

# ارزش غذایی و عمر ماندگاری همبرگر ترکیبی (کیپور علفخوار و گوشت قرمز)

در دمای ۱۸- درجه سانتی گراد



ارائه دهنده: مهلا چزگی و امیررضا دانشمندی 

استاد راهنما: دکتر پرنیان پزشکی 

زمان: ۱۳ آذر ماه سال ۱۴۰۴ 

# Nutritional Value and Shelf life of the Consolidated Burger (Grass Carp-Red Meat) During Freezing Storage at $-18\text{ }^{\circ}\text{C}$



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Supervisor: Dr. Parnian Pezeshki



Date: 23 October 2025

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۵۹

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# جدول اختصارات

عبارت کامل	اختصار
Polyunsaturated Fatty Acids	PUFAs
Total Volatile Basic Nitrogen	TVB-N
Malodialdehyde	MDA
Thiobarbituric Acid	TBA
Ultraviolet-Visible Spectroscopy	UV/Vis

# جدول نمودارها

شماره صفحه	عنوان نمودار
۲۸	تغییرات پروتئین
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۳۸	چسبندگی بافت
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۴۱	آبداری همبرگر
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۴۳	پذیرش کلی

عنوان مقاله:

بررسی ارزش غذایی و ماندگاری برگر تلفیقی (گوشت کپور علفخوار-گوشت قرمز) در طول نگهداری در دمای انجماد ۱۸ - درجه سانتیگراد

نویسندگان:

پروین کاویانی و بابک کرمی

افیلیشن نویسندگان:

گروه علوم و صنایع غذایی، دانشکده علوم زیستی، دانشگاه آزاد اسلامی، واحد تهران شمال، ایران

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نام مجله: تحقیق و نوآوری در علوم و فناوری مواد غذایی





## Study of Nutritional Value and Shelf life of the Consolidated Burger (Grass Carp-Red Meat) During Freezing Storage at -18 °C

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### Abstract

Nutritional value and shelf life of the consolidated burger (grass carp-red meat) during freezing storage at -18 °C was determined in this study. In recent years, with the change in lifestyle and the development of urban life, consuming semi-prepared foods has increased and meat products based on minced meat such as burgers have a major share among these foods in the modern lives. In this study, a combined red meat (beef meat)-grass carp burger with different ratios of 0:100, 25:75, and 50:50 was prepared and stored at -18 °C for 4 months. The value of protein, fat, moisture, ash pH, peroxide value, thiobarbituric acid value, volatile nitrogen bases, fatty acid profiles and sensory evaluation were determined on the first day and end of the storage period. Measuring parameters showed the amount of protein, fat, moisture, and ash decreased and the average pH, peroxide, thiobarbituric acid, and volatile basic nitrogen values increased over storage. With increasing the amount of fish meat used in the burger formulation, protein, moisture, ash, and pH values and sensory properties decreased and fat, peroxide, thiobarbituric acid, and volatile nitrogen values increased. The results of this study suggest that consuming Mix50% burger provides some parts of body's needs for unsaturated fatty acids and protein.

### Keywords

Consolidated burger  
Grass carp  
Red meat  
Shelf life  
Texture

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## مروری بر پژوهش

مقدمه ←

روش کار ←

نتایج و بحث ←

نتیجه گیری ←

منابع ←





# گوشت قرمز

منبع پروتئین بالا



منبع خوب ویتامین ها و مواد معدنی



در اثر مصرف بیش از حد بروز بیماری های قلبی



محبوب ترین محصول گوشت قرمز فراوری شده.





# گوشت ماهی

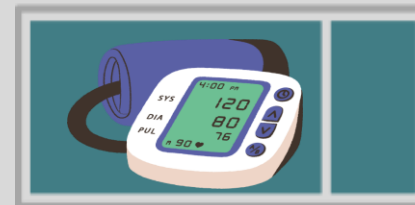
هضم و پخت سریع



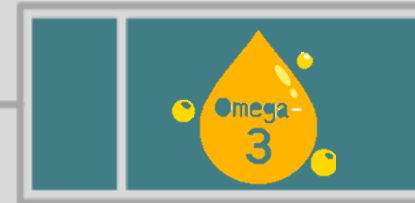
چربی های غیر اشباع



کاهش فشار خون ، بیماری های قلبی عروقی و سرطان



غنی از ویتامین های محلول در آب و چربی مواد معدنی



دارای اسیدهای چرب امگا ۳



# برگر ترکیبی



گوشت گاو



گوشت ماهی کپور





## ماهی کپور علف خوار



۱

رشد سریع

۲

پرورش آسان

۳

هزینه پایین

۴

ارزش غذایی بالا

## آماده سازی نمونه ها

### آماده سازی گوشت ماهی:

۱

ماهی کپور به وزن ۳۰۰ گرم از استخرهای پرورش ماهی واقع در بندر انزلی (استان گیلان، ایران) تهیه و به آزمایشگاه مرکز ملی آبیان منتقل شد.

۲

پس از تخلیه سر و روده ها، آنها چندین بار شسته شدند.

۳

گوشت ماهی کاملاً تمیز و با استفاده از دستگاه استخوان گیر از پوست و سایر استخوان ها جدا شد.

۴

به منظور کاهش بوی فاص ماهی، گوشت ماهی با محلول ۳/۰٪ نمک شسته شد.

## آماده سازی نمونه ها

### آماده سازی گوشت قرمز:

۱

۳ کیلو گرم  
گوشت قرمز گاو  
تهیه میشود.

۲

مشخصات گوشت  
مطابق با استاندارد  
ملی ایران شماره  
۲۳۰۴

۳

به وسیله چرخ  
گوشت با قطر ۳  
میلی متر گوشت  
به طور کامل چرخ  
میشود.

۴

در یخچال با دمای  
۴ درجه سانتی گراد  
نگهداری میشود.

## آماده سازی برگرها

مقدار مجاز استفاده از افزودنی ها طبق استاندارد ملی ایران (۲۳۰۴): ۳۰ درصد

لیست افزودنی های مورد استفاده:

- پودر نان ۱۱٪
- پودر سیر ۰/۱٪
- پیاز ۹٪
- رب گوجه فرنگی ۰/۲٪
- آبلیمو ۰/۰۹۵٪
- ادویه ها ۰/۶٪
- پودر سفیده تخم مرغ ۰/۲٪
- سبزیجات ۱/۸۵٪
- سویا ۵٪

• سه تیمار تهیه شده در پژوهش:

۱۰۰٪ گوشت قرمز ( نمونه شاهد) ← Mix 100%

۷۵٪ گوشت قرمز و ۲۵٪ گوشت ماهی ← Mix 75%

۵۰٪ گوشت قرمز و ۵۰٪ گوشت ماهی ← Mix 50%

(۱) مخلوط کردن مواد در دستگاه میکسر

(۲) قالب گیری نمونه ها با قطر ۸ سانتی متر و ضخامت ۱ سانتی متر

(۳) بسته بندی در بسته های ۵ تایی پلی اتیلنی

(۴) نگهداری به مدت ۴ ماه در دمای منفی ۱۸ درجه سانتی گراد



✓ در روز صفر و ماه چهارم نمونه برداری به صورت تصادفی انجام شد.  
✓ آزمایش های زیر مورد بررسی قرار گرفت.

• پروتئین

• چربی

• رطوبت

• فاکستر

• PH

• عدد پراکسید

• اسید تیوباربیتوریک

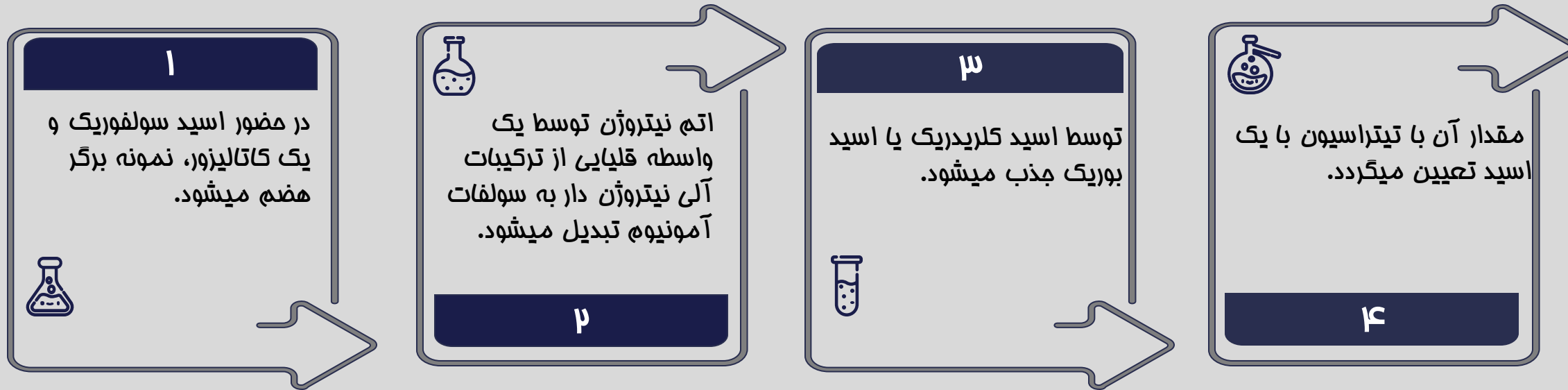
• بازهای نیتروژنی فرار

• پروفایل اسیدهای چرب

• ارزیابی مسی

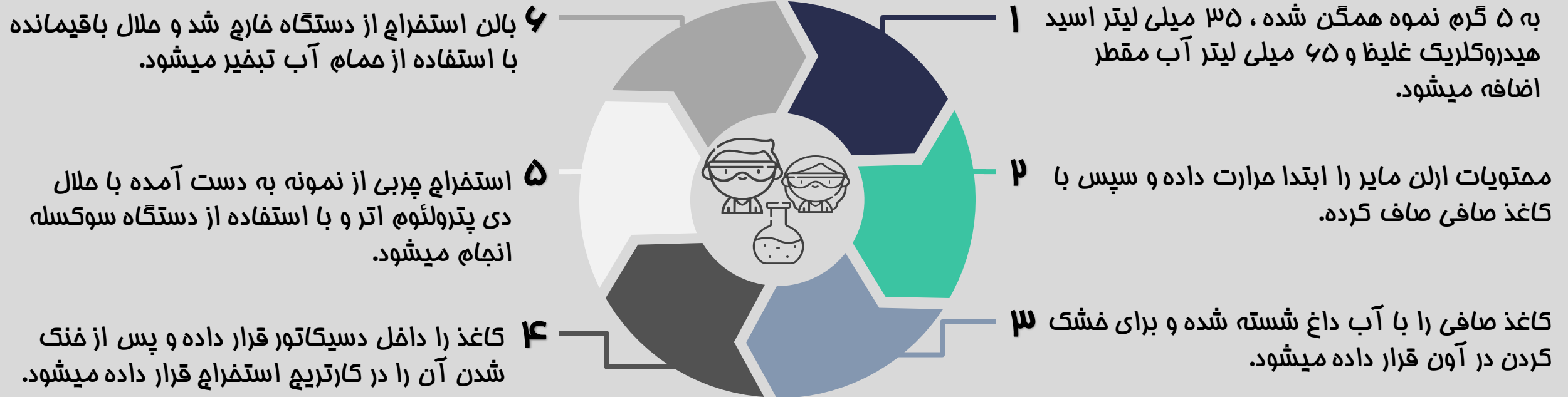


## اندازه گیری پروتئین (کجدال)



$$100 \times \frac{\text{Amount of acid used for titration} \times \text{Acid normality} \times 0.014}{\text{Sample weight}} = \text{Nitrogen percentage}$$

## اندازه گیری چربی (سوکسله)



## اندازه گیری رطوبت

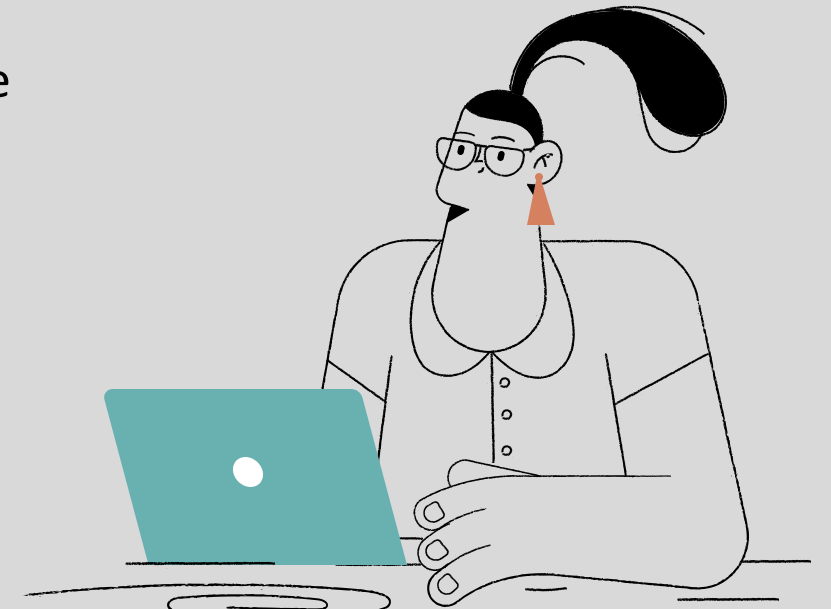
برای اندازه گیری میزان رطوبت، نمونه ها به مدت ۱۲ ساعت در دمای ۱۰۵ درجه سانتی گراد در آون خشک شدند و به صورت غیرمستقیم اندازه گیری شدند. با استفاده از وزن نمونه خشک شده، میزان رطوبت نمونه پس از رسیدن به وزن ثابت طبق فرمول زیر محاسبه شد:

$$100 \times \frac{\text{weight of sample before drying} - \text{weight of sample after drying}}{\text{weight of sample}} = \text{Moisture percentage}$$

## اندازه گیری خاکستر

برای اندازه گیری خاکستر، با مذف مواد آلی و پسماندها و پس مانده های معدنی، خاکستر در دمای ۵۰۰ تا ۵۵۰ درجه سانتی گراد اندازه گیری شد. با استفاده از وزن نمونه خشک شده، میزان خاکستر نمونه ها طبق فرمول زیر محاسبه شد :

$$100 \times \frac{\text{plant weight and ash} - \text{plant weight}}{\text{sample weight}} = \text{Ash percentage}$$



## اندازه گیری pH

برای این منظور، ۵ گرم از نمونه برگر به ۲۰ میلی لیتر آب مقطر اضافه و به مدت ۲ دقیقه توسط هموژنایزر ۴۰۰، همگن میشود. مخلوط حاصل از طریق کاغذ واتمن شماره ۲ فیلتر میشود و در بالن حجمی ۵۰ میلی لیتری دوباره تنظیم میشود. سپس، pH توسط یک pH متر کالیبره شده در سه تکرار اندازه گیری میشود.



## اندازه گیری عدد پراکسید

۱ ۵ گرم روغن استخراج شده به روش سوکسله در یک ارلن مایر ۲۵۰ میلی لیتری وزن شد.

۲ ۳۰ میلی لیتر محلول کلروفرم استیک اسید با نسبت ۲:۳ به روغن اضافه و کاملاً مخلوط شد.

۳ سپس ۰/۵ میلی لیتر یدید پتاسیم اشباع ۳۰ میلی لیتر آب مقطر و ۵ میلی لیتر محلول نشاسته ۱ درصد اضافه شد.

۴ یدید آزاد شده با تیوسولفات ۰/۱ نرمال تیترا شد تا رنگ زرد ناپدید شود.

۵ در نهایت عدد پراکسید بر حسب میلی اکی والان اکسیژن در هر ۱۰۰۰ گرم روغن با استفاده از فرمول زیر بیان شد.

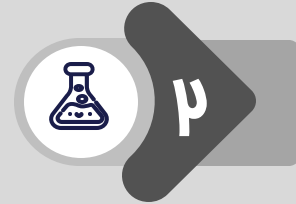
$$\frac{\text{volume of thiosulfate used in milliliters} \times \text{molarity of sodium thiosulfate} \times 1000}{\text{weight of oil in terms of oil}} = \text{Peroxide value}$$

## اندازه گیری تیوباربیتوریک اسید (مالون دی آلدئید)

۵ گرم نمونه برگر و ۲۰ میلی لیتر تری کلرواستیک اسید  
۵٪ به مدت ۵ دقیقه همگن شدند.



مخلوط همگن شده به مدت ۱۰ دقیقه در دمای ۴ درجه سانتی گراد  
با سرعت ۱۲۰۰۰ گره سانتریفیوژ شد.



میلی لیتر از مایع رویی با ۴ میلی لیتر تیوباربیتوریک اسید  
مخلوط و به مدت ۶۰ دقیقه در حمام آب با دمای  
۱۰۰ درجه سانتی گراد انکوبه شد.



جذب محلول در طول موج ۵۳۲ نانومتر توسط اسپکتروفتومتر  
اندازه گیری شد.



مقدار تیوباربیتوریک اسید با استفاده از منحنی استاندارد  
مالون دی آلدئید محاسبه و نتایج بر حسب میکرومول  
مالون دی آلدئید در هر گرم نشان داده شد.

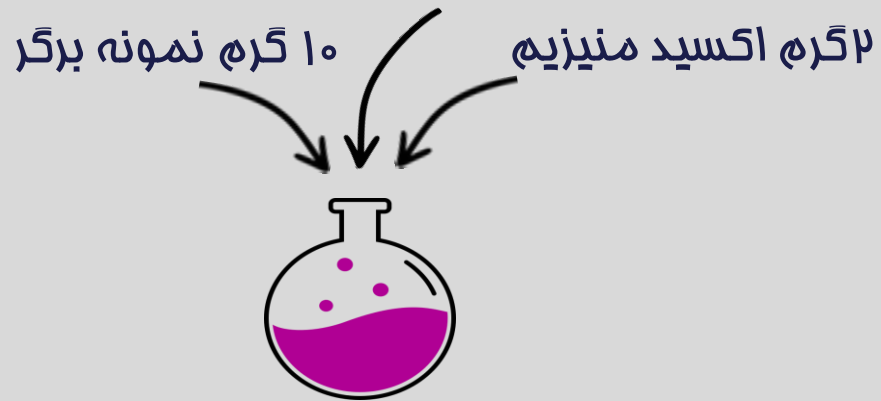


$$\frac{\text{volume of thiosulfate used in milliliters} \times \text{molarity of sodium thiosulfate} \times 1000}{\text{weight of oil in terms of oil}}$$

## ● اندازه گیری نیتروژن بازی فرار

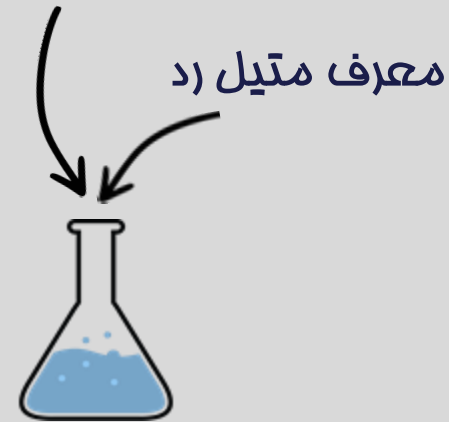
۱

۳۰۰ میلی لیتر آب

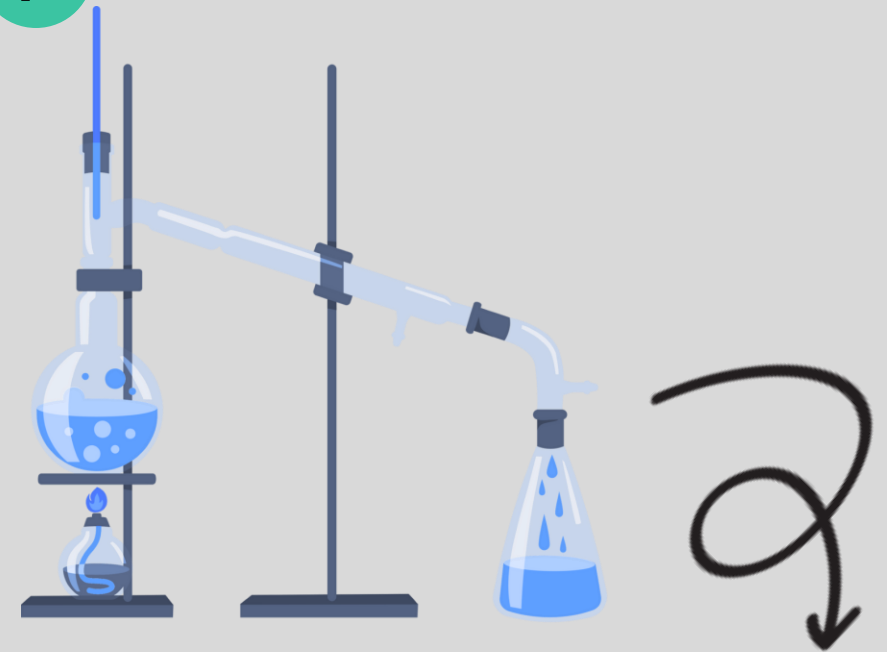


۲

۲۵ سی سی محلول اسید بوریک



۳



پس از عملیات تقطیر، محلول تقطیر شده با اسید سولفوریک تیترا ۰/۱ نرمال رقیق شده و مقدار اسید سولفوریک مصرفی در عدد ۱۴ ضرب شد و به این ترتیب، مقدار ازت بازی فرار بر حسب میلی گرم در هر ۱۰۰ گرم گوشت محاسبه گردید.

