STUDI PEMBUATAN TEPUNG CAMPURAN DARI FORMULASI IKAN TEMBANG (*Sardinella fimbriata*) DAN IKAN SUNGLIR (*Elagatis bipinnulata*) SEBAGAI BAHAN BAKU PEMBUATAN CAMILAN BERBASIS IKAN

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STUDI PEMBUATAN TEPUNG CAMPURAN DARI FORMULASI IKAN TEMBANG (*Sardinella fimbriata*) DAN IKAN SUNGLIR (*Elagatis bipinnulata*) SEBAGAI BAHAN BAKU PEMBUATAN CAMILAN BERBASIS IKAN[1)]

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ABSTRAK

Dalam penelitian ini, tepung campuran diformulasikan dari campuran dua jenis tepung ikan untuk membuat makanan ringan berbahan dasar ikan. Selain itu, tepung campuran berbahan dasar ikan ini dapat memenuhi kebutuhan gizi masyarakat terutama dari kandungan protein melalui produk instan. **Tujuan** : Untuk mengetahui formulasi terbaik tepung campuran berbahan dasar tepung ikan ikan tembang (Sardinella fimbriata) dan ikan Sunglir (Elagatis bipinnulata) serta untuk mengetahui sifat fisik dan kimia dari campuran tepung dan camilan ikan yang dihasilkan. **Metode:** Dilakukan dengan 5 perlakuan melalui uji organoleptik yang meliputi warna, aroma, rasa, dan tekstur. 3 perlakuan teratas yang diperoleh dilakukan pengujian proksimat pada tepung campuran dan jajanan ikan, serta dilakukan uji fisik berupa daya serap air dan derajat warna. **Hasil**: Pada tepung campuran dan camilan ikan diperoleh hasil kadar air sebesar (8,79-1,53% dan 28,55-33,23%); abu (1,11-2,12% dan 1,49-2,34%); lemak (1,48-1,87% dan 16,04-17,88%); protein (29,31-31,67% dan 21,69-24,90%); karbohidrat (55,13-57,83% dan 24,41-31,64%). Daya serap air tepung campuran sebesar 2,22-3,09 ml/gram serta derajat putihsebesar 81,79-82,44%. **Kesimpulan**: Formulasi 3 teratas yang diperoleh dari pengujian organoleptik yaitu F2 (10% tepung ikan tembang: 20% tepung ikan sunglir: tepung terigu 49%:tapioka 21%), F4 (30% tepung ikan tembang: 0% tepung ikan sunglir: tepung terigu 49%:tapioka 21%) dan F5 (0% tepung ikan tembang: 30% tepung ikan sunglir: tepung terigu 49%:tapioka 21%). Pada tepung campuran dan camilan diperoleh hasil tertinggi pada perlakuan F2, yaitu kadar air (9,63% dan 31,58%); kadar abu (2,12% dan 2,34%); lemak (1,87% dan 17,88%); protein (31,67% dan 24,90%); karbohidrat (55,13% dan 24,41%); daya serap air dan derajat putih tepung campuran (3,09ml/gr dan 81,83%).

Keyword **:** Ikan Sunglir (*Elagatis bipinnulata*), Ikan Tembang (*Sardinella fimbriata*), Tepung Campur,

I. PENDAHULUAN

I.1 Latar Belakang

Kebutuhan gizi bagi masyarakat di era modern masih menjadi perhatian yang sangat besar. Menurut *Unicef* (2017), Indonesia menduduki peringkat ke 5 besar negara di dunia dengan jumlah 29,6% anak di bawah 5 tahun mengalami kekurangan gizi. Gizi seimbang dapat didukung melalui pemenuhan kebutuhan pangan. Salah satu upaya yang dapat ditempuh dalam memenuhi kebutuhan pangan, yaitu dengan memenuhi konsumsi pangan alternatif. Indonesia memiliki banyak sektor dalam pemenuhan kebutuhan pangan, salah satunya sektor pertanian dan perikanan. Hasil perikanan dapat dijadikan sebagai pangan alternatif baik dalam bentuk segar maupun olahan. Berikut komoditi hasil perikanan yang dapat memenuhi kebutuhan gizi yang cukup, yaitu ikan.

Ikan merupakan sumber daya perairan yang sangat melimpah dan kaya akan protein. Menurut Data dari Badan Pusat Statistik (2021), Produksi Perikanan Laut

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Indonesia yang dijual di TPI (Tempat Pelelangan Ikan) tahun 2019 mencapai 816.945,30 ton. Pentingnya sumber daya ikan bagi kebutuhan masyarakat, baik itu pangan maupun kegiatan ekonomi mendorong pemanfaatan sumber daya tersebut secara intensif dalam upaya pengolahan yang baik, salah satunya adalah ikan tembang dan ikan sunglir. Ikan tembang (*Sardinella fimbriata*) merupakan jenis ikan yang hidup bergerombol di perairan pantai di seluruh Indonesia. Ikan ini memiliki tubuh berbentuk pipih dengan panjang mencapai 130 mm (Pratiwi, 2013). Kandungan protein pada ikan tembang sangat lengkap karena memiliki kadar asam amino esnsial dan omega 3 (Sukma *et all*., 2019). Selain ikan tembang, Ikan Sunglir (*Elagatis bipinnulata*) juga merupakan salah satu jenis ikan yang cukup melimpah namun memiliki harga yang cukup murah. Ikan sunglir memiliki tubuh yang berbentuk panjang bulat, berwarna biru gelap dan sirip gelap serta perut berwarna putih (Urbansa *et all*., 2016). Kandungan protein pada ikan sunglir sangat tinggi, yaitu mencapai 22,72% (Rieuwpassa dan Cahyono, 2019). Kedua jenis ikan ini memiliki kandungan gizi yang lengkap, namun masih belum banyak dimanfaatkan sebagai bentuk produk olahan dan biasanya hanya langsung dimasak sebagai lauk. Salah satu produk hasil olahan ikan yang banyak dikenal di kalangan masyarakat, yaitu tepung ikan.

Tepung ikan merupakan jenis produk yang berasal olahan ikan baik itu dalam bentuk utuh, limbah maupun tidak layak untuk dikonsumsi. Kandungan protein pada ikan dapat dipengaruhi oleh kandungan protein yang terdapat pada ikan (Widodo *and* Sirajuddin. 2017). Akan tetapi, saat ini tepung ikan hanya identik sebagai bahan baku pakan ikan dan ternak. Oleh karena itu, sebagai sumber protein yang tinggi, dalam meningkatkan produk olahan ikan yang memiliki nilai gizi dalam pemenuhan gizi dan pangan alternatif, yaitu dapat terpenuhi dengan adanya tepung campuran. Tepung campuran, yaitu suatu bentuk teknologi formulasi dengan mencampur beberapa jenis tepung tertentu yang berbeda serta beberapa bahan tambahan sehingga siap untuk diolah (Sukri, 2017). Produk ini memberikan dampak yang baik terhadap minat masyarakat dalam memproduksi makanan secara prakis, terutama dalam pembuatan lauk maupun camilan berbasis ikan seperti empek-empek, otak-otak, sempol, stik ikan maupun kerupuk ikan. Hal ini merujuk pada penelitian (Tawali *et all*., 2019) bahwa teknologi tepung premix ikan bertujuan dalam pembuatan produk dengan formula yang seimbang, praktis dan murah. Selain itu, diharapkan produk tepung tersebut memiliki daya simpan yang cukup lama dibandingkan dengan ikan segar serta pemanfaatannya lebih fleksibel (Nomma, 2020).

Berbagai upaya dapat dilakukan dalam pemenuhan kebutuhan pangan yang bersifat praktis dan sehat dalam upaya pemenuhan kebutuhan gizi masyarakat melalui pemanfaatan bahan pangan yang melimpah. Berdasarkan hal tersebut, maka dilakukan penelitian "Studi Pembuatan Tepung Campuran dari Formulasi Ikan Tembang (*Sardinella fimbriata*) dan Ikan Sunglir (*Elagatis bipinnulata*) sebagai Bahan Baku Pembuatan Camilan Berbasis Ikan"

I.2 Rumusan Masalah

Ikan tembang dan ikan sunglir merupakan jenis ikan jenis ikan murah dan melimpah serta memiliki kandungan protein tinggi. Oleh karena itu, dalam memenuhi kebutuhan gizi masyarakat melalui pangan praktis, maka dilakukan pembuatan tepung campuran yang berbahan baku ikan. Hal ini dikarenakan tepung campuran dapat dijadikan sebagai bahan baku pembuatan camilan berbasis ikan sebagai bentuk upaya dalam pemenuhan gizi, memperpanjang umur simpan serta meningkatkan nilai ekonomis ikan tembang dan ikan sunglir.

I.3 Tujuan Penelitian

Tujuan dari penelitian ini, yaitu :

1. Untuk mengetahui formulasi terbaik tepung campuran dari tepung ikan tembang dan ikan sunglir
2. Untuk mengetahui karakteristik fisik dan kimia tepung campuran dan camilan ikan.

I.4 Manfaat Penelitian

Manfaat penelitian ini, yaitu diharapkan masyarakat mampu mengembangkan potensi tepung campuran dari bahan baku ikan sebagai bentuk upaya memenuhi keutuhan gizi dan meningkatkan pendapatan masyarakat melalui pengolahan ikan yang tepat. Selain itu, dapat memberikan kemudahan bagi masyarakat dalam membuat produk makanan berupa camilan berbasis ikan dari tepung campuran terutama bagi ibu rumah tangga.

II. METODE PENELITIAN

II.1 Waktu dan Tempat Penelitian

Penelitian ini akan dilaksanakan pada bulan Maret hingga Agustus 2022 di Laboratorium Kimia Analisa dan Pengawasan Mutu Pangan, Laboratorium Pengembangan Produk dan Laboratorium Bioteknologi Pangan. Program Studi Ilmu dan Teknologi Pangan, Jurusan Teknologi Pertanian, Fakultas Pertanian, Universitas Hasanuddin, Makassar.

II.2 Alat dan Bahan

Alat-alat yang digunakan pada penelitian ini adalah alat pengering (oven *blower*), ayakan tepung, baskom, cawan porselen (*Haldenwenger*), desikator (*Duran*), erlenmeyer , gela kimia (*Pyrex*), *food proseccor,* gelas ukur (*Pyrex*), kompor, labu *kjedhal,* pisau, panci kukusan, wajan, alat press, sendok, sentrifuse, *soxhlet,* tanur, timbangan analitik, mangkok.

Bahan-bahan yang digunakan pada penelitian ini adalah ikan tembang, ikan sunglir, tepung tapioka, tepung terigu, *aluminium foil, aquades,* bawang merah bubuk, bawang putih bubuk, lada bubuk, garam, air bersih, Asam Sulfat (H_2SO_4), Asam Borak (H_3BO_3), Asam Klorida (HCl), NaOH (Natrium Hidroksida), Choloroform, Selenium dan tissue roll.

II.3 Prosedur Penelitian

II.3.1 Pembuatan Tepung Ikan Tembang (Nur Azizah, 2018)

Ikan tembang segar disiangi dengan memisahkan kulit atau sisik, insang, tulang dan seluruh isi perutnya. Selanjutnya dicuci dengan air sebanyak 3-4 kali. Setelah itu, daging ikan dikukus selama 10 menit guna untuk melunakkan daging-daging ikan lalu disuir-suir. Selanjutnya, daging ikan digiling kemudian dilakukan press lemak selama 15 menit. Selanjutnya, daging ikan dikeringkan dengan cara dimasukkan ke dalam oven blower pada suhu 65^{o} C selama 20 jam. Daging ikan yan telah kering kemudian diblender hingga halu dan diayak dengan ayakan 80 mesh.

II.3.2 Pembuatan Tepung Ikan Sunglir (Nur Azizah, 2018)

Ikan Sunglir segar disiangi dengan memisahkan kulit atau sisik, insang, tulang dan seluruh isi perutnya. Selanjutnya dicuci dengan sebanyak 3-4 kali lalu dikukus selama 10 menit guna untuk melunakkan daging-daging ikan. Selanjutnya, daging ikan digiling kemudian dilakukan press lemak selama 15 menit. Selanjutnya, daging ikan dikeringkan dengan cara dimasukkan ke dalam oven pada suhu 65^o C selama 20 jam. Daging ikan yang telah kering selanjutnya dihaluskan menggunakan penggiling dan diayak 80 mesh.

II.3.3 Pembuatan Tepung Campuran

Dilakukan pencampuran tepung ikan tembang, tepung ikan sunglir, tepung tapioka dan tepung terigu dengan formulasi yang telah ditentukan. Selanjutnya diberikan bahan tambahan atau bumbu dengan formulasi yang telah ditentukan.

II.3.4 Pembuatan Camilan Ikan

Pada proses pembuatan camilan ikan, setiap formulasi ditambahan air secukupnya hingga membentuk adonan yang kaliks. Selanjutnya adonan dibulat-bulat dan digoreng selama 2 menit hingga adonan menjadi kekuningan. Kemudian adonan ditiriskan.

II.4 Parameter Pengamatan

II.4.1 Uji Organoleptik (Diniyah *et all., 2019*)

Pengujian organoleptik ,yaitu pengujian yang dilakukan dengan menggunakan indera manusia sebagai alat utama dalam mengukur daya terima terhadap tepung campuran. Uji organoleptik dilakukan untuk mengetahui tingkat kesukaan atau kelayakan suatu produk agar dapat diterima oleh konsumen. Metode yang digunakan adalah metode hedonik yaitu berdasarkan tingkat kesukaan yang meliputi warna, aroma, cita rasa dan tekstur. Panelis semiterlatih yang digunakan sebanyak 25 orang. Penilaian menggunakan skala 1 sampai 5 :

5 = Sangat suka
4 = Suka
3 = Agak suka
2 = Tidak suka
1 = Sangat tidak suka

III.4.2 Uji Proksimat

1. Kadar Air (AOAC, 2005)

Analisis kadar air produk tepung campuran dan camilan ikan dilakukan dengan menggunakan metode oven. Prosedur pengujian kadar air dimulai dari cawan porselen yang akan digunakan dikeringkan menggunkan oven dengan suhu 105^o C selama 1 jam kemudian didinginkan dalam desikator selama 15 menit lalu ditimbang. Sampel dihaluskan dan ditimbang sebanyak 2 gram kemudian dimasukkan ke dalam cawan porselen yang telah diketahui beratnya. Sampel dimasukkan ke dalam oven kemudian dikeringkan dengan suhu 105^o C selama 5 jam. Setelah itu sampel dikeluarkan dari oven lalu didinginkan dalam desikator selama 15 menit. Kemudian cawan polselen yang berisi sampel ditimbang hingga diperoleh berat konstan. Perhitungan kadar air sampel menggunakan rumus sebagai berikut :

Kadar air (%) = $\frac{Berat\ awal - Berat\ akhir}{Berat\ sampel}$x 100%

2. Kadar Abu (AOAC, 2005)

Pengujian kadar abu produk tepung campuran dan camilan ikan dilakukan dengan menggunakan tanur. Prosedur pengujian kadar abu dimulai dari cawan porselen yang akan digunakan dikeringkan menggunakan oven selama 1 jam kemudian didinginkan dalam desikator selama 15 menit lalu ditimbang. Sampel ditimbang sebanyak 2 gram kemudian dimasukkan ke dalam cawan porselen yang telah diketahui beratnya. Kemudian sampel dimasukkan ke dalam tanur dengan suhu 600^{o} C selama 5 jam atau sampai sampel menjadi abu. Setelah itu sampel dikeluarkan dari tanur lalu didinginkan dalam desikator selama 15 menit. Abu yang dihasilkan dari sampel kemudian ditimbang dan dihitung kadar abunya menggunakan rumus berikut :

Kadar abu (%) = $\frac{Berat\ abu}{Berat\ sampel}$x 100%

3. Kadar Protein (AOAC, 2005)

Pengujian kadar protein dilakukan menggunakan metode *kjeldahl*. Sampel ditimbang sebanyak 0,5 gram lalu dimasukkan ke dalam labu kjeldahl. Kemudian dimasukkan 1 gr selenium ke dalam masing-masing labu kjeldahl yang telah berisi sampel dan ditambahkan 7 ml larutan H_2SO_4. Selanjutnya sampel didestruksi pada suhu 430^{o} C selama 1-2 jam sampai larutan menjadi jernih kemudian didinginkan hingga latutan membentuk kristal. Setelah dingin, larutan ditambahkan dengan 50 ml akuades dan 7 ml NaOH 40% lalu didestilasi menggunakan desilator pada suhu 100^{o} C. Hasil destilasi ditampung dalam Erlenmeyer 125 ml yang telah diisi dengan 10 ml asam borat (H_3BO_3) 2% dan ditambahkan 2-4 tetes indikator bromcherosol green – methyl red. Setelah volume destilat mencapai 50 ml dan berwarna hijau, maka proses destilasi dihentikan. Selanjutnya destilat dititrasi menggunakan larutan HCl 0,1 N sampai berubah warna menjadi merah muda. Volume titran dibaca dan dicatat. Perhitungan kadar protein menggunakan rumus sebagai berikut :

% N = $\frac{(HCl - Blanko)\ x\ NHCl\ x\ 14}{mg\ Sampel}$x 100%

% Kadar protein = % N x faktor konversi

4. Kadar Lemak (AOAC, 2005)

Analisis kadar lemak dilakukan dengan menggunakan *soxhlet*. Labu lemak dikeringkan menggunakan oven dengan suhu 105^{o} C selama 1jam lalu didinginkan dalam desikator selamaa 15 menit kemudian ditimbang. Selanjutnya sampel ditimbang sebanyak 2 gram lalu dimasukkan ke dalam kertas saring. Kemudian dimasukkan ke dalam labu lemak yang sudah ditimbang berat tetapnya dan disambungkan dengan tabung soxhlet. Selongsong lemak dimasukkan ke dalam ruang ekstraktor tabung soxhlet dan disiram dengan pelarut lemak (cloroform). Tabung ekstraksi dipasang pada alat destilasi soxhlet lalu dipanaskan pada suhu 40°C dengan pemanas listrik selama 6 jam. Pelarut lemak yang ada dalam labu lemak didestilasi hingga semua pelarut lemak menguap. Pada saat destilasi pelarut akan tertampung di ruang ekstraktor, pelarut dikeluarkan sehingga tidak kembali ke dalam labu lemak. Selanjutnya labu lemak dikeringkan dalam oven pada suhu 105°C. Setelah itu labu didinginkan dalam desikator kemudian beratnya ditimbang.Kadar lemak dapat dihitung dengan rumus sebagai berikut :

$$\text{Kadar lemak (\%)} = \frac{Berat\ lemak}{Berat\ sampel} \text{x } 100\%$$

5. Kadar Karbohidrat (AOAC, 2005)

Analisis karbohidrat dilakukan dengan cara perhitungan kasar (*proximate analysis*) atau secara *Carbohydrate by difference*. Kadar karbohidrat diporeleh dari pengurangan 100% dengan kadar air, kadar abu, kadar protein dan kadar lemak. Kadar karbohidrat dihitung menggunakan rumus sebagai berikut :

