In [41]:
```
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd
import numpy as np
df = pd.read_csv('bodyPerformance.csv')
df
```

Out[41]:

	age	gender	height_cm	weight_kg	body fat_%	diastolic	systolic	gripForce	sit and bend forward_cm	sit-up count
0	27.0	M	172.3	75.24	21.3	80.0	130.0	54.9	18.4	60.(
1	25.0	M	165.0	55.80	15.7	77.0	126.0	36.4	16.3	53.(
2	31.0	M	179.6	78.00	20.1	92.0	152.0	44.8	12.0	49.(
3	32.0	M	174.5	71.10	18.4	76.0	147.0	41.4	15.2	53.(
4	28.0	M	173.8	67.70	17.1	70.0	127.0	43.5	27.1	45.(
...	...	...	...	...	...	...	...	...	...	.
13388	25.0	M	172.1	71.80	16.2	74.0	141.0	35.8	17.4	47.(
13389	21.0	M	179.7	63.90	12.1	74.0	128.0	33.0	1.1	48.(
13390	39.0	M	177.2	80.50	20.1	78.0	132.0	63.5	16.4	45.(
13391	64.0	F	146.1	57.70	40.4	68.0	121.0	19.3	9.2	0.(
13392	34.0	M	164.0	66.10	19.5	82.0	150.0	35.9	7.1	51.(

13393 rows × 12 columns

In [2]:
```
df.shape
```

Out[2]:
```
(13393, 12)
```

In [3]:
```
df.describe()
```

Out[3]:

	age	height_cm	weight_kg	body fat_%	diastolic	systolic	gripF
count	13393.000000	13393.000000	13393.000000	13393.000000	13393.000000	13393.000000	13393.000(
mean	36.775106	168.559807	67.447316	23.240165	78.796842	130.234817	36.963
std	13.625639	8.426583	11.949666	7.256844	10.742033	14.713954	10.624
min	21.000000	125.000000	26.300000	3.000000	0.000000	0.000000	0.000(
25%	25.000000	162.400000	58.200000	18.000000	71.000000	120.000000	27.500(
50%	32.000000	169.200000	67.400000	22.800000	79.000000	130.000000	37.900(
75%	48.000000	174.800000	75.300000	28.000000	86.000000	141.000000	45.200(
max	64.000000	193.800000	138.100000	78.400000	156.200000	201.000000	70.500(

In [4]:
```
df.dtypes
```

Out[4]:
```
age                          float64
gender                        object
height_cm                    float64
weight_kg                    float64
body fat_%                   float64
diastolic                    float64
systolic                     float64
gripForce                    float64
sit and bend forward_cm      float64
sit-ups counts               float64
broad jump_cm                float64
class                         object
dtype: object
```

In [5]:
```
d = {'M': 'Male',
     'F': 'Female'
    }
df['gender'] = df['gender'].map(d)
df
```

Out[5]:

	age	gender	height_cm	weight_kg	body fat_%	diastolic	systolic	gripForce	sit and bend forward_cm	sit-up count
0	27.0	Male	172.3	75.24	21.3	80.0	130.0	54.9	18.4	60.(
1	25.0	Male	165.0	55.80	15.7	77.0	126.0	36.4	16.3	53.(
2	31.0	Male	179.6	78.00	20.1	92.0	152.0	44.8	12.0	49.(
3	32.0	Male	174.5	71.10	18.4	76.0	147.0	41.4	15.2	53.(
4	28.0	Male	173.8	67.70	17.1	70.0	127.0	43.5	27.1	45.(
...	...	...	...	...	...	...	...	...	...	.
13388	25.0	Male	172.1	71.80	16.2	74.0	141.0	35.8	17.4	47.(
13389	21.0	Male	179.7	63.90	12.1	74.0	128.0	33.0	1.1	48.(
13390	39.0	Male	177.2	80.50	20.1	78.0	132.0	63.5	16.4	45.(
13391	64.0	Female	146.1	57.70	40.4	68.0	121.0	19.3	9.2	0.(
13392	34.0	Male	164.0	66.10	19.5	82.0	150.0	35.9	7.1	51.(