## اندازه گیری پروفایل اسید چرب

پس از تزریق نمونه به دستگاه کروماتوگرافی گازی، منحنی رسم شد و زمان مهار هر اسید چرب با منحنی اسید چرب استاندارد و زمان مهار آن مقایسه شد. به این ترتیب، نوع و تعداد اسیدهای چرب در نمونه مورد آزمایش تعیین شد.

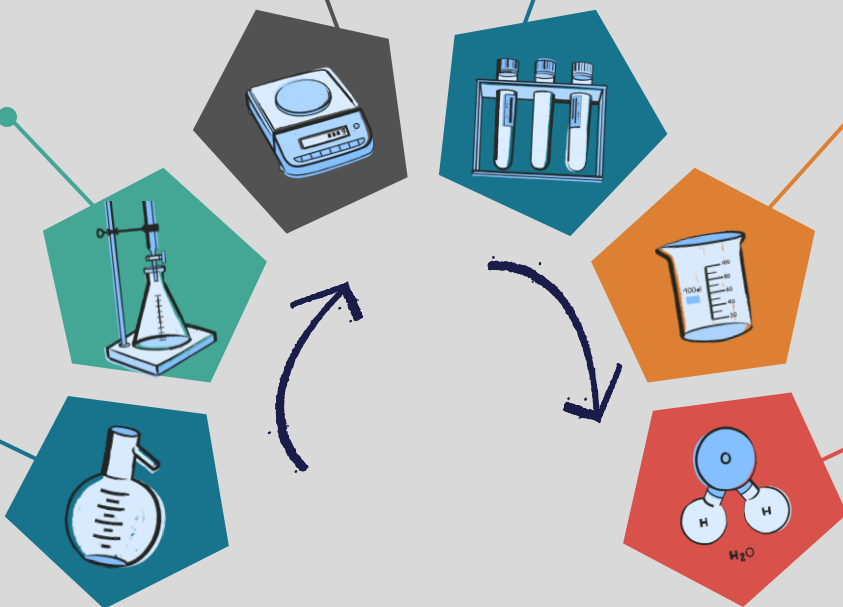
دستگاه کروماتوگرافی گازی مجهز به آشکارساز یونیزاسیون شعله‌ای بود و ستون موئین از جنس سیلیس ذوب شده از نوع فاز پیوندی ساخته شده بود.

گاز هلیوم با فشار ۲۵ بار و خلوص ۹۹/۹۹٪ به عنوان گاز حامل استفاده شد. دمای آشکارساز و تزریق کننده به ترتیب ۲۵۵ و ۲۷۰ درجه سانتیگراد بود.

فاز هگزان بالای حاوی اسیدهای چرب متیل استر مذف و یک میکرولیتر از آن تهیه شد و ۱ میکرولیتر از نمونه متیل استر با استفاده از یک سرنگ میکرولیتری به دستگاه کروماتوگرافی گازی تزریق شد.

۱۲ میلی لیتر فلوتور-برم از طریق مبرد به محتویات فلاسک اضافه شد و به مدت ۱۰ دقیقه به آرامی جوشانده شد. پس از خاموش کردن حرارت، محلول کلرید سدیم به فاز آبی اضافه شد.

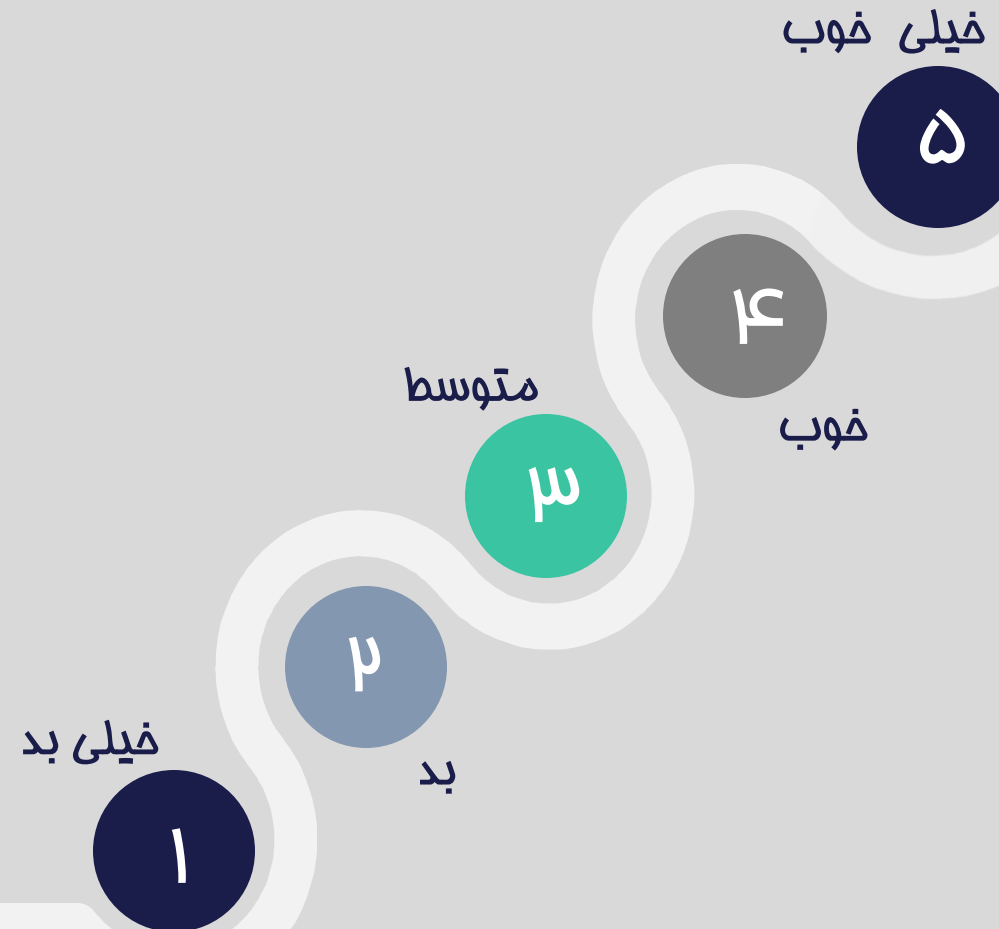
۱ گرم روغن از نمونه‌های مختلف برگر به دست آمد و به مدت ۲۵ دقیقه در فلاسکی حاوی ۲۰ میلی لیتر پتاس متانولی ۱ درصد وزنی/مجمعی قرار داده شد.



## ● ارزیابی ویژگی های مسی

برای ارزیابی ویژگی های مسی از آزمون **هدونیک ۹** نقطه ای استفاده شد و محصول از نظر **رنگ، بو، طعم، بافت و پذیرش کلی** مورد آزمایش قرار گرفت.

هیئت ارزیابی مسی شامل ۱۲ عضو آموزش دیده بود. ۶ نفر از آنها مرد و ۶ نفر زن با محدوده سنی ۳۰ تا ۴۵ سال بودند. نمونه های برگز ترکیبی با استفاده از اجاق میکروویو در دمای ۷۰ درجه سانتیگراد (۷۰۰ وات) به مدت ۷ دقیقه پخته شدند و نمونه مرجع، همبرگر بازاری بود. بین هر مرحله ارزیابی از آب شیرین برای نوشیدن استفاده شد.



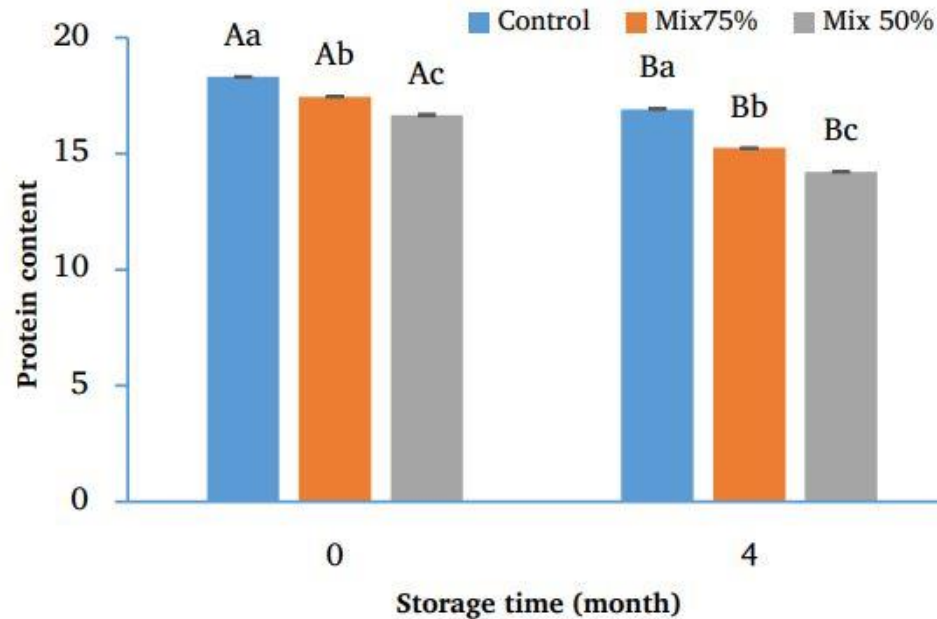
## ● تحلیل آماری

تجزیه و تحلیل نتایج به دست آمده در آزمایش های مرتبط، در قالب طرح کاملاً تصادفی با استفاده از روش آنالیز واریانس یک طرفه (ANOVA) در سطح اطمینان ۹۵٪ انجام شد و برای مقایسه جفت نمونه ها در ابتدا و انتهای دوره نگهداری، از آزمون T-test جفتی استفاده شد.

مقایسه میانگین ها با استفاده از نرم افزار SPSS نسخه ۲۰ انجام شد. به منظور کاهش خطا، تمام آزمایش ها در سه تکرار انجام شد.



## تغییرات پروتئین



**Fig. 1.** Changes of consolidated burger protein during the storage period. Small letters indicate significant differences between different burger samples. Capital letters indicate a significant difference percent of the consolidated burger sample during the storage period ( $P < 0.05$ ).

نتایج:

افزایش میزان گوشت ماهی:



پروتئین

در طول نگهداری:



پروتئین

بحث:

۱) حساسیت بیشتر پروتئین‌های ماهی در برابر فساد آنزیمی و اکسیداتیو

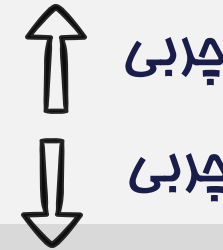
۲) سطح بالاتر اسیدهای چرب غیراشباع در گوشت

۳) آسیب فیزیکی ناشی از تشکیل کریستال‌های یخ در طی انجماد

## تغییرات چربی

نتایج:

افزایش میزان گوشت ماهی:



در طول نگهداری:

بحث:

(۱) آسیب فیزیکی ناشی از کریستال‌های یخ در مین انجماد

(۲) اکسیداسیون چربی در طول مدت نگهداری توسط لیپاز های مقاوم به سرما

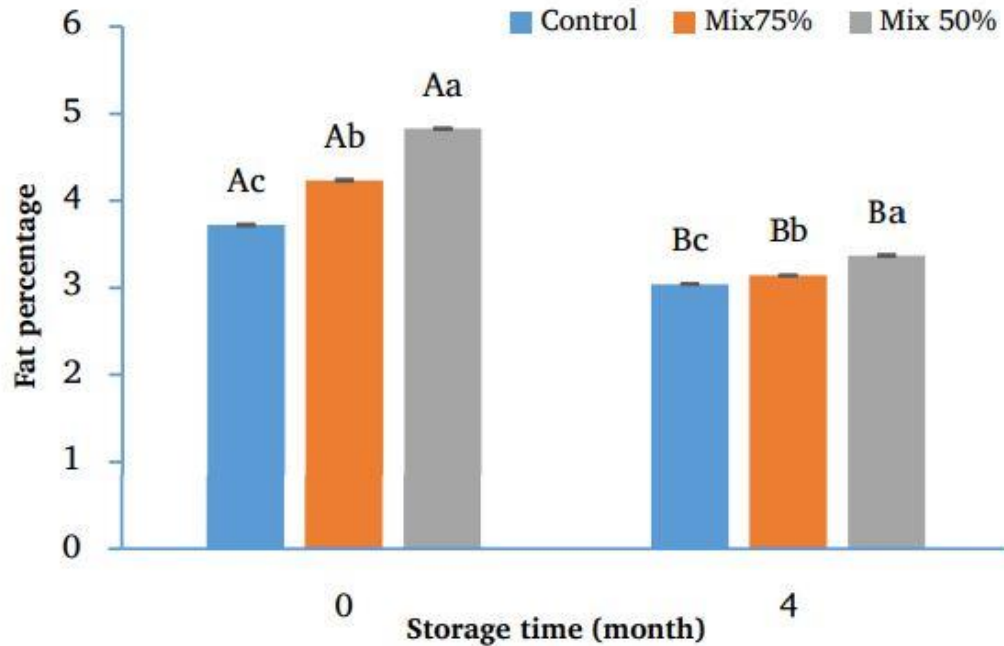


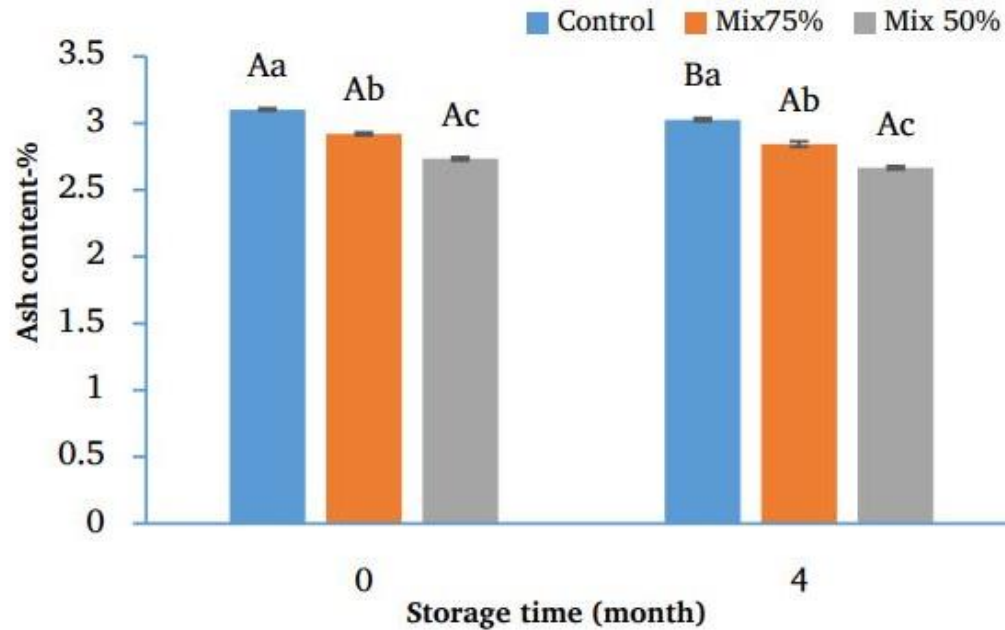
Fig. 2. Changes in consolidated burger fat during the storage period. Small letters represent significant differences between different burger samples. Capital letters denote a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

## تغییرات فاکستر

نتایج:

افزایش میزان گوشت ماهی: فاکستر ↓

در طول نگهداری: فاکستر ↓ (فقط در نمونه Mix 100%)



**Fig. 4.** Changes in consolidated burger ash during the storage period. Small letters represent significant differences between different burger samples. Capital letters denotes a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

## تغییرات رطوبت

نتایج:

افزایش میزان گوشت ماهی:

↓ رطوبت

در طول نگهداری:

↓ رطوبت

بحث:

وجود افزودنی‌ها در فرمولاسیون برگر

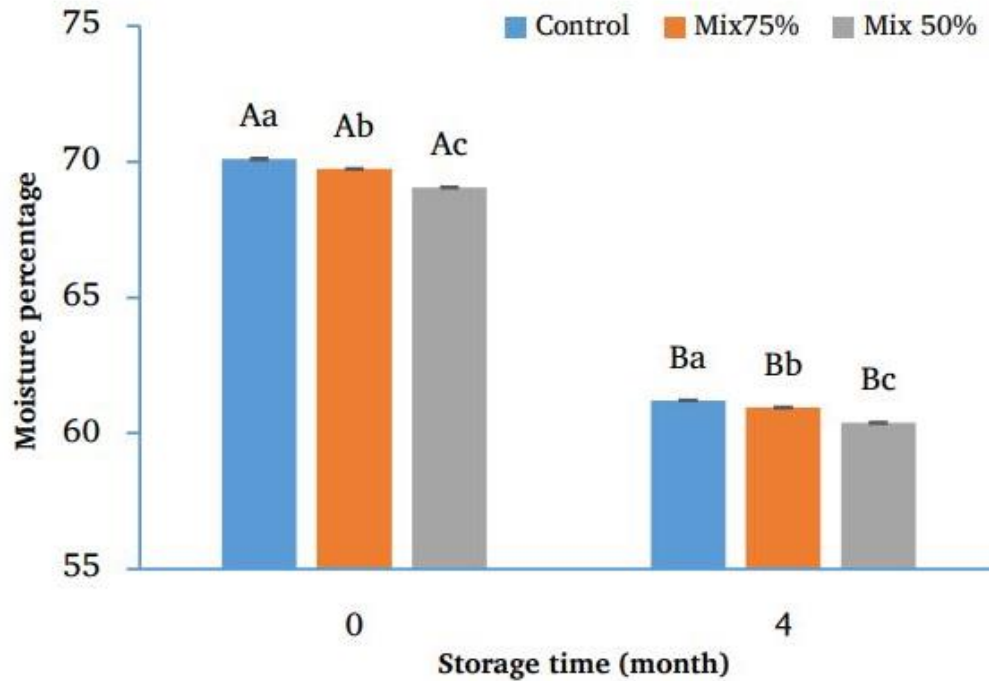
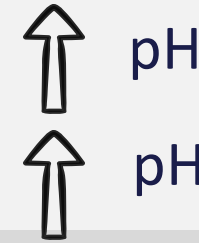


Fig. 3. Moisture changes of consolidated burger during the storage period. Small letters indicate significant differences between different burger samples. Capital letters represent a statistically significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

## تغییرات pH

نتایج:

افزایش میزان گوشت ماهی:



pH

pH

در طول نگهداری:

بحث:

در اثر فعالیت باکتری ها ترکیبات فراری مانند آمونیاک و تری متیل آمین تولید میشود و تجمع اسیدهای آمینه و محصولات تجزیه اسید آمینه، pH را افزایش میدهد.

افزودن ماهی می تواند رشد باکتری ها و قارچ ها را سرکوب کرده و افزایش pH را کاهش دهد.

