`xtgraph` a new command for summary graphs of `xt` data

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With thanks to:

Lucy Chappell, Annette Briley, Andy Shennan, Lucilla Poston.

¥ Original problem:

—RCT of Vitamin C & E supplementation in 160 women at high risk of pre-eclampsia (Chappell et al, 1999)

—1000g of C & 400 IU of E daily, or placebo

—main findings very encouraging.

—blood taken measured at 4 weekly intervals

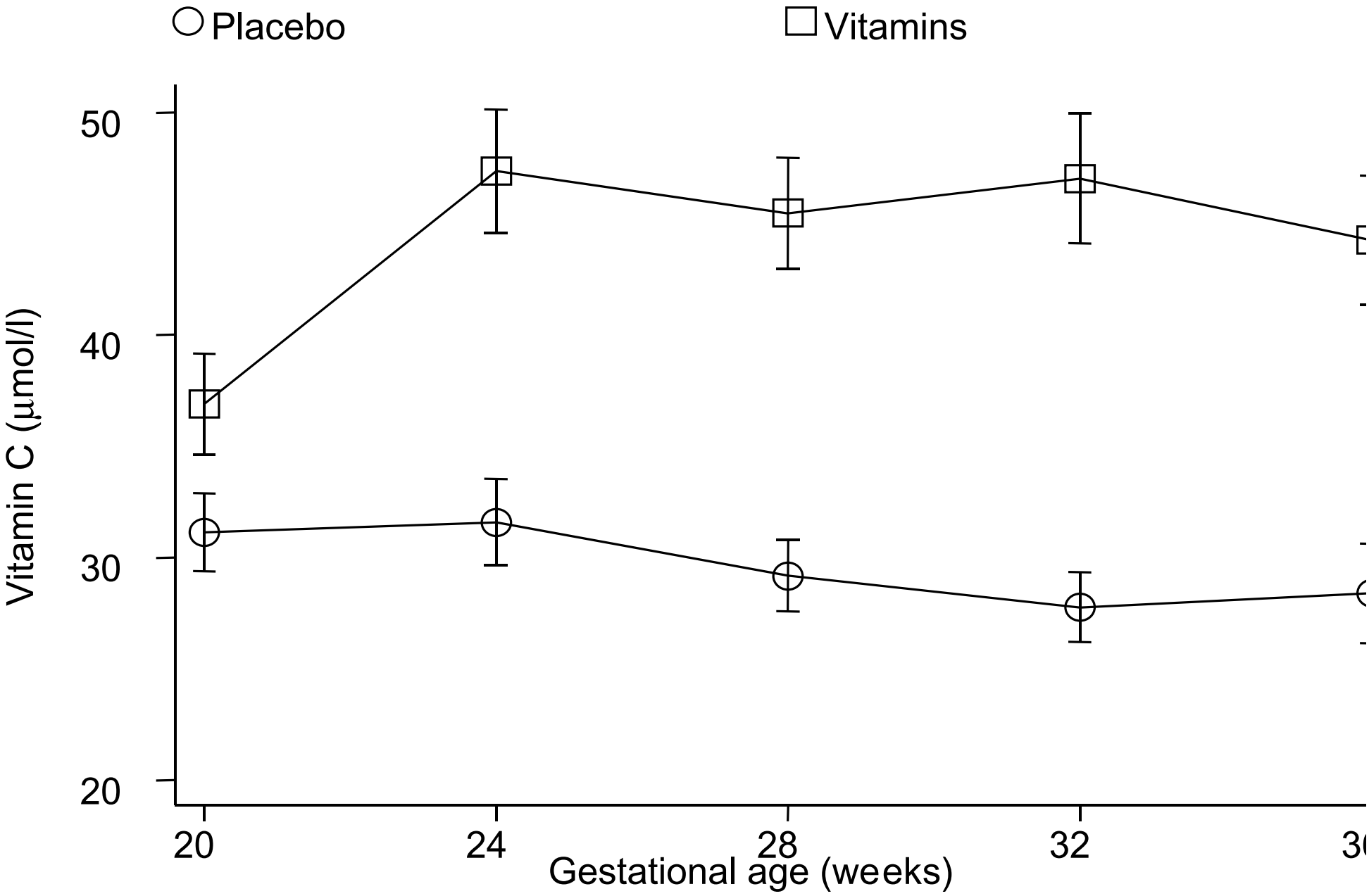
—graphs needed of changes in vitamin C & E over time