13393 rows × 12 columns

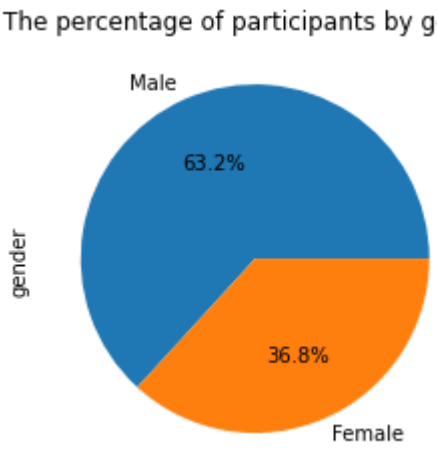
In [6]:
```
ratio_of_participants_by_gender = (
    df['gender'].value_counts(normalize=True)*100
).round(1)
ratio_of_participants_by_gender.astype(str) + '%'
```

Out[6]:
```
Male      63.2%
Female    36.8%
Name: gender, dtype: object
```

In [7]:
```
ax = ratio_of_participants_by_gender.plot.pie(
```

```
    autopct='%.1f%%',
    title = 'The percentage of participants by gender'
)
ax
```

Out[7]:
```
<AxesSubplot:title={'center':'The percentage of participants by gender'}, ylabel='gen
der'>
```



In [8]:
```
# Checking the max and the min values of age to divide all the participants into 5 rar
df['age'].max()
```

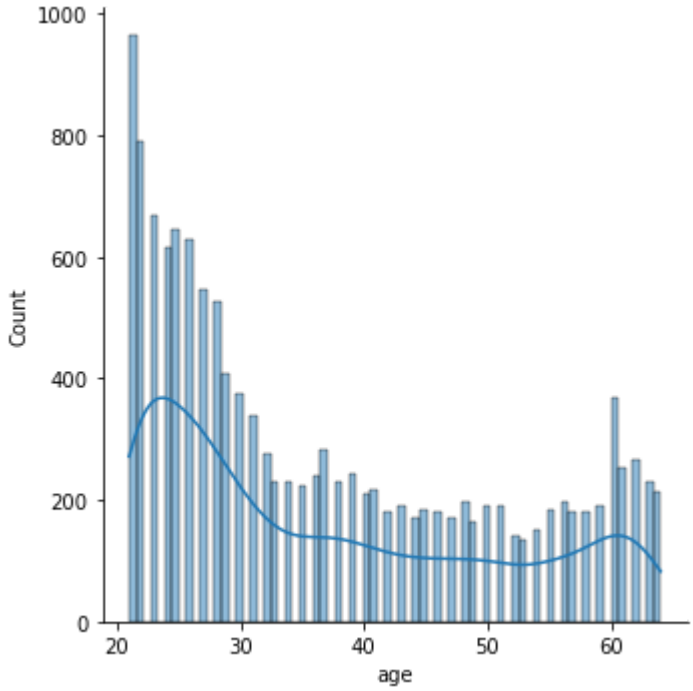
Out[8]:
```
64.0
```

In [9]:
```
df['age'].min()
```

Out[9]:
```
21.0
```

In [10]:
```
ax1 = sns.displot(
    df['age'],
    kde=True,
    bins = 75
)
ax1
```

Out[10]:
```
<seaborn.axisgrid.FacetGrid at 0x275461a6a00>
```



In [11]:
```
# Creating the new column ('age_range') with 5 different age ranges and overwriting th
df['age_range'] = pd.cut(
                        df['age'],
                        [20, 30, 40, 50, 60, 70],
                        labels=['20-30', '31-40', '41-50', '51-60', '60<']
)
df
```