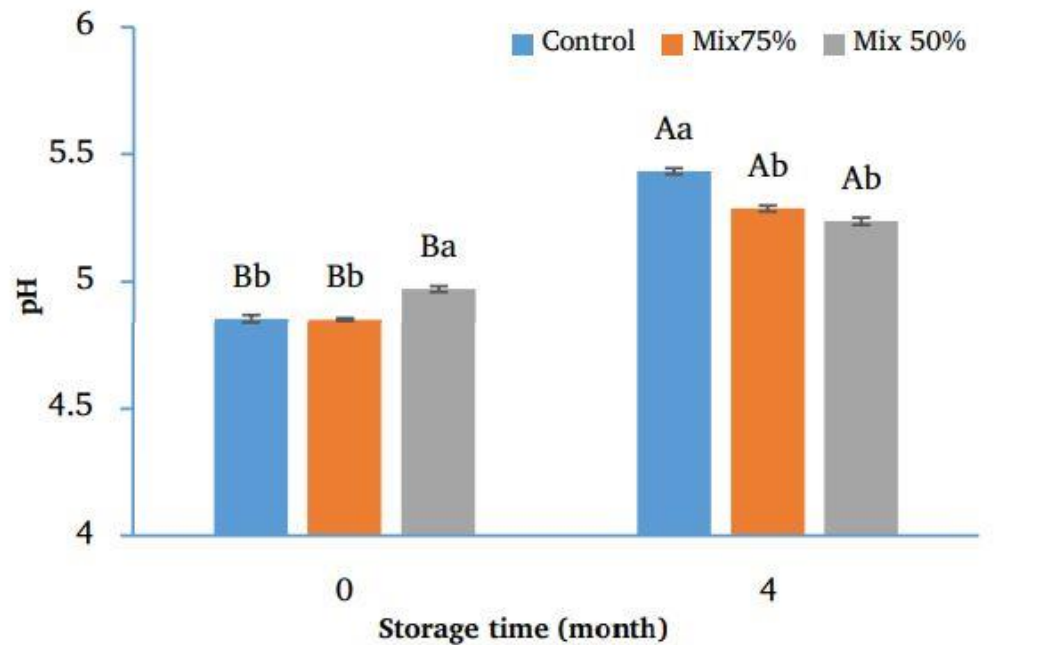


Fig. 5. pH changes of consolidated burger during the storage period. Small letters denote significant differences between different burger samples. Capital letters indicate a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

## تغییرات عدد پراکسید

نتایج:



PV

افزایش میزان گوشت ماهی:

PV

در طول نگهداری:

بحث:

وجود مقادیر بیشتر اسیدهای چرب بلند زنجیر در فرمولاسیون نهایی برگر Mix50%

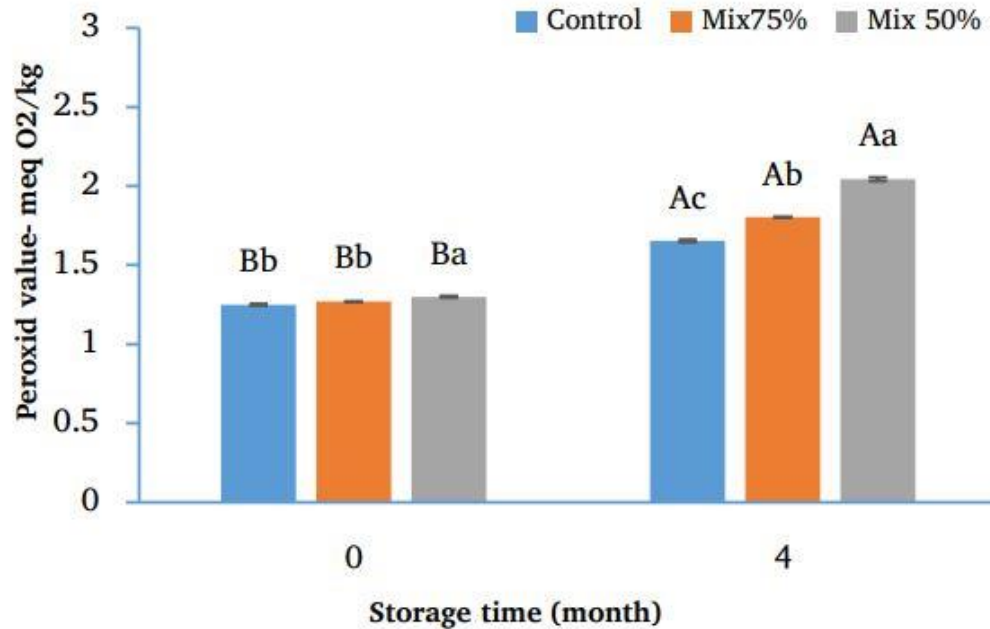


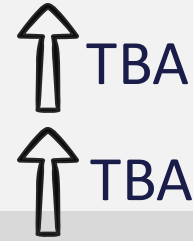
Fig. 6. Changes in consolidated burger's peroxide value during the storage period. Small letters represent significant differences between different burger samples. Capital letters denote a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

## تغییرات تیوباربیتوریک اسید

نتایج:

افزایش میزان گوشت ماهی:

در طول نگهداری:



بحث:

روند افزایشی این شاخص در طول دوره نگهداری ممکن است به دلیل افزایش آهن آزاد و سایر پراکسیدها در عضله باشد.

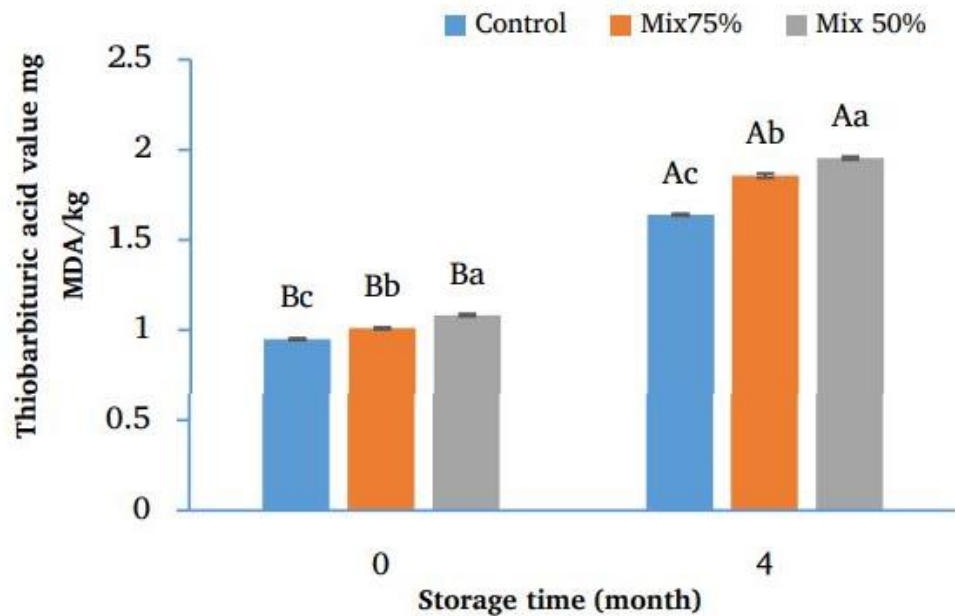


Fig. 7. Changes in consolidated Burger's thiobarbituric acid value during the storage period. Small letters represent significant differences between different burger samples. Capital letters denote a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

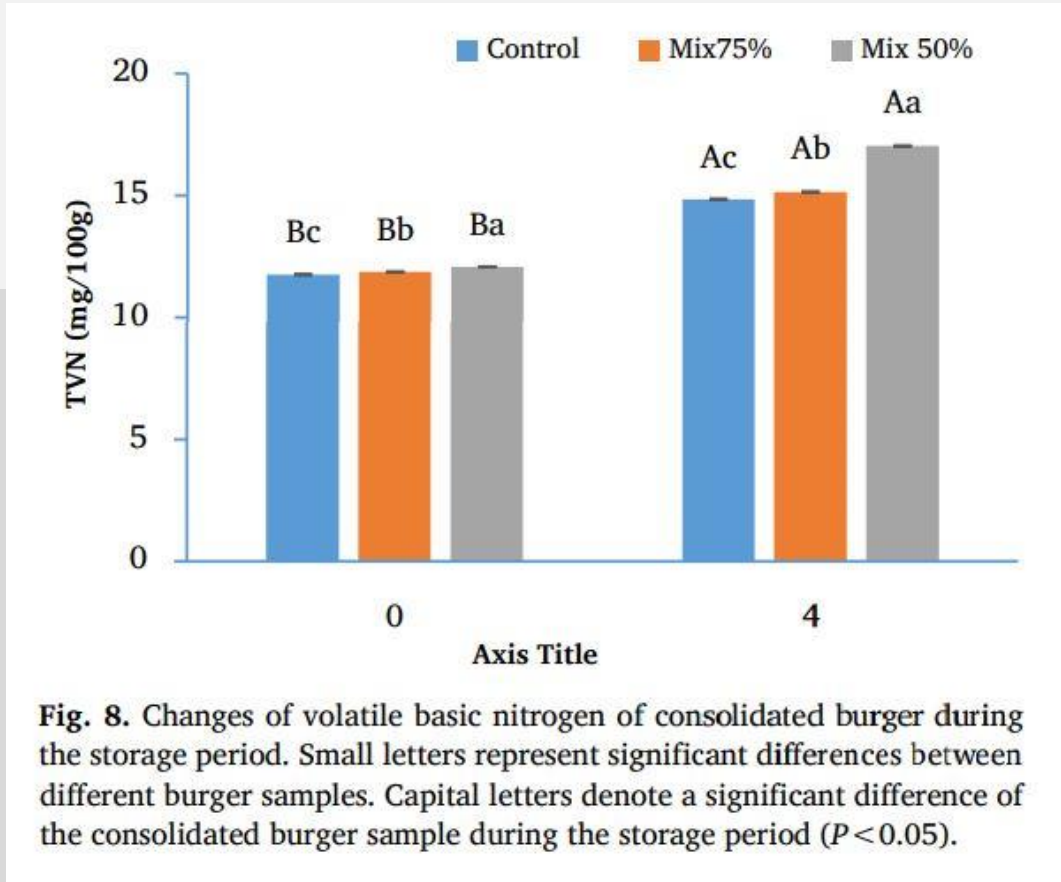
## تغییرات بازهای نیتروژنی فرار

### نتایج:

↑ TVN افزایش میزان گوشت ماهی:  
 ↑ TVN در طول نگهداری:

### بحث:

مقادیر بالای بار باکتریایی، که ترکیباتی مانند اکسید تری متیل آمین، پپتیدها و اسیدهای آمینه را به بازهای فرار تجزیه می‌کنند، می‌تواند توجیهی برای افزایش نیتروژن بازی فرار باشد. افزایش نیتروژن بازی فرار در طول نگهداری منجمد می‌تواند به فعالیت‌های باکتری‌های عامل فساد و آنزیم‌های داخلی مربوط باشد.



## تغییرات پروفایل اسید چرب

Table 2. Fatty acid profile changes of different burger samples during the storage period

Fatty acids	Storage time-month					
	0			4		
	Control	Mix75%	Mix 50%	Control	Mix75%	Mix 50%
C8:0	0.00 <sup>Aa</sup>	0.02 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.03 <sup>Aa</sup>
C12:0	0.18 <sup>Aa</sup>	0.12 <sup>Ab</sup>	0.10 <sup>b</sup>	0.19 <sup>Aa</sup>	0.13 <sup>Ab</sup>	0.11 <sup>Ab</sup>
C14:0	2.50 <sup>Ba</sup>	2.42 <sup>Bab</sup>	2.39 <sup>Ab</sup>	2.75 <sup>Aa</sup>	2.66 <sup>Aab</sup>	2.47 <sup>Ab</sup>
C16:0	17.55 <sup>Bb</sup>	17.75 <sup>Bab</sup>	17.85 <sup>Ba</sup>	19.30 <sup>Aa</sup>	19.53 <sup>Aa</sup>	18.02 <sup>Ab</sup>
C18:0	2.14 <sup>Bc</sup>	3.03 <sup>Bb</sup>	3.48 <sup>Aa</sup>	2.35 <sup>Ab</sup>	3.34 <sup>Aa</sup>	3.56 <sup>Aa</sup>
C19:0	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C20:0	0.31 <sup>Aa</sup>	0.25 <sup>Aab</sup>	0.02 <sup>Ab</sup>	0.34 <sup>Aa</sup>	0.27 <sup>Aa</sup>	0.03 <sup>Ab</sup>
C21:0	0.00 <sup>Ac</sup>	0.46 <sup>Ab</sup>	0.70 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.51 <sup>Ab</sup>	0.75 <sup>Aa</sup>
C24:0	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C14:1	0.80 <sup>Aa</sup>	0.61 <sup>Ab</sup>	0.51 <sup>Ab</sup>	0.77 <sup>Aa</sup>	0.57 <sup>Ab</sup>	0.49 <sup>Ac</sup>
C16:1	3.52 <sup>Ac</sup>	5.30 <sup>Ab</sup>	6.19 <sup>Aa</sup>	3.38 <sup>Ac</sup>	5.03 <sup>Bb</sup>	6.01 <sup>Ba</sup>
C18:1	27.35 <sup>Aa</sup>	23.54 <sup>Ab</sup>	22.64 <sup>Ac</sup>	26.25 <sup>Ba</sup>	22.36 <sup>Bb</sup>	21.96 <sup>Bc</sup>
C20:1	0.00 <sup>Ac</sup>	0.33 <sup>Ab</sup>	0.49 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.31 <sup>Ab</sup>	0.47 <sup>Aa</sup>
C22:1	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C24:1	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C18:2	36.31 <sup>Aa</sup>	25.04 <sup>Ab</sup>	19.4 <sup>Ac</sup>	34.84 <sup>Ba</sup>	23.78 <sup>Bb</sup>	18.8 <sup>Bc</sup>
C18:3	5.65 <sup>Aa</sup>	5.42 <sup>Ab</sup>	5.31 <sup>Ab</sup>	5.43 <sup>Ba</sup>	5.14 <sup>Bb</sup>	5.15 <sup>Bb</sup>
C20:2	0.00 <sup>Ac</sup>	0.09 <sup>Ab</sup>	0.14 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.08 <sup>Ab</sup>	0.13 <sup>Aa</sup>
C20:3	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C20:4	0.60 <sup>Ac</sup>	2.64 <sup>Ab</sup>	3.66 <sup>Aa</sup>	0.58 <sup>Ac</sup>	2.50 <sup>Bb</sup>	3.55 <sup>Aa</sup>
C20:5	0.03 <sup>Ac</sup>	3.03 <sup>Ab</sup>	4.53 <sup>Aa</sup>	0.02 <sup>Ac</sup>	2.87 <sup>Bb</sup>	4.36 <sup>Ba</sup>
C22:2	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C22:4	0.20 <sup>Ac</sup>	0.45 <sup>Ab</sup>	0.57 <sup>Aa</sup>	0.19 <sup>Ac</sup>	0.42 <sup>Ab</sup>	0.55 <sup>Aa</sup>
C22:5- $\omega$ 6	0.10 <sup>Ac</sup>	0.60 <sup>Ab</sup>	0.85 <sup>Aa</sup>	0.09 <sup>Ac</sup>	0.57 <sup>Ab</sup>	0.82 <sup>Aa</sup>
C22:5- $\omega$ 3	0.30 <sup>Ac</sup>	2.01 <sup>Ab</sup>	2.86 <sup>Aa</sup>	0.28 <sup>Ac</sup>	1.91 <sup>Ab</sup>	2.77 <sup>Aa</sup>
C22:6	0.05 <sup>Ac</sup>	4.22 <sup>Ab</sup>	6.30 <sup>Aa</sup>	0.04 <sup>Ac</sup>	4.00 <sup>Bb</sup>	6.11 <sup>Ba</sup>
Total	97.60	97.37	98.09	96.80	96.04	96.20

Small letters denote a statistically significant difference at the probability level of 0.05% between different burger samples. Capital letters denotes a statistically significant difference at the probability level of 0.05% of the pooled burger sample during the storage period.

**Table 2.** Fatty acid profile changes of different burger samples during the storage period

Fatty acids	Storage time-month					
	0			4		
	Control	Mix75%	Mix 50%	Control	Mix75%	Mix 50%
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C12:0	0.18 <sup>Aa</sup>	0.12 <sup>Ab</sup>	0.10 <sup>b</sup>	0.19 <sup>Aa</sup>	0.13 <sup>Ab</sup>	0.11 <sup>Ab</sup>
C14:0	2.50 <sup>Ba</sup>	2.42 <sup>Bab</sup>	2.39 <sup>Ab</sup>	2.75 <sup>Aa</sup>	2.66 <sup>Ab</sup>	2.47 <sup>Ab</sup>
C16:0	17.55 <sup>Bb</sup>	17.75 <sup>Bab</sup>	17.85 <sup>Ba</sup>	19.30 <sup>Aa</sup>	19.53 <sup>Aa</sup>	18.02 <sup>Ab</sup>
C18:0	2.14 <sup>Bc</sup>	3.03 <sup>Bb</sup>	3.48 <sup>Aa</sup>	2.35 <sup>Ab</sup>	3.34 <sup>Aa</sup>	3.56 <sup>Aa</sup>
C19:0	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C20:0	0.31 <sup>Aa</sup>	0.25 <sup>Aab</sup>	0.02 <sup>Ab</sup>	0.34 <sup>Aa</sup>	0.27 <sup>Aa</sup>	0.03 <sup>Ab</sup>
C21:0	0.00 <sup>Ac</sup>	0.46 <sup>Ab</sup>	0.70 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.51 <sup>Ab</sup>	0.75 <sup>Aa</sup>
C24:0	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C14:1	0.80 <sup>Aa</sup>	0.61 <sup>Ab</sup>	0.51 <sup>Ab</sup>	0.77 <sup>Aa</sup>	0.57 <sup>Ab</sup>	0.49 <sup>Ac</sup>
C16:1	3.52 <sup>Ac</sup>	5.30 <sup>Ab</sup>	6.19 <sup>Aa</sup>	3.38 <sup>Ac</sup>	5.03 <sup>Bb</sup>	6.01 <sup>Ba</sup>
C18:1	27.35 <sup>Aa</sup>	23.54 <sup>Ab</sup>	22.64 <sup>Ac</sup>	26.25 <sup>Ba</sup>	22.36 <sup>Bb</sup>	21.96 <sup>Bc</sup>
C20:1	0.00 <sup>Ac</sup>	0.33 <sup>Ab</sup>	0.49 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.31 <sup>Ab</sup>	0.47 <sup>Aa</sup>
C22:1	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C24:1	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C18:2	36.31 <sup>Aa</sup>	25.04 <sup>Ab</sup>	19.4 <sup>Ac</sup>	34.84 <sup>Ba</sup>	23.78 <sup>Bb</sup>	18.8 <sup>Bc</sup>
C18:3	5.65 <sup>Aa</sup>	5.42 <sup>Ab</sup>	5.31 <sup>Ab</sup>	5.43 <sup>Ba</sup>	5.14 <sup>Bb</sup>	5.15 <sup>Bb</sup>
C20:2	0.00 <sup>Ac</sup>	0.09 <sup>Ac</sup>	0.14 <sup>Ac</sup>	0.00 <sup>Ac</sup>	0.08 <sup>Ac</sup>	0.13 <sup>Ac</sup>
C20:3	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C20:4	0.60 <sup>Ac</sup>	2.64 <sup>Ab</sup>	3.66 <sup>Aa</sup>	0.58 <sup>Ac</sup>	2.50 <sup>Bb</sup>	3.55 <sup>Aa</sup>
C20:5	0.03 <sup>Ac</sup>	3.03 <sup>Ab</sup>	4.53 <sup>Aa</sup>	0.02 <sup>Ac</sup>	2.87 <sup>Bb</sup>	4.36 <sup>Ba</sup>
C22:2	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C22:4	0.20 <sup>Ac</sup>	0.45 <sup>Ab</sup>	0.57 <sup>Aa</sup>	0.19 <sup>Ac</sup>	0.42 <sup>Ab</sup>	0.55 <sup>Aa</sup>
C22:5- $\omega$ 6	0.10 <sup>Ac</sup>	0.60 <sup>Ab</sup>	0.85 <sup>Aa</sup>	0.09 <sup>Ac</sup>	0.57 <sup>Ab</sup>	0.82 <sup>Aa</sup>
C22:5- $\omega$ 3	0.30 <sup>Ac</sup>	2.01 <sup>Ab</sup>	2.86 <sup>Aa</sup>	0.28 <sup>Ac</sup>	1.91 <sup>Ab</sup>	2.77 <sup>Aa</sup>
C22:6	0.05 <sup>Ac</sup>	4.22 <sup>Ab</sup>	6.30 <sup>Aa</sup>	0.04 <sup>Ac</sup>	4.00 <sup>Bb</sup>	6.11 <sup>Ba</sup>
<b>Total</b>	<b>97.60</b>	<b>97.37</b>	<b>98.09</b>	<b>96.80</b>	<b>96.04</b>	<b>96.20</b>

Small letters denote a statistically significant difference at the probability level of 0.05% between different burger samples. Capital letters denotes a statistically significant difference at the probability level of 0.05% of the pooled burger sample during the storage period.