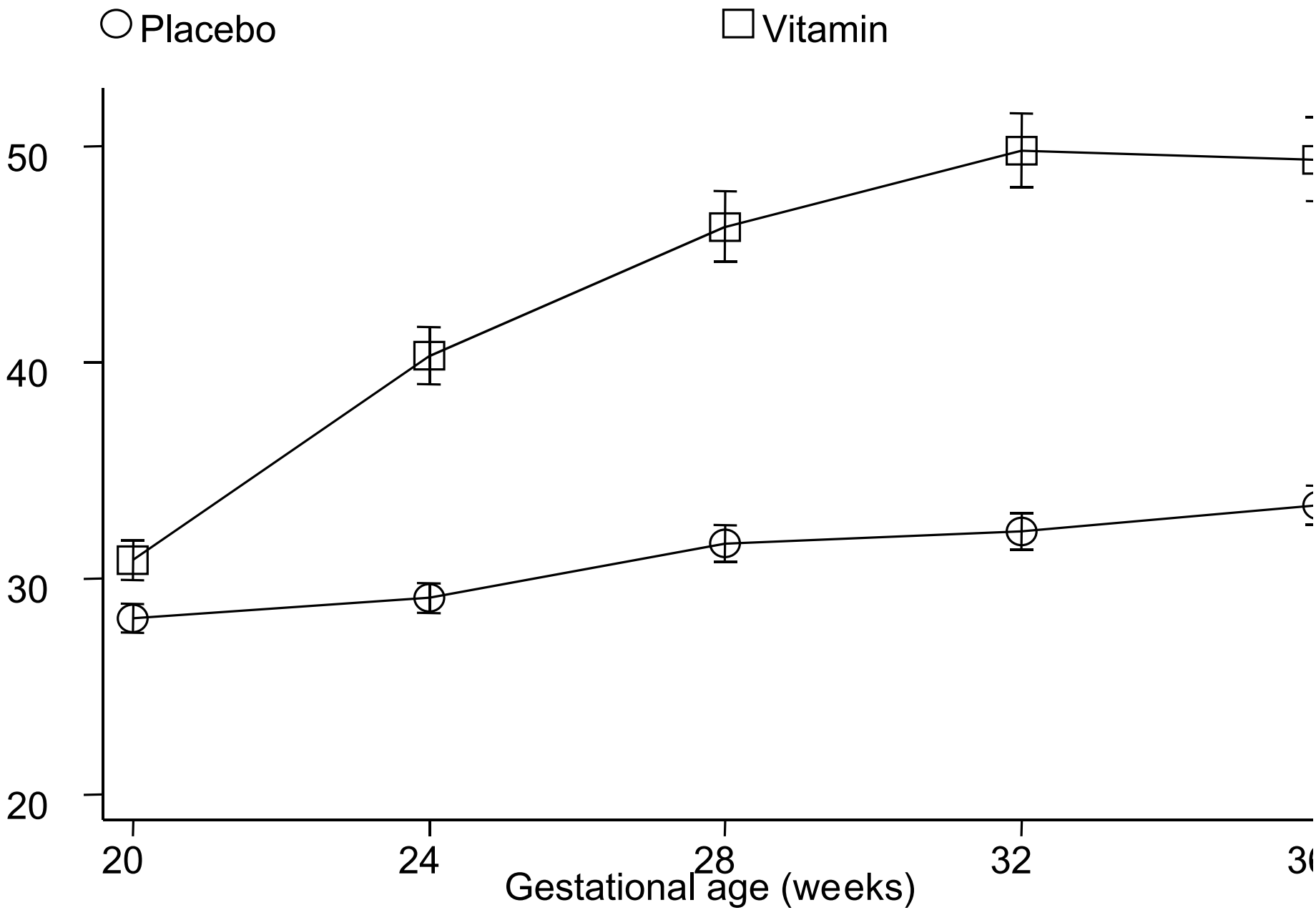
—weekly means with standard errors

¥ Simple solution:

```
egen mean = mean(vitc), by(week group)
egen se = sd(vitc), by(week group)
egen n = count(vitc), by(week group)
replace se = se/n^.5
gen lb = mean - se
...
graph m_vit m_pl lb ub week, s(oi) c(lII)
```

Vitamin E roughly log-normal. Means & SE worked out for log(vite) and then back-transformed to give geometric means.


Placebo
Vitamins
50
40
30
20
Vitamin C (µmol/l)
20
24
28
32
Gestational age (weeks)


Placebo
Vitamin
50
40
30
20
20
24
28
32
Gestational age (weeks)

Additional work on study

- Over 20 blood markers + combinations
  - lipids, known & suspected risk factors etc.
- 3 risk groups
  - High risk Vitamin, high risk placebo, low risk.
- Also comparison by outcome
  - Low risk AGA, SGA , pre-eclampsia

- Time to write a program

xtgraph - basic syntax

```
xtgraph varname  [if] [in] , group(groupvar)
  av(avtype) bar(bartype) graph options xt options
```

Examples:

```
xtgraph vitc if week >=20 & week <= 36,
  group(group) bar(se) i(pno) t(week)
```

```
xtgraph vite if week >=20 & week <= 36,
  group(group) av(gm) bar(se)
```

hese produce similar graphs to those already seen. Plotting symbols can be anged with standard graph options