% Karbohidrat = 100% − % (air+abu+protein+lemak)

II.4.3 Uji Fisik

1. Uji Daya Serap Air (Rauf dan Sarbini, 2015)

Sebanyak 1 gram tepung campuran dimasukkan ke dalam tabung sentrifus dan ditambahkan dengan 10 ml aquades, lalu divorteks selama 2 menit. Kemudian dibiarkan selama 15 menit. Selanjutnya dilakukan sentrifugasi 3000 rpm, selama 25 menit. Supernatan dipisahkan, kemudian sampel ditimbang. Selisih antara berat sampel setelah menyerap air dan sampel kering per 100 g menunjukkan banyaknya air yang diserap oleh tepung. Daya serap air diekspresikan dalam persen daya serap air tepung terhadap daya serap air. Perhitungan daya serap air dilakukan dengan menggunakan rumus :

Daya serap air

$$\frac{(A-B)-(Kadar\ Air\ Contoh \times bobot\ awal\ contoh)}{bobot\ awal\ contoh\ (1-kadar\ air\ contoh} \times 100\%$$

2. Uji Derajat Putih Ariyantoro *et all* (2020)

Sampel dimasukkan pada wadah transparan pengukuran menggunakan *General Colorimeter* dengan menghasilkan nilai L*, a*, dan b*. Nilai L* menyatakan parameter kecerahan (warna kromatis, 0: hitam sampai 100:putih). Warna kromatik campuran merah hijau ditunjukkan oleh nilai a* (a+ = 0-100 untuk warna merah, a- = 0-(-80) untuk warna hijau). Warna kromatik campuran biru kuning ditunjukkan oleh nilai b* (b+ = 0-7 untuk warna kuning, b- = 0-(-70) untuk warna biru). Hasil analisis L*, a*, dan b* dimasukan ke dalam rumus

% Derajat Putih : $\mathbf{100[(100-L)^2+a^2+b^2)]^{0,5}}$

II.5 Desain Penelitian

II.5.1 Penelitian Tahap 1

Penelitian tahap I dilakukan untuk mendapatkan formusi terbaik tepung campuran dengan pembuatan camilan ikan. Pembuatan camilan ikan dari tepung ikan tembang dan ikan sunglir dengan penambahan tepung terigu dan tapioka menggunakan 5 formulasi berdasarkan penelitian (Rombe *et all.*, 2019) dengan melakukan modifikasi perlakuan.

Tabel 1. Formulasi Pembuatan Tepung Campuran camilan ikan

Bahan	**Perlakuan**				
	F1 (%)	F2 (%)	F3 (%)	F4 (%)	F5 (%)
Tepung Ikan Tembang	20	10	15	30	0
Tepung Ikan Sunglir	10	20	15	0	30
Tepung Terigu	49	49	49	49	49
Tepung Tapioka	21	21	21	21	21
Jumlah	100	100	100	100	100

Tabel 2. Bahan tambahan tepung campuran camilan ikan

Bahan	**gr**	**%**
Garam halus	2	2
Penyedap Rasa	2,5	2,5
Bawang putih bubuk	2	2
Bawang merah bubuk	2	2
Lada bubuk	1,5	1,5
Total	10	10

Sumber : Modifikasi Fahmiyah, 2017

Setelah pembuatan camilan ikan dari tepung campuran dengan 5 formulasi, akan dilanjutkan pengujian organoleptik dengan menentukan 3 formulasi terbaik untuk dilanjutkan pada tahapan kedua penelitian.

II.5.2 Penelitian Tahap 2

Formulasi terbaik camilan ikan dari tepung campuran akan dilakukan pengujian proksimat pada tepung campuran dan camilan ikan yang meliputi uji kadar air, kadar abu, protein , lemak dan karbohidrat serta uji fisik pada tepung campuran yang meliputi uji daya seap air dan derajat putih.

II.6 Pengolahan Data

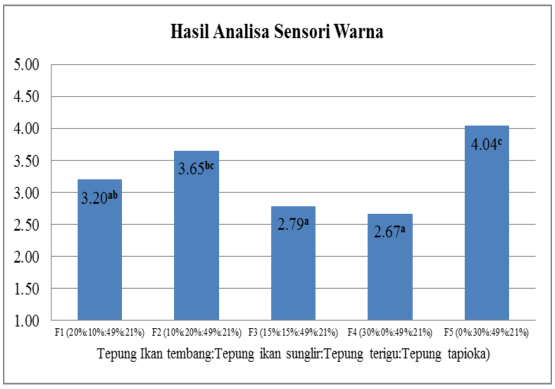
Penelitian ini menggunakan Rancangan Acak Lengkap (RAL) dengan 3 kali ulangan. Data hasil pengamatan diolah menggunakan aplikasi SPSS. Metode one way ANOVA (0.05) yang digunakan untuk mengetahui uji beda pada setiap perlakuan, kemudian dilanjutkan dengan uji Duncan bila ditemukan perbedaan yang signifikan pada setiap perlakuan.

III. HASIL DAN PEMBAHASAN

III.1. Uji Organoleptik Produk Camilan Ikan Menggunakan Tepung Campuran Ikan Tembang dan Ikan Sunglir

III.1.1 Warna

Hasil pengujian organoleptik terhadap parameter warna dari produk camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



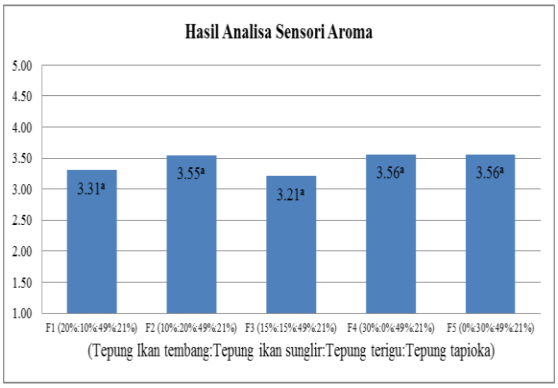
Gambar 1. Hasil Uji Organoleptik Warna Camilan Berbasis Ikan dari Tepung Campuran

Berdasarkan hasil uji organoleptik parameter warna pada produk Camilan ikan dengan perbadingan tepung ikan dan tepung campuran diperoleh nilai rata-rata 3,20 hingga 4,04. Hasil yang diperoleh menunjukan bahwa peilaian panelis terhadap organoleptik warna camilan ikan berada pada rentang agak suka hingga suka. Pada gambar 1 menunjukan bahwa penilaian tertinggi panelis terhadap camilan ikan terdapat pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%), yaitu 4,04 dengan warna kuning kecokelatan. Sedangkan hasil terendah diperoleh pada perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49% : tapioka 21%), yaitu sebesar 2,67 menunjukan warna agak cokelat gelap. Berdasarkan hasil analisa sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata terhadap parameter warna yang dihasilkan pada camilan ikan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukkan bahwa perlakuan F1 berbeda nyata dengan perlakuan F5 tetapi tidak berbeda nyata pada perlakuan F2. F3 dan F4.

Warna yang dihasilkan pada camilan ikan dipengaruhi dengan penggunaan beberapa tepung ikan dan tepung campuran yang berupa tepung terigu dan tepung tapioka dengan perbandingan yang berbeda. Penggunaan tepung ikan tembang yang lebih tinggi pada formulasi dapat menyebabkan warna yang agak gelap pada camilan ikan yang dihasilkan, sehingga kurang disukai oleh panelis. Warna gelap pada camilan ikan diakibatkan karena warna tepung ikan tembang yang cenderung gelap akibat adanya proses pengeringan saat pembuatan tepung. Hal ini sesuai dengan Khalishi (2011) bahwa pada proses pengeringan terjadi reaksi pencoklatan non enzimatis akibat suhu pemanasan. Reaksi pencoklatan atau maillard terjadi karena adanya reaksi antara karbohidrat dan protein pada gula pereduksi dengan gugus asam amino. Sebaliknya, penggunaan tepung ikan sunglir yang lebih tinggi dapat menyebabkan warna camilan ikan yang cenderung agak kuning kecokelatan sehingga disukai oleh panelis.

III.1.2 Aroma

Hasil pengujian organoleptik terhadap parameter aroma dari produk Camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



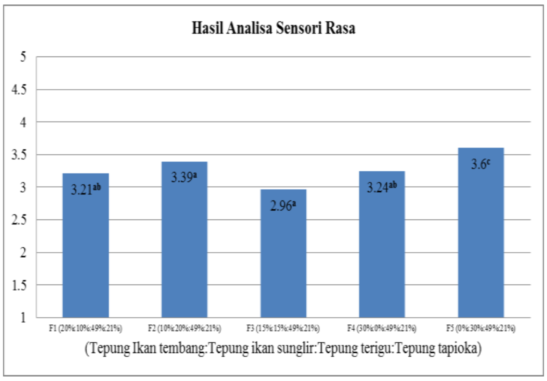
Gambar 2. Hasil Uji Organoleptik Aroma Camilan Berbasis Ikan dari Tepung Campuran

Berdasarkan hasil uji organoleptik parameter aroma pada produk camilan ikan dengan perbadingan tepung ikan dan tepung campuran diperoleh nilai rata-rata berkisar antara 3,21 hingga 3,56. Hasil yang diperoleh menunjukan bahwa penilaian panelis terhadap parameter aroma pada camilan ikan berada pada rentang agak suka hingga suka. Pada gambar 2 menunjukan bahwa hasil uji organoleptik terhadap aroma pada camilan diperoleh hasil tertinggi pada 2 perlakuan dengan nilai yang sama, yaitu pada perlakuan F5 (tepung ikan tembang 0%:tepung ikan sunglir 30%:tepung terigu 49%:tapioka 21%) dan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : %:tepung terigu 49% : tapioka 21%), yaitu 3,56. Sedangkan hasil terendah diperoleh pada perlakuan F3 (tepung ikan tembang 15% : tepung ikan sunglir 15% :tepung terigu 49% : tapioka 21%), yaitu dengan nilai sebesar 3,39. Berdasarkan hasil analisa sidik ragam ANOVA diperoleh nilai ($p>0,05$) menunjukan bahwa tidak terdapat perbedaan yang nyata antara produk camilan ikan terhadap parameter aroma yang dihasilkan, sehingga tidak perlu dilakukan uji lanjut (Duncan).

Aroma pada camilan ikan dipengaruhi oleh penggunaan dua jenis tepung ikan. Pada penggunaan dua jenis tepung ikan, akan membuat camilan ikan memiliki aroma ikan yang cukup kuat. Sedangkan penggunaan satu jenis ikan pada produk camilan ikan memiliki aroma yang tidak terlalu menyengat, sehingga panelis hanya menyukai aroma pada perlakuan yang hanya menggunakan satu jenis ikan. Hal ini sesuai dengan Valentina *et al* (2021) bahwa semakin banyak jenis tepung ikan yang ditambahkan, maka aroma yang ditimbulkan semakin keras sehingga mengurangi nilai kesukaan panelis terhadap produk. Senyawa volatil yang terkandung dalam tepung ikan dapat mempengaruhi karakteristik camilan ikan terutama pada aroma. Senyawa volatil akan menguap pada saat penggorengan berlangsung (Pratama *et all*, 2021).

III.1.3 Rasa

Hasil pengujian organoleptik terhadap parameter rasa dari produk camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



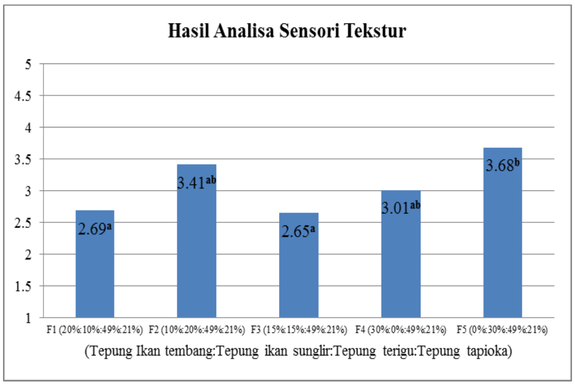
Gambar 3. Hasil Uji Organoleptik Rasa Camilan Berbasis Ikan dari Tepung Campuran

Berdasarkan hasil uji organoleptik parameter rasa pada produk camilan ikan dengan perbadingan tepung ikan dan tepung campuran melalui 5 perlakuan diperoleh nilai rata-rata berkisar antara 2,96 hingga 3,60. Hasil yang diperoleh menunjukan bahwa penilaian panelis terhadap rasa dari camilan ikan berada pada rentang agak suka hingga suka. Pada gambar 3 uji organoleptik rasa diperoleh hasil tertinggi pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%), yaitu dengan nilai 3,60. Sedangkan hasil terendah diperoleh pada perlakuan F3 (tepung ikan tembang 15% : tepung ikan sunglir 15% : tepung terigu 49% : tapioka 21%), yaitu 2,96. Berdasarkan hasil analisa sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara produk camilan ikan terhadap parameter rasa yang dihasilkan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukkan bahwa perlakuan F3 berbeda nyata terhadap perlakuan F2 dan F5, tetapi tidak berbeda nyata terhadap perlakuan F1 dan F4

Penilaian sensori rasa pada camilan ikan dipengaruhi oleh penggunaan dua jenis tepung ikan dengan penambahan tepung campuran seperti tepung tapioka dan tepung terigu. Pada perlakuan yang menggunakan dua jenis tepung ikan akan menyebabkan cita rasa khas ikan akan semakin meningkat sehingga daya terima panelis terhadap camilan ikan menurun. Hal ini sesuai dengan Anwar, *et al* (2019) bahwa jenis ikan yang berbeda dapat menyebabkan rasa produk berbeda walaupun dengan penambahan tepung terigu dan tapioka yang sama. Selain itu, proses penggorengan juga akan mempengaruhi cita rasa dari camilan ikan.

III.1.4 Tekstur

Hasil pengujian organoleptik tekstur terhadap produk camilan ikan dapat dilihat pada gambar berikut:



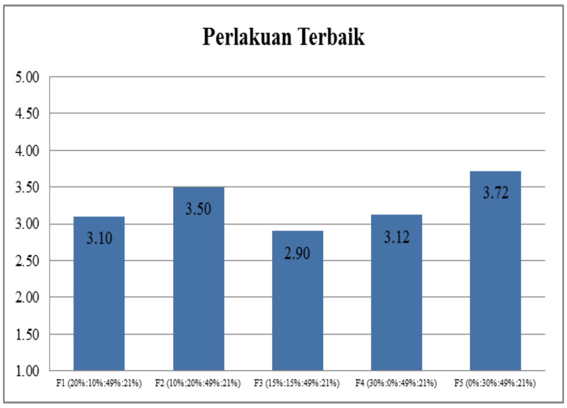
Gambar 4. Hasil Uji Organoleptik Tekstur Camilan Berbasis Ikan dari Tepung Campuran

Berdasarkan hasil uji organoleptik parameter tekstur pada produk camilan ikan dengan perbadingan tepung ikan dan tepung campuran diperoleh nilai rata-rata berkisar antara 2,65 hingga 3,68. Hasil yang diperoleh menunjukan bahwa penilaian panelis terhadap tekstur dari camilan ikan berada pada rentang agak suka hingga suka. Berdasarkan gambar 4 hasil uji organoleptik tekstur diperoleh hasil tertinggi pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%), yaitu 3,68. Sedangkan hasil terendah diperoleh pada perlakuan F3 (tepung ikan tembang 15% : tepung ikan sunglir 15% : tepung terigu 49% : tapioka 21%), yaitu 2,65. Berdasarkan hasil analisa sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara produk camilan ikan terhadap parameter tekstur yang dihasilkan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukkan bahwa perlakuan F3 berbeda nyata pada perlakuan F5. Akan tetapi tidak berbeda nyata pada perlakuan F1, F2 dan F4

Hasil uji organoleptik terhadap tekstur yang diperoleh oleh konsentrasi penambahan tepung ikan. Perlakuan yang menggunakan konsesntrasi tepung ikan sunglir yang lebih tinggi, memiliki tingkat kesukaan tekstur yang lebih tinggi. Hal ini disebabkan karena kandungan protein ikan sunglir yang cukup tinggi, sehingga dapat meningkatkan kerenyahan dan kegurihan camilan ikan. Selain itu, penambahan tepung tapioka dan tepung terigu dapat memberikan tekstur yang kenyal pada produk camilan ikan. Hal ini sesuai dengan Hermanto dan Susanti (2020) bahwa tepung ikan memiliki gugus hirofil yang terdapat pada protein ditambah dengan kandungan pati yang terkandung dalam tepung tapioka sehingga dapat menimbulkan kerenyahan.

III.2. Perlakuan Terbaik

Perlakuan terbaik diperoleh dari hasil rekapitulasi nilai dari tingkat kesukaan panelis melalui uji hedonik dengan parameter warna, aroma, rasa dan tekstur. Dari hasil uji organoleptik maka diperoleh 3 perlakuan terbaik dari 5 perlakuan.



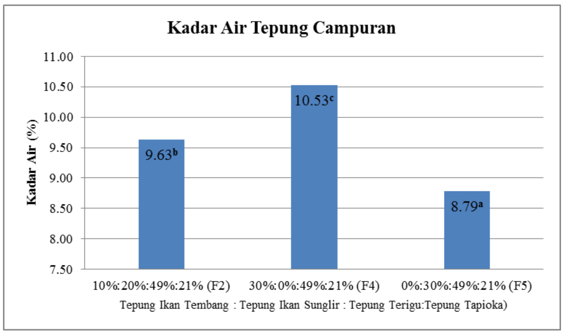
Perlakuan terbaik hasil uji organoleptik

Dilihat dari data grafik di bawah ini maka dapat dilihat 3 perlakuan terbaik yang diperoleh, yaitu perlakuan F5, F2 dan F4. Perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%) dengan nilai 3,72. Perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : tepung terigu 49% : tapioka 21%) dan perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49% : tapioka 21%). Perlakuan terbaik yang didapatkan kemudian dilakukan pengujian profil nutrisi dengan uji proksimat (kadar air, kadar abu, kadar protein, kadar lemak dan karbohidrat) serta pengujian fisik, yaitu daya serap air dan derajat warna.