## تغییرات خواص ارگانولپتیکی

### چسبندگی بافت

#### نتایج:

افزایش میزان گوشت ماهی

در طول نگهداری

#### بحث:

دلیل کاهش چسبندگی، تخریب ساختار پروتئینی به علت اکسیداسیون و ایجاد پیوندهای عرضی بین گروه‌های تیول و آمین است.

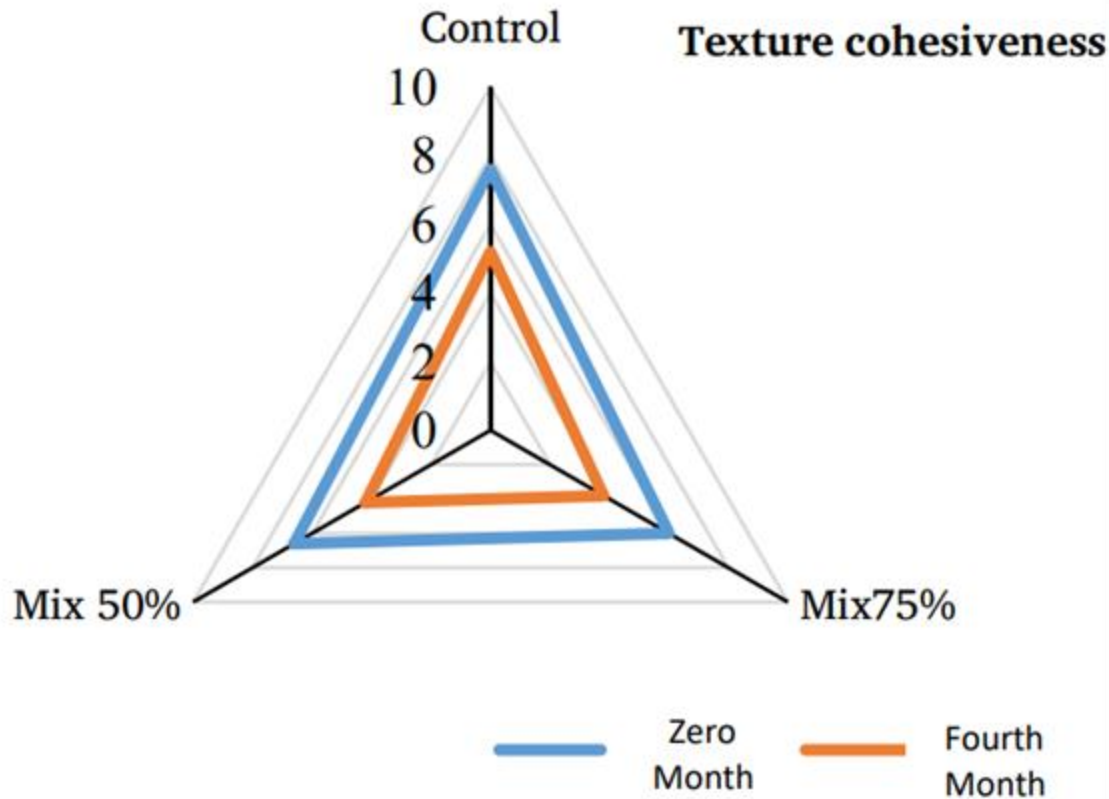


Fig. 9. Sensory evaluation of consolidated burger samples during the storage period.

## ● تغییرات خواص ارگانولپتیکی

### آبداری همبرگر

#### نتایج:

افزایش میزان گوشت ماهی ↓

در طول نگهداری ↓

#### بحث:

در نمونه همبرگر کنترل رطوبت بیشتر است که منجر به آبدارتر شدن بافت برگر میشود.

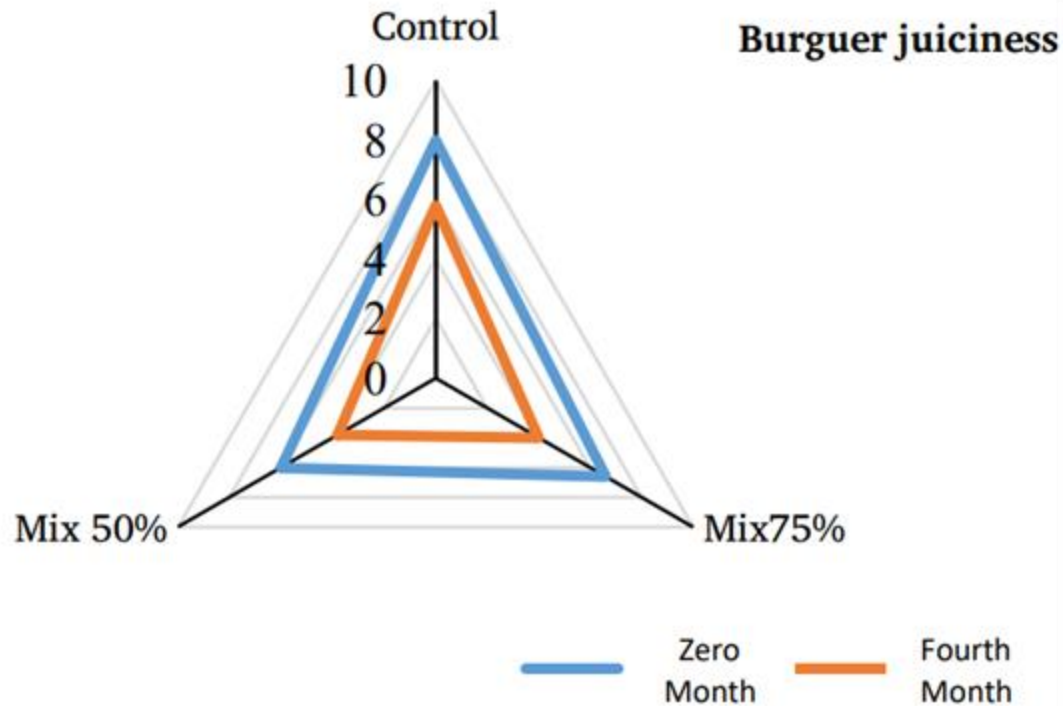


Fig. 9. Sensory evaluation of consolidated burger samples during the storage period.

## تغییرات خواص ارگانولپتیکی

نرمی بافت

نتایج:

افزایش میزان گوشت ماهی

در طول نگهداری

بحث:

در اثر اکسیداسیون چربی ها، ویژگی های حسی و محتوای مواد مغذی از بین میرود. افزایش شاخص هایی مثل عدد پراکسید و مقدار تیوباربیتوریک اسید نشان دهنده اکسیداسیون است.

در طول نگهداری همبرگر ها در سرما و افزایش هیدرولیز چربی و تجمع اسیدهای چرب آزاد منجر به کاهش شاخص های پذیرش محصول میشود.

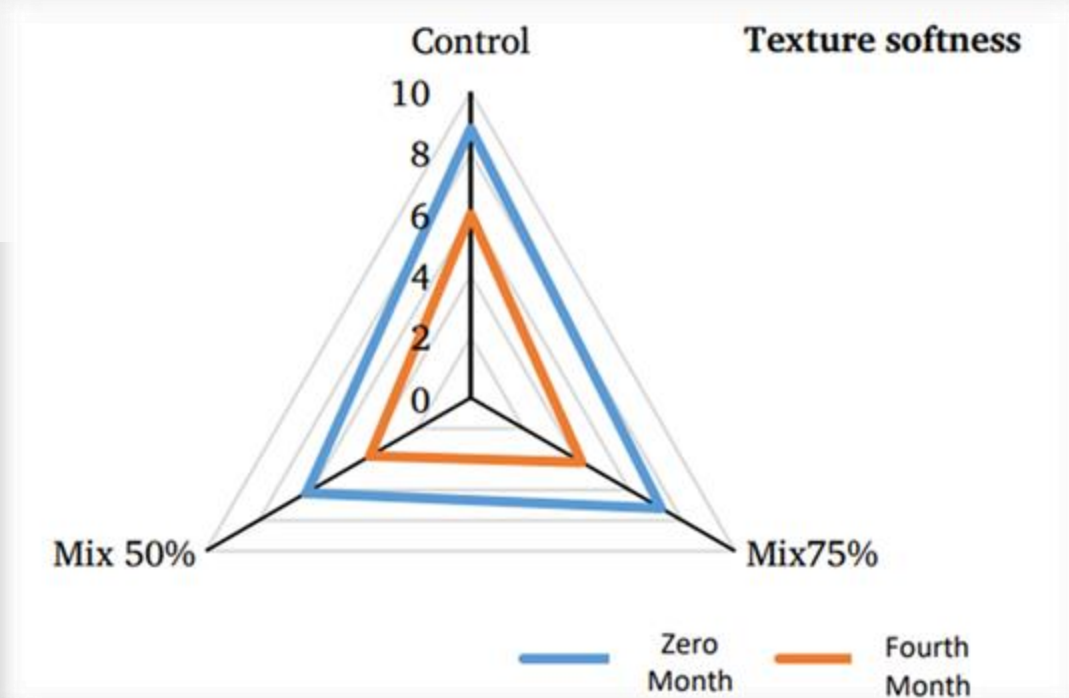


Fig. 9. Sensory evaluation of consolidated burger samples during the storage period.

## ● تغییرات خواص ارگانولپتیکی

### چسبندگی سطحی

#### نتایج:

↓ افزایش میزان گوشت ماهی  
↓ در طول نگهداری

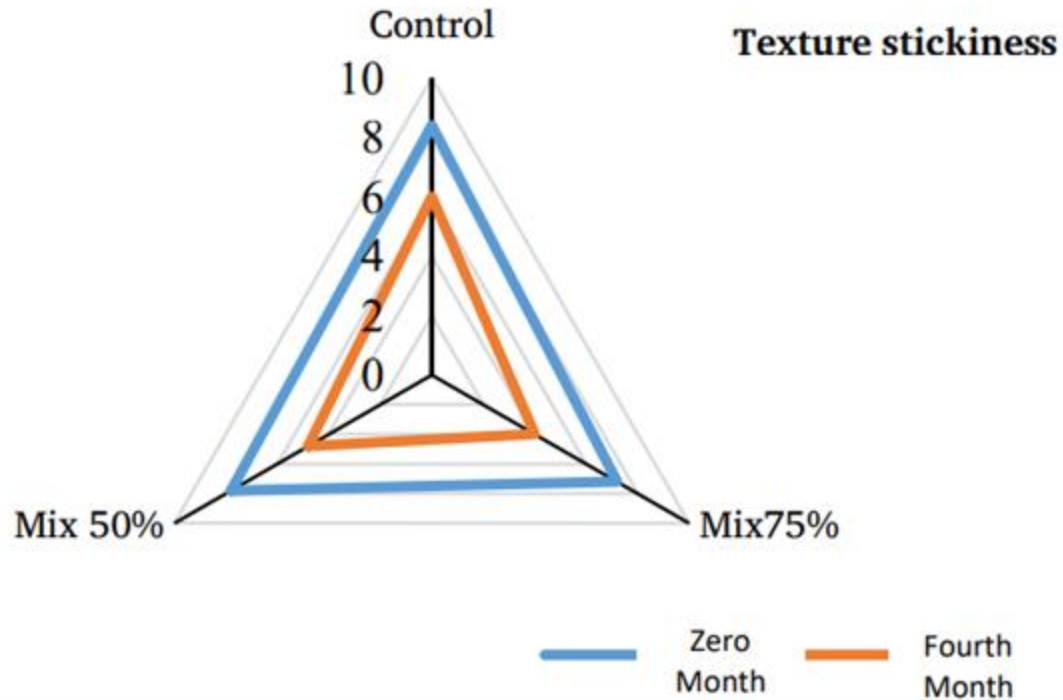


Fig. 9. Sensory evaluation of consolidated burger samples during the storage period.

## تغییرات خواص ارگانولپتیکی

### قابلیت جویدن

#### نتایج:

↓ افزایش میزان گوشت ماهی  
↓ در طول نگهداری

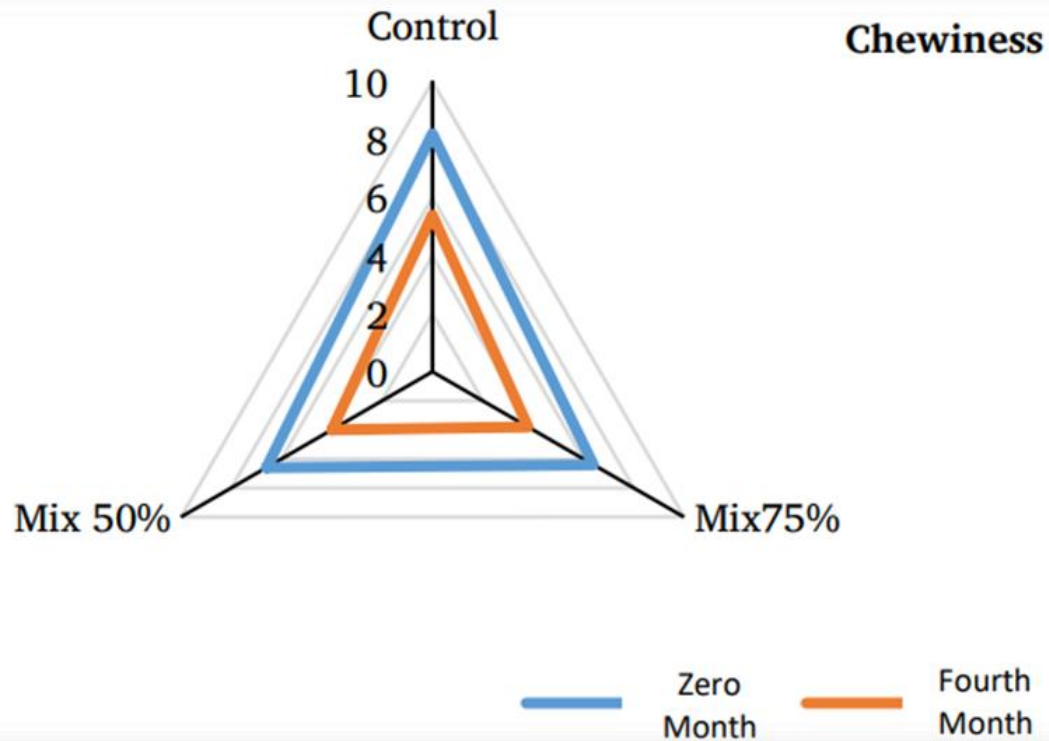


Fig. 9. Sensory evaluation of consolidated burger samples during the storage period.

## ● تغییرات خواص ارگانولپتیکی

پذیرش کلی

نتایج:

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↓ در طول نگهداری

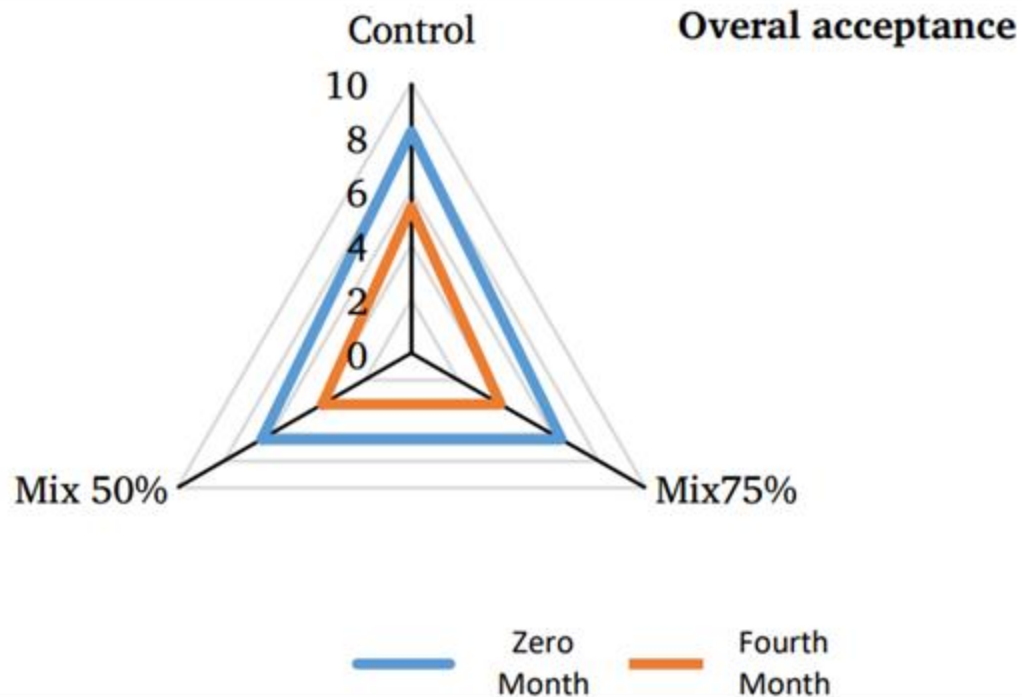


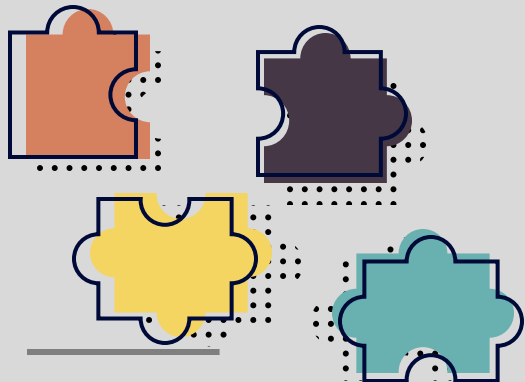
Fig. 9. Sensory evaluation of consolidated burger samples during the storage period.

## تغییرات در اثر گذشت مدت زمان نگهداری:

↓ پروتئین، چربی، رطوبت و خاکستر تمامه خواص مسی بافت و پذیرش کلی نمونه ها  
↑ عدد پراکسید، pH، عدد تیوباربیتوریک اسید و نیتروژن فرار

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↓ پروتئین، رطوبت، خاکستر و pH و میزان چربی، عدد پراکسید، اسید تیوباربیتوریک و نیتروژن فرار  
↑ میزان اسیدهای چرب لینولئیک و لینولنیک



اسیدهای چرب غیراشباع موجود در ماهی که بیشترین میزان را دارند، اسیدهای چرب لینولئیک، لینولنیک و آراشیدونیک، به ویژه ایکوزاپنتانویک اسید و دوکوزاهگزانویک اسید هستند، برگری که از ۵۰٪ گوشت ماهی تهیه شده باشد، منبع ارزشمندی از این ترکیبات محسوب می شود.

نتایج این تحقیق نشان می دهد که با مصرف یک برگر مخلوط ۵۰٪ می توان بخشی از نیاز بدن به اسیدهای چرب غیراشباع و پروتئین را تأمین کرد.





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### Author contributions

**Parvin Kaviani:** Data collection, Data analysis, Data analysis and interpretation, Writing the draft of the manuscript; **Babak Karami:** Presented the research idea and study design, Revise and edited the manuscript, Supervised the study, Approved the final version.

### Conflict of interest

There is no conflict of interest based on the writers.

تقدیر و تشکر

مشارکت های نویسندگان

تضاد منافع

Alexandre, S., Vital, A. C. P., Mottin, C., do Prado, R. M., Ornaghi, M. G., Ramos, T. R., Guerrero, A., Pilau, E. J., & do Prado, I. N. (2021). Use of alginate edible coating and basil (*Ocimum spp*) extracts on beef characteristics during storage. *Journal of food science and technology*, 58, 3835-3843 .

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Food Technology - Meat, Chicken, Fish and Their Products

### Study of Nutritional Value and Shelf life of the Consolidated Burger (Grass Carp-Red Meat) During Freezing Storage at -18 °C

Pages 117-128

[doi https://doi.org/10.22101/JRIFST.2023.387259.1441](https://doi.org/10.22101/JRIFST.2023.387259.1441)

Parvin Kaviani; Babak Karami

**Abstract** Nutritional value and shelf life of the consolidated burger (grass carp-red meat) during freezing storage at -18 °C was determined in this study. In recent years, with the change in lifestyle and the development of urban life, consuming semi-prepared foods has increased and meat products based on minced meat such as burgers have a major share among these foods in the modern lives.