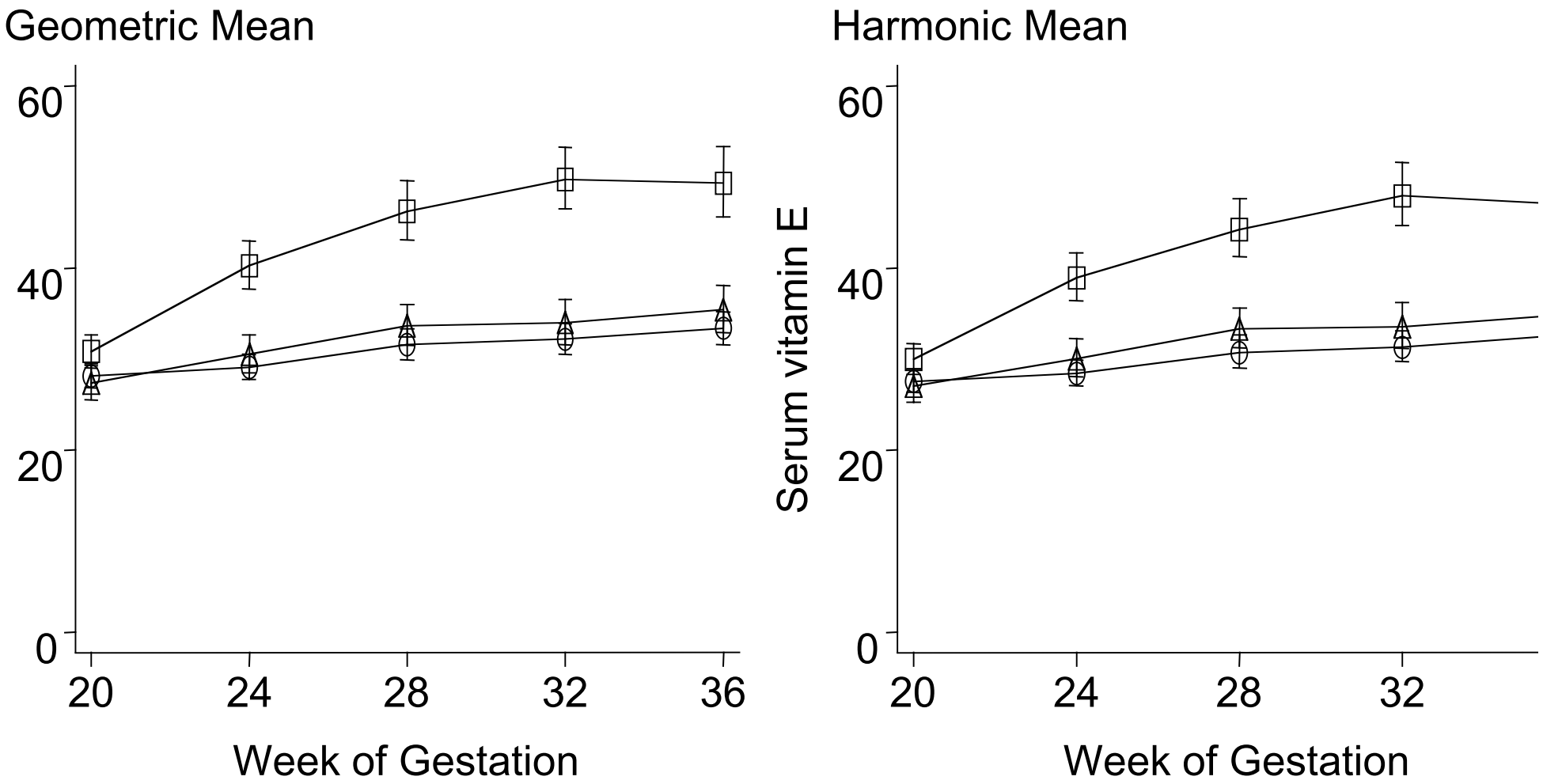
Choice of average

```
xtgraph    , av(avtype)
```

The average types are

- `am` - arithmetic mean, the default
- `gm` - geometric mean
- `hm` - harmonic mean
- `median` - only with bars `ci` - default, `iqr` or `rr`.

For `gm` and `hm`, values are worked out for log or inverse of data & then back-transformed

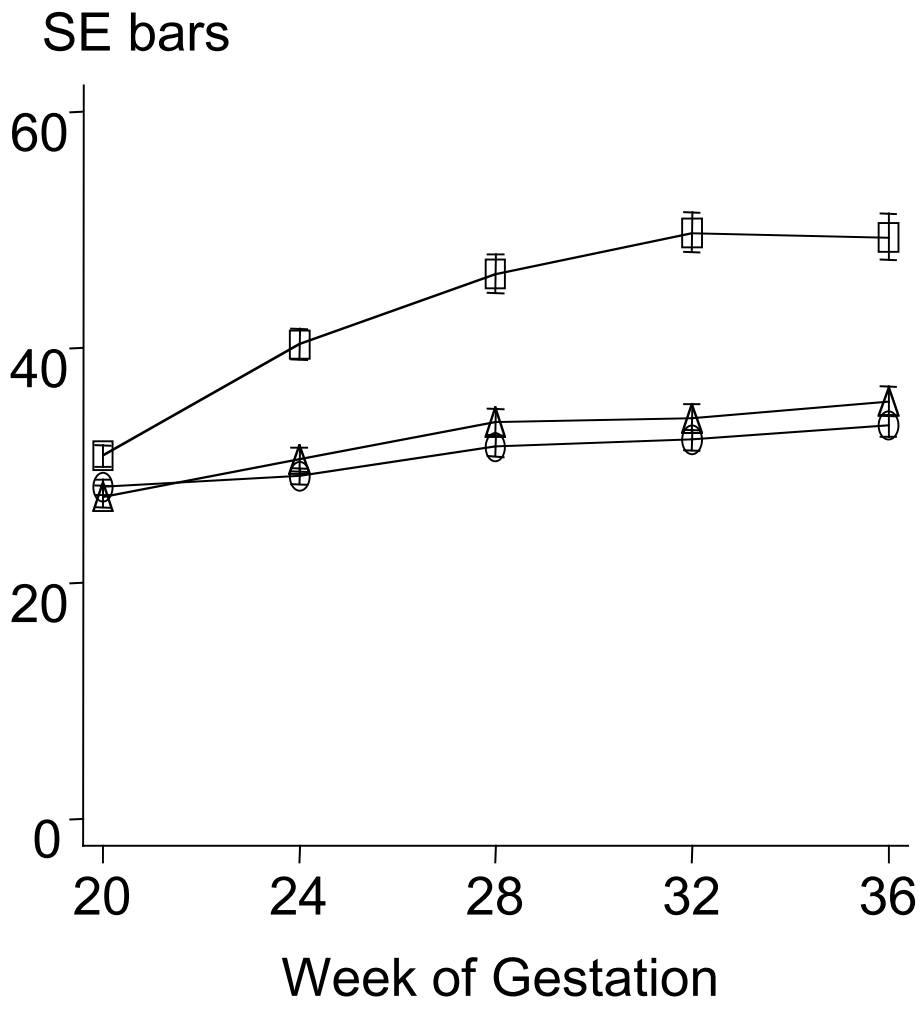

Geometric Mean
Harmonic Mean
Serum vitamin E
60
40
20
0
20
24
28
32
36
Week of Gestation