III.3 Uji Proksimat Tepung Campuran dan Camilan Ikan

III.3.1 Kadar Air

Hasil pengujian kadar air terhadap tepung campuran dapat dilihat pada gambar berikut:

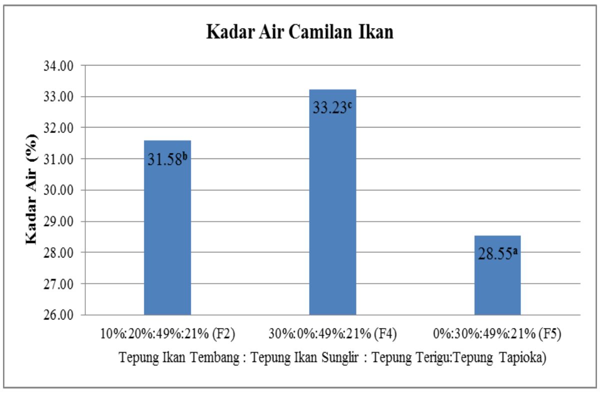


Gambar 5. Hasil Pengujian Kadar Air Tepung Campuran

Berdasarkan hasil analisis kadar air tepung campuran pada Gambar 5, menunjukkan bahwa hasil pengujian kadar air dari ketiga perlakuan berkisar antara 8.79% hingga 10,53%. Hasil pengujian kadar air tepung campuran dari ketiga perlakuan, maka diperoleh kadar air tertinggi pada perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49%: tapioka 21%), yaitu sebesar 10,53%. Sedangkan kadar air terendah dari tepung campuran terdapat pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49%: tapioka 21%), yaitu sebesar 8,79%. Hasil pengujian kadar air pada tepung campuran yang diperoleh telah memenuhi SNI 01-2715-1996, yaitu kadar air maksimal 12%. Hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan nyata terhadap 3 perlakuan. Perlakuan F2 berbeda nyata terhadap F4 dan F5. Perlakuan F4 berbeda nyata terhadap perlakuan F5 dan F2

Kadar air tertinggi diperoleh karena adanya penambahan tepung ikan tembang. Kadar air pada produk akan dipengaruhi oleh bahan bakunya. Selain itu, kandungan protein pada tepung ikan yang ditambahkan pada setiap perlakuan juga dapat mempengaruhi kadar air yang dihasilkan. Semakin tinggi tingkat protein pada suatu produk, maka kadar air yang dihasilkan akan semakin rendah, begitu pula sebaliknya. Adanya interaksi antara pati pada tepung terigu dan tapioka dengan protein pada tepung ikan menyebabkan air yang terikat oleh pati tidak lagi sempurna. Hal ini disebabkan karena gugus protein mampu mengikat pati, sehingga kadar air akan semakin menurun. Hal ini sesuai dengan Rosyidi dan Widyastuti (2014) bahwa ikatan pati dan protein yang semakin meningkat akan menyebabkan air yang terikat tidak maksimal.

Hasil pengujian kadar air terhadap camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



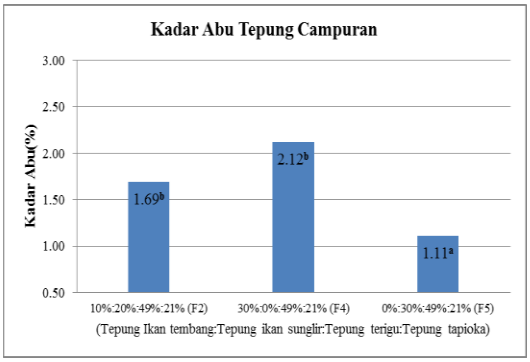
Gambar 6. Hasil Pengujian Kadar Air Camilan Ikan

Berdasarkan pada gambar di atas hasil analisis kadar air pada produk dari camilan ikan, menunjukkan bahwa kadar air dari ketiga perlakuan berkisar antara 28,55% hingga 33,23%. Kadar air camilan pada perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49%: tapioka 21%) meningkat dari tepung campuran, yaitu sebesar 33,23%. Sedangkan kadar air terendah terdapat pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49%: tapioka 21%), yaitu sebesar 28,55%. Hasil yang diperoleh dari tiga perlakuan telah memenuhi kadar abu, yang berlandakan pada SNI 7758:2013 Nugget Ikan, yaitu kadar air maksimal 60%. Hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$), menunjukan bahwa terdapat perbedaan yang nyata antara camilan ikan terhadap kadar air yang dihasilkan, sehingga perlu dilakukan uji lanjut (Duncan). Perlakuan F2 berbeda nyata terhadap F4 dan F5. Perlakuan F4 berbeda nyata terhadap perlakuan F5 dan F2.

Kadar air dari tepung campuran hingga menjadi produk camilan ikan terjadi peningkatan yang sangat signifikan. Hal ini dikarenakan pada pembuatan camilan ikan, terdapat penambahan air sehingga tepung terigu dan tepung tapioka dapat mengikat air serta adanya perlakuan penggorengan. Hal ini sesuai dengan Sari, *et all* (2017) kadar air suatu produk dapat meningkat diakibatkan tingginya penggunaan tepung terigu yang mengandung pati sehingga dapat mengikat air. Kandungan protein dari kedua jenis tepung ikan mudah terdeturasi pada saat penggorengan, sehingga dapat meningkatkan kemampuan daya ikat air pada camilan ikan. Hal ini sesuai dengan Filaili dan Sulistiani (2020) bahwa protein yang terdenaturasi pada suhu tinggi dapat berikatan dengan air, sehingga sangat sulit untuk diuapkan.

III.2.2 Kadar Abu

Kadar Abu merupakan kandungan di dalam suatu bahan pangan yang menggambarkan kandungan mineral suatu produk. Hasil pengujian kadar abu terhadap dari tepung campuran dapat dilihat pada gambar berikut:

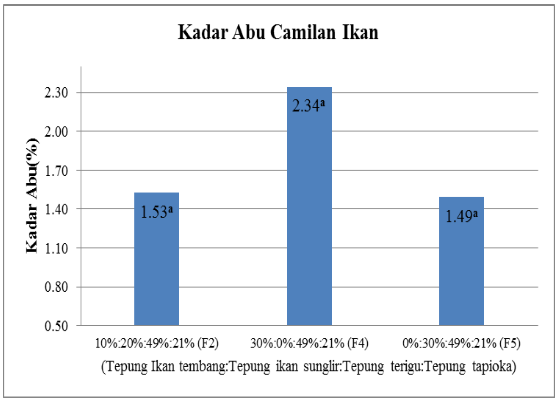


Gambar 7. Hasil Pengujian Kadar Abu Tepung Campuran

Berdasarkan gambar di atas hasil analisis kadar abu pada produk dari tepung campuran, menunjukkan bahwa kadar abu dari ketiga perlakuan berkisar antara 1,11 hingga 2,12%. Perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49%: tapioka 21%) menghasilkan kadar abu tertinggi, yaitu sebesar 2,12%. Sedangkan pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49%: tapioka 21%) menghasilkan kadar abu terendah, yaitu sebesar 1,11%. Kadar abu yang diperoleh pada tepung campuran ikan sesuai dengan SNI 01-2715-1996, yaitu maksimum 20%. Hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara tepung campuran terhadap kadar abu yang dihasilkan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukkan bahwa perlakuan F4 berbeda nyata dengan perlakuan F5, tetapi tidak berbeda nyata dengan perlakuan F2

Pada penambahan tepung ikan tembang sangat berpengaruh terhadap kadar abu yang dihasilkan. Hal ini dikarenakan kandungan mineral pada tepung ikan tembang. Mineral diperoleh dari tulang halus ikan tembang yang masih terdapat pada saat pengolahan tepung. Sehingga pada perlakuan dengan penggunaan tepung ikan tembang dihasilkan kadar abu yang cukup tinggi. Hal ini sesuai dengan pernyataan Kalishi (2011) dalam (Saputra, *et al.* 2016) bahwa kadar abu yang tinggi disebabkan karena tingginya kandungan mineral seperti kalsium dan fosfor pada tepung ikan.

Hasil pengujian kadar abu terhadap dari camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



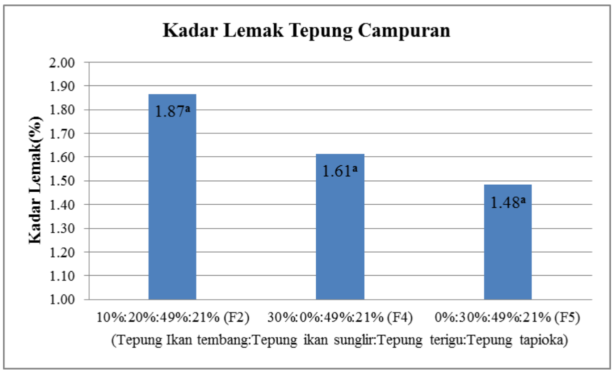
Gambar 8. Hasil Pengujian Kadar Abu Camilan Ikan

Berdasarkan pada gambar di atas hasil analisis kadar abu pada produk dari camilan ikan, menunjukkan bahwa kadar abu dari ketiga perlakuan berkisar antara 1,49 hingga 2,34%. Perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49% : tapioka 21%) diperoleh nilai kadar abu tertinggi, yaitu 2,34%. Sedangkan pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%) diperoleh nilai kadar abu terendah, yaitu sebesar 1,49%. Kadar abu yang diperoleh dari tiga perlakuan telah memenuhi SNI, yaitu maksimal 2,5%. Hasil analisis sidik ragam ANOVA diperoleh nilai ($p>0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara camilan ikan terhadap kadar abu yang dihasilkan, sehingga tidak perlu dilakukan uji lanjut (Duncan).

Proses penggorengan juga dapat mempengaruhi nilai kadar abu yang dihasilkan pada produk camilan ikan. Penggorengan dengan suhu tinggi dapat menyebabkan kadar abu meningkat karena hilangnya kadar air pada suatu produk. Hal ini sesuai dengan Fahmiyah (2017) bahwa nilai kadar abu pada sampel dapat meningkat karena dipengaruhi oleh hilangnya kadar air pada saat penggorengan menggunakan suhu tinggi, akan tetapi peningkatannya cukup kecil. Selain itu, penambahan garam sebanyak 2% juga dapat meningkatkan kandungan mineral pada produk. Pada saat penggorengan dapat menyerap kandungan mineral pada tepung ikan dan garam sehingga kadar abu akan meningkat (Rustam, 2019).

III.2.3 Kadar Lemak

Lemak merupakan salah satu nutrisi yang terkandung dalam bahan pangan yang sangat penting bagi tubuh. Hasil pengujian kadar lemak terhadap dari tepung campuran dapat dilihat pada gambar berikut:

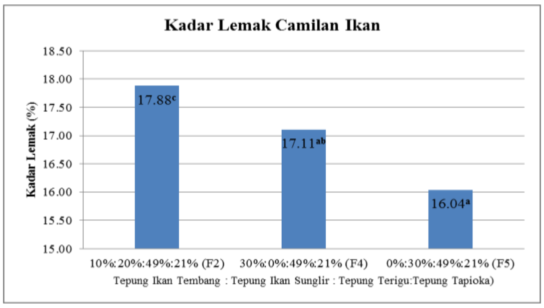


Gambar . 9 Hasil Pengujian Kadar Lemak Tepung Campuran

Berdasarkan gambar di atas, hasil analisis kadar lemak pada tepung campuran, menunjukkan bahwa kadar lemak dari ketiga perlakuan diperoleh nilai berkisar antara 1,48 hingga 1,87%. Perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : : tepung terigu 49% : tapioka 21%) diperoleh hasil kadar lemak tertinggi, yaitu sebesar 1,87%. Sedangkan kadar lemak terendah diperoleh pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : : tepung terigu 49% : tapioka 21%), yaitu sebesar 1,48%. Menurut FAO standar mutu tepung campuran sama dengan tepung premix ikan, yaitu maksmal 3%. Kadar lemak yang diperoleh dari tiga perlakuan memenuhi standar FAO. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai ($p>0,05$) menunjukan bahwa tidak terdapat perbedaan yang nyata antara tepung campuran terhadap kadar lemak yang dihasilkan, sehingga tidak perlu dilakukan uji lanjut (Duncan).

Penggunaan dua jenis tepung ikan pada perlakuan F2 dapat meningkatkan kadar lemak dari tepung campuran. Hal ini disebabkan tembang mengandung lemak sekitar 2%, sedangkan ikan sunglir mengandung lemak sebesar 0,91% (Rieuwpassa dan Cahyono, 2019). Selain itu, penambahan bubuk bawang merah dan bawang putih yang dapat meningkatkan kadar lemak pada tepung campuran. Hal ini sesuai dengan Wibowo (1999) dalam (Wahyuni, 2017) bahwa bawang merah dan bawang putih mengandung lemak masing-masing sebesar 0,3%.

Hasil pengujian kadar lemak terhadap camilan ikan yang terbuat dari tepung campuran dapat dilihat pada gambar berikut:



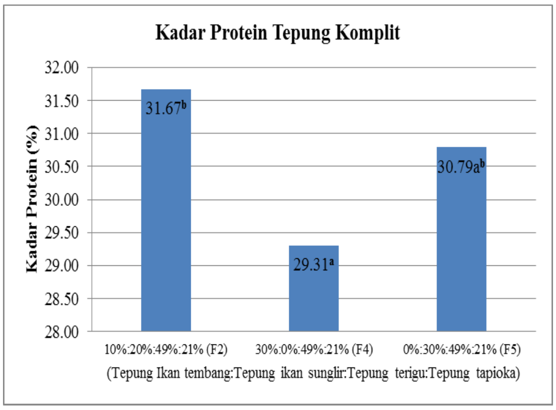
Gambar 10. Hasil Pengujian Kadar Lemak Camilan Ikan

Berdasarkan gambar di atas, hasil analisis kadar lemak pada camilan ikan, menunjukkan bahwa kadar lemak dari ketiga perlakuan berkisar antara 16,04 hingga 17,88%. Kandungan kadar lemak tertinggi diperoleh pada perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : : tepung terigu 49% : tapioka 21%), yaitu sebesar 17,88%. Sedangkan kadar lemak terendah diperoleh pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%), yaitu sebesar 16,04%. Hasil kadar lemak dari camilan ikan tidak memenuhi standar SNI, yaitu maksimal 15%. Hal ini dikarenakan adanya proses penggorengan pada camilan ikan. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa tidak terdapat perbedaan yang nyata antara camilan terhadap kadar lemak yang dihasilkan, sehingga perlu dilakukan uji lanjut (Duncan). Perlakuan F2 berbeda nyata terhadap perlakuan F4 dan F5. Sedangkan pada perlakuan F4 tidak berbeda nyata terhadap perlakuan F5.

Kandungan lemak dari tepung campuran menjadi camilan ikan mengalami peningkatan. Hal ini dikarenakan adanya proses penggorengan terhadap tepung campuran menjadi camilan ikan. Semakin lama penggorengan, maka kadar lemak akan semakin meningkat. Kadar lemak yang meningkat disebabkan karena adanya penambahan tepung ikan pada produk camilan ikan. Hal ini sesuai dengan pernyataan Saputra (2016) bahwa kadar lemak yang tinggi disebabkan karena banyaknya kombinasi tepung ikan yang ditambahkan pada produk. Hal ini juga didukung oleh pernyataan Agustiana dan Aisyah (2019) bahwa semakin tinggi konsentrasi tepung ikan yang ditambahkan , maka kandungan lemak pada produk juga akan semakin meningkat.

III.2.4 Kadar Protein

Protein merupakan zat makanan yang mengandung nitrogen yang sangat penting bagi tubuh. Hasil pengujian kadar protein tepung campuran dapat dilihat pada gambar berikut:

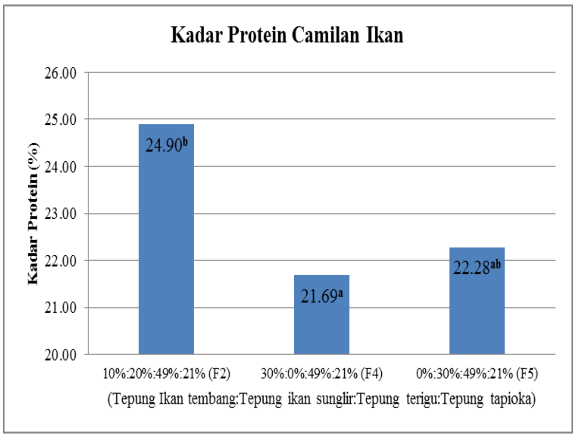


Gambar 12. Hasil Pengujian Kadar Protein Tepung Campuran

Berdasarkan gambar di atas, hasil analisis kadar protein pada tepung campuran, menunjukkan bahwa kadar protein dari ketiga perlakuan diperoleh nilai berkisar antara 29,31% hingga 31,67%. Perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : tepung terigu 49%: tapioka 21%) diperoleh hasil kadar protein tertinggi, yaitu sebesar 31,67%. Perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49%: tapioka 21%) diperoleh hasil kadar protein terendah, yaitu sebesar 29,31%. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara tepung campuran terhadap kadar protein yang dihasilkan dari tiga perlakuan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukan bahwa F2 berbeda nyata terhadap perlakuan F4. Akan tetapi, tidak berbeda nyata terhadap perlakuan F5. Hal ini disebabkan karena adanya pengaruh bahan berupa tepung ikan yang digunakan pada setiap perlakuan yang berbeda.

Pada perlakuan dengan penambahan tepung ikan sunglir memiliki kadar protein yang lebih tinggi dibandingkan dengan perlakuan yang hanya menggunakan tepung ikan tembang. Hal ini disebabkan karena daging ikan sunglir memiliki kandungan protein yang cukup tinggi dibandingkan dengan ikan tembang, yaitu sekitar 22,72%. Kadar protein tinggi tepung ikan sunglir diperoleh karena karakteristik daging ikan sunglir. Semakin putih daging ikan sunglir, maka kadar protein juga akan semakin tinggi. (Rieuwpassa dan Cahyono, 2019). Selain itu, proses pengolahan berupa pengukusan dan pengovenan pada pembuatan tepung ikan juga dapat mempengaruhi kandungan protein yang terdapat pada tepung ikan.