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## **Abstract**

Nutritional value and shelf life of the consolidated burger (grass carp-red meat) during freezing storage at  $-18\text{ }^{\circ}\text{C}$  was determined in this study. In recent years, with the change in lifestyle and the development of urban life, consuming semi-prepared foods has increased and meat products based on minced meat such as burgers have a major share among these foods in the modern lives. In this study, a combined red meat (beef meat)-grass carp burger with different ratios of 0:100, 25:75, and 50:50 was prepared and stored at  $-18\text{ }^{\circ}\text{C}$  for 4 months. The value of protein, fat, moisture, ash pH, peroxide value, thiobarbituric acid value, volatile nitrogen bases, fatty acid profiles and sensory evaluation were determined on the first day and end of the storage period. Measuring parameters showed the amount of protein, fat, moisture, and ash decreased and the average pH, peroxide, thiobarbituric acid, and volatile basic nitrogen values increased over storage. With increasing the amount of fish meat used in the burger formulation, protein, moisture, ash, and pH values and sensory properties decreased and fat, peroxide, thiobarbituric acid, and volatile nitrogen values increased. The results of this study suggest that consuming Mix50% burger provides some parts of body's needs for unsaturated fatty acids and protein.



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**Study of Nutritional Value and Shelf life of the Consolidated Burger  
(Grass Carp-Red Meat) During Freezing Storage at -18 °C**

Parvin Kaviani<sup>1a</sup>, Babak Karami<sup>1a,\*</sup>

a- Department of Food Science and Technology, Faculty of Biological Sciences, Islamic Azad University, Tehran North Branch, Tehran, Iran

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### **Measurement of Volatile Basic Nitrogen**

The method proposed by Jeon *et al.* (2002) was used in order to measure volatile basic nitrogen. For this purpose, 10 g of Berger's sample, 2 g of magnesium oxide (Merk, Germany), 300 mL of water and a few pieces of grinding stone were added to the Kjeldal distillation flask **25 cm<sup>3</sup>** of 2% boric acid solution and few drops of methyl red reagent were added in an Erlenmeyer flask with a capacity of 500 to **700 cm<sup>3</sup>**, which was placed under the cooling part of the distillation apparatus as a receiver. After the distillation operation, the distilled solution was diluted with 0.1 normal titer sulfuric acid and the amount of sulfuric acid consumed was multiplied by 14, and in this way, the amount of volatile basic nitrogen was calculated in terms of mg per 100 g of meat.



### Math formulae

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$$\text{Nitrogen percentage} = \frac{\text{Acid normality} \times \text{Amount of acid used for titration} \times 0.014}{\text{Sample weight}} \times 100 \quad (1)$$



$$\text{Moisture percentage} = \frac{\text{weight of sample before drying} - \text{weight of sample after drying}}{\text{weight of sample}} \times 100 \quad (2)$$

$$\text{Ash percentage} = \frac{\text{plant weight and ash} - \text{plant weight}}{\text{sample weight}} \times 100 \quad (3)$$

## Tables

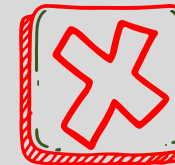
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Fatty acids	Storage time-month			
	0			
	Control	Mix75%	Mix 50%	Control
C8:0	0.00 <sup>Aa</sup>	0.02 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C12:0	0.18 <sup>Aa</sup>	0.12 <sup>Ab</sup>	0.10 <sup>b</sup>	0.19 <sup>Aa</sup>
C14:0	2.50 <sup>Ba</sup>	2.42 <sup>Bab</sup>	2.39 <sup>Ab</sup>	2.75 <sup>Aa</sup>



## References style

Text: In-text citations should follow the American Psychological Association's style of referencing. You are referred to the Publication Manual of the American Psychological Association, Seventh Edition, ISBN 978-1-4338-3215-4, copies of which can be ordered online. List: **References should first be sorted alphabetically and then,** if necessary, chronologically. More than one reference by the same author(s) in the same year must be identified by the letters a, b, c, etc. followed by the year of publication.

Examples:

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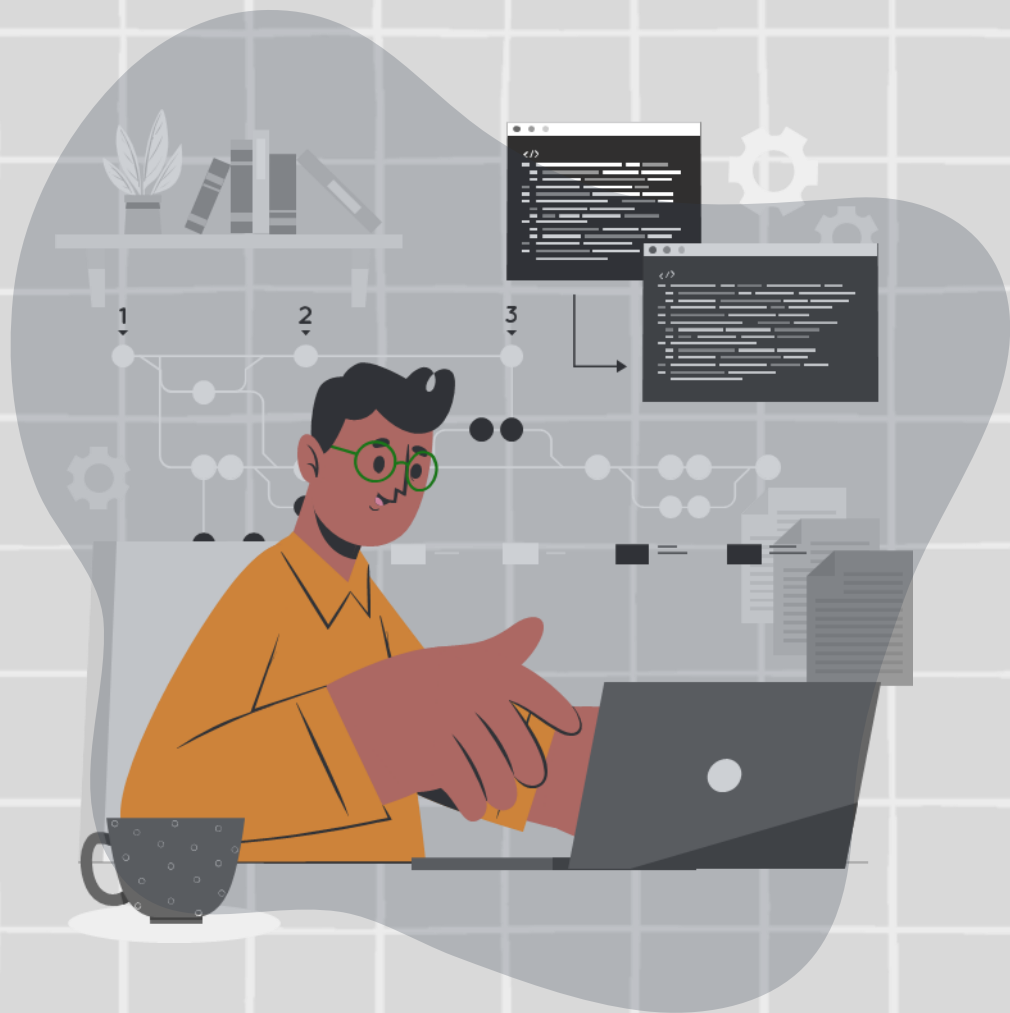
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# نقد ساختاری و علمی



## Study of Nutritional Value and Shelf life of the Consolidated Burger (Grass Carp-Red Meat) During Freezing Storage at -18 °C

Beef meat

### Keywords

Consolidated burger  
Grass carp  
Red meat  
Shelf life

Texture

بہتر بود از موارد زیر استفاده میشود.  
sensory properties, nutritional value

### Abstract

Nutritional value and shelf life of the consolidated burger (grass carp-red meat) during freezing storage at -18 °C was determined in this study. In recent years, with the change in lifestyle and the development of urban life, consuming semi-prepared foods has increased and meat products based on minced meat such as burgers have a major share among these foods in the modern lives. In this study, a combined red meat (beef meat)-grass carp burger with different ratios of 0:100, 25:75, and 50:50 was prepared and stored at -18 °C for 4 months. The value of protein, fat, moisture, ash pH, peroxide value, thiobarbituric acid

هدف پژوهش بهتر است  
در پاراگراف انتهایی چکیده  
ذکر بشود.

به این علت که همیشه اول گوشت ماهی و بعد گوشت قرمز ذکر شده، بهتر است اینها هم اول گوشت ماهی بیان شود.

علامت % باید نوشته میشود.  
مشخص نیست نسبت ها مربوط به کدام گوشت هست.

lifestyle and the development of urban life, consuming semi-prepared foods has increased and meat products based on minced meat such as burgers have a major share among these foods in the modern lives. In this study, a combined red meat (beef meat)-grass carp burger with different ratios of 0:100, 25:75, and 50:50 was prepared and stored at -18 °C for 4 months. The value of protein, fat, moisture, ash pH, peroxide value, thiobarbituric acid value, volatile nitrogen bases, fatty acid profiles and sensory evaluation were determined on the first day and end of the storage period. Measuring parameters showed the amount of protein, fat, moisture, and ash decreased and the average pH, peroxide, thiobarbituric acid, and volatile basic nitrogen values increased over storage. With increasing the amount of fish meat used in the burger formulation, protein, moisture, ash, and pH values and sensory properties decreased and fat, peroxide, thiobarbituric acid, and volatile nitrogen values increased. The results of this study suggest that consuming Mix50% burger provides some parts of body's needs for unsaturated fatty acids and protein.

بعد فاکستر باید " , " میگذاشت

۵۰/۵۰ گوشت گاو و ماهی فاصله گذاری

نتیجه گیری بسیار خلاصه و ضعیف

باید به صورت آماری بیان شود.  
مشخص نیست برای تمامی دادها صادق است یا خیر  
"in all samples"

ground meat

## Introduction

In recent years, with evolving lifestyle and the development of urban life, preparing and cooking food at home has declined and the propensity to consume ready-made and semi-prepared foods has increased. Meat products based on minced meat such as burgers account for a major share of these nutritional needs of modern lives (Taşkaya *et al.*, 2003). The red meat used in the preparation of burgers includes beef, veal, sheep, and lamb. Red meat is a major source of proteins with some valuable nutrients such as vitamins and minerals (Pal *et al.*, 2018). Despite these benefits, overconsumption of red meat has negative effects on health and can increase blood cholesterol or cause cardiovascular diseases (Wolk, 2017). Nowadays, processed products made from red meat have gained great attention among the human society, one of which is hamburger, prepared from minced red meat with spices and vegetables (Velioglu *et al.*, 2010; Wolk, 2017). Fish meat is very easy to digest because of the low connective texture, short length of connective texture strands and the absence of elastin, also in terms of water-soluble vitamins such as vitamin B1, B2, pantothenic acid, niacin, and various fat-soluble vitamins such as vitamins, it is considered a rich source of calcium, iron, calcium, phosphorus, selenium, and iodine (Gokoglu & Yerlikaya, 2015).

بهتر بود این پاراگراف قبل از معرفی گوشت قرمز نوشته میشد.

بهتر بود می نوشت myofibrill

باید نوع ویتامین ها محلول در چربی رو مینوشت.  
such as K, A, D, E

کلسیم دوبار نوشته شده.

Today, the consumption of fish as a health food , preventive of all kinds of diseases ~~has been approved by~~ scientists and nutritional science experts (Oliva-Teles, 2012), and providing it and placing it in the household food basket is one of the concerns of those in charge of production and nutrition affairs (Fathi *et al.*, 2014). Most of the fat in fish is unsaturated fatty acids Fish is a very valuable source of unsaturated fatty acids such as linoleic acid, linolenic acid, arachidonic acid, and especially omega-3 fatty acids (such as docosahexaenoic acid and docosapentaenoic acid), (Öz, 2018; Shekarabi *et al.*, 2020). Among the positive effects of omega-3, we can mention the reduction of the risks of blood pressure, cardiovascular diseases, and some cancers (Vianna *et al.*, 2020). Also, the therapeutic effects of these compounds have been recognized. The amount of cholesterol and fat in fish is much less compared to red meat Fish has a very high nutritional value and contains most of the useful and essential nutrients for humans alone Therefore, the special feature of fish that makes it important among other foods is the type of fat in it, which is more than the unsaturated type, and they do not increase cholesterol and undesirable fats in the blood

جمله غیر علمی

اضافه گویی-تکراری

این جمله مطلق نیست. گوشت ماهی تمام مواد ضروری را ندارد.

نیازی به آوردن کلمه red نیست. "Beef meat"

(Watson *et al.*, 2018). Consolidated burger is produced by combining different types of meat in order to reduce cost and increase health (Fathi *et al.*, 2014). In this research, a consolidated red beef meat and fish burger were investigated. The fish used in this project is Grass Carp fish, which is one of the types of freshwater fish widely cultivated in China, and this fish is also bred in Iran, which has been introduced and accepted in Europe and America due to its fast growth, healthy breeding, high yield, low cost, and high nutritional value. This fish has an elongated and wide body with short and strong fins, which is similar to a white fish, but its body is covered with large scales that turn bright yellow. Their main food is fodder and aquatic plants and they are introduced to aquatic environments to control plants (Liu *et al.*, 2020). Considering the increasing popularity of hamburgers among people of different ages, we decided to prepare a consolidated burger of red meat and fish, which can be a healthy and low cost product to the market (Liu *et al.*, 2020).

was

اضافی است

اطلاعات غیر ضروری و اضافه گویی

غیر علمی  
the aim of this study...

## Materials and methods

### Preparation of Samples

In order to prepare and produce samples, first, 30 g carp fish (Amur fish) were prepared from fish breeding ponds located in Anzali port (Guilan province, Iran) and transferred to the laboratory of the National Aquatic Center. After cutting off the head and emptying the intestines they were washed several times. The fish meat was completely cleaned and separated from the skin and other bones using a deboning device (Chuangbo CBYU-150, China). In order to reduce the specific smell of fish, fish meat was washed with 0.3% salt in the proportion of four parts water and one-part fish. 3 kg of red meat (beef meat), which was prepared from halal meat animals and in accordance with the characteristics mentioned in the national standard of Iran No. 2304 (Iranian National Standardization Organization, 2016), was ground with a meat grinder (TZ, China) with a diameter of 3 mm and kept in a refrigerator with 4 °C for mixing with other ingredients.

باید ویرگول باشد.

عدد در مقایسه با مقدار گوشت گاو  
غیر منطقی هست. احتمالا kg

eviscerating

بهتر بود می نوشت:  
at a ratio of 4:1 (water:fish)

at

and شماره استاندارد باید ذکر شود.

### Preparation of Burgers

In order to prepare burgers, fish meat and red meat are ground together or separated to the extent of 70% with other permitted spices according to the national standard of Iran with 30% of additives (bread powder 11%, onion 9%, garlic powder 01 0.0%, tomato paste 0.2%, lemon juice 0.095%, salt 1.1%, spices 0.6%, egg white powder 0.2%, vegetables 1.85%, and soy 5%) poured in the mixer machine and mixed well with each other. At this stage three treatments were prepared: control treatment (containing 100% red meat), MIX treatment 75% (containing 25% fish meat and 75% red meat), and treatment (containing 50% fish meat and 50% red meat). Then, using a manual molding machine, samples with a diameter of 8 cm and a thickness of 1 cm were prepared. They were placed in polyethylene wrappers, packed, and marked in groups of 5, and stored at -18 °C for a period of time. They were kept for 4 months. Sampling was done randomly on day zero and month 4, and then the relevant tests were done.

مشخص نبودن درصد ادویه پودر سیر

باید قبلش با نسبتهای تیمار مخلوط و سپس چرخ شوند.

نیازی نیست با ظروف بزرگ نوشته شود.

بعد از مخلوط کردن به نسبت های مختلف تقسیم کرده.

معمولا برای بیان تیمارها، ترکیب افزودنی بولد میشود. بنابراین بهتر بود بجای mix 75%، مینوشتت mix25%.

modeling

درست نبودن علامت درجه سانتی گراد

باید مینوشتت 50% mix treatment

اضافه گویی

تعداد تکرارها مشخص نیست، چرا بین بازده زمانی 0-4 ماه نمونه برداری نداشت؟

method, in the presence of sulfuric acid and a catalyst, the burger sample is digested, then the nitrogen atom is converted into ammonium sulfate by an alkaline mediator of nitrogen-containing organic compounds, and then it is absorbed in hydrochloric acid or boric acid, and its amount is determined by titration with an acid. Therefore, the amount of protein was determined in three stages of digestion, distillation and titration, and the amount of protein was calculated using the following formula:

(1)

$$\text{Nitrogen percentage} = \frac{\text{Acid normality} \times \text{Amount of acid used for titration} \times 0.014}{\text{Sample weight}} \times 100$$



این درصد پروتئین هست نه درصد نیتروژن!

اگر با دستگاه اندازه گیری شده که توضیحات کاملا اضافی و غیر ضروری است و باید نام و مشخصات دستگاه ذکر میشد.

اگر به روش دستی اندازه گیری شده باید مقدار نمونه، نوع کاتالیست، زمان، دما و... کامل ذکر میشد.

### Fat Measurement

Soxhlet method was used to measure the amount of fat in burgers. For this purpose, 5 gr of the dried homogenized sample of the moisture measurement stage was placed in an Erlenmeyer and 35 mL of concentrated hydrochloric acid (Merk, Germany), and 65 mL of distilled water were added to it and heated. Then filter the contents of Erlenmeyer with filter paper and wash the filter paper with hot water until the water does not change the blue color of litmus paper. After drying the filter paper and its contents in the oven (Memmert UN30, Germany) and cooling in the desiccator (Guide Medlab 180mm, China), it was placed in the extraction cartridge. Extraction of fat from the obtained sample was done with the solvent of dipetroleum ether using a Soxhlet apparatus (Schott Duran Soxhlet Extractor 100ml, Poland). At the end, the extraction flask was removed from the device and the remaining solvent was evaporated using a water bath (Bligh & Dyer, 1959).

g

غلظت؟

طولانی و گیج کننده  
until filtrate is neutral

چند درجه؟ چه مدت؟

فرمول مناسبه  
درصد چربی!!

### Moisture Measurement

To measure the moisture content, the samples were dried in an oven at 105 °C for 12 h and measured indirectly (AOAC, 2006). Using the weight of the dried sample, the moisture content of the sample after reaching a constant weight was calculated according to the following formula:

Moisture percentage =

$$\frac{\text{weight of sample before drying} - \text{weight of sample after drying}}{\text{weight of sample}} \times 100 \quad (2)$$

مقدار جرم بیان نشده

جمله نامفهوم

until all organic matter was removed,  
leaving only the mineral residues

مقدار وزن نمونه و مدت زمان آن ذکر نشده است.

### Ash Measurement

In order to measure the ash, it was measured at a temperature of 500-550 °C by removing organic materials and residues and mineral residues. Using the weight of the dried sample, the ash content of the samples was calculated according to the following formula (AOAC, 2006):

بوته چینی:  
Crucible

$$\text{Ash percentage} = \frac{\text{plant weight and ash} - \text{plant weight}}{\text{sample weight}} \times 100 \quad (3)$$

### pH Measurement

For this purpose, 5 g of burger sample was added to 20 mL of distilled water and homogenized for 2 min by homogenizer (Stomacher 400, United Kingdom). The resulting mixture was filtered through Whatman Medium No. 2 paper and readjust in 50 mL volumetric flask. Then, the pH was measured by a calibrated pH meter in triplicate (Lee & Yoon, 2001).

نام و اطلاعات دستگاه ذکر نشده.

بهتر بود اختصار (PV) اینجا آورده بشه.

**Peroxide Value**

In order to determine the peroxide value in the samples, the oil of the samples was extracted using the Soxhlet method (Volpe et al., 2015) About 5 g of oil extracted by Soxhlet method was weighed in a 250 mL Erlenmeyer flask and 30 mL of chloroform acetic acid solution (Merk, Germany) was added to the oil with a ratio of 2:3 and mixed completely, and then 0.5 mL of saturated potassium iodide (Merk, Germany) 50 mL of distilled water and 0.5 mL of 1% starch solution were added. The released iodide was titrated with 0.1 normal thiosulfate (Merk, Germany) until the yellow color disappeared. During the titration, the mixture was stirred vigorously to separate the iodine from the chloroform layer. All procedures were performed for the control sample without oil, finally, the peroxide value was expressed in milliequivalents of oxygen per 1000 g of oil using the following formula (AOAC, 2006):

این فرانس، با فرنسی که برای استخراج روغن در اندازه گیری چربی گفته متفاوت است.