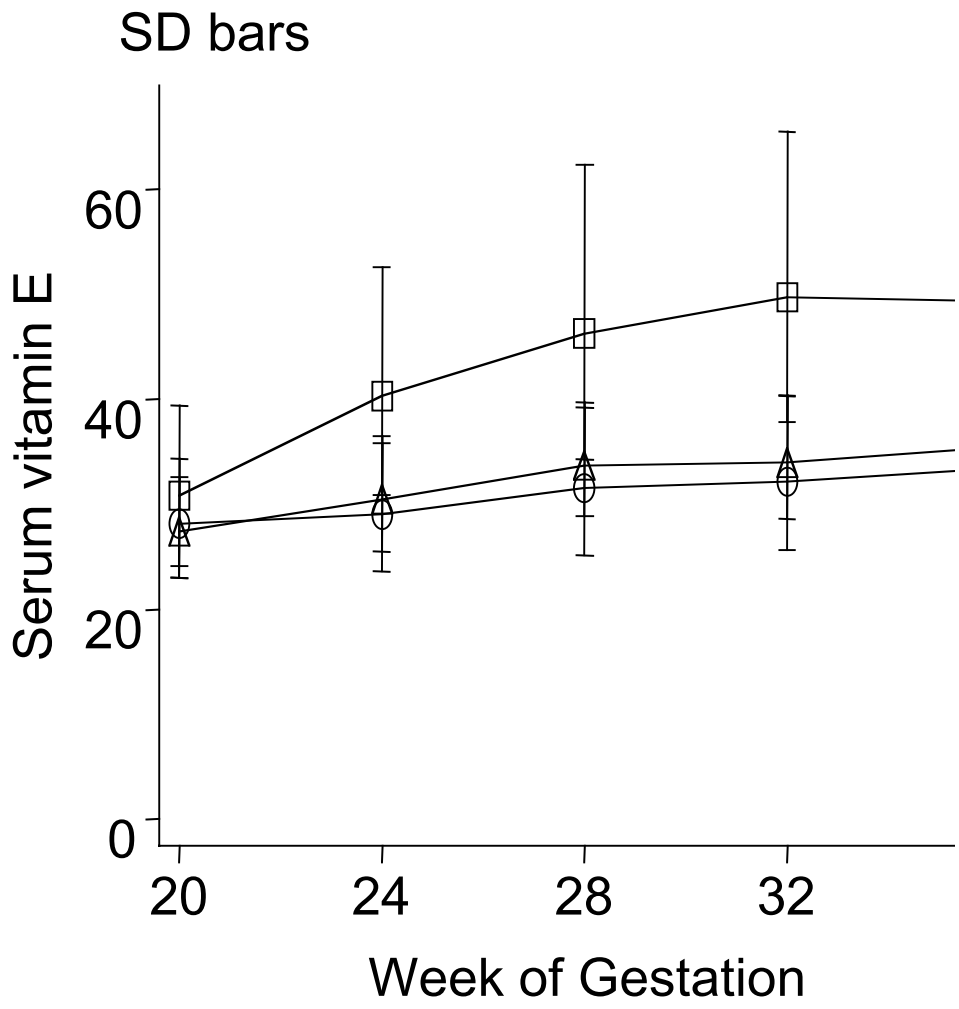
Choice of error bars

```
xtgraph   , bar(bar type)
 level(significance level)
```

The bar types are

- `ci` - the default, significance set by `level()`
- `se` - standard error
- `sd` - standard deviation
- `rr` - reference range, level set by `level()`
- `iqr` -same as `bar(rr) level(50)`
- `no` - no bars


SE bars
60
40
20
0
20
24
28
32
36
Week of Gestation


SD bars
Serum vitamin E
60
40
20
0
20
24
28
32
Week of Gestation

`xtgraph` - extensions

- saving & displaying summary data
- separating error bars
- choice of transformation for normality
- handling missing data
- post-model fitting
- displaying interactions

Saving & displaying summary data

```
xtgraph   , nograph list
  saving(graph file[, replace])
  savedat(datafile[, replace])
```

- `nograph` suppresses the graph output
- `list` outputs a list of the graphed values
- `savedat()` saves the list in a Stata data file
- `saving()` work as standard graph options

Geometric mean of vite with bars based on 95% CI by group and week.

-> group= High Risk

week	n	mean	lb	ub
20	73	28.134	26.85224	29.47695
24	77	29.0821	27.73691	30.49253
28	72	31.58989	29.93666	33.33442
32	73	32.16195	30.50241	33.91177
36	60	33.36979	31.60051	35.23814