Hasil pengujian kadar protein camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



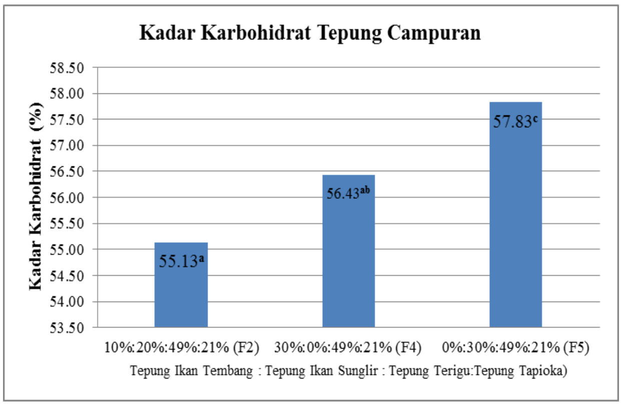
Gambar 13. Hasil Pengujian Kadar Protein Camilan Ikan

Berdasarkan gambar di atas, hasil analisis kadar protein pada camilan ikan, menunjukkan bahwa kadar protein dari ketiga perlakuan diperoleh nilai berkisar antara 21,69% hingga 24,90%. Perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% tepung terigu 49%: tapioka 21%), diperoleh kadar protein tertinggi, yaitu sebesar 24,90%. Pada perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49%: tapioka 21%) diperoleh kadar protein terendah, yaitu sebesar 21,69%. Pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49%: tapioka 21%) diperoleh kadar protein sebesar 22,28%. Kadar protein pada camilan ikan yang diperoleh sesuai dengan SNI, yaitu minimal 5%. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara camilan ikan terhadap kadar protein yang dihasilkan dari tiga perlakuan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukan bahwa F2 berbeda nyata terhadap perlakuan F4, akan tetapi tidak berbeda nyata dengan perlakuan F5.

Kadar protein yang diperoleh dari camilan ikan mengalami penurunan dibandingkan dengan tepung campuran, yaitu 31,67% menjadi 24,90%. Penurunan hasil kadar protein pada camilan ikan diakibatkan karena adanya perlakuan penggorengan. Penggorengan dengan suhu tinggi akan menyebabkan terjadinya reaksi maillard sehingga kadar protein camilan semakin menurun. Reaksi maillard terjadi karena adanya reaksi antara gugus amin bebas dari protein dengan gula pereduksi (Fitri dan Purwani, 2017).

III.2.5 Kadar Karbohidrat

Karbohidrat merupakan sumber energi utama yang sangat berperan penting bagi tubuh manusia. Kadar karbohidrat dapat ditentukan dengan menggunakan metode *by different*. Hasil pengujian kadar karbohidrat tepung campuran dapat dilihat pada gambar berikut:

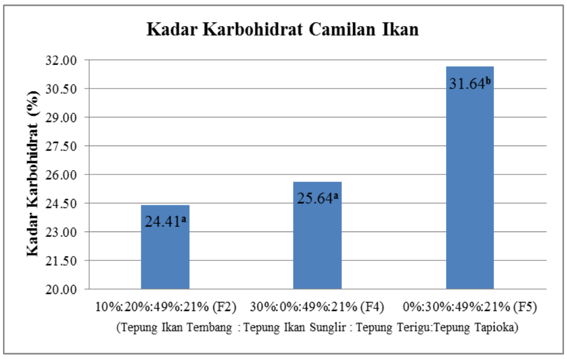


Gambar 14. Hasil Pengujian Kadar Karbohidrat Tepung Campuran

Berdasarkan gambar di atas, hasil analisis kadar karbohidrat pada tepung campuran, menunjukkan bahwa kadar karbohidrat dari ketiga perlakuan diperoleh nilai berkisar antara 55,13% hingga 57,83%. Perlakuan F2 (tepung ikan tembang 10%:tepung ikan sunglir 20%:tepung terigu 49%:tapioka 21%) diperoleh kadar karbohidrat terendah, yaitu sebesar 55,13%. Perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49%: tapioka 21%) diperoleh hasil tertinggi, yaitu sebesar 57,83%. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai (p<0,05) menunjukan bahwa terdapat perbedaan yang nyata antara tepung campuran terhadap kadar protein yang dihasilkan dari tiga perlakuan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukan bahwa F2 berbeda nyata terhadap perlakuan F5. Tetapi tidak berbeda nyata terhadap perlakuan F4.

Kadar karbohidrat dipengaruhi dengan penambahan tepung ikan pada setiap perlakuan. Penambahan dua jenis tepung ikan pada perlakuan F2 akan menyebabkan kandungan karbohidrat tepung campuran akan menurun. Hal ini dikarenakan, pada penggunaan dua jenis tepung ikan, diperoleh kadar protein yang semakin tinggi. Sebaliknya, penambahan dengan menggunakan satu jenis ikan pada perlakuan F4 dan F5, akan meningkatkan kadar karbohidrat pada tepung campuran. Hal ini sesuai dengan Fahmiyah (2017) bahwa kadar karbohidrat akan menurun jika kadar air, abu, protein dan lemak tinggi. Sebaliknya, jika kadar air, abu, lemak dan protein rendah, maka kadar karbohidrat akan semakin tinggi.

Hasil pengujian kadar karbohidrat camilan ikan dari tepung campuran dapat dilihat pada gambar berikut:



Gambar 15 Hasil Pengujian Kadar Karbohidrat Camilan Ikan

Berdasarkan gambar di atas, hasil analisis kadar karbohidrat pada camilan ikan, menunjukkan bahwa kadar karbohidrat dari ketiga perlakuan diperoleh nilai berkisar antara 24,41% hingga 31,64%. Perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : tepung terigu 49% : tapioka 21%) diperoleh kadar karbohidrat terendah, yaitu sebesar 24,41%. Sedangkan pada F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%) diperoleh kadar karbohidrat tertinggi, yaitu sebesar 31,64%. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai (p<0,05) menunjukan bahwa terdapat perbedaan yang nyata antara camilan ikan terhadap kadar karbohidrat yang dihasilkan dari tiga perlakuan, sehingga perlu dilakukan uji lanjut (Duncan). Dimana, perlakuan F2 berpengaruh nyata terhadap perlakuan F5, tetapi tidak berbeda nyata pada perlakuan F4.

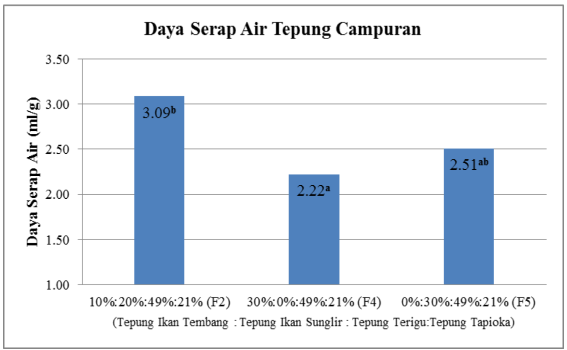
Kadar karbohidrat dari tepung campuran menjadi camilan ikan menjadi karena adanya perlakuan penggorengan. Camilan ikan dengan perlakuan yang menggunakan dua jenis tepung ikan menghasilkan kadar karbohidrat terendah, dibandingkan dengan perlakuan yang hanya menggunakan satu jenis tepung ikan. Hal ini dikarenakan, perlakuan yang menggunakan dua jenis tepung ikan memiliki kadar protein yang tinggi, sehingga dapat menurunkan kadar karbohidrat (Fahmiyah. 2017). Selain itu, pengaruh penggorengan terhadap karbohidrat dapat mempengaruhi rasa pada camilan ikan yang dihasilkan.

III.3 Uji Fisik Tepung Campuran

III.3.1 Daya Serap Air

Daya serap air tepung merupakan presentasi jumlah air yang dapat diserap oleh tepung yang dapat dibandingkan dengan berat awal tepung. Kemampuan dalam proses penyerapana air dalam suatu bahan pangan dapat disebut sebagai kapasitas penyerapan air.

Hasil Pengujian daya serap air tepung campuran dapat dilihat pada gambar di bawah ini:



Gambar 16. Hasil Pengujian Daya Serap Air Tepung Campuran

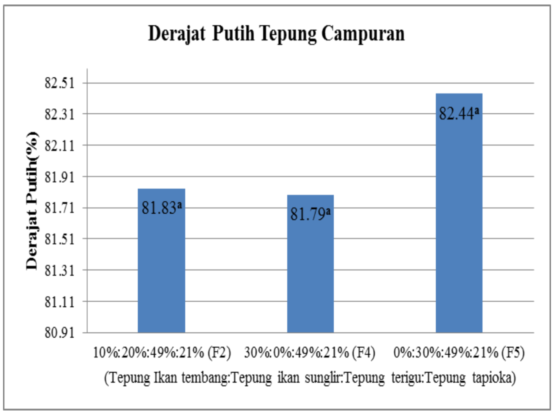
Berdasarkan gambar di atas, hasil analisis Daya serap air pada tepung campuran, menunjukkan bahwa daya serap air dari ketiga perlakuan diperoleh nilai berkisar antara 2,22 ml/g hingga 3,09 ml/gr. Perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : tepung terigu 49% : tapioka 21%) diperoleh nilai daya serap air tertinggi, yaitu sebesar 3,09 ml/g. Perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49% : tapioka 21%) diperoleh nilai terendah sebesar 2,22 ml/gr. Sedangkan pada perlakuan F5 (tepung ikan tembang 0% : tepung ikan sunglir 30% : tepung terigu 49% : tapioka 21%) diperoleh nilai daya serap air, yaitu sebesar 2,51 ml/gr. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai ($p<0,05$) menunjukan bahwa terdapat perbedaan yang nyata antara tepung campuran terhadap daya serap air yang dihasilkan dari tiga perlakuan, sehingga perlu dilakukan uji lanjut (Duncan). Hasil uji lanjut Duncan menunjukan bahwa F2 berbeda nyata terhadap perlakuan F4, tetapi tidak berbeda nyata terhadap perlakuan F5.

Hasil pengujian daya serap air yang dihasilkan dari tiga perlakuan, dipengaruhi oleh adanya kandungan protein, amilosa dan amilopektin serta ukuran partikel pada tepung. Perlakuan dengan penambahan dua jenis tepung ikan akan lebih mudah menyerap air karena kandungan proteinnya yang lebih tinggi dibandingkan dengan pelakuan lain yang hanya menggunakan satu jenis ikan. Protein yang lebih tinggi akan mampu menyerap air yang lebih banyak. Hal ini dikarenakan, protein memiliki sifat hidrofilik, yaitu mampu mengikat molekul air dengan kuat. Hal ini sesuai dengan Rombe (2020) bahwa produk dengan kandungan protein yang tinggi akan mudah menyerap air karena mampu menyediakan ruang terbukan untuk imobilisasi air. Selain itu, kandungan amilosa dan amilopektin yang terdapat pada tepung terigu dan tapioka dapat mempengaruhi daya serap air suatu produk. Semakin tinggi, kandungan amilopektin dan amilosa suatu produk, maka kemampuan dalam menyerap air akan semakin meningkat. Hal ini dikarenakan amilosa berkaitan dengan meningkatnya jumlah gugus hidrofilik yang memiliki kemampuan daya serap air yang lebih besar.

III.3.2 Derajat Putih

Derajat putih merupakan salah satu parameter yang dapat menentukan mutu tepung campuran dan tingkat kesukaan konsumen. Nilai derajat putih dari suatu produk dapat ditentukan menggunakan alat *Chromameter*. Skala warna yang digunakan dalam menentukan derajat putih, yaitu L*a*b color space. Nilai L menunjukan kecerahan, nilai a menunjukan redness/greeness dan nilai b menunjukan yelloeness/blueness. Nilai kecerahan (L*) tepung campuran yang diperoleh pada F2=86,62 ; F4=84,96; F5=87,75. Nilai (a*) tepung campuran yang diperoleh pada F2=2,55; F4=1,29; F5=3,55. Sedangkan nilai (b*) yang diperoleh pada perlakuan F2=12,01; F4=10,14; F5=13,40.

Nilai derajat putih pada tepung campuran, dapat dilihat pada gambar berikut :



Gambar 17. Hasil Pengujian Derajat Putih Tepung Campuran

Berdasarkan hasil perhitungan derajat putih tepung campuran yang diperoleh dari ketiga perlakuan, yaitu berkisar antara 81,79% hingga 82,44%. Pada perlakuan F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : tepung terigu 49% :tapioka 21%) diperoleh nilai derajat putih, yaitu sebesar 81,83%. Pada perlakuan F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49% :tapioka 21%) diperoleh nilai terendah, yaitu 81,79%. Sedangkan pada perlakuan F5 diperoleh derajat putih, yaitu 82,40%. Berdasarkan hasil analisis sidik ragam ANOVA diperoleh nilai (p>0,05) menunjukan bahwa tidak terdapat perbedaan yang nyata antara tepung campuran terhadap derajat putih yang dihasilkan dari tiga perlakuan, sehingga tidak perlu dilakukan uji lanjut (Duncan).

Tingkat kecerahan tepung campuran dipengaruhi oleh penggunaan konsentrasi dan jenis tepung ikan. Semakin tinggi nilai derajat putih yang didapatkan, maka tepung campuran yang dihasilkan semakin putih. Perlakuan dengan penambahan tepung ikan tembang memiliki tingkat kecerahan yang lebih rendah dibandingkan dengan penambahan tepung ikan sunglir dengan tingkat kecerahan yang lebih tinggi. Hal ini ini dikarenakan warna tepung ikan tembang yang cenderung gelap akibat adanya proses pengeringan saat pembuatan tepung. Selain itu, Kandungan protein pada tepung campuran juga mempengaruhi nilai derajat putih yang dihasilkan. Semakin tinggi nilai protein, maka nilai derajat putih semakin rendah. Hal ini sesuai dengan Ariyantoro *et all* (2020) bahwa protein dan gula mudah mengalami pre gelatinisasi pada suhu yang tinggi sehingga mampu menghasilkan warna cokelat pada tepung.

IV. PENUTUP

IV.1 Kesimpulan

Kesimpulan yang diperoleh dari penelitian ini, yaitu :

1. Formulasi terbaik yang diperoleh dari panelis berdasarkan pengujiian organoleptik, yaitu Formulasi F2 (tepung ikan tembang 10% : tepung ikan sunglir 20% : tepung terigu 49% : tapioka 21%), F4 (tepung ikan tembang 30% : tepung ikan sunglir 0% : tepung terigu 49% : tapioka 21%) dan F5 (tepung ikan tembang 0% : tepung ikan sunglir 0% : tepung terigu 49% :tapioka 21%).
2. Pada tepung campuran dan camilan diperoleh hasil tertinggi pada perlakuan F2, yaitu kadar air (9,63% dan 31,58%); kadar abu (2,12% dan 2,34%); lemak (1,87% dan 17,88%); protein (31,67% dan 24,90%); karbohidrat (55,13% dan 24,41%); daya serap air dan derajat putih tepung campuran (3,09% dan 81,83%).

IV.2 Saran

Saran untuk penelitian selanjutnya yaitu melakukan perhitungan daya serap minyak untuk mengetahui pengaruh minyak dalam menghasilkan flavour bagi produk camilan ikan. Selain itu, disarankan untuk melakukan pengujian daya simpan produk tepung campuran .

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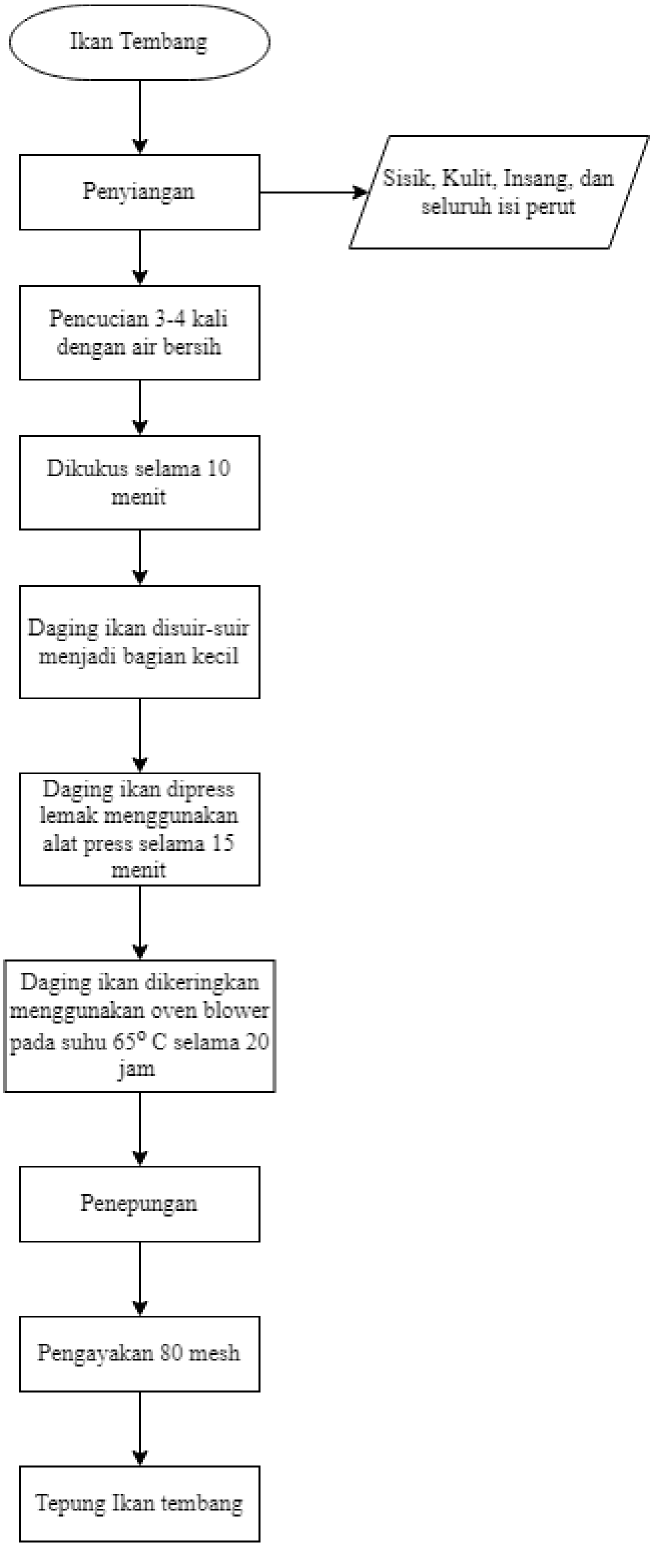
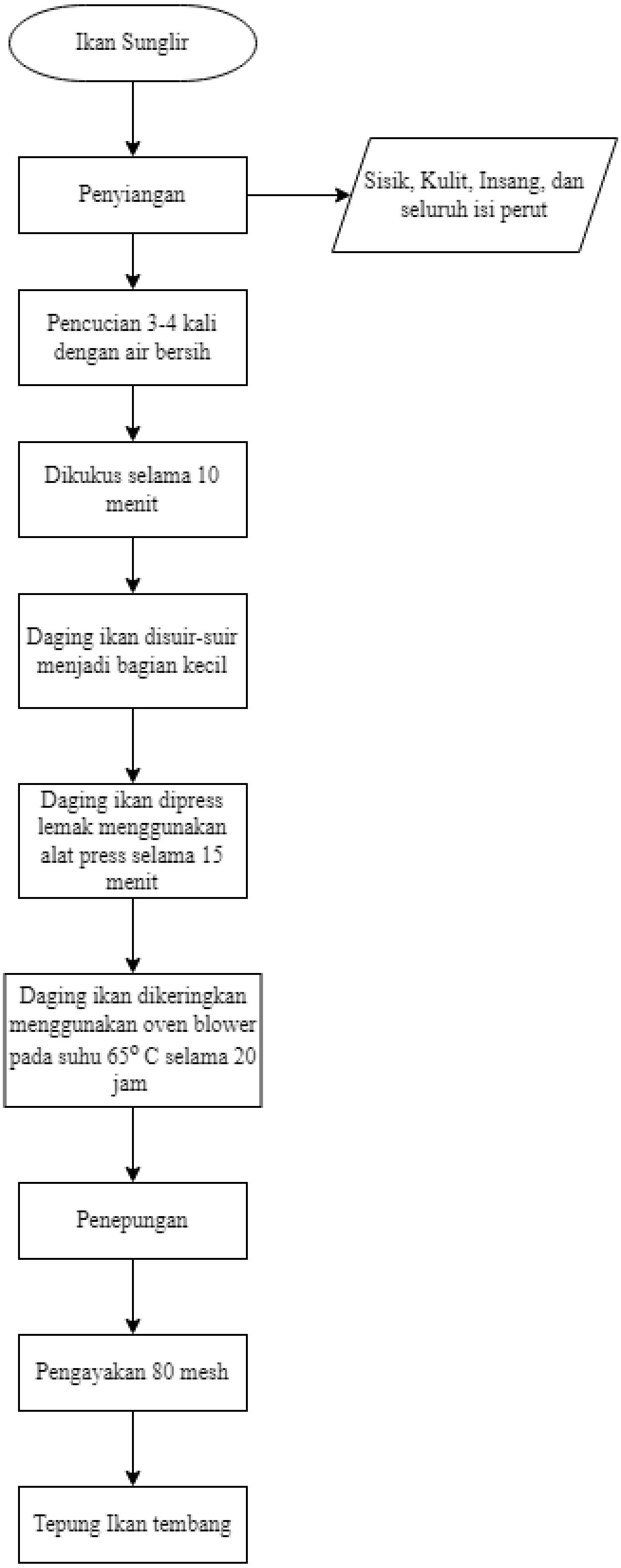
LAMPIRAN