واحد حجمی / حجمی

بهتر بود با N نوشته شود.

sodium thiosulfate

(4)

sodium thiosulfate

$$\text{Peroxide value} = \frac{\text{volume of thiosulfate used in milliliters} \times \text{molarity of sodium thiosulfate} \times 1000}{\text{weight of oil in terms of oil}}$$

Weight of oil

بهتر بود اختصار در پرانتز نوشته میشد و در ادامه به جای تکرار کل کلمه در متن، از اختصار استفاده میشد.

for thiobarbituric acid reactive substances determination (measurement)

### Measurement of Thiobarbituric Acid Value

For thiobarbituric acid 5 g of burger sample and 20 mL of trichloroacetic acid (5%), (Merk, Germany) were homogenized for 5 min. The homogenized mixture was centrifuged at 12,000 g for 10 min at 4 °C. 4 mL of the supernatant liquid was mixed with 4 mL of thiobarbituric acid and incubated in a water bath at 100 °C for 60 min. The absorbance of the supernatant was measured at 532 nm by Spectrophotometer Uv/Vis (Rayleigh, China). The thiobarbituric acid value was calculated using the malondialdehyde standard curve and the results were shown in micromoles of malondialdehyde per gram (Jridi *et al.*, 2017).

قبلش باید علامت ضرب میزاشت.

آیا با دستگاه انجام شده؟  
مشخصات دستگاه؟  
در چه دوری؟ با چه سرعتی؟

غلظت ذکر نشده است.

در فرانس پس از بن ماری مجدد محلول سانتریفوژ شده و سپس جذب سوپرناتانت گرفته میشود.

μmoles

Thiobarbituric acid فرمول غلط

$$\frac{\text{measured optical absorbance}}{\text{optical tube thickness in centimeters}} \times \text{sample weight in grams} \quad (5)$$

## Total volatile basic nitrogen (TVB-N)

### Measurement of Volatile Basic Nitrogen

The method proposed by Jeon *et al.* (2002) was used in order to measure volatile basic nitrogen. For this purpose, 10 g of Berger's sample, 2 g of magnesium oxide (Merk, Germany), 300 mL of water and a few pieces of grinding stone were added to the Kjeldahl distillation flask. 25 cm<sup>3</sup> of 2% boric acid solution and few drops of methyl red reagent were added in an Erlenmeyer flask with a capacity of 500 to 700 cm<sup>3</sup>, which was placed under the cooling part of the distillation apparatus as a receiver. After the distillation operation, the distilled solution was diluted with 0.1 normal titer sulfuric acid and the amount of sulfuric acid consumed was multiplied by 14, and in this way, the amount of volatile basic nitrogen was calculated in terms of mg per 100 g of meat.

$$\text{TVB-N (mg/100 g)} = V \times N \times 14$$

Burger  
نیازی به s نیست.

Kjeldahl

titrated with 0.1 N  
sulfuric acid

N

Burger

بهتر بود فرمول  
نوشته شود.

boiling stone

بر اساس SI نیست.

اضافی

حجم اسید مصرفی باید  
ضربدر نرمالیته اسید و ۱۴  
شود که اینجا به نرمالیته  
اشاره نشده است.

boron trifluoride–methanol ( $\text{BF}_3$ –methanol)

### *Measurement of Fatty Acid Profile*

In order to measure the profile of fatty acids, 1 g of oil obtained from different burger samples was placed in a flask with 20 mL of methanolic potash of 1 w/v% , for 25 min under reflux and then 12 mL of fluorine bromine was added to the contents of the flask through refrigerant and boiled slowly for 10 min. After turning off the heat, sodium chloride solution was added to the aqueous phase. The upper hexane phase containing methyl ester fatty acids was removed and one microliter was

Extracted

KOH

Cooling

مقدار غلظت ذکر نشده.

بهتر به عدد نوشته شود.  $\mu\text{lit}$

immediately injected into the gas chromatograph (Shimadzu, GC-2010 pro, Japan).

1  $\mu\text{L}$  of the methyl ester sample was injected into the gas chromatograph using a microliter syringe. The gas chromatography device was equipped with a flame ionization detector, and the capillary column was made of fused silica of the bonded phase type. Helium gas with a pressure of 25 bar with a purity of 99.99% was used as carrier gas. The detector and injector temperatures were 255 and 270  $^{\circ}\text{C}$ , respectively. After injecting the sample into the gas chromatography device, a curve was drawn and the inhibition time of each fatty acid was compared with the curve of the standard fatty acid and its inhibition time. In this way, the type and number of fatty acids in the tested sample was determined (Botinestean *et al.*, 2012).

جمله تکراری است.

باید مشخصات ستون ذکر شود.

retention time

در مقیاس ها از ۵ نقطه استفاده شده.

### Sensory Characteristics

For this purpose, the **nine-point** hedonic method (1 = very bad, 2 = bad, 3 = moderate, 4 = good, and 5 = very good) was tested in terms of color, smell, taste, texture, and overall acceptance. The sensory evaluation panel had 12 **male** trained members. 6 of them **was** male and 6 of them **was** female with range of 30 to 45 years old. The consolidated burger samples were cooked using a **microwave** oven at 70 °C (700 watts) for 7 min and the reference sample was **market hamburger**. Fresh water was used for drinking between each assessment stage (Liu *et al.*, 2020; Tometri *et al.*, 2020). **Table (1)** shows the **sensory** characteristics of the sample in the sensory evaluation test.

were

اضافی است.

مشخصات دستگاه ذکر نشده.

مرجع مناسبی نیست.  
مشخصات گفته نشده.

با توجه به جدول، این پارامترها فقط مربوط به بافت همبرگر است نه خواص حسی.

چون با توجه به نتایج، هم تیمارها و هم زمان مقایسه شده است، بنابراین ANOVA دو طرفه هست نه یک طرفه!

## Statistical Analysis

The analysis of the results obtained in the associated tests was carried out in the form of a completely random design using the **one-way ANOVA** analysis of variance method at the 95% confidence level, and T-test pairwise test was used in order to compare the pairs of samples during the beginning and end of **the maintenance** period. **Comparison of means** was done using SPSS version 20 software. **In order to reduce the error** all experiments were performed in three replicates.

storage ←

با چه روشی؟

Tukey, Duncan, LSD

افزافی و غیرعلمی

## Results and discussion

### Protein changes

In this research, for the first time, red meat, and grass carp fish meat have been used to produce a consolidated burger, and its physicochemical and sensory changes during the storage period will be investigated. The results for protein changes of different consolidated burger samples during 4 months of storage at -18 °C have been revealed in Fig. (1). As it is observed, with the passage of storage time for 4 months, the amount of protein in all three investigated samples has decreased significantly ( $t < 0.0001$  for all three treatments). By increasing the amount of fish meat used in the formulation from zero% in the control sample (1.39%) to 50% in the Mix50% sample (2.45%), the amount of protein reduction has increased. In other words, in the sample that contains higher amounts of fish meat, protein breakdown is higher. Also, adding fish meat to the sample caused a significant decline in the protein percentage in the samples, so that the highest and lowest protein percentages were obtained at the beginning and end of the storage period, respectively, in the control sample and the Mix50% sample ( $t_0$ :  $df = 2,8$ ;  $F = 5292.60$ ;  $P < 0.0001$ ;  $t_4$ :  $df = 2,8$ ;  $F = 1018.98$ ;  $P < 0.0001$ ).

were investigated

در ANOVA از T استفاده نمیشود.  
ضمن اینکه در شکل هم p گزارش شده.

بهرتر بود به صورت عدد نمایش داده میشد.

اضافی

تغییرات نامفهوم هستند.

به صورت زیر بازنویسی شود:

so that the highest and lowest protein percentages at the beginning and end of the storage period, were obtained in the control sample and the Mix50% sample, respectively.

species

The protein content in fish varies from 15-20% depending on their type and the important point is that the absorption coefficient of fish protein in the human body is equal to 96% (Fathi *et al.*, 2014). The longer the shelf life increases, the release rate of nitrogen substances increases over time which lead to its elimination from the main components of the protein chain. Hence, a decrease in the amount of protein in the treatments during storage in freezing conditions will occur. It is worth mentioning that this decline occurs more at higher temperatures (above zero) which leads to more reduction in protein percentage. If the storage temperature of the product is lower than -18 °C, this reduction will occur less. Similar results regarding the decrease in the protein percentage of burgers prepared from burger samples prepared from Klika fish and carp (Fathi *et al.*, 2014), burger samples prepared from rainbow trout (Taşkaya *et al.*, 2003), Burgers produced from mirror carp surimi (Tokur *et al.*, 2006), *Catla catla* fish burgers (Vanitha *et al.*, 2015), and Common carp (*Cyprinus carpio*), (Bavitha *et al.*, 2016) have been reported, which is in line with the results of the present study.

during storage

اضافی

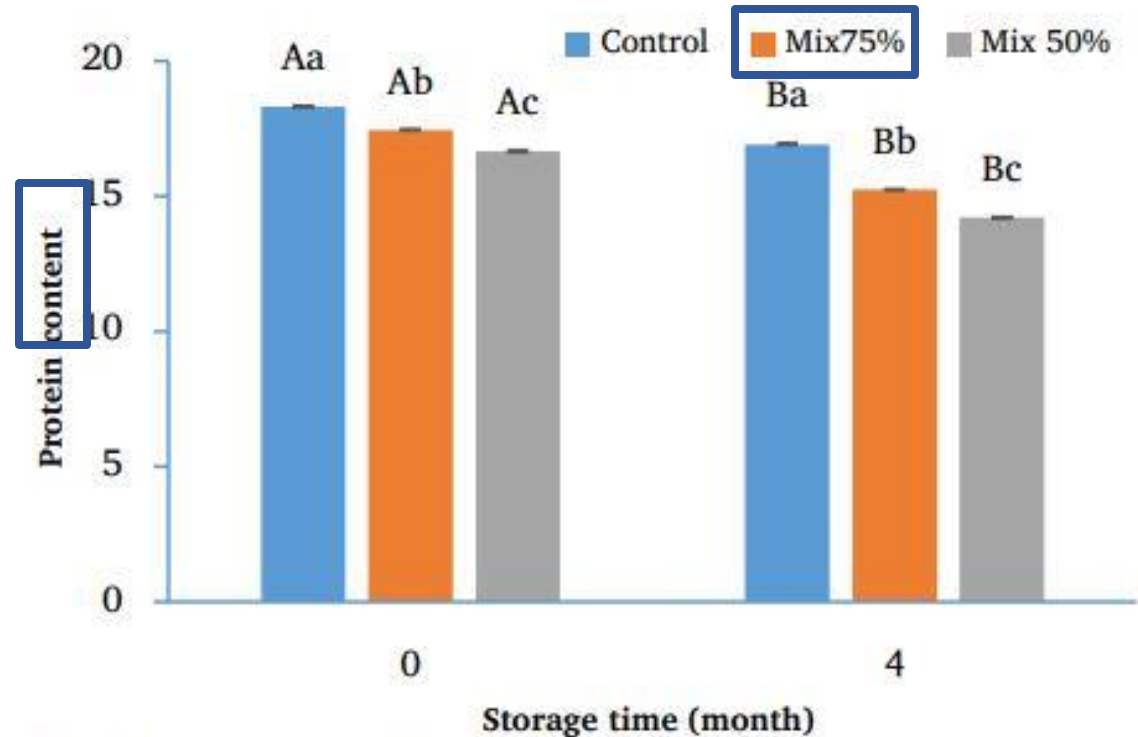
اضافی

اضافی

اضافی

فاصله گذاری

protein percentage  
protein content (%)



**Fig. 1.** Changes of consolidated burger protein during the storage period. Small letters indicate significant differences between different burger samples. Capital letters indicate a significant difference percent of the consolidated burger sample during the storage period ( $P < 0.05$ ).

افزافی

اعداد دقیق قابل تفمین  
نیستند، بهتر است یا در متن  
یا زیر نمودار، جدول اعداد را  
گزارش کند.

### *Fat changes*

The results for the fat changes of different consolidated burger samples during 4 months of storage at -18 °C have been illustrated in Fig. (2). As can be seen, with the passage of storage time for 4 months, the fat content in all three examined samples has decreased significantly ( $t < 0.0001$  for all three treatments). Also, with the increase in the amount of fish meat used in the formulation, the amount of fat has increased significantly ( $t_0$ :  $df = 2,8$ ;  $F = 2587.87$ ;  $P < 0.0001$ ;  $t_4$ :  $df = 2,8$ ;  $F = 429.50$ ;  $P < 0.0001$ ) In other words, lipociasis is higher in the sample containing higher amounts of fish meat. The reduction of fat during the freezing storage period depends on the freezing conditions (slow or rapid freezing),

دلیل توضیح داده نشده است.

نمایش ۳، تیمار ماه صفر و ۴ ماه بوده که بهتر بود با  $t_0$  و  $t_4$  اینجا منظور از میداد و اینکه اگر اختصار استفاده میکنه قبلا باید در متن به این اختصارات یا علائم اشاره میکرد. این مورد در تمام متن صادق است.

آوردن این جمله با شروع "به عبارت دیگر" اصلا معنی نمیده چون ربطی به جمله قبل نداره.

can reduce the percentage of fat at the end of the product's storage period. The final reduction of total fat amounts in the measured samples is due to the effect of enzymes effective in the hydrolytic corruption of fat, especially cold-resistant lipases and its conversion to free fatty acids and fat oxidation in the presence of oxygen. Similar results regarding the reduction of fat have been obtained regarding the reduction of fat in gray and golden mullet and anchovy sprat (or sprat and carp fish) during the storage time (Fathi *et al.*, 2014). Moreover, Jorjani (2013) reported that the changes in the total fat percentage of common carp fish burger samples during storage at -18 °C decreased and between 6.00-7.01%, which is in accordance with the results obtained from the present study. دلیل توضیح داده نشده است.

اضافی

lipolytic enzyme

تکراری و اضافی

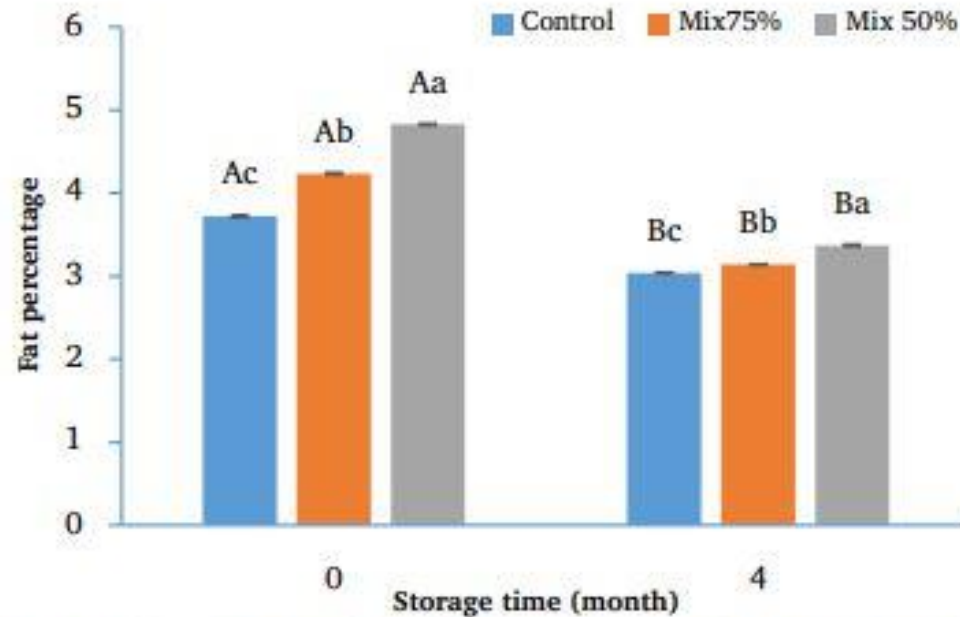


Fig. 2. Changes in consolidated burger fat during the storage period. Small letters represent significant differences between different burger samples. Capital letters denote a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

رایج تر است. Indicate



indicate

### Moisture changes

The results for the changes in moisture content of different consolidated burger samples during 4 months of storage at 18 °C have been shown in Fig. (3). As can be seen, with the passage of storage time for 4 months, the moisture content in all three investigated samples decreased significantly ( $t < 0.0001$  for all three treatments). Fathi *et al.* (2014) also obtained similar results regarding moisture reduction in

burger samples prepared from sprat and carp fish stored at -18 °C during storage. Vanitha *et al.* (2015) presented a decrease in the trend of moisture changes in fish burger samples during storage in cold conditions. It was **expected** that the moisture content would increase during the storage period, but considering that the samples were placed in polyethylene plastic after being prepared, not only there was no increase in humidity, but also a significant decrease **was** occurred. In line with our study, the moisture content of beef slices decreased significantly as a function of cold storage time (Alizadeh Behbahani *et al.*, 2021; Kiarsi *et al.*, 2020). A **decrease** in the moisture content was also noticed in fish burgers from over a **19-days** period at **refrigeration** by Bavitha *et al.* (2016).

به چه علت؟

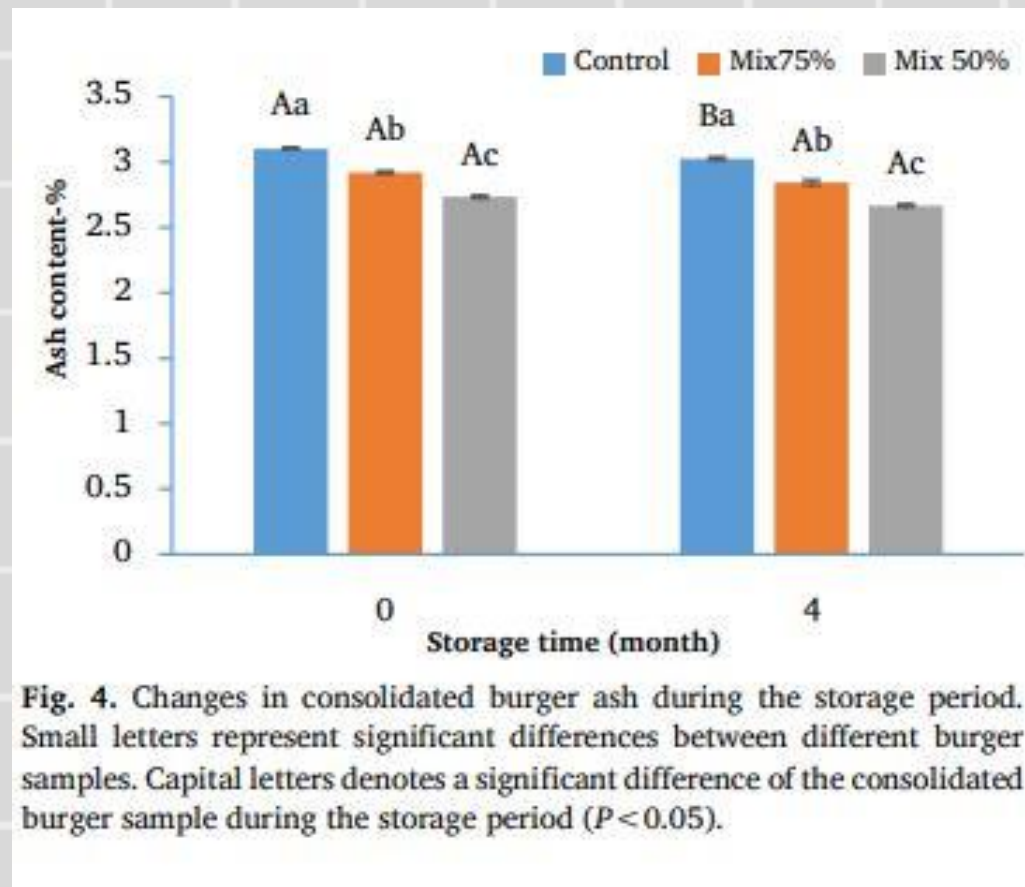
اضافی

refrigerator or refrigeration condition

Also, with the increase in the amount of fish meat used in the formulation, the moisture percentage of the samples decreased significantly ( $t_0: df=2,8; F=776.45; P<0.0001; t_4: df=2,8; F=450.03; P<0.0001$ ). Similarly, Parvizi and Moosavi-Nasab (2021) stated that moisture value in raw surimi was much higher than that in fish burger, maybe because of presence of additives in fish burger which can absorb water and decrease the moisture content of fish burger (Park, 2005).