-> group=High Risk with vitamins

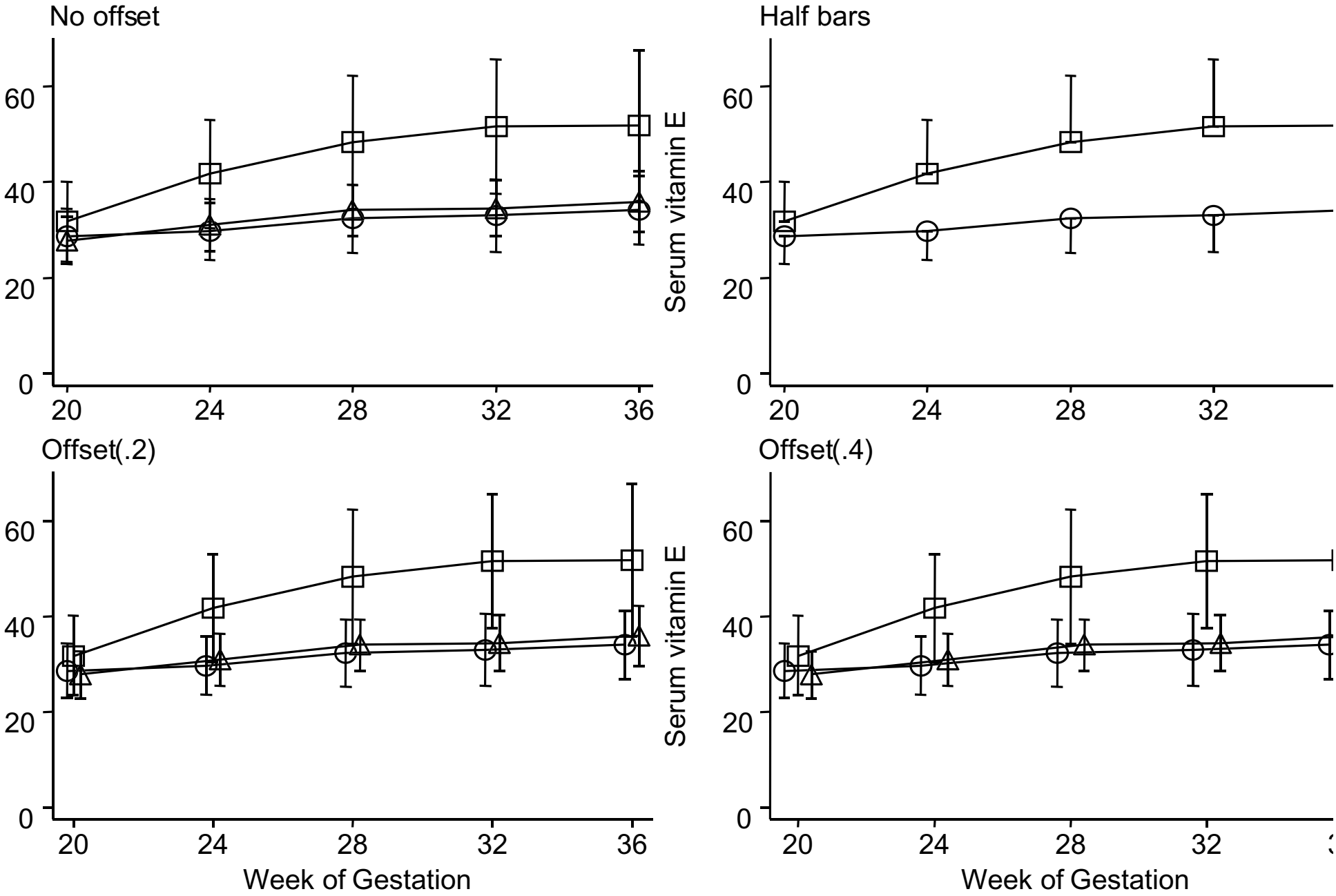
week	n	mean	lb	ub
20	69	30.81844	29.05559	32.68825
24	66	40.29107	37.72833	43.02788
28	72	46.24894	43.11024	49.61615

...

Separating error bars

```
xtgraph    , offset(num)
xtgraph    , half
```

- `offset` moves estimates and error bars a small distance away from one another.
- `half` draws half-bars from the mean to the upper or lower limit.
  - `half` only works with 2 groups.


No offset
Half bars
Offset(.2)
Offset(.4)
Serum vitamin E
Week of Gestation
0
20
40
60
20
24
28
32
36