Lampiran 1. Diagram Alir Pembuatan Tepung Ikan Tembang



1) Paper presented at the seminar on ITP Unhas results
2) Food Science and Technology Students
3) Lecturer of Food Science and Technology

Lampiran 2. Diagram Alir Pembuatan Tepung Ikan Sunglir



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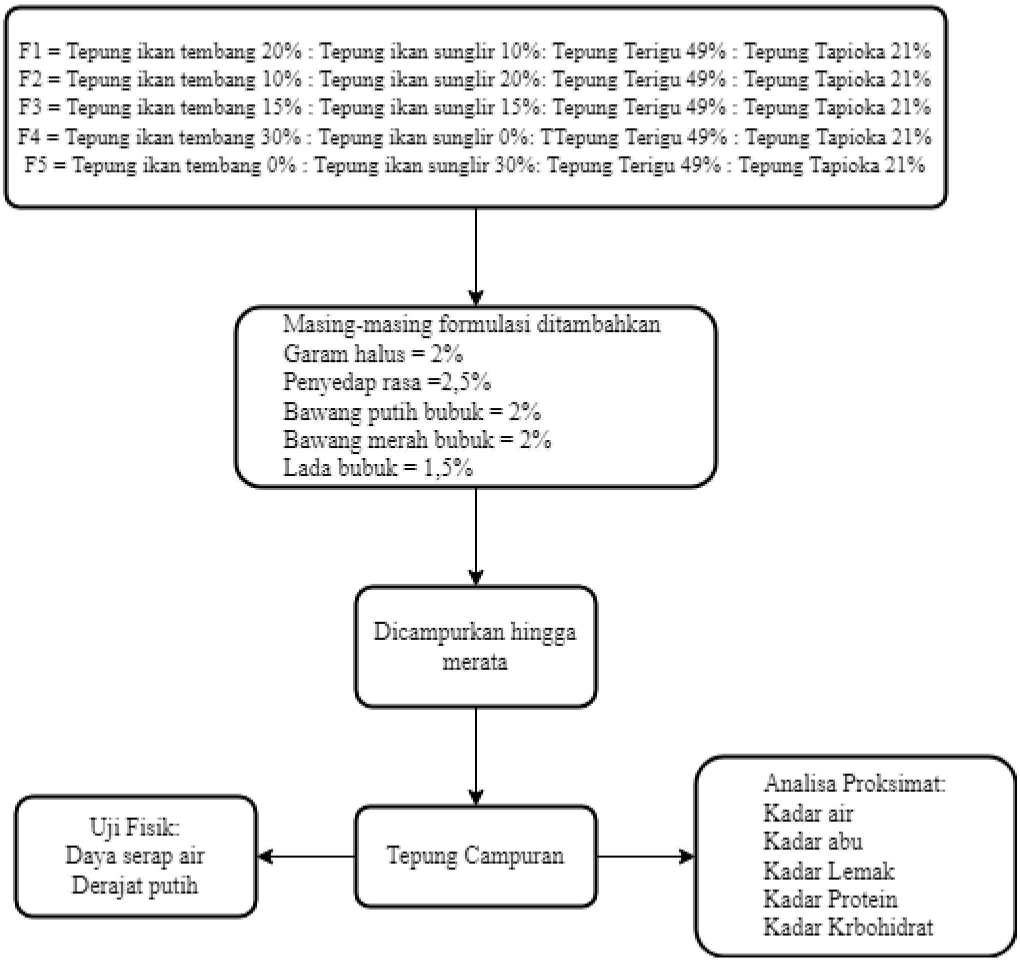
Lampiran 3. Diagram Alir Pembuatan Tepung Campuran



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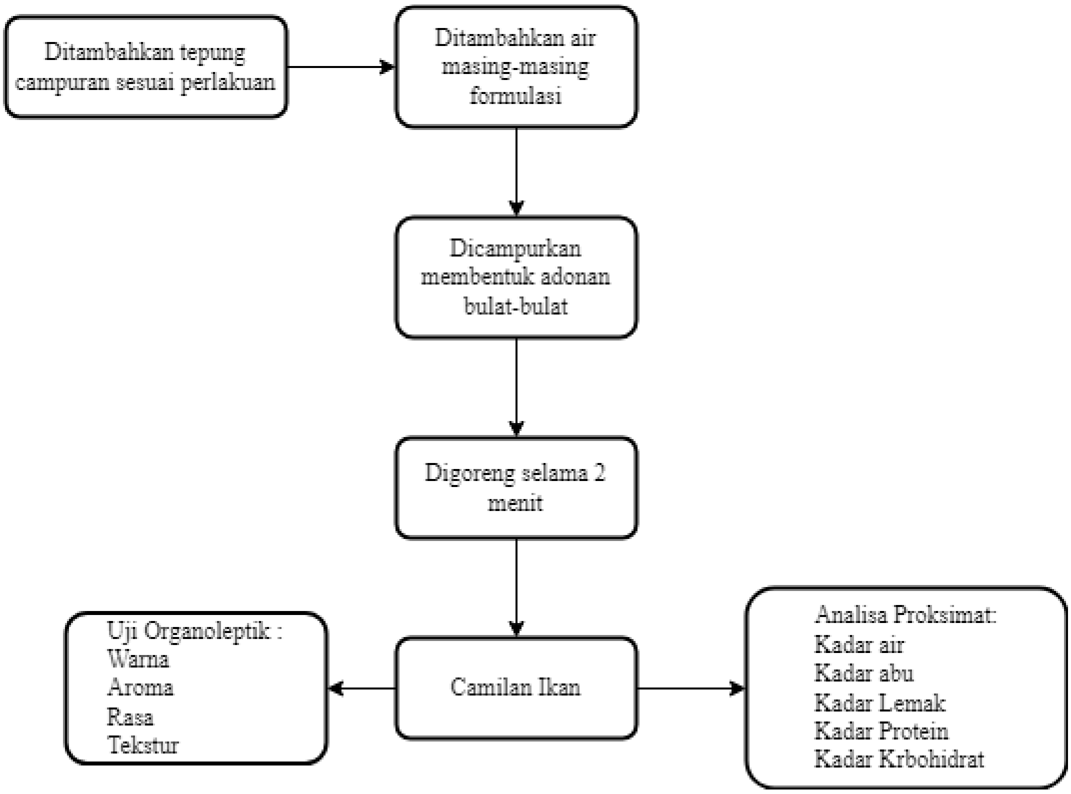
Lampiran 4. Diagram Alir Pembuatan Camilan Ikan dari Tepung Campuran



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STUDY OF MIXED FLOUR FROM THE FORMULATION OF TEMBANG FISH (*Sardinella fimbriata*) AND SUNGLIR FISH (*Elagatis bipinnulata*) AS RAW MATERIALS FOR MAKING FISH-BASED Snacks

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STUDY OF MAKING MIXED FLOUR FROM THE FORMULATION OF TEMBANG FISH (*Sardinella fimbriata*) AND SUNGLIR FISH (*Elagatis bipinnulata*) AS RAW MATERIALS FOR MAKING FISH-BASED Snacks [1)]

Musdalifah [2)] , [)] Abu Bakr Tawali [3)] , Mulyati M. Tahir [3]

ABSTRACT

In this study, mixed flour was formulated from a mixture of two types of fish meal to make fish-based snacks. In addition, this fish-based mixed flour can meet the nutritional needs of the community, especially from the protein content through instant products. **Objective** : To determine the best formulation of mixed flour based on fish meal of tembang fish (Sardinella fimbriata) and Sunglir fish (Elagatis bipinnulata) and to determine the physical and chemical properties of the mixture of flour and fish snacks produced. **Methods:** Performed with 5 treatments through organoleptic tests which include color, aroma, taste, and texture. The top 3 treatments obtained were tested proximately on mixed flour and fish snacks, and physical tests were carried out in the form of water absorption and color degrees. **Results** : In mixed flour and fish snacks, the water content was (8.79-1.53% and 28.55-33.23%); ash (1.11-2.12% and 1.49-2.34%); fat (1.48-1.87% and 16.04-17.88%); protein (29.31-31.67% and 21.69-24.90%); carbohydrates (55.13-57.83% and 24.41-31.64%). The water absorption of the mixed flour is 2.22 -3.09 ml/gram and the degree of whiteness is 81.79-82.44% . **Conclusion** : The top 3 formulations obtained from organoleptic testing were F2 (10% tembang fish meal: 20% sunglir fish meal: 49% flour : tapioca 21%), F4 (30% tembang fish meal: 0% sunglir fish meal: flour wheat flour 49%: tapioca 21%) and F5 (0% fish flour: 30% fish meal sunglir: wheat flour 49%: tapioca 21%) . In mixed flour and snacks, the highest results were obtained in the F2 treatment, namely water content (9.63% and 31.58%); ash content (2.12% and 2.34%); fat (1.87% and 17.88%); protein (31.67% and 24.90%); carbohydrates (55.13% and 24.41%); water absorption and whiteness of mixed flour (3.09ml/gr and 81.83%).

Keywords **:** Sunglir Fish (*Elagatis bipinnulata*), Tembang Fish (*Sardinella fimbriata*), Mixed Flour,

V. PRELIMINARY

I.5 Background

The nutritional needs of people in the modern era are still a very big concern. According to *Unicef* (2017), Indonesia is ranked in the top 5 countries in the world with 29.6% of children under 5 years old experiencing malnutrition. Balanced nutrition can be supported through the fulfillment of food needs. One of the efforts that can be taken in meeting food needs is to meet alternative food consumption. Indonesia has many sectors in meeting food needs, one of which is the agriculture and fisheries sector. Fishery products can be used as alternative food both in fresh and processed form. The following commodities are fishery products that can meet adequate nutritional needs, namely fish.

Fish is a very abundant water resource and rich in protein. According to data from the Central Statistics Agency (2021), Indonesia's marine fisheries production sold at TPI (Fish Auction Place) in 2019 reached 816,945.30 tons. The importance of fish resources for the needs of the community, both for food and economic

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activities, encourages the intensive use of these resources in a good processing effort, one of which is tembang fish and sunglir fish. Tembang fish (*Sardinella fimbriata*) is a type of fish that lives in groups in coastal waters throughout Indonesia. This fish has a flat body with a length of up to 130 mm (Pratiwi, 2013). The protein content in tembang fish is very complete because it has levels of essential amino acids and omega 3 (Sukma *et al* ., 2019). In addition to tembang fish, Sunglir fish (*Elagatis bipinnulata*) is also one type of fish that is quite abundant but has a fairly cheap price. Sunglir fish have a long round body, dark blue in color and dark fins and a white belly (Urbansa *et all* ., 2016). The protein content in sunglir fish is very high, reaching 22.72 % (Rieuwpassa and Cahyono, 2019). Both types of fish have complete nutritional content, but are still not widely used as a form of processed product and are usually only cooked directly as a side dish. One of the processed fish products that is widely known among the public is fish meal .

Fish meal is a type of product derived from processed fish, whether in whole form, waste or unfit for consumption. The protein content in fish can be influenced by the protein content in fish (Widodo *and* Sirajuddin. 2017). However, currently fish meal is only identical as a raw material for fish and livestock feed. Therefore, as a source of high protein, in increasing processed fish products that have nutritional value in fulfilling nutrition and alternative foods , which can be fulfilled by the presence of mixed flour. Mixed flour, which is a form of formulation technology by mixing certain different types of flour and some additional ingredients so that it is ready to be processed (Sukri, 2017). This product has a good impact on people's interest in producing practical food, especially in making fish-based side dishes and snacks such as empek-empek, otak-otak, sempol, fish sticks and fish crackers. This refers to research (Tawali *et all.*, 2019) that fish premix flour technology aims to manufacture products with balanced, practical and inexpensive formulas. In addition, it is hoped that the flour product has a long shelf life compared to fresh fish and its utilization is more flexible (Nomma, 2020).

Various efforts can be made to fulfill food needs that are practical and healthy in an effort to meet the nutritional needs of the community through the use of abundant food ingredients. Based on this, a research was conducted "Study of Making Mixed Flour from the Formulation of Tembang Fish (*Sardinella fimbriata*) and Sunglir Fish (*Elagatis bipinnulata*) as Raw Materials for Making Fish-Based Snacks "

I.6 Formulation of the problem

Tembang fish and sunglir fish are cheap and abundant types of fish and have high protein content. Therefore, in meeting the nutritional needs of the community through practical food, a mixture of flour made from fish is made. This is because the mixed flour can be used as a raw material for making fish-based snacks as a form of effort to fulfill nutrition, extend shelf life and increase the economic value of tembang fish and sunglir fish.

I.7 Research purposes

The purpose of this research, namely:

3. To find out the best formulation of mixed flour from tembang fish meal and sunglir fish
4. To determine the physical and chemical characteristics of mixed flour and fish snacks.

I.8 Benefits of research

The benefit of this research is that the community is expected to be able to develop the potential of mixed flour from fish raw materials as an effort to fulfill nutritional integrity and increase community income through proper fish processing. In addition, it can provide convenience for the community in making food products in the form of fish-based snacks from mixed flour, especially for housewives .

VI. RESEARCH METHODS

II.7 Research Time and Place

This research will be carried out from March to August 2022 at the Chemical Analysis and Food Quality Control Laboratory, Product Development Laboratory and Food Biotechnology Laboratory. Food Science and Technology Study Program, Department of Agricultural Technology, Faculty of Agriculture, Hasanuddin University, Makassar .

II.8 Tools and materials

The tools used in this study were a dryer (oven *blower*), flour sieve, basin, porcelain cup (*Haldenwenger*), desiccator (*Duran*), erlenmeyer, chemical beaker (*Pyrex*), *food proseccor*, measuring cup (*Pyrex*), stove , *kjedhal* flask , knife, steam pot, frying pan, press, spoon, centrifuge, *soxhlet*, kiln, analytical balance, bowl.

The materials used in this study were tembang fish, sunglir fish, tapioca flour, wheat flour, *aluminum foil, aquades,* shallot powder, garlic powder, pepper powder, salt, clean water, sulfuric acid (H_2SO_4) , Boric Acid (H_3BO_3), Hydrochloric Acid (HCl), NaOH (Sodium Hydroxide), Choloroform, Selenium and tissue roll.

II.9 Research procedure

II.3.1 Making Tembang Fish Flour (Nur Azizah, 2018)

Fresh tembang fish are weeded by separating the skin or scales, gills, bones and the entire contents of the stomach. Then washed with water as much as 3-4 times. After that, the fish meat is steamed for 10 minutes in order to soften the fish meat and then shredded. Next, the fish meat is ground and then press the fat for 15 minutes. Furthermore, the fish meat was dried by placing it in a blower oven at a temperature of ^{65oC} for 20 hours. The dried fish meat is then blended until smooth and sieved through an 80 mesh sieve.

II.3.2 Brewing Fish Flour (Nur Azizah, 2018)

Fresh Sunglir fish are weeded by separating the skin or scales, gills, bones and the entire contents of the stomach. Then washed 3-4 times and then steamed for 10 minutes in order to soften the fish meat. Next, the fish meat is ground and then press the fat for 15 minutes. Furthermore, the fish meat was dried by placing it in an oven at a temperature of ^{65oC} for 20 hours. The dried fish meat was then mashed using a grinder and sieved through 80 mesh.

II.3.3 Making Mixed Flour

Mixed fish flour, sunglir fish meal, tapioca flour and wheat flour with a predetermined formulation. Furthermore , additional ingredients or seasonings are given with a predetermined formulation.

II.3.4 Making Fish Snacks

In the process of making fish snacks, each formulation is added with enough water to form a calyx dough. Then the dough is rounded and fried for 2 minutes until the dough turns yellowish. Then the dough is drained.