Out[11]:

	age	gender	height_cm	weight_kg	body fat_%	diastolic	systolic	gripForce	sit and bend forward_cm	sit-up count
0	27.0	Male	172.3	75.24	21.3	80.0	130.0	54.9	18.4	60.(
1	25.0	Male	165.0	55.80	15.7	77.0	126.0	36.4	16.3	53.(
2	31.0	Male	179.6	78.00	20.1	92.0	152.0	44.8	12.0	49.(
3	32.0	Male	174.5	71.10	18.4	76.0	147.0	41.4	15.2	53.(
4	28.0	Male	173.8	67.70	17.1	70.0	127.0	43.5	27.1	45.(
...	...	...	...	...	...	...	...	...	...	.
13388	25.0	Male	172.1	71.80	16.2	74.0	141.0	35.8	17.4	47.(
13389	21.0	Male	179.7	63.90	12.1	74.0	128.0	33.0	1.1	48.(
13390	39.0	Male	177.2	80.50	20.1	78.0	132.0	63.5	16.4	45.(
13391	64.0	Female	146.1	57.70	40.4	68.0	121.0	19.3	9.2	0.(
13392	34.0	Male	164.0	66.10	19.5	82.0	150.0	35.9	7.1	51.(

13393 rows × 13 columns

In [12]:
```
df.columns
df = df[
```

```
        ['age', 'age_range', 'gender', 'height_cm', 'weight_kg', 'body fat_%', 'diasto
       'systolic', 'gripForce', 'sit and bend forward_cm', 'sit-ups counts',
       'broad jump_cm', 'class']
]
df
```

Out[12]:

	age	age_range	gender	height_cm	weight_kg	body fat_%	diastolic	systolic	gripForce	sit b forwarc
0	27.0	20-30	Male	172.3	75.24	21.3	80.0	130.0	54.9	
1	25.0	20-30	Male	165.0	55.80	15.7	77.0	126.0	36.4	
2	31.0	31-40	Male	179.6	78.00	20.1	92.0	152.0	44.8	
3	32.0	31-40	Male	174.5	71.10	18.4	76.0	147.0	41.4	
4	28.0	20-30	Male	173.8	67.70	17.1	70.0	127.0	43.5	
...	...	...	...	...	...	...	...	...	...	
13388	25.0	20-30	Male	172.1	71.80	16.2	74.0	141.0	35.8	
13389	21.0	20-30	Male	179.7	63.90	12.1	74.0	128.0	33.0	
13390	39.0	31-40	Male	177.2	80.50	20.1	78.0	132.0	63.5	
13391	64.0	60<	Female	146.1	57.70	40.4	68.0	121.0	19.3	
13392	34.0	31-40	Male	164.0	66.10	19.5	82.0	150.0	35.9	

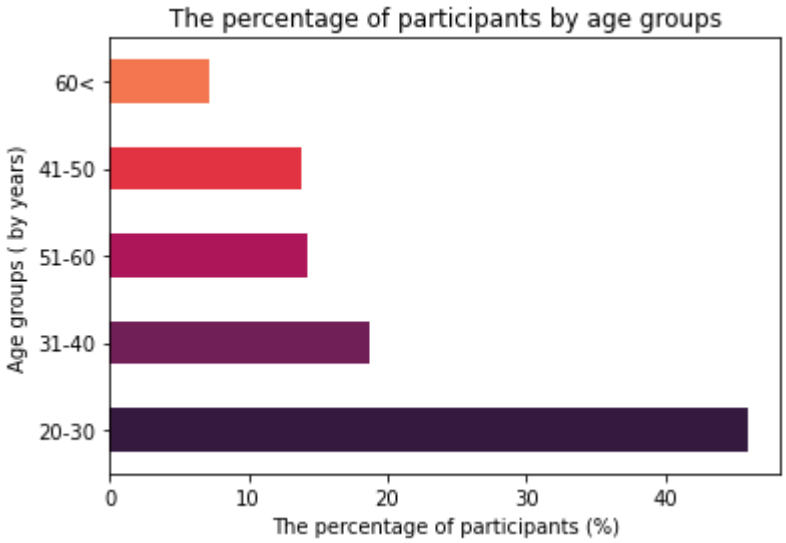
13393 rows × 13 columns

In [13]:
```
ratio_of_participants_by_age = (
    df['age_range'].value_counts(normalize=True)*100
).round(1)
ratio_of_participants_by_age.astype(str) + '%'
```