Choice of transformation for normality

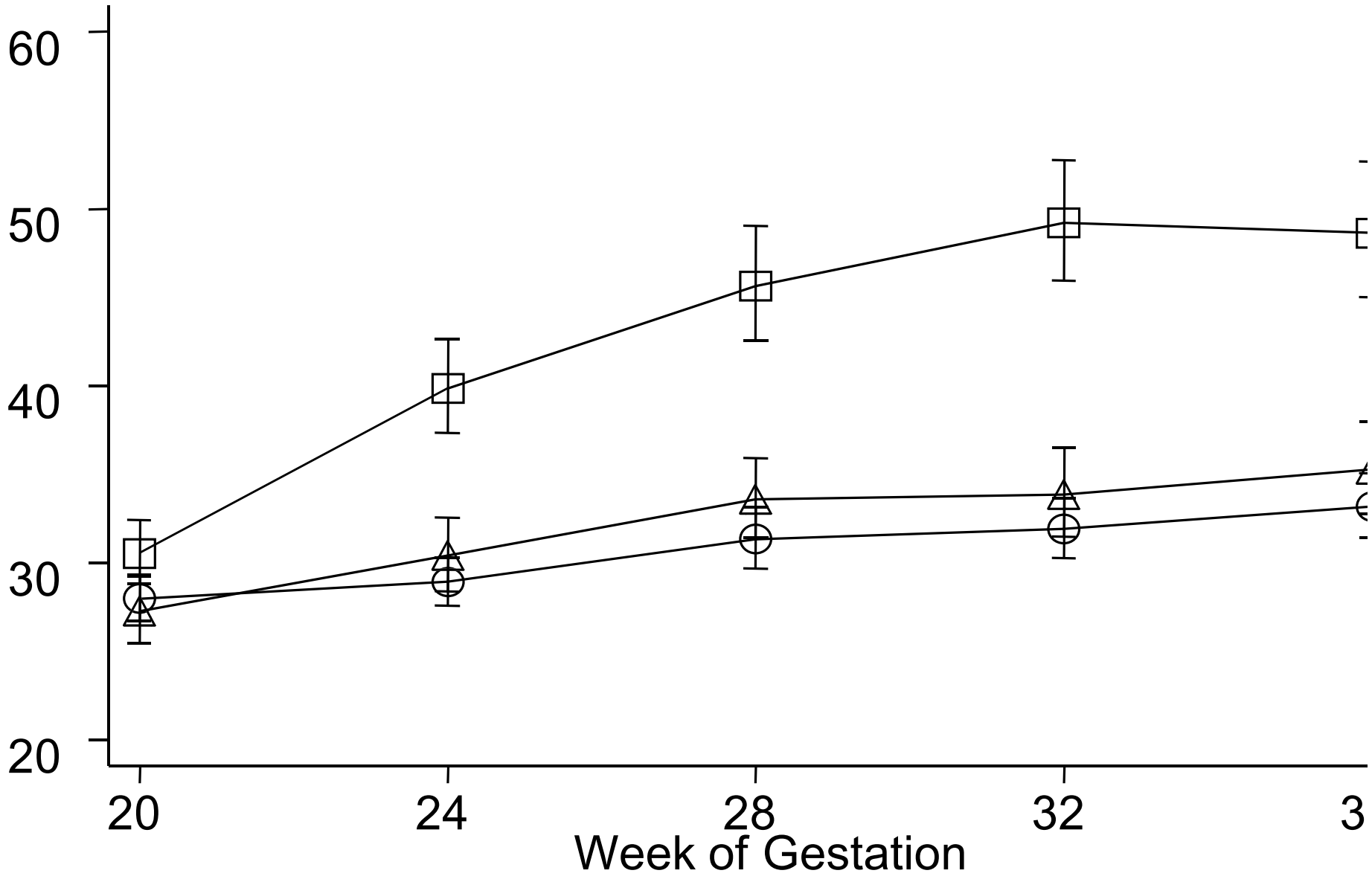
```
xtgraph   , power(num)
xtgraph   , log(num)
```

- estimates & bars for y^{power} or *log(y-k)*
- values back-transformed before plotting
- Stata can determine suitable values
  - power by `ladder`, `boxcox` or `bcskew0`
  - 3 parameter log: $y = log(x-k)$ by `lnskew0`

- `power(0)` = `log(0)` = `av(gm)`
- `power(-1)` = `av(hm)`

¥ Example of transformation for normality

```
xi: boxcox vite i.week*vitamin
i.week*placebo

local power = $S_1

xtgraph vite, group(group) bar(ci)
power('power')
```


Based on power transformation: (vitamin E)^-0.30
60
50
40
30
20
20
24
28
32
3
Week of Gestation

Missing data

```
xtgraph ... [listwise] [minobs(#)]
```

- ¥ `listwise` specifies that no panel with missing data may be used
- ¥ `minobs` gives the minimum number of observations needed per panel

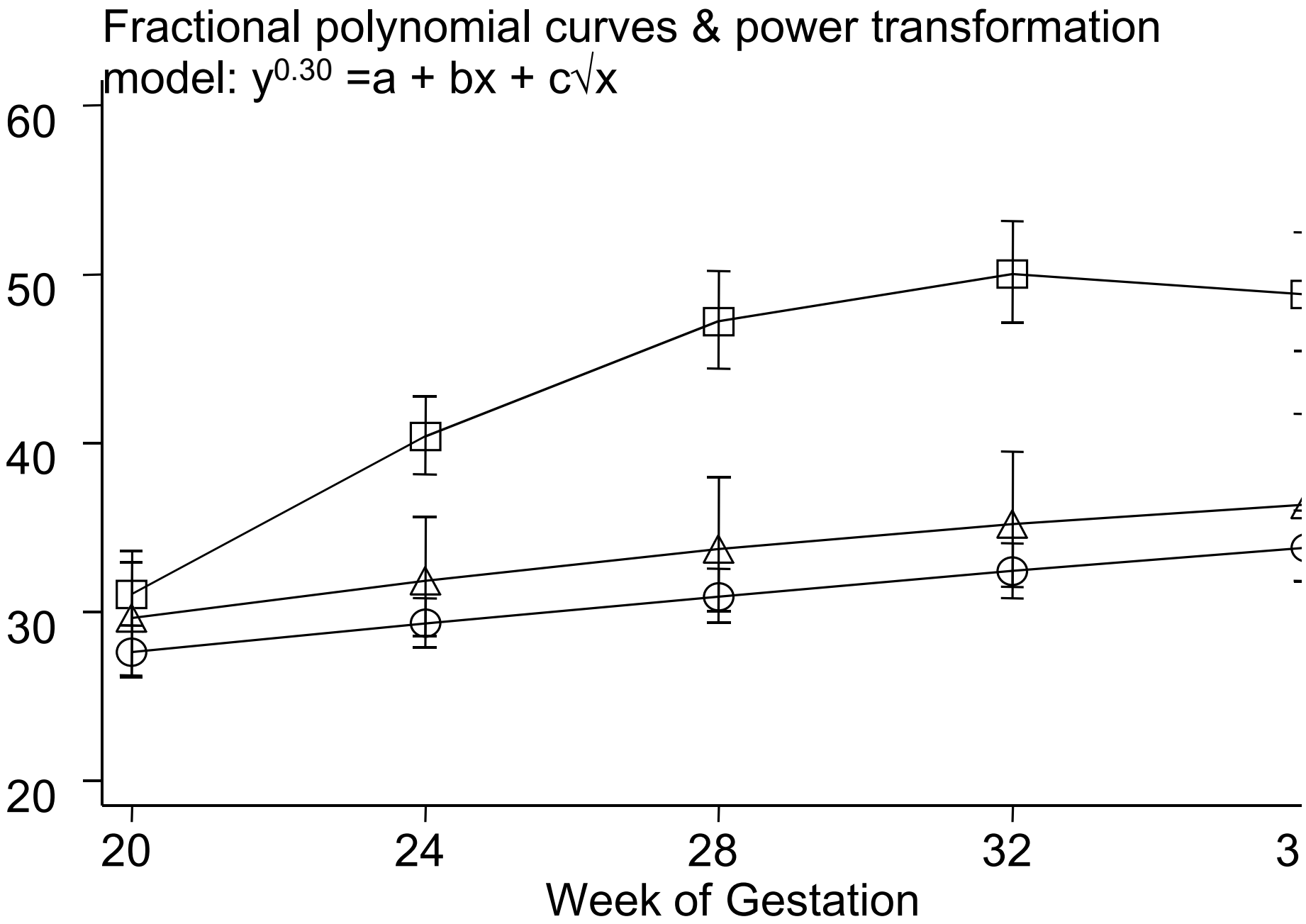
Post-model fitting

```
xtgraph var,... model
```