II.10 Observation Parameter

II.4.1 Organoleptic Test (Diniyah *et all., 2019*)

Organoleptic testing , which is a test carried out using the human senses as the main tool in measuring the acceptability of mixed flour. Organoleptic test is carried out to determine the level of preference or feasibility of a product so that it can be accepted by consumers. The method used is the hedonic method, which is based on the level of preference which includes color, aroma, taste and texture. The semi-trained panelists used were 25 people. The assessment uses a scale of 1 to 5:

5 = Really like
4 = Like
3 = Somewhat like
2 = Dislike
1 = Very dislike

III.4.2 Proximate Test

1. Moisture Content (AOAC, 2005)

Analysis of the moisture content of mixed flour products and fish snacks was carried out using the oven method. The procedure for testing the moisture content starts from the porcelain cup to be used, dried in an oven at 105 ^{oC} for 1 hour, then cooled in a desiccator for 15 minutes and then weighed. The sample was mashed and weighed as much as 2 grams and then put into a porcelain dish whose weight was known. The sample was put into the oven and then dried at 105 ^{oC} for 5 hours. After that the sample was removed from the oven and cooled in a desiccator for 15 minutes. Then the porcelain cup containing the sample was weighed until a constant weight was obtained. Calculation of the water content of the sample uses the following formula:

$$\text{Water content (\%)} = \frac{Berat\ awal - Berat\ akhir}{Berat\ sampel} \text{x } 100\%$$

2. Ash content (AOAC, 2005)

Testing the ash content of mixed flour products and fish snacks was carried out using a kiln. The procedure for testing the ash content starts from the porcelain cup to be used, dried in an oven for 1 hour, then cooled in a desiccator for 15 minutes and then weighed. The sample is weighed as much as 2 grams and then put into a porcelain dish whose weight is known. Then the sample is put into a kiln with a temperature of 600 ^{oC} for 5 hours or until the sample becomes ash. After that, the sample was removed from the furnace and cooled in a desiccator for 15 minutes. The ash produced from the sample is then weighed and the ash content calculated using the following formula:

$$\text{Ash content (\%)} = \frac{Berat\ abu}{Berat\ sampel} \text{x } 100\%$$

3. Protein content (AOAC, 2005)

Protein content testing was carried out using the *Kjeldahl method* . The sample was weighed as much as 0.5 grams and then put into a Kjeldahl flask. Then put 1 g of selenium into each Kjeldahl flask containing the sample and add 7 ml of H_2SO_4 solution . Then the sample was destroyed at 430 ^{o} C for 1-2 hours until the solution became clear and then cooled until the solution formed crystals . After cooling, the solution was added with 50 ml of distilled water and 7 ml of 40% NaOH then distilled using a desiccator at a temperature of 100 ^{o} C. The distillation results were accommodated in a 125 ml Erlenmeyer which had been filled with 10 ml of 2% boric acid (H_3BO_3) and added 2-4 drops of bromcherosol green – methyl red indicator. After the distillate volume reaches 50 ml and turns green, the distillation process is stopped. Furthermore, the distillate was titrated using 0.1 N HCl solution until it changed color to pink. The titrant volume is read and recorded. Calculation of protein content using the following formula:

$$\% N = \frac{(HCl - Blanko)\ x\ NHCl\ x\ 14}{mg\ Sampel} x\ 100\%$$

% Protein content = % N x conversion factor

4. Fat Content (AOAC, 2005)

content analysis was carried out using *Soxhlet* . The fat flask was dried using an oven at a temperature of 105 ^{oC} for 1 hour and then cooled in a desiccator for 15 minutes and then weighed. Then the sample was weighed as much as 2 grams and then put into filter paper. Then put into a fat flask that has been weighed and connected to a Soxhlet tube. The fat sleeve was put into the extractor chamber of the Soxhlet tube and rinsed with fat solvent (chloroform). The extraction tube was mounted on a Soxhlet distillation apparatus and then heated at 40°C with an electric heater for 6 hours. The fat solvent in the fat flask is distilled until all the fat solvent has evaporated. At the time of distillation the solvent will be accommodated in the extractor chamber, the solvent is removed so that it does not return to the fat flask. Furthermore, the fat flask was dried in an oven at a temperature of 105°C. After that the flask is cooled in a desiccator and then its weight is weighed. The fat content can be calculated by the following formula:

$$\text{Fat content (\%)} = \frac{Berat\ lemak}{Berat\ sampel} x\ 100\%$$

5. Carbohydrate Content (AOAC, 2005)

Carbohydrate analysis was carried out by means of a rough calculation (*proximate analysis*) or by *Carbohydrate by difference* . Carbohydrate content was obtained from a 100% reduction in water content , ash content, protein content and fat content. Carbohydrate content is calculated using the following formula:

% Carbohydrate = 100% % (water+ash+protein+fat)

II.4.3 Physical Test

1. Water Absorption Test (Rauf and Sarbini, 2015)

A total of 1 gram of mixed flour was put into a centrifuge tube and added with 10 ml of distilled water, then vortexed for 2 minutes. Then let it sit for 15 minutes. Then centrifugation was carried out at 3000 rpm for 25 minutes. The supernatant was separated, then the sample was weighed. The difference between the weight of the sample after absorbing water and the dry sample per 100 g indicates the amount of water absorbed by the flour. Water absorption is expressed in the percent water absorption of flour to water absorption. Calculation of water absorption is done using the formula:

Water absorption

$$\frac{(A - B) - (Kadar\ Air\ Contoh \times bobot\ awal\ contoh)}{bobot\ awal\ contoh\ (1 - kadar\ air\ contoh} \times 100\%$$

2. White Degree Test Ariyantoro *et all* (2020)

The sample is inserted into a transparent container measuring using the *General Colorimeter* by producing the values of L*, a*, and b*. The L* value represents the brightness parameter (chromatic color, 0: black to 100 : white). The chromatic color of the red-green mixture is indicated by the value of a* (a+ = 0-100 for red, a- = 0-(-80) for green). The mixed chromatic color of blue-yellow is indicated by the value of b* (b+ = 0-7 for yellow, b- = 0-(-70) for blue). The results of the analysis of L*, a*, and b* are entered into the formula

White Degree : $\mathbf{100[(100-L)^2 + a^2 + b^2)]^{0.5}}$

II.11 Research design

II.5.1 Research Phase 1

Phase I research was conducted to obtain the best formulation of mixed flour by making fish snacks. Making fish snacks from tembang fish meal and sunglir fish with the addition of wheat flour and tapioca using 5 formulations based on research (Rombe *et all.,* 2019) by modifying the treatment.

Table 1. Formulation for Making Fish Snack Mixed Flour

Ingredient	Treatment				
	F1 (%)	F2 (%)	F3 (%)	F4 (%)	F5 (%)
Song Fish Flour	20	10	15	30	0
Fish Flour Sunlir	10	20	15	0	30
Flour	49	49	49	49	49
Tapioca flour	21	21	21	21	21
Amount	100	100	100	100	100

Table 2. Additives for fish snack mix flour

Ingredient	gr	%
Fine salt	2	2
Flavoring	2.5	2.5
Garlic Powder	2	2
Onion powder	2	2
Pepper powder	1.5	1.5
Total	10	10

Source: Modification Fahmiyah, 2017

After making fish snacks from mixed flour with 5 formulations, organoleptic testing will be continued by determining the best 3 formulations to be continued in the second stage of the study.

II.5.2 Research Phase 2

The best formulation of fish snacks from mixed flour will be tested for proximate tests on mixed flour and fish snacks which include tests for water content, ash content, protein, fat and carbohydrates as well as physical tests on mixed flour which include tests for water permeability and whiteness.

II.12 Data processing

This study used a completely randomized design (CRD) with 3 replications. Observational data were processed using the SPSS application. One way ANOVA method (0.05) was used to determine the different tests for each treatment , then continued with Duncan's test if significant differences were found in each treatment.

VII. RESULTS AND DISCUSSION

III.1. Organoleptic Test of Fish Snack Products Using Mixed Flour of Tembang Fish and Sunglir Fish

III. 1.1 Color

The results of organoleptic testing on the color parameters of fish snack products from mixed flour can be seen in the following figure:

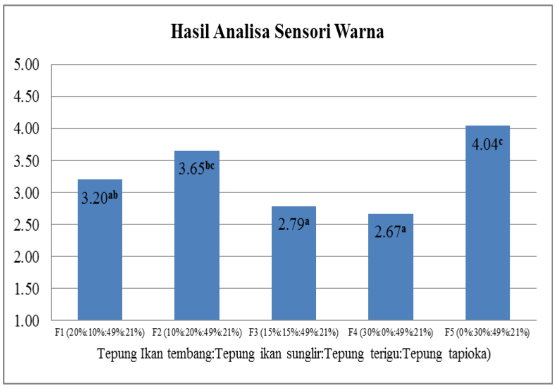


Figure 1. Results of Organoleptic Test of Fish-Based Snack Color from Mixed Flour

Based on the results of organoleptic test of color parameters on fish snack products with a comparison of fish meal and mixed flour, an average value of 3.20 to 4.04 was obtained. The results obtained showed that the panelists' assessment of the organoleptic color of the fish snacks was in the range of somewhat like to like. Figure 1 shows that the panelists' highest assessment of fish snacks was in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21 percent tapioca), which is 4.04 with a yellow-brown color. While the lowest results were obtained in the F4 treatment (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21%), which was 2.67 showing a slightly dark brown color. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) indicates that there is a significant difference in the color parameters produced in fish snacks, so further testing is necessary (Duncan). Duncan's further test results showed that the F1 treatment was significantly different from the F5 treatment but not significantly different from the F2 treatment. F3 and F4 .

The color produced in fish snacks is influenced by the use of some fish flour and mixed flour in the form of wheat flour and tapioca flour with different ratios. The use of fish meal which is higher in the formulation can cause a slightly darker color in the fish snacks produced, so that the panelists do not like it. The dark color of fish snacks is caused by the color of tembang fish meal which tends to be dark due to the drying process when making flour. This is in accordance with Khalishi (2011) that in the drying process a non-enzymatic browning reaction occurs due to the heating temperature. Browning or Maillard reaction occurs because of the reaction between carbohydrates and proteins in reducing sugars with amino acid groups. On the other hand, the higher use of fish meal can cause the color of the fish snacks to tend to be slightly yellow-brown so that the panelists like it.

III. 1.2 Scent

The results of organoleptic testing on the aroma parameters of fish snack products from mixed flour can be seen in the following figure:

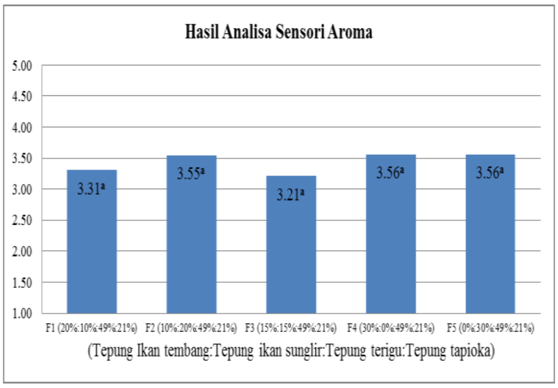


Figure 2. Organoleptic Test Results of Fish-Based Snack Aroma from Mixed Flour

, the average value ranges from 3.21 to 3.56. The results obtained indicate that the panelists' assessment of the aroma parameters in fish snacks is in the range of somewhat like to like. Figure 2 shows that the results of the organoleptic test on the aroma of the snacks obtained the highest results in 2 treatments with the same value, namely in treatment F5 (0% tembang fish flour: sunglir fish flour 30%: 49% wheat flour: 21% tapioca) and F4 (30% tembang fish meal: 0% sunglir fish meal: %:49% wheat flour: 21%), which is 3.56. While the lowest results were obtained in the F3 treatment (15% tembang fish meal: 15 % sunglir fish meal: 49% wheat flour: 21%), ie with a value of 3.39. Based on the analysis of variance ANOVA, the value ($p > 0.05$) indicates that there is no significant difference between fish snack products and the resulting aroma parameters, so there is no need for further testing (Duncan).

The aroma of fish snacks is influenced by the use of two types of fish meal. The use of two types of fish meal will make fish snacks have a strong fish aroma. While the use of one type of fish in fish snack products has a less pungent aroma, so that the panelists only like the aroma in the treatment that uses only one type of fish. This is in accordance with Valentina *et al* (2021) that the more types of fish meal are added, the stronger the aroma produced, thereby reducing the panelists' preference for the product. Volatile compounds contained in fish meal can affect the characteristics of fish snacks, especially on aroma. Volatile compounds will evaporate during frying (Pratama *et all*, 2021).

III. 1.3 Flavor

The results of organoleptic testing on the taste parameters of fish snack products from mixed flour can be seen in the following figure:

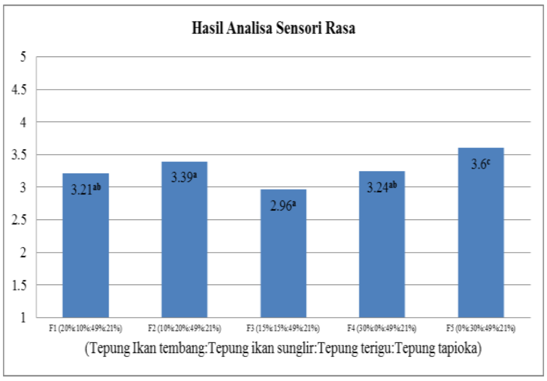


Figure 3. Organoleptic Test Results for Fish-Based Snacks from Mixed Flour

Based on the results of organoleptic test of taste parameters on fish snack products with a comparison of fish meal and mixed flour through 5 treatments, the average value ranged from 2.96 to 3.60. The results obtained showed that the panelists' assessment of the taste of the fish snacks was in the range of somewhat like to like. In Figure 3, the organoleptic taste test obtained the highest results in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21%), ie with a value of 3.60. While the lowest results were obtained in the F3 treatment (15 % tembang fish meal : 15 % sunglir fish meal : 49 % wheat flour : 21 % tapioca), which was 2.96. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) indicates that there is a significant difference between fish snack products and the resulting taste parameters, so further testing is necessary (Duncan). Duncan's further test results showed that the F3 treatment was significantly different from the F2 and F5 treatments, but not significantly different from the F1 and F4 treatments.

Sensory assessment of taste in fish snacks was influenced by the use of two types of fish meal with the addition of mixed flour such as tapioca flour and wheat flour. In the treatment that uses two types of fish meal, it will cause the distinctive taste of fish to increase so that the panelists' acceptance of fish snacks decreases. This is in accordance with Anwar, *et al* (2019) that different types of fish can cause different product flavors even with the addition of the same wheat flour and tapioca . In addition, the frying process will also affect the taste of the fish snack.

III. 1.4 Texture

The results of texture organoleptic testing of fish snack products can be seen in the following figure:

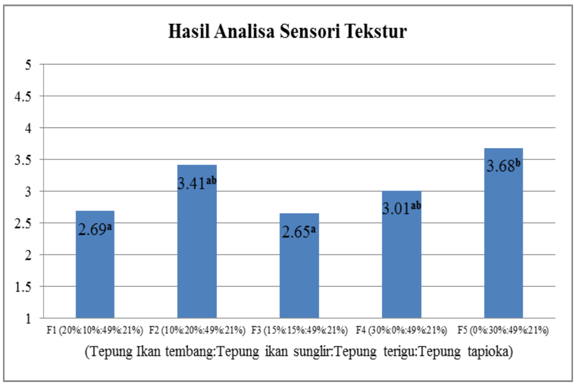


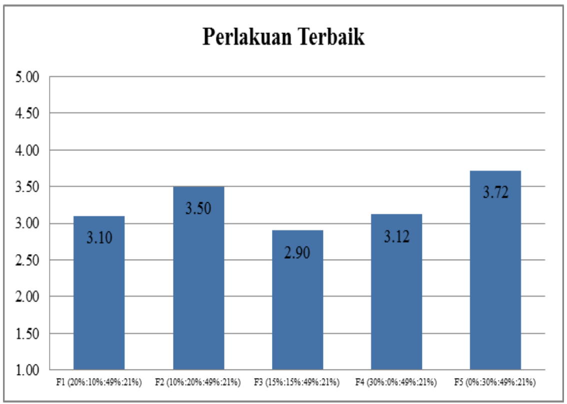
Figure 4. Organoleptic Test Results of Fish-Based Snack Texture from Mixed Flour

Based on the results of the organoleptic test of texture parameters on fish snack products with a comparison of fish meal and mixed flour, the average value ranges from 2.65 to 3.68. The results obtained showed that the panelists' assessment of the texture of the fish snacks was in the range of somewhat like to like. Based on Figure 4, the results of the organoleptic texture test obtained the highest results in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21%), ie 3.68. While the lowest results were obtained in the F3 treatment (15% tembang fish meal: 15% sundried fish meal: 49% wheat flour: 21% tapioca), which was 2.65. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) indicates that there is a significant difference between fish snack products and the resulting texture parameters, so further testing is necessary (Duncan). Duncan's further test results showed that the F3 treatment was significantly different from the F5 treatment. However, it was not significantly different in F1, F2 and F4 perlakuan treatments

The results of the organoleptic test on the texture obtained by the concentration of addition of fish meal. Treatments that used higher concentrations of sunglir fish meal had a higher level of texture preference. This is due to the high protein content of sunglir fish, so it can increase the crispness and savoriness of fish snacks. In addition, the addition of tapioca flour and wheat flour can give a chewy texture to fish snack products. This is in accordance with Hermanto and Susanti (2020) that fish meal has a hydroxyl group found in protein plus the starch content contained in tapioca flour so that it can cause crispness.

III.2. Best Treatment

The best treatment was obtained from the recapitulation of the value of the panelists' preference level through a hedonic test with parameters of color, aroma, taste and texture. From the results of the organoleptic test, the best 3 treatments out of 5 treatments were obtained.



The best treatment of organoleptic test results

Judging from the graphic data below, it can be seen that the 3 best treatments were obtained, namely F5, F2 and F4 treatments. F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) with a value of 3.72. Treatment F2 (10 % tembang fish meal: sunglir fish meal 20%: 49% wheat flour: tapioca 21%) and F4 treatment (30% tembang fish meal: sunglir fish meal 0%: 49% wheat flour: 21%). The best treatment obtained was then tested for nutritional profiles with proximate tests (water content , ash content, protein content, fat and carbohydrate content) as well as physical testing, namely water absorption and color degrees.