علت توضیح داده نشده  
دلیلی که در ادامه گفته منطقی  
نیست چون افزودنی تمام برگرها در  
این مطالعه یکسان بوده

معمولا نمودارها بعد از متن توضیح آن شکل می آید. اینجا اول نمودار اومده بعد متن در مورد pH هم همینطور.



### Ash changes

The results for the ash changes of different consolidated burger samples during four months of storage at -18 °C have been shown in Fig. (4). As the results show, the ash content in the control sample decreased significantly with the passage of storage time for 4 months. However, no significant difference was observed in the amount of ash in the other two samples during storage time (Control:  $t=0.006$ , Mix75%:  $t=0.0303$ , Mix50%:  $t=0.0172$ ). Also, the amount of ash decreased significantly with the increase in the amount of red meat used in the formulation ( $t_0$ :  $df=2,8$ ;  $F=288.78$ ;  $P<0.0001$ ;  $t_4$ :  $df=2,8$ ;  $F=138.87$ ;  $P<0.0001$ ). Nemati *et al.* (2009) reported the amount of ash in burger samples with equal amounts of fish and red meat to be 2.75%.

با نمودار مغایرت دارد.

گوشت ماهی با نمودار مطابقت داشته باشد

جمله بی ربط است. باید دلیلی برای کاهش فاکتور ارائه میشد.

### pH changes

The pH value is not suggested as a reliable factor for measuring spoilage and is only used as auxiliary tool to estimate the quality of meat, fish and products prepared from them. This factor is influenced by other chemical, sensory, and microbial factors (Jorjani, 2013). The results related to the pH changes of different consolidated burger samples during four months of storage at -18 °C have been shown in Fig. (5). As is observed, with the passage of storage time for 4 months, the value of pH has increased in all three investigated samples ( $t < 0.0001$  for all three treatments).

Microbial and enzymatic activities during the storage period increased the pH values of all samples over time.

The increase in the pH of meat samples during the storage period is due to the use of amino acids and protein reserves as substrates for activities of bacteria. As a result, they produce volatile compounds such as ammonia and trimethylamine and the accumulation of amino acids and amino acid decomposition products increase the pH (Ruiz-Capillas & Moral, 2002). Meat contains endogenous and microbial enzymes such as proteases and lipases that affect the pH of meat. Jorjani

(2013) reported an upward trend for the pH of carp burger samples during 4 months of storage at -18 °C, which is in line with the results of the present study. Tokur *et al.* (2006)

reported the fluctuating pH changes in fish fingers obtained from washed and unwashed minced meat of common carp

پس بهتر بود آنالیز میکروبی هم در مطالعه انجام میشد.

نباید با قطعیت در یک مقاله علمی دلیل را به نتایج نسبت داد.  
بهتر بود مینوشت:

“The potential microbial and enzymatic activities in meat during storage may contribute to an increase in pH.”

(فرنس اشتباه)

Consistent with the obtained results

freezing storage

during 6 months of storage in a cold storage at  $-18\text{ }^{\circ}\text{C}$  (Tokur *et al.*, 2006). In consistent to obtained results all beef slices samples in previous studies (Alizadeh Behbahani *et al.*, 2021; Kiarsi *et al.*, 2020) experienced an increase in pH value as a function of storage time.

Although there was a significant difference between the sample containing 50% fish meat and the other two samples in terms of pH with a higher pH at the beginning of the storage period, the lowest increase in pH (0.26) was related to this sample. The largest change in pH belonged to the control sample (0.58), which was completely prepared from red meat ( $t_0$ :  $df=2,8$ ;  $F=37.09$ ;  $P=0.0004$ ;  $t_4$ :  $df=2,8$ ;  $F=62.69$ ;  $P<0.0001$ ) Indeed, adding fish could suppress the growth of bacteria and fungi and subsequently lower the pH increase.

کل پاراگراف فیلی گیج  
کننده و مبهم. نیاز به  
بازنویسی دارد.

عبارت داخل پرانتز به تفاوت معنادار نمونه ها با هم در طول  
زمان اشاره دارد و ربطی به جمله قبل نوشته شده ندارد.

غیر علمی

افزودن گوشت ماهی بسیار مناسب برای رشد باکتریهاست.

هیچ جا قبلا اشاره نشده pv مخفف چی هست. پس یا باید قبلا اشاره میشد یا اینجا کامل مینوشت.

### PV changes

Lipid oxidation is one of the major parameters that limit the quality and acceptability of beef, as it is responsible for various changes in beef and the production of potentially toxic compounds (Branciari *et al.*, 2015). The results related to the changes in the consolidated burger's peroxide value during four months of storage at -18 °C have been shown in Fig. (6). As is observed, with the passage of storage time for 4 months, the peroxide value in all three investigated samples has increased significantly ( $t < 0.0001$  for all three treatments). The increase in the peroxide value of all samples showed the higher speed of new peroxide compounds formation compared to their decomposition into secondary products. The highest increase in peroxide value was observed in the Mix50% sample, which was equal to 0.74, and the lowest increase in peroxide value was also related to the control sample, which was 0.40. These results were consistent with the results obtained by Khanipour *et al.* (2013). They announced an increasing trend in the peroxide

بهبتره در متن به صورت مخفف آورده بشه

بهبتر بود بنویسه primary

بدون واحد اندازه گیری

which are considered to be the main units of fish fat. Also, at the beginning of the storage period, the peroxide value in the sample containing 50% fish meat was higher than the other two treatments ( $df = 2,8$ ;  $F = 28.50$ ;  $P = 0.0009$ ). The reason for this is the presence of higher amounts of long chain fatty acids in the final burger formulation. In addition, the peroxide values of the samples after four months of storage were also significantly different from each other ( $df = 2,8$ ;  $F = 497.57$ ;  $P < 0.0001$ ). The permitted peroxide value limit in products containing fish is 5 MDA of oxygen per kg of fish texture, and in this respect, all the examined samples were within the permissible range (Yanar, 2007). Fat oxidation causes unpleasant odor and taste in fish and its products, and hydroperoxide and free radicals formed may directly react with fish textures to create complex reactions and cause this process (Yanar, 2007). Jorjani (2013) reported an upward trend for the peroxide value of carp burger samples during six months of storage at  $-18\text{ }^{\circ}\text{C}$ , which is in agreement with the results of the present study. Vanitha *et al.* (2015) declared the trend of peroxide value changes in fish burger samples during storage in cold conditions to increase. In agreement with our finding, PV content showed an increasing trend by the end of storage period in fish burgers produced from catla (*Catla*

به کاهش و افزایش اشاره شود.

گوشت ماهی نه بافت

دما باید مشخص شود. freezing

عبارت کامل گفته نشده. ضمناً برای pv از میلی اکی والان استفاده میشود بنابراین مقایسه با MDA غلط هست.

تکراری و غلط (cyprinus carpio)

-18 °C have been shown in Fig. (7). As it can be seen, with the passage of storage time for 4 months, the amount of TBA value has increased in all three investigated samples and the difference is statistically significant ( $t < 0.0001$  for all three treatments). This improvement is associated with the increase of iron and other oxides in meat (Alexandre *et al.*, 2021). The highest increase in TBA value was observed in the Mix50% sample, which was 0.87 and the lowest increase in TBA value was in the control sample, which was 0.69. Also, at both times, increasing the fish meat content caused a significant increase in TBA value ( $t_0$ :  $df = 2,8$ ;  $F = 120.40$ ;  $P = 0.0004$ ;  $t_4$ :  $df = 2,8$ ;  $F = 302.22$ ;  $P < 0.0001$ ).

بار معنایی مثبت دارد  
باید بنویسه:  
elevation یا increase

pro-oxidant compounds

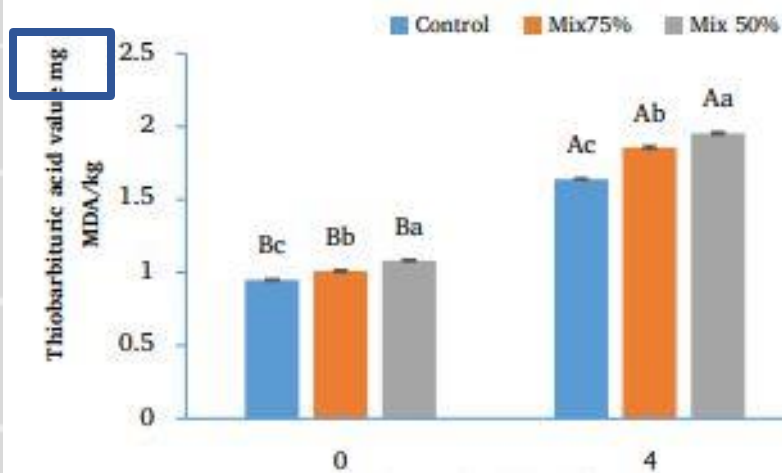
واحد ندارد

off-flavor and odor ←

secondary oxidation products from the decomposition of hydroperoxides. The increasing trend of hydroperoxides can also be a reason for increasing TBA. The presence of aldehyde compounds in fish meat causes change in its sensory characteristics, including taste and smell. The TBA value is about 1-2 mg of MDA/kg of sample as the limiting limit of acceptability for consumers, due to its unpleasant smell and taste (Goulas & Kontominas, 2007; Izi *et al.*, 2011). In all samples, at the end of the storage period, the TBA value was 2. Vanitha *et al.* (2015) announced an increase in the TBA value in fish burger samples during cold storage. Proteolytic enzymes synthesize the protein structure of meat and as a result of these interactions, volatile nitrogenous and free ammonia are produced and released in meat. Therefore, one of the methods to determine the spoilage of burger is to measure the content of volatile bases in it (Koohdar & Radmehr, 2016).

acceptability limit

واحد ندارد ←



### TVB-N changes

The results related to the variations of volatile basic nitrogen (TVB-N) of consolidated burger samples during four months of storage at  $-18\text{ }^{\circ}\text{C}$  have been shown in Fig (8). The results showed that adding fish meat to the samples significantly increased the amount of TVB-N ( $t_0$ :  $df=2,8$ ;  $F=237.81$ ;  $P=0.0004$ ;  $t_4$ :  $df=2,8$ ;  $F=5120.55$ ;  $P<0.0001$ ). Also, according to the figure, with the passage of storage time for 4 months, the amount of TVB-N in all three investigated samples has increased significantly ( $t<0.0001$  for all three treatments). Osheba *et al.* (2013) showed that TVB-N increases in fish finger samples over time, and the amount of volatile basic nitrogen in coated samples was lower than in uncoated control samples (Osheba *et al.*, 2013). The highest increase in volatile basic nitrogen was observed in Mix50% sample, which was equal to 4.95, and the lowest increase in TVB-N was related to the control sample, which was equal to 3.09. These results are consistent with the results obtained by (Koohdar & Radmehr, 2016) for the increase in the amount of TVB-N in chicken meat during the storage period. Moreover, the TVB-N content of fish burgers prepared from *C. carpio* increased during 19-days storage period at refrigerated temperature (Turgut *et al.*, 2016). Baltić *et al.*

چرا افزودن ماهی باعث بیشتر شدن TVB-N شده؟

بهبتر بود مخفف گفته میشود.

واحد ندارد

نباید داخل پرانتز نوشته میشود.

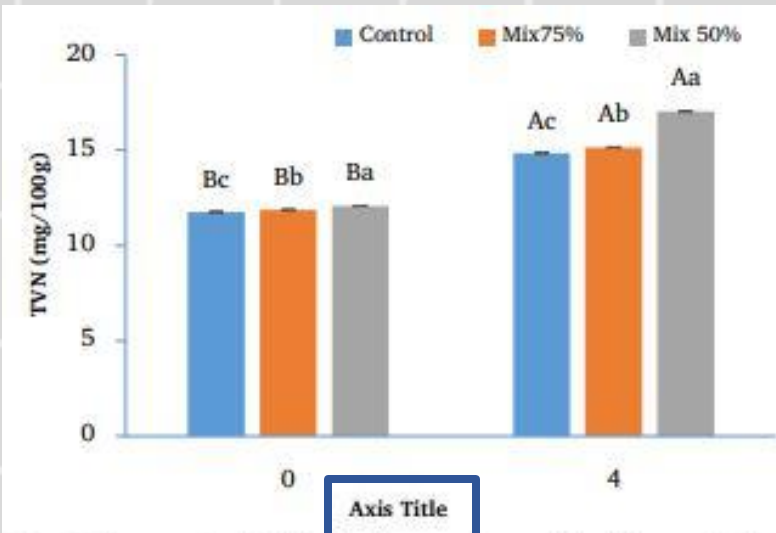


Fig. 8. Changes of volatile basic nitrogen of consolidated burger during the storage period. Small letters represent significant differences between different burger samples. Capital letters denote a significant difference of the consolidated burger sample during the storage period ( $P < 0.05$ ).

Volatile basic nitrogen in burgers is used as an indicator of burger quality. The increase in the amount of volatile nitrogenous depends on the activity of spoilage bacteria and enzymes within the texture (Ruiz-Capillas & Moral, 2002). Khanipour *et al.* (2013) reported that the values of volatile basic nitrogen in fish burger samples increased during the storage period, which is in accordance with the results obtained from the present study. The increase of volatile basic nitrogen during frozen storage can be related to the activities of spoilage bacteria and internal enzymes. Since TVB-N is mainly caused by the bacterial decomposition of fish meat, the increase in fish bacterial load during the period will be the reason for the increase of TVB-N. According to available reports, 25 mg of TVB-N per 100 g of meat is the highest acceptable level for TVB-N (Jorjani, 2013) and in this respect,

تکراری

نگهداری در چه شرایطی بوده؟  
انجماد یا یخچال

تکراری

### *Fatty acid changes*

The results related to changes in the fatty acid profile of different consolidated burger samples at the beginning and end of the storage period have been shown in Table (2). As can be seen, the total amount of fatty acids has decreased to a small amount after the storage period, which is due to the synthesis of fat and fatty acids during the storage period. With the increase in the amount of fish meat used in the burger formulation, the reduction in total fatty acids increased, which is related to the higher sensitivity of polyunsaturated fatty acids in fish meat fat to oxidation.

غلط  
احتمالا منظورش لیپولیز یا  
اکسیداسیون بوده

آیا این کاهش معنادار است.

اضافی

مقایسه آماری اسیدهای چرب در این مطالعه خیلی ضرورت ندارد. و در متن هم هیچ کاربردی نداشته و اشاره ای ندارد. و در عوض بهتر بود عدد total مقایسه آماری میشد.

Table 2 Fatty acid profile changes of different burger samples during the storage period

Fatty acids	Storage time-month					
	0			4		
	Control	Mix75%	Mix 50%	Control	Mix75%	Mix 50%
C8:0	0.00 <sup>Aa</sup>	0.02 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.03 <sup>Aa</sup>
C9:0	0.19 <sup>Aa</sup>	0.13 <sup>Ab</sup>	0.11 <sup>Ab</sup>	0.19 <sup>Aa</sup>	0.13 <sup>Ab</sup>	0.11 <sup>Ab</sup>
C10:0	2.75 <sup>Aa</sup>	2.66 <sup>Aab</sup>	2.47 <sup>Ab</sup>	2.75 <sup>Aa</sup>	2.66 <sup>Aab</sup>	2.47 <sup>Ab</sup>
C12:0	19.30 <sup>Aa</sup>	19.53 <sup>Aa</sup>	18.02 <sup>Ab</sup>	19.30 <sup>Aa</sup>	19.53 <sup>Aa</sup>	18.02 <sup>Ab</sup>
C14:0	2.35 <sup>Ab</sup>	3.34 <sup>Aa</sup>	3.56 <sup>Aa</sup>	2.35 <sup>Ab</sup>	3.34 <sup>Aa</sup>	3.56 <sup>Aa</sup>
C16:0	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C19:0	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.02 <sup>Aa</sup>
C20:0	0.31 <sup>Aa</sup>	0.25 <sup>Aab</sup>	0.25 <sup>Aab</sup>	0.31 <sup>Aa</sup>	0.25 <sup>Aab</sup>	0.25 <sup>Aab</sup>
C21:0	0.00 <sup>Ac</sup>	0.46 <sup>Ab</sup>	0.46 <sup>Ab</sup>	0.00 <sup>Ac</sup>	0.46 <sup>Ab</sup>	0.46 <sup>Ab</sup>
C24:0	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C14:1	0.80 <sup>Aa</sup>	0.61 <sup>Ab</sup>	0.61 <sup>Ab</sup>	0.80 <sup>Aa</sup>	0.61 <sup>Ab</sup>	0.61 <sup>Ab</sup>
C16:1	3.52 <sup>Ac</sup>	5.30 <sup>Ab</sup>	5.30 <sup>Ab</sup>	3.52 <sup>Ac</sup>	5.30 <sup>Ab</sup>	5.30 <sup>Ab</sup>
C18:1	27.35 <sup>Aa</sup>	23.54 <sup>Ab</sup>	23.54 <sup>Ab</sup>	27.35 <sup>Aa</sup>	23.54 <sup>Ab</sup>	23.54 <sup>Ab</sup>
C20:1	0.00 <sup>Ac</sup>	0.33 <sup>Ab</sup>	0.33 <sup>Ab</sup>	0.00 <sup>Ac</sup>	0.33 <sup>Ab</sup>	0.33 <sup>Ab</sup>
C22:1	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>
C18:2	6.19 <sup>Aa</sup>	22.64 <sup>Ac</sup>	22.64 <sup>Ac</sup>	3.38 <sup>Ac</sup>	22.36 <sup>Bb</sup>	21.96 <sup>Bc</sup>
C18:3	0.49 <sup>Aa</sup>	0.49 <sup>Aa</sup>	0.49 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.31 <sup>Ab</sup>	0.47 <sup>Aa</sup>
C20:2	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C20:3	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C22:2	19.4 <sup>Ac</sup>	5.31 <sup>Ab</sup>	5.31 <sup>Ab</sup>	34.84 <sup>Ba</sup>	23.78 <sup>Bb</sup>	18.8 <sup>Bc</sup>
C22:3	0.14 <sup>Aa</sup>	0.14 <sup>Aa</sup>	0.14 <sup>Aa</sup>	5.43 <sup>Ba</sup>	5.14 <sup>Bb</sup>	5.15 <sup>Bb</sup>
C22:4	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Ac</sup>	0.08 <sup>Ab</sup>	0.13 <sup>Aa</sup>
C22:5-ω6	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.00 <sup>Aa</sup>
C22:5-ω3	3.66 <sup>Aa</sup>	3.66 <sup>Aa</sup>	3.66 <sup>Aa</sup>	0.58 <sup>Ac</sup>	2.50 <sup>Bb</sup>	3.55 <sup>Aa</sup>
C22:6	4.53 <sup>Aa</sup>	4.53 <sup>Aa</sup>	4.53 <sup>Aa</sup>	0.02 <sup>Ac</sup>	2.87 <sup>Bb</sup>	4.36 <sup>Ba</sup>
Total	0.03 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.03 <sup>Aa</sup>	0.00 <sup>Aa</sup>	0.01 <sup>Aa</sup>	0.01 <sup>Aa</sup>
	0.57 <sup>Aa</sup>	0.57 <sup>Aa</sup>	0.57 <sup>Aa</sup>	0.19 <sup>Ac</sup>	0.19 <sup>Ac</sup>	0.19 <sup>Ac</sup>
	0.85 <sup>Aa</sup>	0.85 <sup>Aa</sup>	0.85 <sup>Aa</sup>	0.09 <sup>Ac</sup>	0.09 <sup>Ac</sup>	0.09 <sup>Ac</sup>
	2.86 <sup>Aa</sup>	2.86 <sup>Aa</sup>	2.86 <sup>Aa</sup>	0.28 <sup>Ac</sup>	0.28 <sup>Ac</sup>	0.28 <sup>Ac</sup>
	6.30 <sup>Aa</sup>	6.30 <sup>Aa</sup>	6.30 <sup>Aa</sup>	0.04 <sup>Ac</sup>	0.04 <sup>Ac</sup>	0.04 <sup>Ac</sup>
	97.60	97.37	98.09	96.80	96.04	96.20

بهرتره تمام عناوین و اعداد در یک ستون باشند. برای بقیه ستون ها هم صادق است

در همبرگرهایی که درصد گوشت ماهی زیادی دارند، بیشترین اسید چربشون لینولئیک و لینولنیک نیستند.

بهرتر بود در متن به تفاوت آماری امگا ۳ اشاره میکرد و بولد میشد، چون عنوان مقاله بررسی اثر ارزش غذایی همبرگر هست در صورتیکه در هیچ جای مقاله به این موضوع اشاره نشده است.