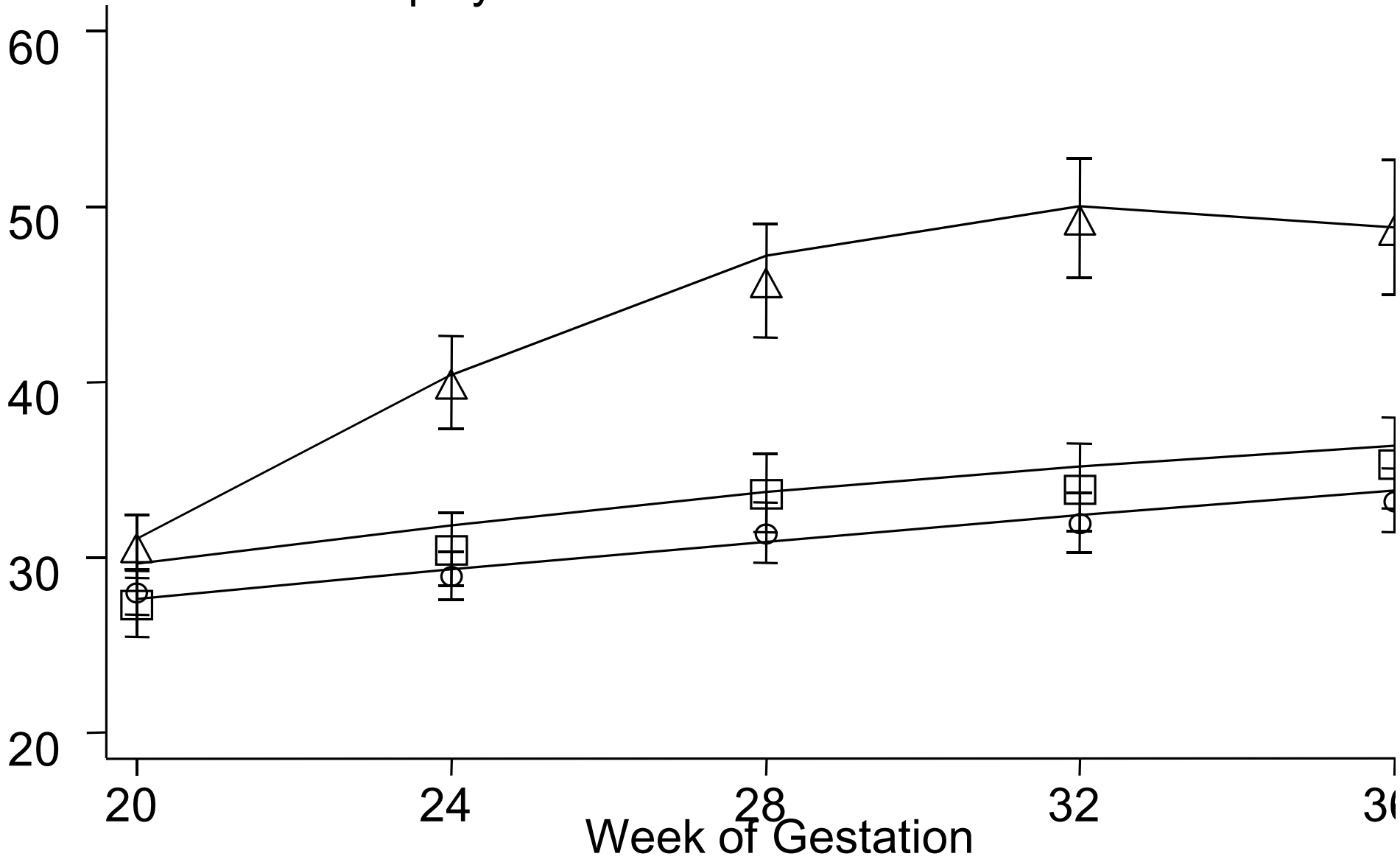
- Graphs predicted values after any regression
- Bars based on `stdf` (for SD, RR) or `stdp` (for SE, CI).
- Estimates are back-transformed if appropriate.
- `Var` only gives name to predicted values
  - —it need not be the outcome specified in the regression

¥ Example

```
gen bc_vite = vite^`power'
fracpoly regress bc_vite week vitamin placebo

...

xi: xtgee bc_vite i.group*week__1
  i.group*week__2 , nolog corr(ar1)

xtgraph vite ,   model power(`power )
```