III.3 Proximate Test of Mixed Flour and Fish Snacks

III. 3.1 Moisture Content

The results of testing the water content of the mixed flour can be seen in the following figure:

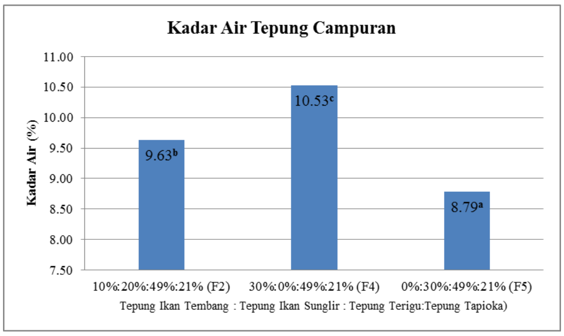


Figure 5. Mixed Flour Moisture Test Results

Based on the results of the analysis of the water content of the mixed flour in Figure 5, it shows that the results of testing the water content of the three treatments ranged from 8.79% to 10.53 % . The results of testing the water content of the mixed flour from the three treatments, the highest water content was obtained in the F4 treatment (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca), which was 10.53%. Meanwhile, the lowest water content of the mixed flour was found in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21%), which was 8.79%. The results of testing the water content in the mixed flour obtained have met SNI 01-2715-1996 , namely the maximum water content of 12%. The results of the analysis of variance ANOVA obtained a value ($p < 0.05$) indicating that there were significant differences between the 3 treatments. The treatment of F2 was significantly different from F4 and F5. The treatment of F4 was significantly different from the treatment of F5 and F2

The highest water content was obtained due to the addition of tembang fish meal. The water content of the product will be influenced by the raw material. In addition, the protein content in fish meal added to each treatment can also affect the water content produced. The higher the protein level in a product, the lower the water content produced, and vice versa. The interaction between starch in wheat flour and tapioca with protein in fish meal causes the water bound by starch is no longer perfect. This is because the protein groups are able to bind starch, so the water content will decrease. This is in accordance with Rosyidi and Widyastuti (2014) that the increasing starch and protein bonds will cause the bound water to be not optimal.

The results of testing the water content of fish snacks from mixed flour can be seen in the following figure:

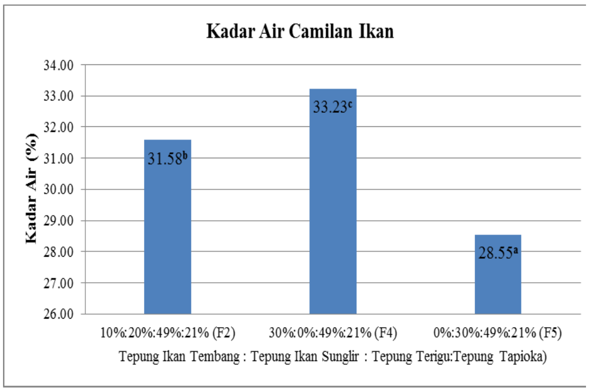


Figure 6. Fish Snack Moisture Test Results

Based on the picture above, the results of the analysis of the water content in the product from fish snacks, showed that the water content of the three treatments ranged from 28.55% to 33.23 %. The water content of the snacks in the F4 treatment (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) increased from the mixed flour, which was 33.23 %. While the lowest water content was found in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21 percent tapioca), which was 28.55%. The results obtained from the three treatments have met the ash content , which is based on SNI 7758:2013 Fish Nugget, which is a maximum water content of 60%. The results of the analysis of variance ANOVA obtained a value ($p < 0.05$), indicating that there was a significant difference between fish snacks and the water content produced, so further tests were needed (Duncan). The treatment of F2 was significantly different to F4 and F5. The treatment of F4 was significantly different from the treatment of F5 and F2.

The water content of the mixed flour to become a fish snack product was a very significant increase. This is because in the manufacture of fish snacks, there is an addition of water so that wheat flour and tapioca flour can bind water and there is a frying treatment. This is in accordance with Sari, *et all* (2017) The water content of a product can increase due to the high use of wheat flour which contains starch so that it can bind water. The protein content of both types of fish meal is easily dehydrated during frying, so it can increase the water holding capacity of fish snacks. This is in accordance with Filaili and Sulistiani (2020) that proteins that are denatured at high temperatures can bind to water, making it very difficult to evaporate.

III. 2.2 Ash Content

Ash content is the content in a food ingredient that describes the mineral content of a product. The results of testing the ash content of the mixed flour can be seen in the following figure:

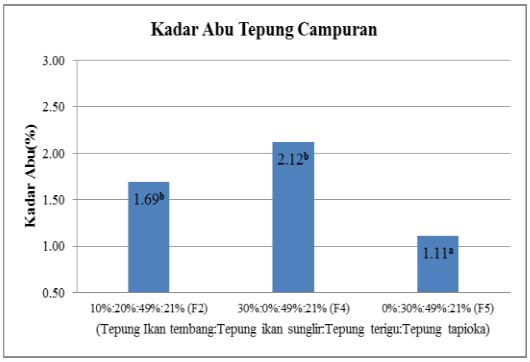


Figure 7. Mixed Flour Ash Content Test Results

Based on the picture above, the results of the analysis of the ash content of the mixed flour product, showed that the ash content of the three treatments ranged from 1.11 to 2.12%. Treatment F4

(30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) produced the highest ash content, which was 2.12%. While the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) produced the lowest ash content, which was 1.11%. The ash content obtained in the mixed fish meal was in accordance with SNI 01-2715-1996, which was a maximum of 20%. The results of the analysis of variance ANOVA obtained a value ($p < 0.05$) indicating that there was a significant difference between the mixed flour and the resulting ash content, so it was necessary to carry out further tests (Duncan). Duncan's further test results showed that the F4 treatment was significantly different from the F5 treatment, but not significantly different from the F2 . treatment

addition of tembang fish meal greatly affects the ash content produced . This is due to the mineral content in tembang fish meal. Minerals are obtained from the fine bones of tembang fish that are still present during flour processing. So that the treatment with the use of tembang fish meal resulted in a fairly high ash content. This is in accordance with the statement of Kalishi (2011) in (Saputra, *et al.* 2016) that the high ash content is due to the high content of minerals such as calcium and phosphorus in fish meal.

The results of testing the ash content of fish snacks from mixed flour can be seen in the following figure:

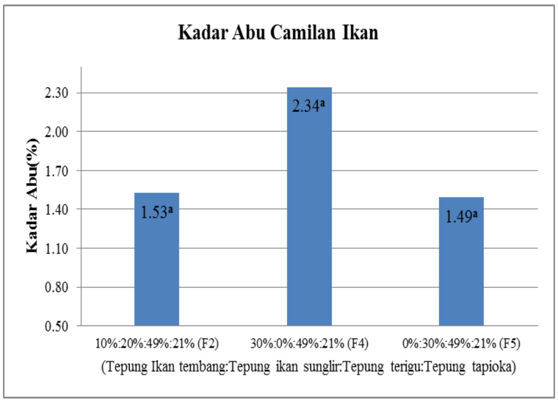


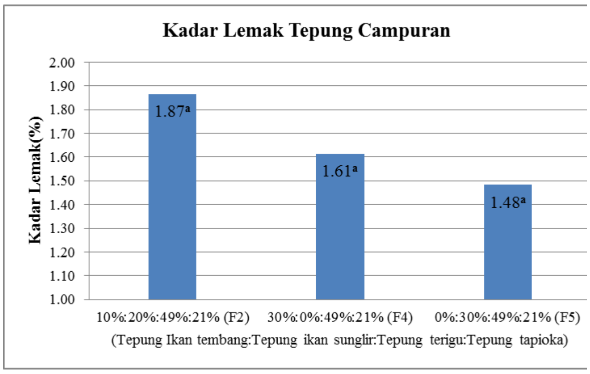
Figure 8. Fish Snack Ash Content Test Results

Based on the picture above, the results of the analysis of the ash content of the product from fish snacks, showed that the ash content of the three treatments ranged from 1.49 to 2.34%. Treatment F4 (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the highest ash content value, which was 2.34%. While in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) the lowest ash content value was 1.49%. The ash content obtained from the three treatments has met the SNI, which is a maximum of 2.5 % . The results of the analysis of variance ANOVA obtained a value ($p > 0.05$) indicating that there was a significant difference between fish snacks and the resulting ash content , so there was no need for further tests (Duncan).

The frying process can also affect the value of the ash content produced in fish snack products. Frying with high temperatures can cause the ash content to increase due to the loss of water content in a product. This is in accordance with Fahmiyah (2017) that the value of the ash content in the sample can increase because it is influenced by the loss of water content when frying using high temperatures, but the increase is quite small. In addition, the addition of 2% salt can also increase the mineral content of the product. At the time of frying, it can absorb the mineral content in fish meal and salt so that the ash content will increase (Rustam, 2019).

III.2.3 Fat Content

Fat is one of the nutrients contained in food that is very important for the body. The results of testing the fat content of the mixed flour can be seen in the following figure:



Picture . 9 Test Results for Mixed Flour Fat Content

Based on the picture above, the results of the analysis of the fat content in the mixed flour, showed that the fat content of the three treatments obtained values ranging from 1.48 to 1.87%. The F2 treatment (10 % tembang fish meal: 20% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the highest fat content, which was 1.87%. While the lowest fat content was obtained in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca), which was 1.48%. According to FAO, the quality standard of mixed flour is the same as that of fish premix flour, which is a maximum of 3%. The fat content obtained from the three treatments met FAO standards. Based on the results of the analysis of variance ANOVA obtained a value ($p > 0.05$) indicates that there is no significant difference between the mixed flour on the fat content produced, so there is no need for further test (Duncan).

The use of two types of fish meal in the F2 treatment can increase the fat content of the mixed flour. This is because tembang contains about 2% fat, while sunglir fish contains 0.91 % fat (Rieuwpassa and Cahyono, 2019). In addition, the addition of onion and garlic powder can increase the fat content of the mixed flour. This is in accordance with Wibowo (1999) in (Wahyuni, 2017) that shallots and garlic contain 0.3% fat each .

The results of testing the fat content of fish snacks made from mixed flour can be seen in the following figure:

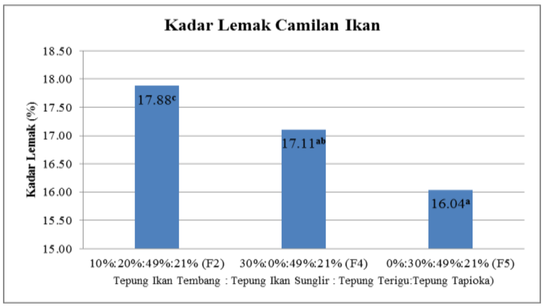


Figure 10. Fish Snack Fat Content Test Results

Based on the picture above, the results of the analysis of fat content in fish snacks, showed that the fat content of the three treatments ranged from 16.04 to 17.88%. The highest fat content was obtained in the F2 treatment (10 % tembang fish meal: 20% sunglir fish meal: 49% wheat flour: 21% tapioca), which was 17.88%. While the lowest fat content was obtained in the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21 percent tapioca), which was 16.04%. The results of the fat content of fish snacks do not meet the SNI standard, which is a maximum of 15%. This is due to the frying process in fish snacks. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) indicates that there is no significant difference between snacks and the fat content produced, so further testing is necessary (Duncan). The treatment of F2 was significantly different from the treatment of F4 and F5. While the F4 treatment was not significantly different from the F5 treatment.

The fat content of the mixed flour into fish snacks has increased. This is due to the frying process of the mixed flour into fish snacks. The longer the frying time, the higher the fat content . The increased fat content was caused by the addition of fish meal in fish snack products. This is in accordance with Saputra's (2016) statement that the high fat content is due to the many combinations of fish meal added to the product. This is also supported by the statement of Agustiana and Aisyah (2019) that the higher the concentration of fish meal added, the fat content in the product will also increase.

III.2.4 Protein Level

Protein is a food substance that contains nitrogen which is very important for the body. The results of testing the protein content of the mixed flour can be seen in the following figure:

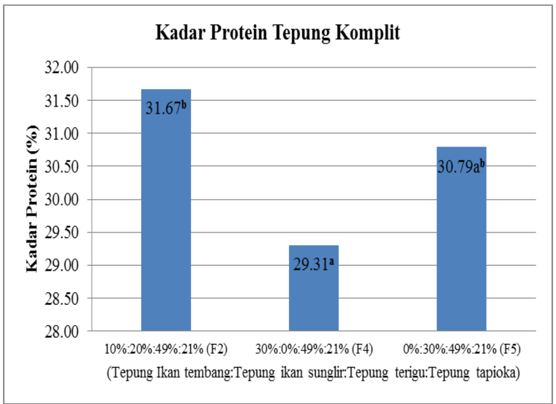


Figure 12. Test Results for Mixed Flour Protein Content

Based on the picture above, the results of the analysis of protein content in mixed flour, showed that the protein content of the three treatments obtained values ranging from 29.31 % to 31.67%. Treatment F2 (10 % tembang fish flour: 20% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the highest protein content, which was 31.67%. Treatment F4 (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the lowest protein content, which was 29.31%. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) showed that there was a significant difference between the mixed flour and the protein content produced from the three treatments, so further tests were needed (Duncan). Duncan's further test results showed that F2 was significantly different from the F4 treatment. However, it was not significantly different from the F5 treatment. This is due to the influence of the material in the form of fish meal used in each different treatment.

treatment with the addition of sunglir fish meal had a higher protein content than the treatment that only used tembang fish meal. This is because the sunglir fish meat has a fairly high protein content compared to tembang fish, which is around 22.72 %. The high protein content of Sunglir fish meal was obtained because of the characteristics of the Sunglir fish meat. The whiter the sundried fish meat, the higher the protein content. (Rieuwpassa and Cahyono, 2019). In addition, the processing process in the form of steaming and oven in the manufacture of fish meal can also affect the protein content contained in fish meal.

The results of testing the protein content of fish snacks from mixed flour can be seen in the following figure:

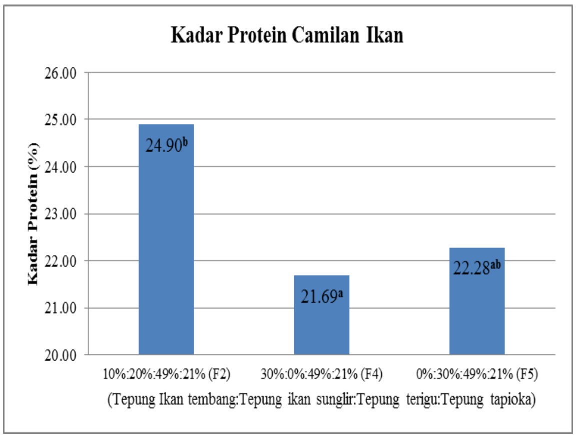


Figure 13. Test Results of Fish Snack Protein Levels

Based on the picture above, the results of the analysis of protein content in fish snacks, showed that the protein content of the three treatments obtained values ranging from 21.69% to 24.90 %. Treatment F2 (10 % tembang fish flour: 20% sunglir fish meal 49% wheat flour: 21%), obtained the highest protein content, which was 24.90%. In the F4 treatment (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) the lowest protein content was 21.69%. In the F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) the protein content was 22.28%. The protein content of the fish snacks obtained is in accordance with SNI, which is at least 5%. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) showed that there was a significant difference between fish snacks and the protein content of the three treatments, so further tests were needed (Duncan). Duncan's further test results showed that F2 was significantly different from the F4 treatment, but not significantly different from the F5 treatment.

The protein content obtained from fish snacks decreased compared to the mixed flour, which was 31.67% to 24.90 %. The decrease in protein content in fish snacks was caused by the frying treatment. Frying with a high temperature will cause the Maillard reaction so that the protein content of the snack decreases. The Maillard reaction occurs due to a reaction between the free amine group of the protein and the reducing sugar (Fitri and Purwani, 2017).

III.2.5 Carbohydrate Content

Carbohydrates are the main source of energy that plays an important role in the human body. Carbohydrate content can be determined using the *by different method*. The results of testing the carbohydrate content of the mixed flour can be seen in the following figure:

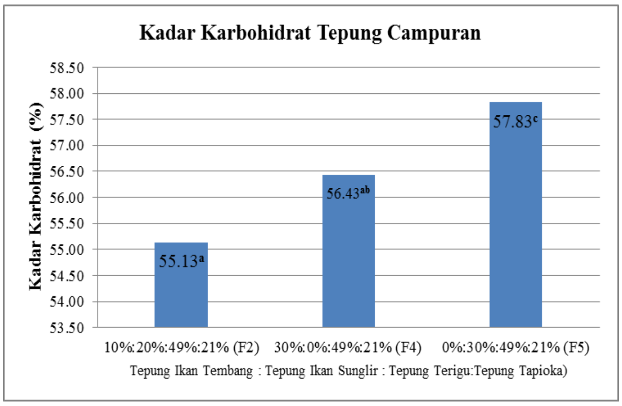


Figure 14. Test Results for Mixed Flour Carbohydrate Content

Based on the picture above, the results of the analysis of carbohydrate content in mixed flour, showed that the carbohydrate content of the three treatments obtained values ranging from 55.13 % to 57.83%. The F2 treatment (10% tembang fish flour: sunglir fish flour 20%: 49% wheat flour: 21% tapioca) obtained the lowest carbohydrate content, which was 55.13%. The F5 treatment (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the highest result, which was 57.83%. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) showed that there was a significant difference between the mixed flour and the protein content produced from the three treatments, so further tests were needed (Duncan). Duncan's further test results showed that F2 was significantly different from the F5 treatment. But not significantly different from the F4 treatment.

Carbohydrate content was influenced by the addition of fish meal in each treatment. The addition of two types of fish meal in the F2 treatment will cause the carbohydrate content of the mixed flour to decrease. This is because, with the use of two types of fish meal, higher protein content was obtained. On the other hand, the addition of one type of fish in the F4 and F5 treatments, will increase the carbohydrate content of the mixed flour. This is in accordance with Fahmiyah (2017) that carbohydrate content will decrease if the water, ash, protein and fat content is high. Conversely, if the water, ash , fat and protein content is low, the carbohydrate content will be higher.