Out[13]:
```
20-30    46.0%
31-40    18.7%
51-60    14.3%
41-50    13.8%
60<       7.2%
Name: age_range, dtype: object
```

In [14]:
```
ax2 = ratio_of_participants_by_age.plot.barh(
    color = sns.color_palette("rocket"),
    title = 'The percentage of participants by age groups'
)
ax2.set_xlabel("The percentage of participants (%)")
ax2.set_ylabel("Age groups ( by years)")
```

Out[14]:
```
Text(0, 0.5, 'Age groups ( by years)')
```

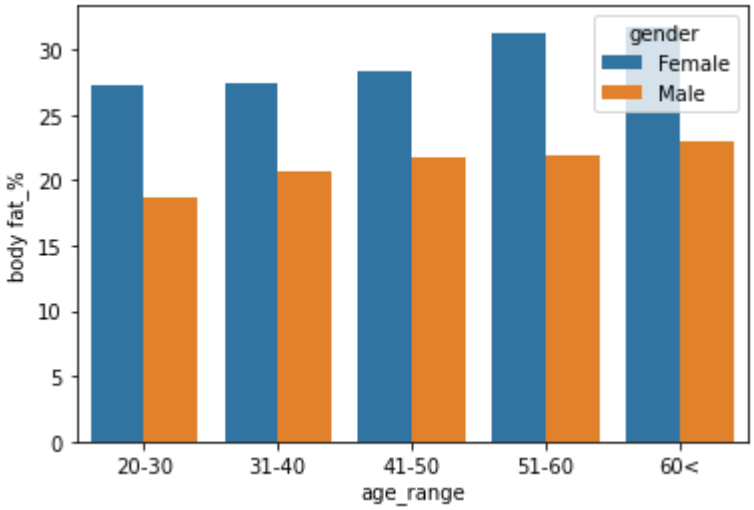


In [15]:
```
Average_health_parameters_by_age_range_and_gender = df.groupby(
    ['age_range', 'gender']
)[['body fat_%', 'diastolic', 'systolic']].mean()
bx = Average_health_parameters_by_age_range_and_gender.reset_index()
bx
```

Out[15]:

	age_range	gender	body fat_%	diastolic	systolic
0	20-30	Female	27.193598	73.970253	120.390145
1	20-30	Male	18.724054	78.398002	131.627119
2	31-40	Female	27.352906	75.483287	121.369081
3	31-40	Male	20.635829	81.543290	133.739978
4	41-50	Female	28.352941	77.035361	124.848656
5	41-50	Male	21.679692	84.030783	135.267370
6	51-60	Female	31.242979	77.658314	130.080866
7	51-60	Male	21.900599	83.323106	137.417066
8	60<	Female	31.761471	77.447689	133.411192
9	60<	Male	22.915630	82.175407	140.759494

In [16]:
```
ax3 = sns.barplot(
    data = bx,
    x = 'age_range',
    y = 'body fat_%',
    hue = 'gender',
           )
```



In [17]:
```
cx= bx.copy()
cx
```

Out[17]:

	age_range	gender	body fat_%	diastolic	systolic
0	20-30	Female	27.193598	73.970253	120.390145
1	20-30	Male	18.724054	78.398002	131.627119
2	31-40	Female	27.352906	75.483287	121.369081
3	31-40	Male	20.635829	81.543290	133.739978
4	41-50	Female	28.352941	77.035361	124.848656
5	41-50	Male	21.679692	84.030783	135.267370
6	51-60	Female	31.242979	77.658314	130.080866
7	51-60	Male	21.900599	83.323106	137.417066
8	60<	Female	31.761471	77.447689	133.411192
9	60<	Male	22.915630	82.175407	140.759494

In [18]:
```
cx["gender_age_range"] = cx[
    ["gender", "age_range"]
].astype(str).apply(" ".join, axis=1)
cx
```

