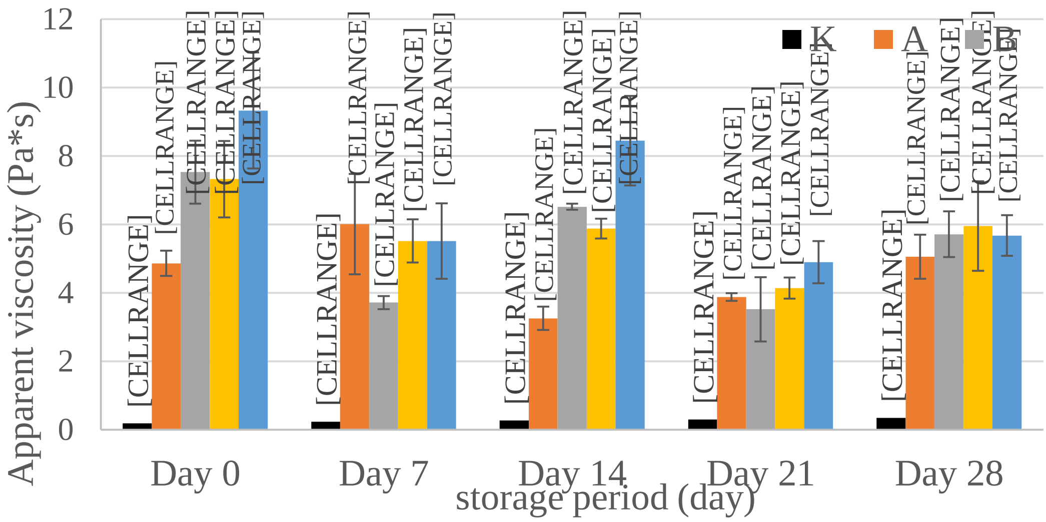

Fig. 2. Apparent viscosity of kefir samples in 28 days (n=3, ±SD)

* $^{a, b, c, d}$ Means different samples in the same day with different superscripts significantly differ ($P<0.05$)

* $^{X, Y, Z, W, M}$ Means in different day for the samples with different superscripts significantly differ ($P<0.05$)

* K= control sample, A= kefir with 2% DSF, B= kefir with 4% DSF, C= kefir

with 6% DSF, D= kefir with 8% DSF.

Conclusion The addition of DSF conferred many benefits to kefir. The addition of DSF could significantly improve the apparent viscosity and water holding capacity of kefir, give kefir a better concretionary state and thicker texture, and finally meet consumer's demand for kefir. The only defect is the scorched flavor of DSF, which negatively affected the sensory evaluation of kefir. Further research from the direction of odor removal is expected to fully solve the application problem of DSF in kefir.

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