نباید علامت درصد بزاره یا اگر درصد میزاره باید بنویسه %

Small letters denote a statistically significant difference at the probability level of 0.05% between different burger samples. Capital letters denotes a statistically significant difference at the probability level of 0.05% of the pooled burger sample during the storage period.

مقایرت

As the results show, in burgers containing fish meat, the most fatty acids are linoleic and linolenic fatty acids. These results are in line with the results obtained by Khanipour *et al.* (2013). While investigating the changes of unsaturated fatty acids during the storage period in burger fish samples, they announced a decreasing trend for unsaturated fatty acids such as linoleic and linolenic. The reason for the reduction of these unsaturated fatty acids can be due to oxidation during storage. Jorjani (2013) showed that the amount of unsaturated fatty acids in breaded Kilka fish after freezing in the 5 month of storage in a cold store is decreasing. Similar results have been reported for mackerel, shark, sokla, and *scombromorus* fish kept in -18 °C cold storage (Nazemroaya *et al.*, 2009; Sahari *et al.*, 2009; Taheri *et al.*, 2012). Polyunsaturated fatty acids are highly sensitive to oxidation and freezing, so their amount decreases during the storage period.

جای دیگر گفته ۴ ماه

جاهای دیگر برای این نویسند  
گفته carp اینجا گفته کیلکا

چون تمام  $p$  ها بالای  $0.05$  هستند پس اثر معنادار نبوده و بنابراین نباید بنویسه. has an effect. تناقض علمی و معنایی دارد.

### Organoleptic indicators changes

The evaluation of organoleptic indicators along with chemical and microbial tests (as a complementary method) is necessary as one of the quality indicators of meat products during the storage period and to determine the level of spoilage and their shelf life (Pourashouri *et al.*, 2014). The results for texture sensory changes and general acceptance of burger samples have been shown in Fig. (9). Addition of fish meat (25 or 50%) has an effect on stickiness ( $t_0$ :  $df=2,14$ ;  $F=0.43$ ;  $P=0.6631$ ;  $t_4$ :  $df=2,14$ ;  $F=1.75$ ;  $P=0.2158$ ), texture cohesiveness ( $t_0$ :  $df=2,14$ ;  $F=1.08$ ;  $P=0.3714$ ;  $t_4$ :  $df=2,14$ ;  $F=1.53$ ;  $P=0.2561$ ) and general acceptance ( $t_0$ :  $df=2,14$ ;  $F=3.06$ ;  $P=0.0846$ ;  $t_4$ :  $df=2,14$ ;  $F=4.74$ ;  $P=0.0304$ ) and no difference was observed between different treatments.

overall

باید مینوشتند significant differences were

پذیرش کلی در ماه چهارم نگهداری، با توجه به عدد  $p$  تفاوت معناداری بین نمونه ها دیده شده در صورتیکه در ادامه نوشته تفاوت معناداری بین تیمارها مشاهده نشد.

## معنادار نیست

چون این عبارت به کل پارامترها مرتبط هست باید در ابتدای جمله آورده میشد.

Chewiness ( $t_0$ :  $df=2,14$ ;  $F=3.04$ ;  $P=0.0854$ ;  $t_4$ :  $df=2,14$ ;  $F=4.56$ ;  $P=0.0336$ ) with increasing amount of fish meat in the formulation increases and softness ( $t_0$ :  $df=2,14$ ;  $F=4.23$ ;  $P=0.0407$ ;  $t_4$ :  $df=2,14$ ;  $F=4.68$ ;  $P=0.0314$ ) and juiciness of texture (only in the fourth month), ( $t_0$ :  $df=2,14$ ;  $F=3.29$ ;  $P=0.725$ ;  $t_4$ :  $df=2,14$ ;  $F=7.57$ ;  $P=0.0074$ ) decreased.

باید مینوشت  
statistically decreased

معنا دار نوشته شود

On the other hand, the passage of storage time leads to a decrease in texture juiciness (control:  $t=0.005$ , Mix75%:  $t=0.002$ , Mix50%:  $t=0.0438$ ), chewiness (control:  $t=0.0068$ , Mix75%:  $t=0.0062$ , Mix50%:  $t=0.0025$ ) and overall acceptance (control:  $t=0.0068$ , Mix75%:  $t=0.0062$ , Mix50%:  $t=0.0062$ ) of all three treated samples. Also, increasing the storage time decreases the stickiness of the Mix50% treatment (control:  $t=0.1330$ , Mix75%:  $t=0.0285$ , Mix50%:  $t=0.0094$ ), the softness of the Mix75% and Mix50% treatments (control:  $t=0.0116$ , Mix75%:  $t=0.0025$ , Mix50%:  $t=0.0337$ ) and the cohesiveness of Mix75% and Mix50% treatments was (control:  $t=0.0857$ , Mix75%:  $t=0.0530$ , Mix50%:  $t=0.0053$ ).

کاهش معنادار داشت  
نمونه ۵۰٪

کاهش معنادار داشت  
نمونه کنترل

اضافی

معمولا از کلمه aggregation برای تجمع پروتئین استفاده میشود.

بهبتر بود نوشته شود  
through several mechanisms

highly

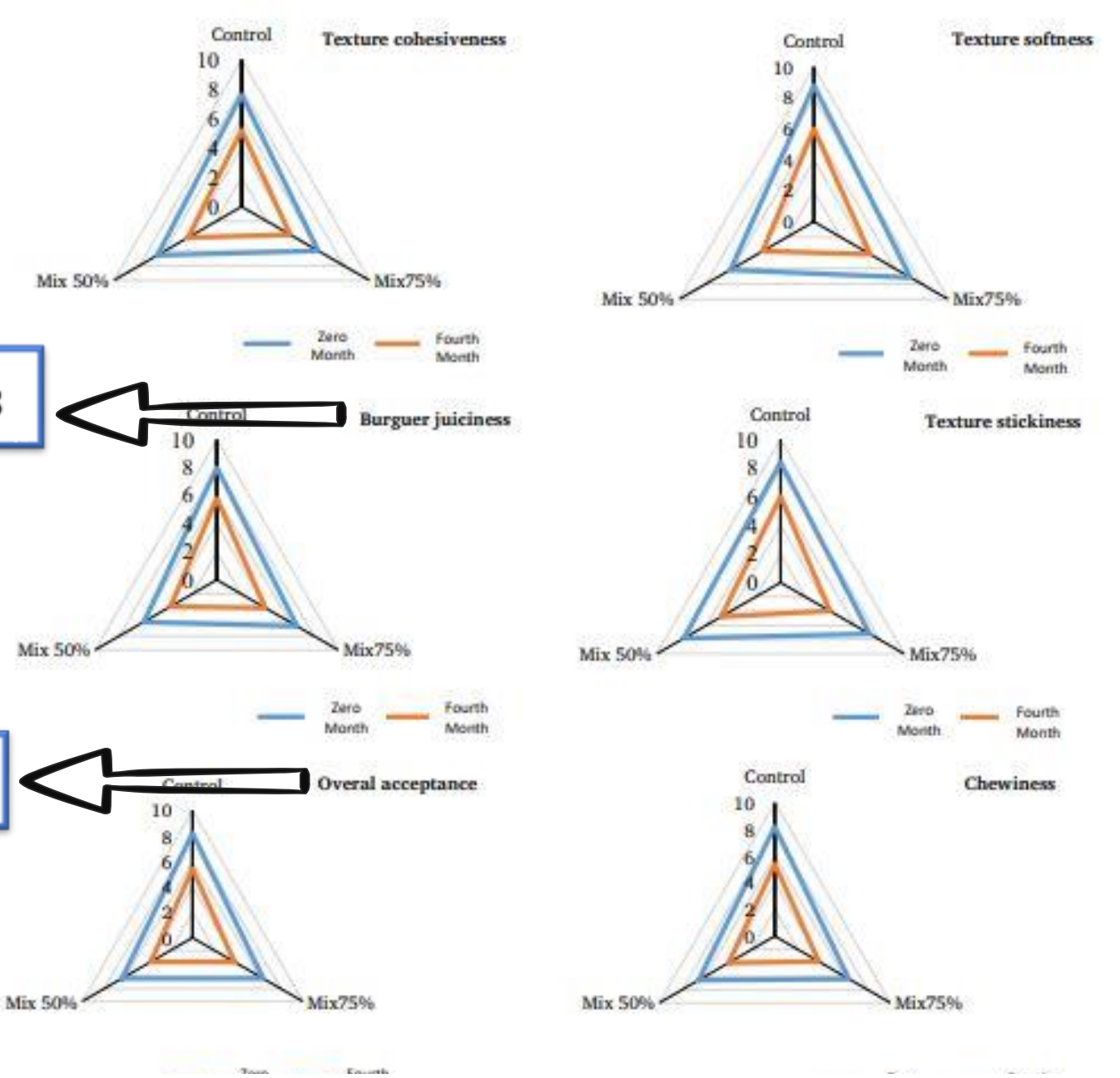
Oxidation of fats and proteins during the storage period affects the texture of meat samples. As a result of the oxidation of meat proteins, proteins accumulate and this happens in different ways. Oxidation of thiol groups of disulfide bonds, reaction between carbonyl and protein and cross-linking between proteins of amino groups of lysine residues can lead to the accumulation of proteins. Cross-links of proteins are created in very oxidative conditions and reduce the sensitivity of proteins against hydrolysis by proteolytic enzymes. In other studies, the relationship between the protein and fat oxidation rate and the crispness of the burger texture has been mentioned (Lund *et al.*, 2011; 2007).

همه جا نوشته TEXTURE  
 اینجا هم باید تبصیر میکرد و مثل بقیه مینوشت.

**Burguer juiciness**

Overall  
**Overall acceptance**

فقط ویژگی های بافت رو گزارش کرده نه خواص مسد!



**Fig. 9.** Sensory evaluation of consolidated burger samples during the storage period.

این مقاله که مروری نیست.  
باید مینوست this study

کاملا غلط

هرچه خشک تر باشد، پروک تر هست. ولی اینجا برعکس گفته!

معاوره ای و غیر اصولی

The juiciness of the burger texture is a crucial sensory characteristic and is directly related to the wrinkling of the burger texture surface. In other words, the more wrinkled the texture of the burger, the juicier it will be. The juiciness of the texture directly affects the quality and economy of the burger. As seen in this review, the burger sample prepared from red meat had the highest level of juiciness. In the control sample, the moisture content of the burger is higher, which leads to juicier texture of the burger. Removing more water from the product leads to a decrease in its juiciness. Juiciness also affects the appearance of samples, so that the water leaves the product and the texture juiciness decreases, an unbalanced pressure is created between the inside and outside of the burger, which creates contraction forces and causes deformation and wrinkling (Hoseini & Aliabadi, 2017).

Mahmoudzadeh *et al.* (2010) regarding the shelf life of uncoated raw frozen fish burgers prepared from Kijar Mangut fish, stated that according to the sensory scores obtained, the best use-by date for the fish burgers is after 3 months of storage, while the pH and TBA factors in their research could not cover the sensory characteristics, and the sensory evaluation compared to the chemical indicators was a reliable tool to evaluate the quality of the said product. Izci *et al.* (2011) produced and examined the quality of fish fingers obtained from *A. boyeri* during 6 months of storage at -18 °C. According to the sensory evaluation results, the produced fish fingers maintained their good quality until the end of the sixth month. Moini and Bassimi (2004) suggested the maximum shelf life of carp fish burger stored at -18 °C for 90 days and declared peroxide index as the main factor of shelf life, and this was while there was no change in the TVN index during 120 days of storage at -18 °C. Based on the organoleptic results in the research of Jorjani (2013), the reduction of the overall acceptance score and also considering that the TVB-N value in the 5 month exceeded the suggested acceptable limit, evaluated the maximum shelf life of carp

اسامی خاص باید ایتالیک باشند

یا باید 5<sup>th</sup> month باشد یا 5 months

همه جا و در تمام نتایج 75%mix رو ذکر کرده و در نتیجه گیری نهایی پکیده هم اینو گفته. بعد اینجا میاد میگه ۲۵٪ گوشت ماهی. کمی گیج کننده است و باید یکسان نوشته شود.

اگر روند عکس نتایج مطالعات (مطالعات ناهمسو) بیان میشود معمولا به دلیل آن هم باید اشاره شود!  
ولی احتمالا اینجا به جای increase میخواستند بنویسه decrease چون قبلا گفته پذیرش کلی در طول نگهداری کم شده.

reflected

In this research, according to all the physicochemical and sensory tests, it can be said that the burger prepared with 25% fish meat can be a good substitute for burgers made from red meat, considering that it has good quality characteristics after 4 months of storage.

The trend of changes in the sensory score of overall acceptance in all examined samples during the storage period was decreasing. Chemical and microbial changes cause secondary metabolites and chemical compounds production which reduce the sensory score of overall acceptance. Jorjani (2013) reported an increasing trend for texture sensory evaluation score and overall acceptance of carp burger samples during six months of storage at -18 °C. A negative correlation was observed between storage period and overall acceptability scores in other previous studies (Alizadeh Behbahani *et al.*, 2021; Bavitha *et al.*, 2016; Kiarsi *et al.*, 2020; Surasani *et al.*, 2022). As observed, the process of changing the sensory characteristics of the burgers during the storage period was reflecting the oxidation changes. This issue can be attributed to fat oxidation that causes the elimination and loss of sensory characteristics and the reduction of the nutrients content such as PUFAs and the production of toxic materials.

نتیجه گیر کلی فیلی طولانی و تکرار مکررات بود.

## Conclusion

Today, the consumption of fish as a health food is approved by scientists and nutritional science experts as a prevention of various diseases and effective in the treatment of some diseases, and its provision and inclusion in the household food basket is one of the concerns of those in charge of production and nutrition affairs. In this research, red meat beef and grass carp burgers were produced at the ratios of 0:100, 25:75, and 50:50. The content of protein, fat, moisture and

درصدها برعکس گذاشته شده  
علامت % هم نگذاشته

قبل شروع نتایج باید بنویسه این همبرگرها در چه دما و زمانی نگهداری شده اند.

ash decreased with the storage time. However, pH value, peroxide value, thiobarbituric acid number and volatile basic nitrogen increased with the passage of storage time. By raising the amount of fish meat used in the burger formulation from zero to 50%, the contents of protein, moisture, ash and pH decreased and the amount of fat, peroxide value, thiobarbituric acid and volatile basic nitrogen increased. The amount of C18:2 and C18:1 fatty acids declined with increasing fish meat content. But the values of C22:5- $\omega$ 3, C22:5- $\omega$ 6, and C22:6 increased. All sensory properties of the texture and overall acceptance of the samples decreased with the passage of storage time, and the same trend was observed with the measured properties of oxidation and approximate decomposition of the samples. Considering that the unsaturated fatty acids in fish with the highest contents are linoleic, linolenic, and arachidonic fatty acids, especially eicosapentaenoic acid and docosahexaenoic acid, a burger made from 50% fish meat is considered a valuable source of these compounds. The results of this research show that by consuming a 50% mixed burger, part of the body's needs for unsaturated fatty acids and protein can be met. It is also worth mentioning that the current study provides baseline information on the shelf life of consolidated burger (grass carp-red meat) during freezing storage at -18 °C. Therefore, for more concrete and conclusive assessments, further related researches are needed.

غیر علمی

باید از value استفاده شود

این نتایج در result نیامده و نباید اولین بار در conclusion بیاید. ضمناً در ماهی دو اسید چرب EPA و DHA مهم و متفاوت است که در اینجا به EPA اشاره نکرده و عوضش C22:5 W6 که خیلی کم و ناچیز بود گفته شده.

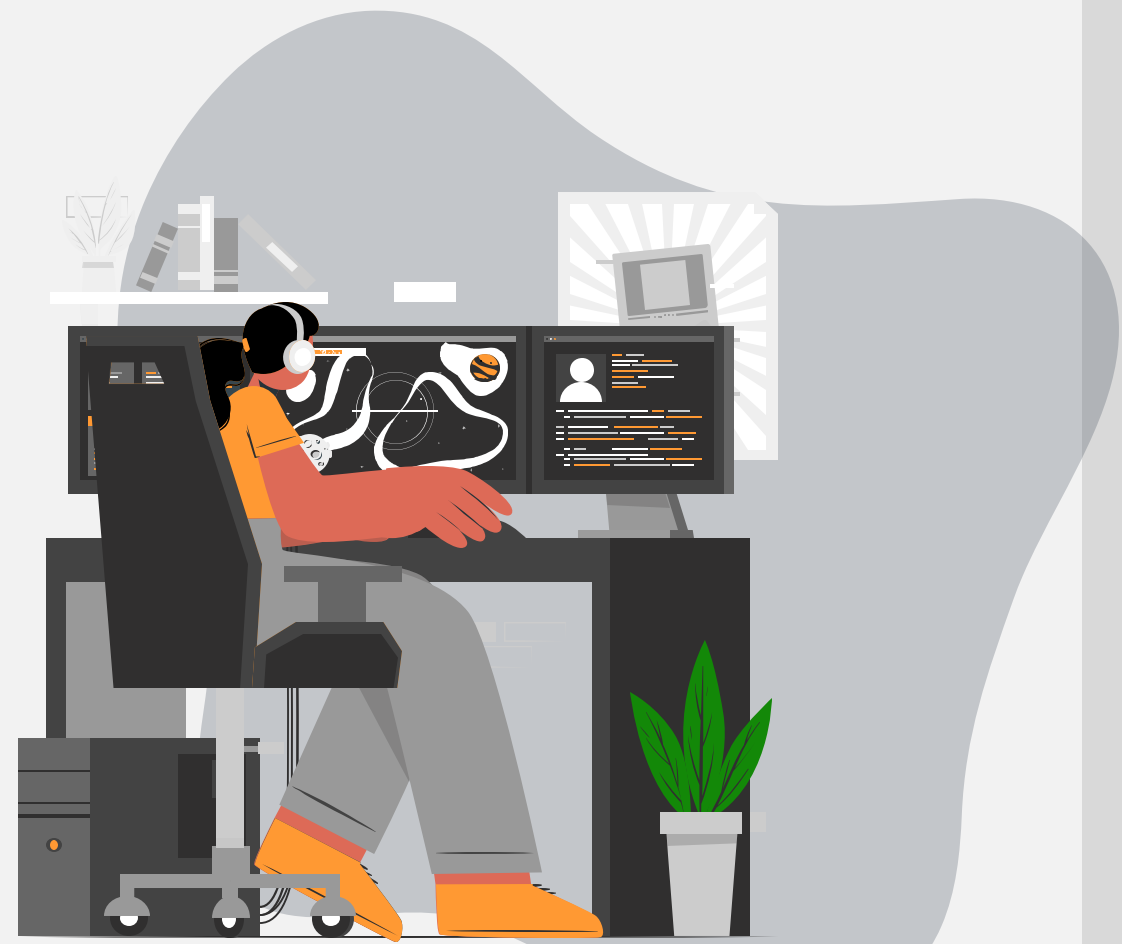
مغایرت

اقتضات

این نتیجه گیر در مطالعه نیامده. هیچ آنالیزی در این فصول صورت نگرفته و مدس زده میشود. ضمن اینکه به لحاظ تکنولوژیکی ۷۵٪ توصیه شد ولی اینجا طوری القا میکند که ۵۰٪ بهتر بوده. جمله از نظر نگارشی محاوره ای و غیر آکادمیک هست.

## نقاط قوت مقاله:

- بررسی متون قوی
- روش کار دقیق با جزئیات
- ارائه مکانیسم و علل نتایج



## نقاط ضعف مقاله:

- عدم نوآوری و کپی برداری از سایر مطالعات
- عدم مقایسه با مطالعات ناهمسو
- عدم آنالیز میکروبی به عنوان یک پارامتر مهم در عمر ماندگاری برگر
- عدم گزارش نتایج مربوط به سایر خواص مسی (در متد گفته اندازه گیری شده ولی در نتایج نیاورده)
- عدم ارائه نتایج مربوط به ارزش غذایی نظیر امگا ۳، چون در عنوان به ارزش غذایی اشاره شده ولی در نتایج چیزی گزارش نشده
- عدم اندازه گیری پارامترهای مهمی نظیر بافت (توسط بافت سنج)، رنگ (با رنگ سنج) و ... که در برگر مهم هست.
- عدم ارائه پیشنهادات آتی برای محققین



# ممنون از توجه شما ♡