Out[18]:

	age_range	gender	body fat_%	diastolic	systolic	gender_age_range
0	20-30	Female	27.193598	73.970253	120.390145	Female 20-30
1	20-30	Male	18.724054	78.398002	131.627119	Male 20-30
2	31-40	Female	27.352906	75.483287	121.369081	Female 31-40
3	31-40	Male	20.635829	81.543290	133.739978	Male 31-40
4	41-50	Female	28.352941	77.035361	124.848656	Female 41-50
5	41-50	Male	21.679692	84.030783	135.267370	Male 41-50
6	51-60	Female	31.242979	77.658314	130.080866	Female 51-60
7	51-60	Male	21.900599	83.323106	137.417066	Male 51-60
8	60<	Female	31.761471	77.447689	133.411192	Female 60<
9	60<	Male	22.915630	82.175407	140.759494	Male 60<

In [19]:
```
cx['systolic-diastolic'] = cx['systolic'] - cx['diastolic']
cx
cx[['diastolic', 'systolic-diastolic', 'systolic']] = cx[['diastolic', 'systolic-diast
cx
```

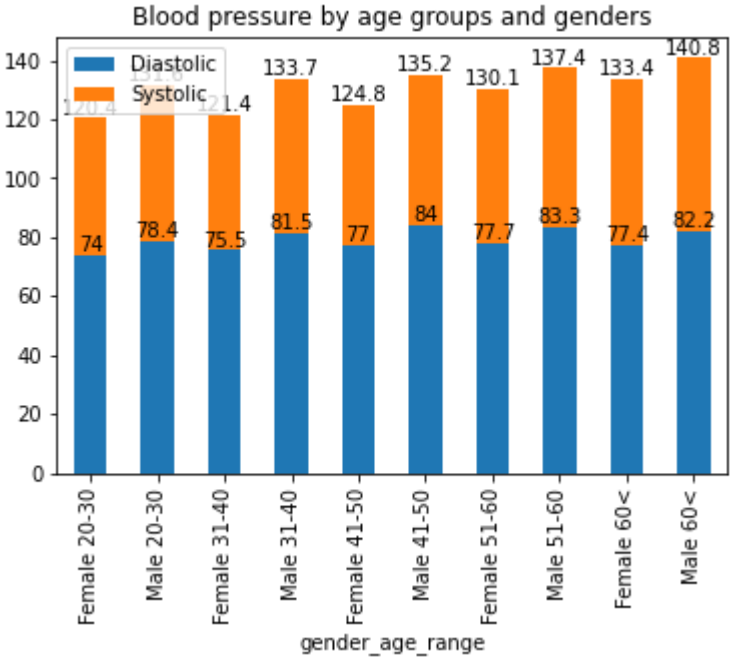
Out[19]:

	age_range	gender	body fat_%	diastolic	systolic	gender_age_range	systolic-diastolic
0	20-30	Female	27.193598	74.0	120.4	Female 20-30	46.4
1	20-30	Male	18.724054	78.4	131.6	Male 20-30	53.2
2	31-40	Female	27.352906	75.5	121.4	Female 31-40	45.9
3	31-40	Male	20.635829	81.5	133.7	Male 31-40	52.2
4	41-50	Female	28.352941	77.0	124.8	Female 41-50	47.8
5	41-50	Male	21.679692	84.0	135.3	Male 41-50	51.2
6	51-60	Female	31.242979	77.7	130.1	Female 51-60	52.4
7	51-60	Male	21.900599	83.3	137.4	Male 51-60	54.1
8	60<	Female	31.761471	77.4	133.4	Female 60<	56.0
9	60<	Male	22.915630	82.2	140.8	Male 60<	58.6

In [20]:
```
cx.rename(columns = {
    'diastolic':'Diastolic',
    'systolic-diastolic':'Systolic'},
          inplace = True
)
ax4 = cx.plot.bar(
    x='gender_age_range',
    y=['Diastolic', 'Systolic'],
    stacked=True,
    title='Blood pressure by age groups and genders'
)
for container in ax4.containers:
    ax4.bar_label(container)
```

```
ax4
```