Fractional polynomial curves & power transformation
model: y^0.30 =a + bx + c√x
60
50
40
30
20
20
24
28
32
Week of Gestation

Averages & SD using transformation $y^{0.30}$.
with fractional polynomial curves



Possible extension: Show the simple averages and the fitted lines on the same curves

```
xtgraph   , line(avtype)
```

`avtype` would include `model`

¥ Can be achieved by

—saving averages,

—appending data

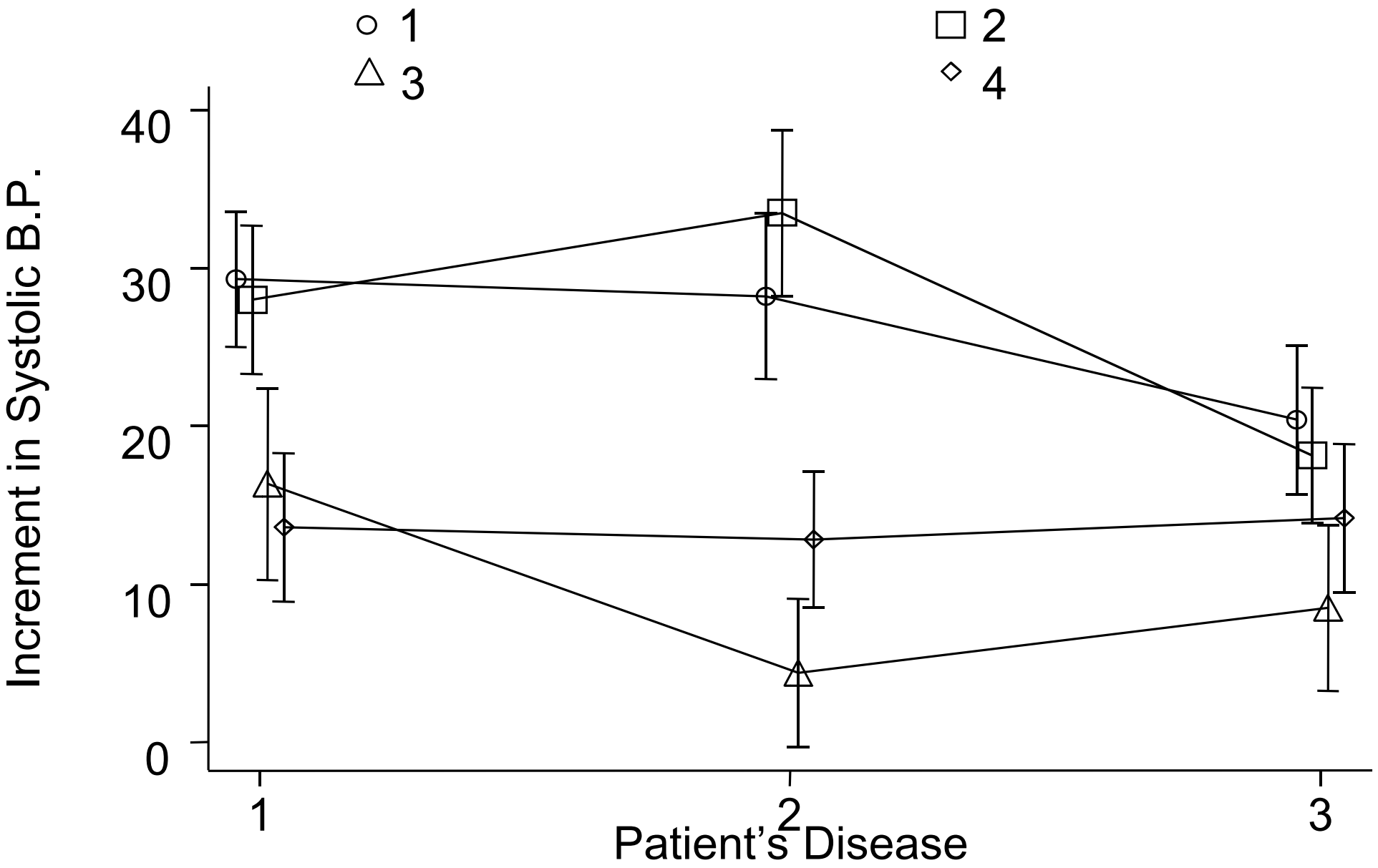
—standard graph commands

Displaying interactions

- xtgraph works on non-XT data
  - any variable for `i`
  - `t` need not be ordered

- Example uses Stata s `systolic.dta`
  - SBP change with 4 drugs for 3 diseases

```
anova systolic drug*disease
xtgraph systolic, group(drug) model
```


1
2
3
4
Increment in Systolic B.P.
40
30
20
10
0
1
2
3
Patient's Disease

Summary

- `xtgraph` produces summary graphs of `xt` data, by time and group. Features include
  - —power & log transformation,
  - —error bars for SE, CI, SD & Reference Range
  - —offset & half-bars for clarity
  - —medians with IQR.
  - – `model` option uses last model fitted. This can show linear and non-linear effects & interactions
  - —graphed results can be saved for further work
  - —may be used to display interactions following anova etc.

What next?

- all the planned options are now in place
  - ideas for more options welcome
  - `model` option can be developed further
  - `line` option possible

- beta-testing
- release via STB

Acknowledgements

Tommy Campaign

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eferences:

Chappell LC et al.Prevention of pre-eclampsia by antioxidants *Lancet* 1999; 354: 810-816

Seed PT. `xtgraph` a new command for summary graphs of `xt` data. Stata Technical Bulletin (to be submitted)