The results of testing the carbohydrate content of fish snacks from mixed flour can be seen in the following figure:

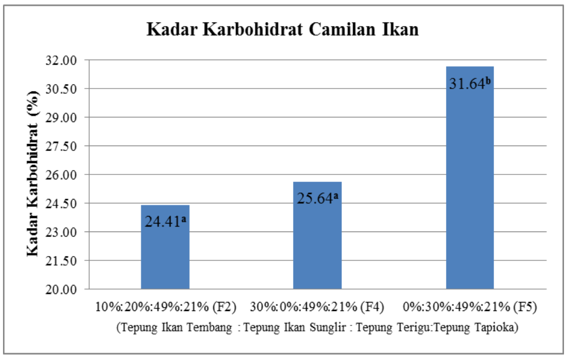


Figure 15 Test Results for Fish Snack Carbohydrate Levels

Based on the picture above, the results of the analysis of carbohydrate content in fish snacks, showed that the carbohydrate content of the three treatments obtained values ranging from 24.41 % to 31.64%. The F2 treatment (10 % tembang fish meal: 20% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the lowest carbohydrate content, which was 24.41%. While in F5 (0 % tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) the highest carbohydrate content was obtained, which was 31.64%. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) indicates that there is a significant difference between fish snacks and carbohydrate content resulting from the three treatments, so further tests need to be carried out (Duncan). Where, F2 treatment had a significant effect on F5 treatment, but was not significantly different from F4 treatment.

The carbohydrate content of the mixed flour into fish snacks is due to the frying treatment. Fish snacks with the treatment using two types of fish meal produced the lowest carbohydrate content , compared to the treatment using only one type of fish meal. This is because the treatment using two types of fish meal has a high protein content, so it can reduce carbohydrate levels (Fahmiyah, 2017). In addition, the effect of frying on carbohydrates can affect the taste of the fish snacks produced.

III.3 Mixed Flour Physical Test

III.3.1 Water Absorption

Water absorption of flour is a percentage of the amount of water that can be absorbed by flour which can be compared with the initial weight of flour. The ability to absorb water in a food ingredient can be referred to as water absorption capacity.

The results of the water absorption test of mixed flour can be seen in the image below:

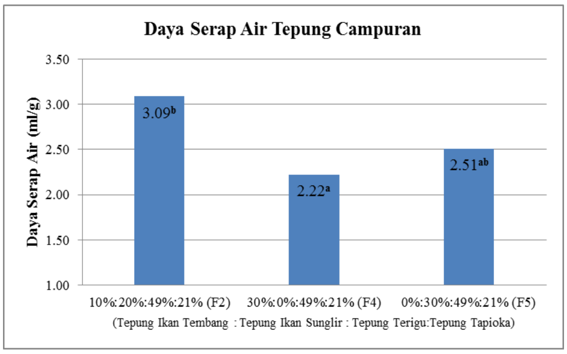


Figure 16. Test Results for Mixed Flour Water Absorption

Based on the picture above, the results of the analysis of water absorption in the mixed flour, showed that the water absorption of the three treatments obtained values ranging from 2.22 ml/g to 3.09 ml/gr. Treatment F2 (10% tembang fish meal: 20% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the highest water absorption value, which was 3.09 ml/g. Treatment F4 (30% tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) obtained the lowest value of 2.22 ml/gr. While in the F5 treatment (0% tembang fish meal: 30% sunglir fish meal: 49% wheat flour: 21% tapioca) the water absorption value was 2.51 ml/gr. Based on the results of the analysis of variance ANOVA, the value ($p < 0.05$) showed that there was a significant difference between the mixed flour and water absorption resulting from the three treatments, so further tests were needed (Duncan). Duncan's further test results showed that F2 was significantly different from the F4 treatment, but not significantly different from the F5 treatment.

The results of the water absorption test produced from the three treatments were influenced by the presence of protein, amylose and amylopectin content as well as the particle size of the flour. Treatment with the addition of two types of fish meal will more easily absorb water because of its higher protein content compared to other treatments that only use one type of fish. Higher protein will be able to absorb more water. This is because, proteins have hydrophilic properties, which are able to bind water molecules strongly. This is in accordance with Rombe (2020) that products with high protein content will easily absorb water because they are able to provide open space for water immobilization. In addition, the content of amylose and amylopectin found in wheat flour and tapioca can affect the water absorption of a product. The higher the amylopectin and amylose content of a product, the higher the ability to absorb water . This is because amylose is associated with an increase in the number of hydrophilic groups which have greater water absorption capacity.

III.3.2 Degree White

The degree of whiteness is one of the parameters that can determine the quality of mixed flour and the level of consumer preference. The whiteness value of a product can be determined using the *Chromameter* tool . The color scale used in determining the degree of whiteness is the L*a*b color space. L value indicates brightness, a value indicates redness/greeness and b value indicates yelloeness/blueness. The brightness value (L*) of the mixed flour obtained at F2=86 ,62 ; F4=84.96; F5=87.75. The value (a*) of mixed flour obtained at F2= 2,55 ; F4=1.29; F5=3.55. While the value (b*) obtained in the treatment F2 = 12.01 ; F4=10,14; F5=13.40.

The value of whiteness in mixed flour can be seen in the following picture:

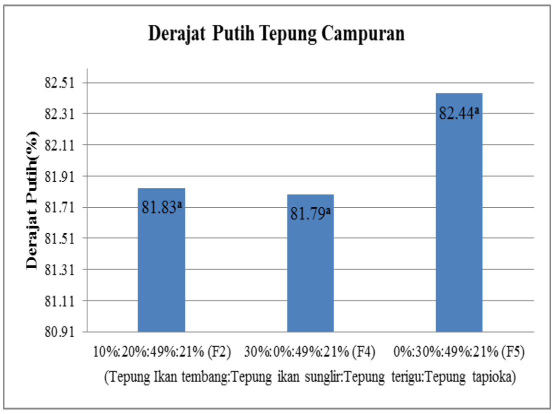


Figure 17. Test Results of Mixed Flour White Degree

Based on the results of the calculation of the whiteness of the mixed flour obtained from the three treatments, which ranged from 81.79 % to 82.44%. In the F2 treatment (10 % tembang fish meal: 20% sunglir fish meal: 49% wheat flour: 21% tapioca) the white degree value was 81.83%. In the F4 treatment (30 % tembang fish meal: 0% sunglir fish meal: 49% wheat flour: 21% tapioca) the lowest value was obtained, namely 81.79%. While the F5 treatment obtained white degree, which is 82.40 %. Based on the results of the analysis of variance ANOVA obtained a value (p> 0.05) indicates that there is no significant difference between the mixed flour to the degree of whiteness resulting from the three treatments, so there is no need for further test (Duncan).

The brightness level of the mixed flour is influenced by the concentration and type of fish meal used. The higher the whiteness value obtained, the whiter the resulting mixture will be. The treatment with the addition of tembang fish meal had a lower brightness level than the addition of sunglir fish meal with a higher brightness level. This is because the color of tembang fish meal tends to be dark due to the drying process when making flour. In addition, the protein content of the mixed flour also affects the whiteness value produced. The higher the protein value, the lower the whiteness value. This is in accordance with Ariyantoro *et al* (2020) that protein and sugar are easily pre-gelatinized at high temperatures so as to produce a brown color in flour.

VIII. CLOSING

IV.1 Conclusion

The conclusions obtained from this study, namely:

3. The best formulation obtained from the panelists based on organoleptic testing, namely Formulation F2 (10 % tembang fish meal: 20% sunglir fish meal: 49% wheat flour: 21%), F4 (30 tembang fish flour: 0% sunglir fish meal: flour 49% : tapioca 21%) and F5 (fish flour 0% : fish meal sunglir 0% : wheat flour 49% : tapioca 21%).
4. In mixed flour and snacks, the highest results were obtained in the F2 treatment, namely water content

(9.63% and 31.58%); ash content (2.12% and 2.34%); fat (1.87% and 17.88%); protein (31.67% and 24.90%); carbohydrates (55.13% and 24.41%); water absorption and whiteness of mixed flour (3.09% and 81.83%).

IV.2 Suggestions

Suggestions for further research is to calculate the absorption of oil to determine the effect of oil in producing flavor for fish snack products. In addition, it is recommended to test the shelf life of mixed flour products.

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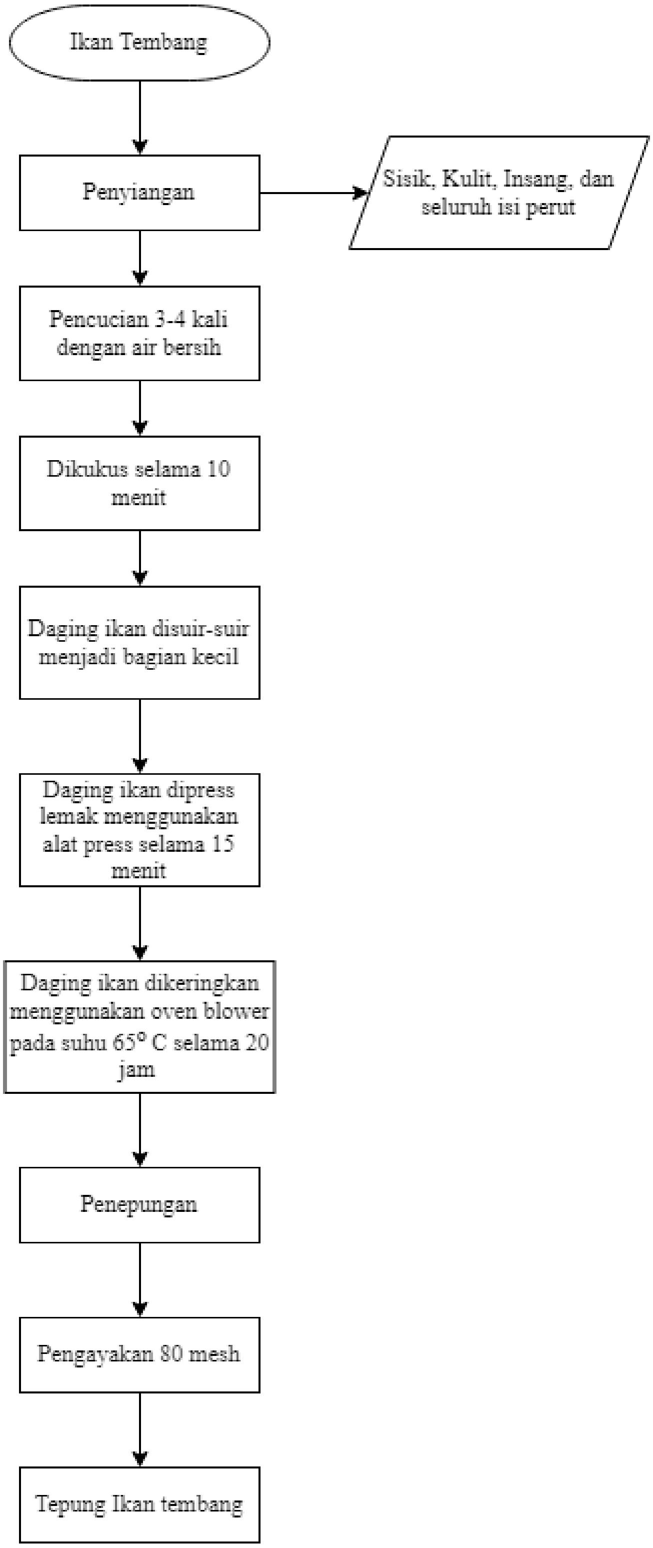
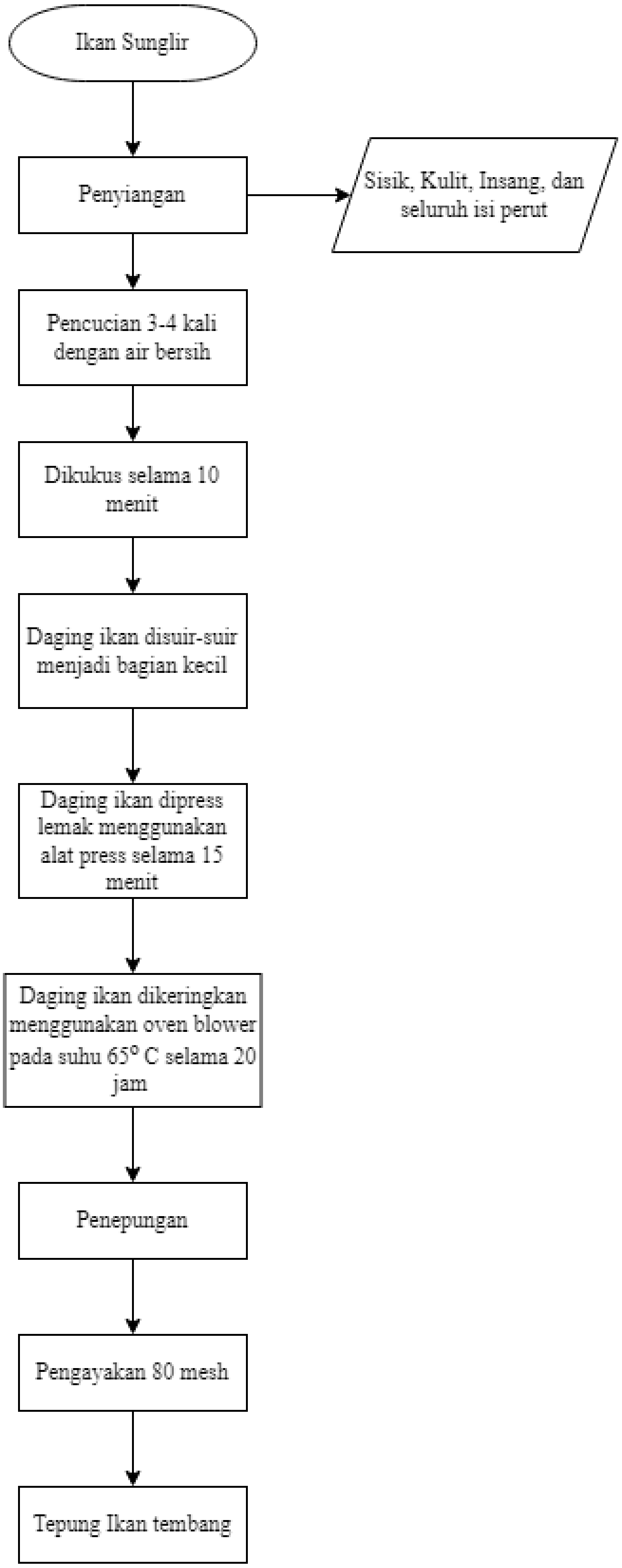
ATTACHMENT

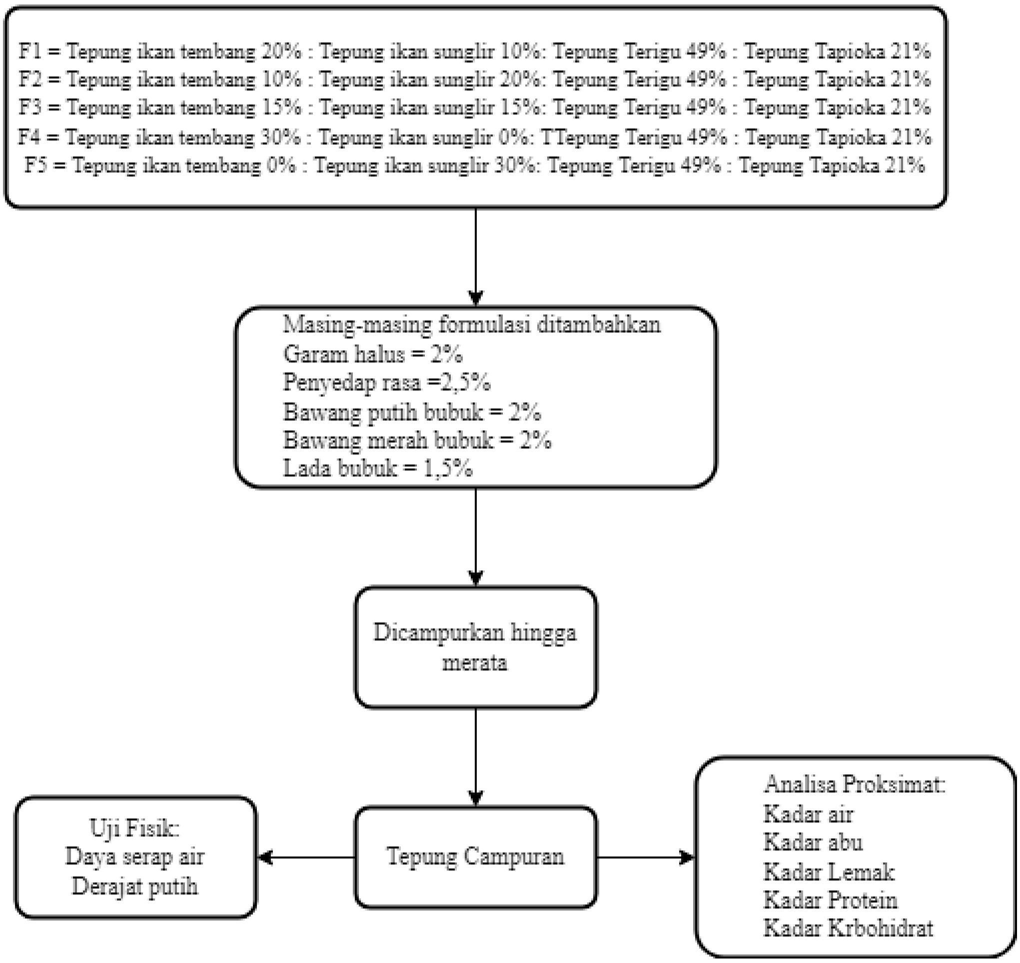
Appendix 1. Flowchart of Making Tembang Fish Meal



Appendix 2. Flowchart of Making Sunglir Fish Meal



Appendix 3. Mixed Flour Production Flowchart


F1 = Tepung ikan tembang 20% : Tepung ikan sunglir 10%: Tepung Terigu 49% : Tepung Tapioka 21%
F2 = Tepung ikan tembang 10% : Tepung ikan sunglir 20%: Tepung Terigu 49% : Tepung Tapioka 21%
F3 = Tepung ikan tembang 15% : Tepung ikan sunglir 15%: Tepung Terigu 49% : Tepung Tapioka 21%
F4 = Tepung ikan tembang 30% : Tepung ikan sunglir 0%: TTepung Terigu 49% : Tepung Tapioka 21%
F5 = Tepung ikan tembang 0% : Tepung ikan sunglir 30%: Tepung Terigu 49% : Tepung Tapioka 21%
Masing-masing formulasi ditambahkan
Garam halus = 2%
Penyedap rasa =2,5%
Bawang putih bubuk = 2%
Bawang merah bubuk = 2%
Lada bubuk = 1,5%
Dicampurkan hingga merata
Uji Fisik:
Daya serap air
Derajat putih
Tepung Campuran
Analisa Proksimat:
Kadar air
Kadar abu
Kadar Lemak
Kadar Protein
Kadar Krbohidrat

Appendix 4. Flowchart of Making Fish Snacks from Mixed Flour