Out[20]:
```
<AxesSubplot:title={'center':'Blood pressure by age groups and genders'}, xlabel='gen
der_age_range'>
```



In [21]:
```
df_filtered = df.loc[:, ['age_range', 'age', 'gender', 'gripForce', 'sit and bend forw
df_filtered
```

Out[21]:

	age_range	age	gender	gripForce	sit and bend forward_cm	sit-ups counts	broad jump_cm
0	20-30	27.0	Male	54.9	18.4	60.0	217.0
1	20-30	25.0	Male	36.4	16.3	53.0	229.0
2	31-40	31.0	Male	44.8	12.0	49.0	181.0
3	31-40	32.0	Male	41.4	15.2	53.0	219.0
4	20-30	28.0	Male	43.5	27.1	45.0	217.0
...	...	...	...	...	...	...	...
13388	20-30	25.0	Male	35.8	17.4	47.0	198.0
13389	20-30	21.0	Male	33.0	1.1	48.0	167.0
13390	31-40	39.0	Male	63.5	16.4	45.0	229.0
13391	60<	64.0	Female	19.3	9.2	0.0	75.0
13392	31-40	34.0	Male	35.9	7.1	51.0	180.0

13393 rows × 7 columns

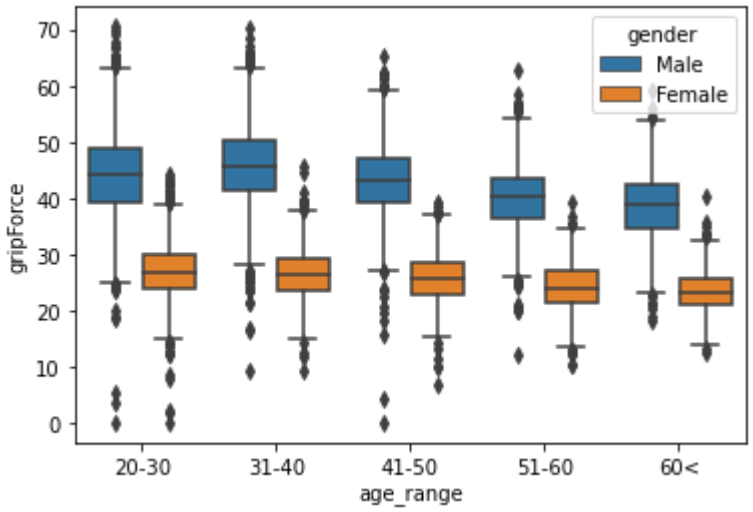
In [22]:
```
df_filtered_median = df_filtered.groupby("gender").median()
df_filtered_median
```

Out[22]:

gender	age	gripForce	sit and bend forward_cm	sit-ups counts	broad jump_cm
Female	34.0	25.6	20.0	32.0	156.0
Male	32.0	43.3	14.2	46.0	214.0

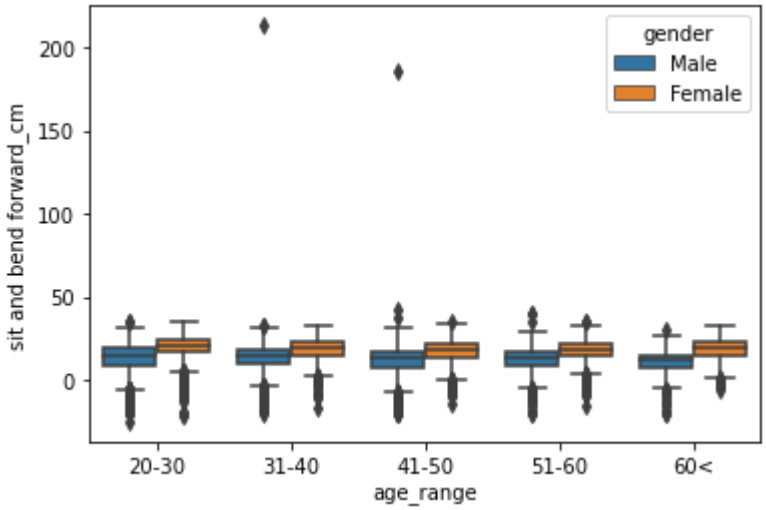
In [23]:
```
ax5 = sns.boxplot(
    data = df_filtered,
    x = "age_range",
    y = "gripForce",
    hue = "gender"
)
ax5
```

Out[23]:
```
<AxesSubplot:xlabel='age_range', ylabel='gripForce'>
```



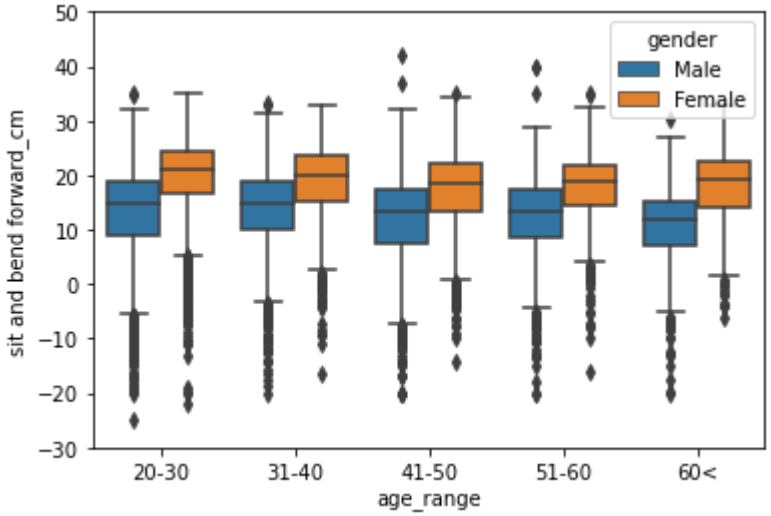
In [24]:
```
ax6 = sns.boxplot(
    data = df_filtered,
    x = "age_range",
    y = "sit and bend forward_cm",
    hue = "gender"
)
ax6
```

Out[24]:
```
<AxesSubplot:xlabel='age_range', ylabel='sit and bend forward_cm'>
```



In [25]:
```
ax6 = sns.boxplot(
    data = df_filtered,
    x = "age_range",
    y = "sit and bend forward_cm",
    hue = "gender"
)
ax6.set(
    ylim=(-30, 50)
)
ax6
```

Out[25]:
```
<AxesSubplot:xlabel='age_range', ylabel='sit and bend forward_cm'>
```



In [26]:
```
top_performers = df[
        (df['gripForce']>= (df['gripForce'].mean()))
    &   (df['sit-ups counts'] >= (df['sit-ups counts'].mean()))
    &   (df['broad jump_cm'] >= (df['broad jump_cm'].mean()))
    &   (df['sit and bend forward_cm'] >= (df['sit and bend forward_cm'].mean()))
]
top_performers
```

Out[26]:

	age	age_range	gender	height_cm	weight_kg	body fat_%	diastolic	systolic	gripForce	sit b forwarc
0	27.0	20-30	Male	172.3	75.24	21.3	80.0	130.0	54.9	
4	28.0	20-30	Male	173.8	67.70	17.1	70.0	127.0	43.5	
10	42.0	41-50	Male	169.2	65.40	19.3	63.0	110.0	43.5	
13	22.0	20-30	Male	175.7	67.90	11.3	71.0	103.0	52.5	
17	26.0	20-30	Male	179.9	71.50	9.7	64.0	135.0	59.6	
...	...	...	...	...	...	...	...	...	...	
13363	37.0	31-40	Male	181.1	81.10	14.4	68.0	124.0	52.9	
13365	22.0	20-30	Male	170.5	77.20	23.2	84.0	134.0	47.7	
13370	44.0	41-50	Male	171.3	77.90	22.8	94.0	148.0	42.0	
13371	54.0	51-60	Male	164.7	67.50	15.2	83.0	139.0	43.8	
13390	39.0	31-40	Male	177.2	80.50	20.1	78.0	132.0	63.5	

2728 rows × 13 columns

In [27]:
```
top_performers_by_gender = top_performers['gender'].value_counts()
top_performers_by_gender
```

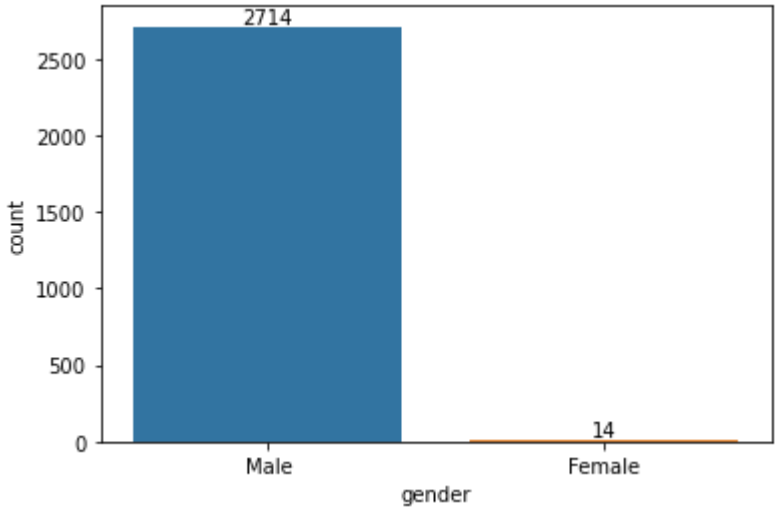
Out[27]:
```
Male      2714
Female      14
Name: gender, dtype: int64
```

In [28]:
```
ax7 = sns.countplot(
    data=top_performers,
    x='gender'
)

for container in ax7.containers:
    ax7.bar_label(container)

ax7
```

Out[28]:
```
<AxesSubplot:xlabel='gender', ylabel='count'>
```



In [29]:
```
Top_female_performers = top_performers[
    top_performers['gender'] == 'Female'
]
Top_female_performers.sort_values("body fat_%")
```

Out[29]:

	age	age_range	gender	height_cm	weight_kg	body fat_%	diastolic	systolic	gripForce	sit forwarc
11712	32.0	31-40	Female	163.0	51.60	15.6	87.0	120.0	39.7	
7803	23.0	20-30	Female	165.8	56.70	15.7	77.0	115.0	39.8	
1944	21.0	20-30	Female	165.7	51.94	19.1	80.0	120.0	37.5	
7340	21.0	20-30	Female	170.3	63.20	21.5	71.0	111.0	38.1	
5173	34.0	31-40	Female	162.0	52.30	21.6	85.0	120.0	38.0	
6597	28.0	20-30	Female	161.5	65.50	22.0	76.0	135.0	37.7	
6420	32.0	31-40	Female	174.2	73.30	23.3	70.0	122.0	39.3	
6230	37.0	31-40	Female	178.2	74.90	23.8	77.0	128.0	44.7	
9870	26.0	20-30	Female	162.2	64.50	24.4	65.0	100.0	38.0	
11089	29.0	20-30	Female	164.1	70.50	26.1	92.0	125.0	41.3	
6566	22.0	20-30	Female	173.5	69.70	27.5	71.0	145.0	39.9	
7651	23.0	20-30	Female	165.8	66.00	28.0	59.0	119.0	39.5	
7616	27.0	20-30	Female	166.6	70.00	29.0	74.0	140.0	37.9	
5644	27.0	20-30	Female	161.4	65.50	30.9	78.0	122.0	43.5	

In [33]:
```
top_female_performers_mean_body_fat = round(Top_female_performers['body fat_%'].mean()
top_female_performers_mean_body_fat
# That's how to round float type value.
```

Out[33]:
```
23.5
```

In [34]:
```
All_female_performers_mean_body_fat = round(df[
```

```
    df['gender'] == 'Female'
]['body fat_%'].mean(),1)
All_female_performers_mean_body_fat
```

Out[34]:
```
28.5
```

In [ ]: