Speech Audiometry

- Assessment of hearing by PTA provides only partial pictures of the patient's auditory status

WHY ?

Because it does not give any direct information regarding to the patient`s ability **to hear and understand of speech**. **Only gives information about sensitivity but limited information concerning receptive auditory communication ability.**

General purposes of Speech Audiometry Tests:

1- To measure the patient`s ability to recognize speech stimuli

2- To confirm PTA results

3- To rule out the presence of non-organic hearing loss and RCP (retro-cochlear pathology)

4- To measure the outcomes of HA evaluation

Presentation Mode:

1- Recorded voice; the ideal method (more accurate) but it is not flexible and restricted to clinic setting only

2- Live voice

3- Monitored live voice;

- The examiner can control his/her voice intensity and to have the speech balanced at 0 dB on VU(volume unit) meter
- More flexible but lip reading may occur and less accurate than recorded (why??).

Response Format:

1- Open set:

- Patient repeats or write down the responses / no options gives to the patient
- Suitable for adult with normal speech production

2- Closed set:

- There are options. It is suitable for children and results in the greatest scoring accuracy.

Speech Audiometry Tests:

1. Speech Detection Threshold (SDT).
2. Speech Recognition Threshold (SRT)
3. (Speech Discrimination Test SDT) or (Word Recognition Score WRS)
4. Others

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❖ **Speech Detection Threshold** (SDT)

The lowest level at which the presence of a speech signal can be **heard** 50% of the time. (The listener can tell that something is there)

The listener does not have to identify the material as speech, but must indicate awareness of the presence of sound.

Speech Awareness Threshold (**SAT**): The speech awareness threshold is a commonly used **synonymous** term for speech detection threshold. Speech detection threshold is the more accurate term because it specifies the listener's task.

When we can use it:

Only used when we can`t perform SRT, for those who are not able to repeat words

1. young children (less than 2 years , they can't repeat spondaic words) or they are not cooperative
2. when testing pt. in their second language or pt. with foreign language
3. stroke victims

Purpose:

To confirm the patient thresholds and reflects hearing abilities

Procedures:

No specific steps

- ❖ We can using ascending or descending method (descending "10 dB down & 5 dB up" and ascending "10 dB up & 5 dB down)
- ❖ We can just call the person by his /her name or give them familiar words, nonsense words. Syllables, phrases, sentences, or running speech (running speech and sentences are more preferable)
- ❖ Conducted by head phone or speakers
- ❖ Pt. just detect or not the presence of the speech even without repeating it correctly by verbal , hand signal, or push the buttons.

NB

- ❖ SDT will be 10-12 less than SRT except in audiogram rises in High Frequency, SDT will be +/- 5 of the best threshold

- ❖ **Recognition or understanding of the speech stimuli does not occur until about 7 -9 dB above the level of detection**

❖ Speech Recognition Threshold (SRT):

- It is the lowest hearing level (intensity) at which the patient can correctly **RECOGIZE (REPEAT, PERCIVE**) the speech stimuli **50 %** of the time.

- "lowest level at which the listener can actual identify what the speech stimuli is"

Materials:

- **Spondaic Words**: which are 2-syllable words that have equal stress on both syllables "can be divided into 2 monosyllables"

E.g. pancake, base ball, birthday, eardrum,

- There is no standard or guideline that stipulates which words should be used to obtain the SRT. **ASHA guidelines do recommend familiarizing the patient with the spondaic words that will be used (ASHA Committee on Audiologic Evaluation, 1988).**
- **An assessment of familiarity should be completed before the SRT test begins>>> this can be done by having the patient read or repeat the list of words and indicate if any are unfamiliar. These words can be eliminated from the list**

Why Spondee?

-Provide a much more accurate threshold

-It has been noted that spondaic words appeared to be most appropriate for this purpose

- These words may be presented from:

    a. Tape recording
    b. Monitored live voice (MLV) **without lip reading** (more common) WHY….? It offers more flexibility and requires less test time

Procedures:

***Don't forget to do the biologic check of the audiometer and to check the familiarity of the words**

1- Instruct the pt. about (by press TALK FORWARD button or face to face)

A. the nature of the test
B. Mode of response: 1- repeating/orally 2- pointing to pic 3- writing.

2&3 for pt. with speech difficulties

C. the need to respond even when the stimuli are soft

2- Adjust the setting by change the mode of the stimulus to **MIC**

3-Control the Volume Unit (VU) meter by manipulating **TEST MIC** button (**each syllable of each spondee should be presented at zero VU (_+3))**

4- To ensure less difficulty with task, some audiologists prefer to test **the better ear first**

5- Remember Avoid **LIP READING**

There are different **Methods**, for example the following:

1 **-ASHA**:

There are different procedures>>> Ascending and Descending methods

ASHA (1988) procedure:

- First the PTA should obtained
- Instruct the patient about the test
- Find a starting level by using **a ballpark estimate** (for more details see p264 in Essential of Audiology)

2- **Martin and Dowdy Abbreviated Procedure** (1986) for SRT: **see the attached document (Speech Tests Procedures)**

3- **Others**: for Arabic patients

The SRT-PTA Agreement

- **3 freq. PTA average is a good predictor of SRT except of sharply sloping hearing loss(SRT & PTA are within 6 – 12dB with SRT depending on the procedure used and if HL in the 3 speech frequencies is relatively similar)**
- **According to Ventry and Chaiklin, >>> they considered the SRT to be in agreement with the PTA if there was than a 12-dB difference between these measures; the SRT was considered to be in agreement with the PTA if there was not more than a 25-dB difference between these measures in cases of sharply sloping losses with at least a 25-dB drop in thresholds between 500 and 1000Hz.**
- **The single frequency with highest correlation to the SRT is 1000Hz, unless when the audiogram steeply sloping it is often useful to compare SRT with frequency with best threshold, which is often 500Hz,and can even sometimes be 250(Gelfand &Silman, 1985,1993; Silman &Silverman, 1991)**
- **Exception for steeply-sloping high frequency HL>>> the SRT will be better than PTA**
- **Also when the SRT is better than PTA, It could indicate the case of malingerers** (pretend illness in order to avoid work)**.**
- **In some cases like elderly patients and patient with CANS disorders>>>> SRT will be poorer than PTA.**

- If there is **Disagreement** that's may indicates the following **Cases** :
  - Misunderstanding of the instructions by pt.
  - Functional hearing loss(non-organic)
  - Audiologic instrumentation malfunction.
  - Pathology along CANS including 8th nerve
  - Cognitive and language difficulties
  - Developmental age (IQ ↓)

Clinical Functions/ Purpose:

1- To serve as a measure for corroborating PTA thresholds
2- To serve as a reference point for deciding on appropriate levels at which to administer supra-threshold recognition tests
3- To determine hearing aid needs and performance
4- To ascertain the need for aural (re)-habilitation and progress in the management process
5- To determine hearing sensitivity for young children and other who are difficult to test.

SRT Masking:

If different **45 dB or more** between SRT in TE & BC average for speech freq. in NTE

SRT - IA ≥ best BC Thresh $_{NTE}$

Best=lowest threshold IA= 40dB

*** Type of noise= pink noise (speech noise)**; It's a broadband (white) noise that is filtered to resemble the speech spectrum and provides more energy in the LF spectrum than does white noise.

*** STARTING LEVEL** (amount of noise) = $SRT_{TE} - 35 + ABG_{NTE}$

Or = effective masking=$EM_{NTE} = SRT_{NTE}$

*** OVERMASK = EM_{NTE}-IA≥ Best BC Thresh $_{TE}$**

***Procedure: see the attached document (Speech Tests Procedures)**

Testing SRT by BC:

This approach has been used to:

1- Help indicate whether a CHL is present in **children** and other pt. reliable pure-tone results are lacking>>>> by comparing SRT for air and bone ,if there is big difference (more than 20 dB) that`s mean there is CHL
2- Provide insight about the status of the cochlea before and after middle ear surgery
3- To corroborate/ support BC pure tone threshold
4- Useful in malingerers(pretend illness in order to avoid work)

Procedure: The same procedure except use Bone Vibrator (Oscillator) instead headphone and change the transducer from phone to bone.

Most comfortable loudness level MCL:

It is the hearing level at which the patient experiences speech material to be most comfortable. Where pt. prefers to listen to speech material

*** Important concept that the MCL is really a range of levels instead of a level

It is about 40-50/55 dB above SRT for normal hearing

Purpose: to determine the limit of amplification suitable for the candidate for the H.A fitting

Procedures>>> see the attached document (Speech Tests Procedures)

Uncomfortable Loudness Level UCL:

It is the hearing level at which the pt. considers speech material to be uncomfortably loud

Purpose: 1- to find out the limit of patient`s hearing for speech so, the following tests administered at lower level

2-it represents the maximum amplification that the pt. can accept with H.A

Procedures>> see the attached document (Speech Tests Procedures)

Dynamic Range- DR:

DR=UCL-SRT

The range in decibels between the patient`s SRT and UCL

The patient`s usable listening range

For normal hearing person: 100 dB or more

- Unchanged in CHL

- Can be much smaller in SNHL>>> **WHY**?

Thresholds of Patients with SNHL are elevated but their UCLs remain essentially unchanged, which results in a constricted (**narrow less than 40 dB**) DR. especially patients with cochlear pathology CP >>> this is due to **Recruitment** (which means the loudness of the sounds "as a perception" grows abnormally rapidly as the intensity of the sound "it`s physical level" is raised above the patient`s threshold).

- **This important point for Hearing Aid (H.A) fitting and will be problem in H.A use.**

Examples: If pt. has an SRT of 15 dB HL and a UCL of 100 dB HL>>>> DR=100-15= 85 dB >> **wide**.

- a patient`s SRT might be elevated to 65 dB HL, and UCL might still be 100>>>DR=100-65=35 dB>>> **Narrow** DR

❖ Supra-Threshold Recognition Tests (Speech Discrimination Test SDT)

↓

Word Recognition Score WRS or **Sentence Recognition Score**:

It is the percentage of test words correctly repeated by the patient.

Materials:

Monosyllabic words that are presented in an open set format/ or close set.

- These monosyllabic should be ***Phonetically balance PB*** words (sets of words that contain speech sounds with the same frequency of occurrence as in everyday conversation).

Examples

1- Picture Identification Task (PIT)

2- Central Institute of the Deaf (CID) W-22 word list

3- Word Intelligibility by Picture Identification (WIPI) Test

4-Northwestern University NU-Auditory Test # 6

5- Northwestern University Children's Perception of Speech (NU-CHIPS)

Procedures:

1- Instruct the pt. to repeat each test word.

2- Adjust attenuator to desired presentation level (there are different ways);

30 or 35 +SRT …… (30dB if the audiogram is flat or 35 if it is slopping)

35 or 40 +SRT …….(35dB if the audiogram is flat or 40 if it is slopping)

Or **MCL+ 5-10 dB**…… (This is more accurate)

3-Use **CARRIER PHRASE (say the word** …) when you presetting each word … **WHY**????>>>> To monitor stress and to alert the patient to the fact that the test word was to follow.

4- Remember to **control the VU meter** and **avoid LIP READING**.

5-Then presenting list of **50 monosyllabic** list or **25 word lists** to avoid time consuming

6- Then press the **correct or incorrect buttons** in the audiometer for each response in the audiometer or calculate manually:

If you use **50** words list >>> give **2%** for each correct response

If you use **25 words list >>> give 4% for each correct response**

If you use **20 words list** >>> give **5%** for each correct response

7- Then record the percent correct score at the presentation level.

8- Repeat the procedure for the other ear.

TABLE 5.3 General Guide for the Evaluation of Word-Recognition Tests

Word-Recognition Scores (in Percent)	*General Word-Recognition Ability*
90 to 100	Normal limits
75 to 90	Slight difficulty, comparable to listening over a telephone
60 to 75	Moderate difficulty
50 to 60	Poor recognition; marked difficulty in following conversation
<50	Very poor recognition; probably unable to follow running speech

90 to 100%>>> **Normal**

80-or 60 to 100%>>>> **CHL**

0% - 100 % >>>> **SNHL** but it is depending to etiology and degree of loss…**HOW**?

Pt. has CP =60 -100% but ////////// Pt. has RCP = 0-70 % poor WRS

Other application of this test **Performance-Intensity PI function**:

Patient`s speech recognition performance depends on the intensity of the test materials .it is called a PI-PB function when phonemically balanced PB words are used.

"Shows how the performance score grows as the PL (presentation level) of speech is increased above threshold"

PB max: is the maximum score on the PI-PB

- Word recognition score improve as intensity increase.

Roll over – is a reduction of speech recognition scores that occurs at intensities above the level where PB max is obtained.

- ☐ WRS increases, reaches a peak and then declines or rolls over sharply
- ☐ mild rollover as in the graph below **d** is not considered abnormal but
- ☐ **significant amount of rollover** as in curve **e** are pathologic and are associated with **retrocochlear disorders or higher site of lesion**

Application:

1- Help in determine the site of lesion (to rule out RCP)

2- Assess central auditory function

3- Plan and evaluate aural rehabilitation programs

4- Evaluate H.A candidacy and select appropriate amplification.

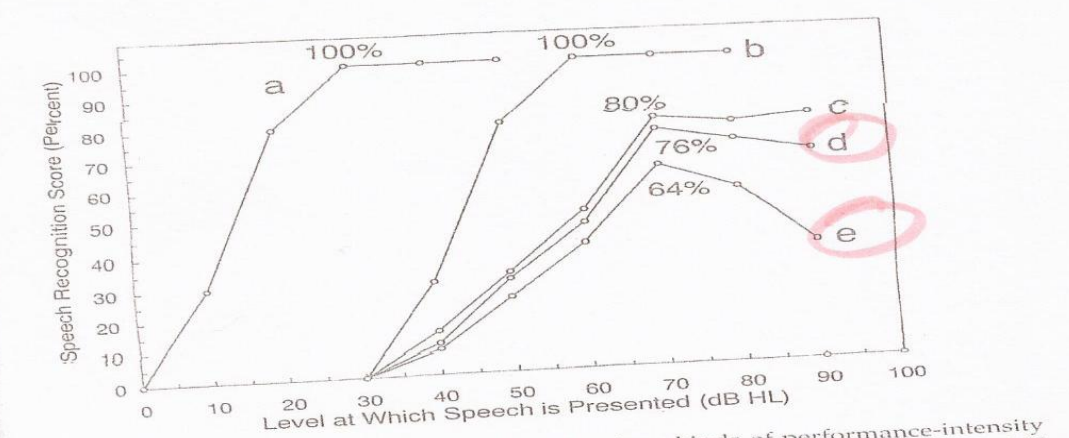


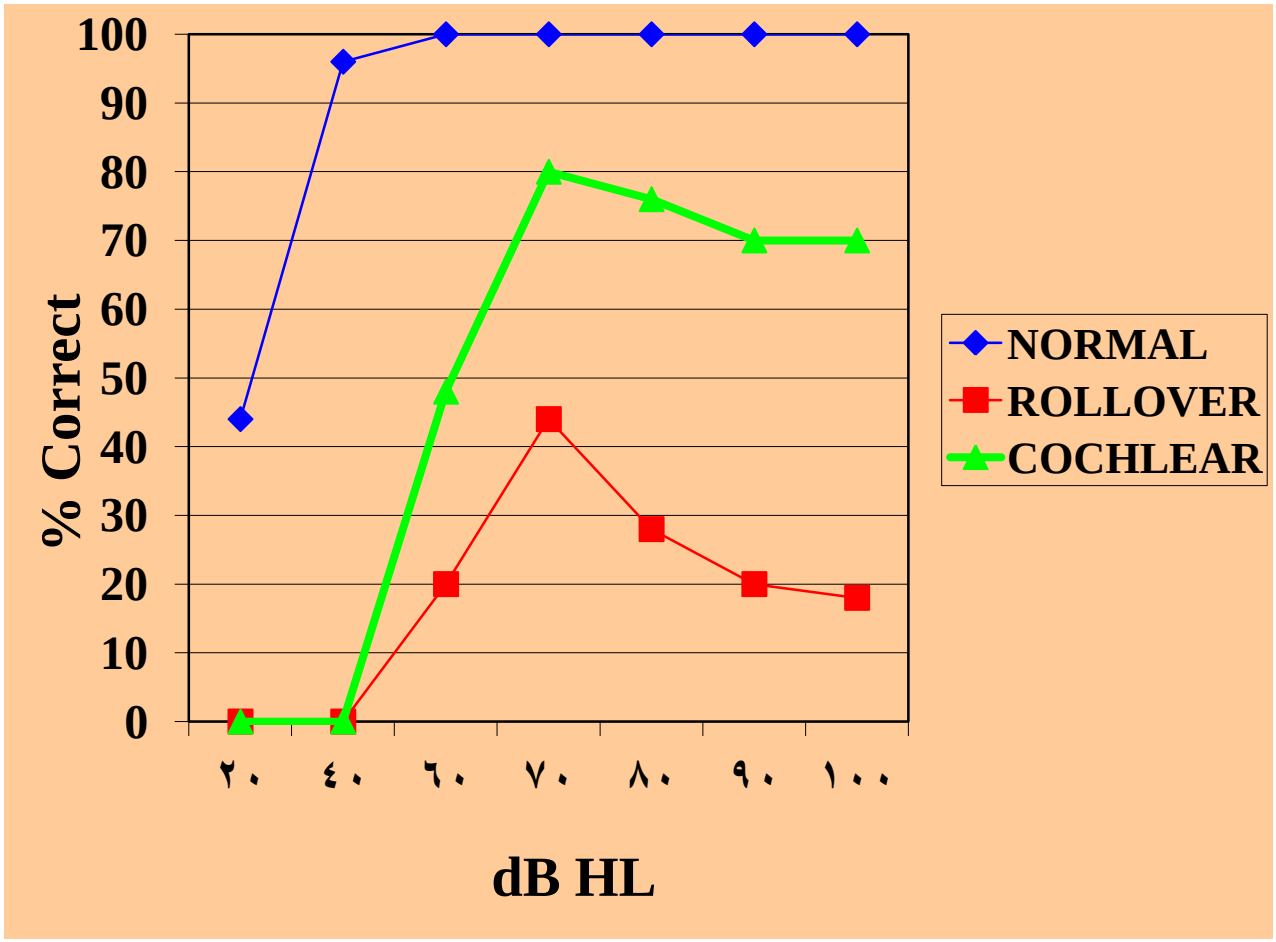
FIGURE 8–6 Several representative examples of various kinds of performance-intensity functions. (a) The same normal PI function from the prior figure. (b) The same normal PI function displaced rightward by 30 dB HL due to a conductive loss. (c) The PI function of a patient with sensorineural loss whose scores reach PB_{max} of 30% at 70 dB HL and remain essentially the same at higher levels. (d) The PI function of a patient with sensorineural loss with PB_{max} of 76% at 70 dB HL, which rolls over slightly at higher intensities. (e) A PI function with PB_{max} of 64% and pathologic rollover in a patient with retrocochlear pathology.

By calculating **Rollover Index (RI)**:

RI= PB max – PB min / PB max

- Retro cochlear Pathology is suggested when **RI is greater than 0.45** when using PALPB-50 materials.

*** For <u>further reading, please see the attached document (PI function & rollover)</u>



Blue >>> Normal- no rollover

Green>>> slight rollover- Not Significant

Red>>> Significant Rollover>>> which indicates RCP

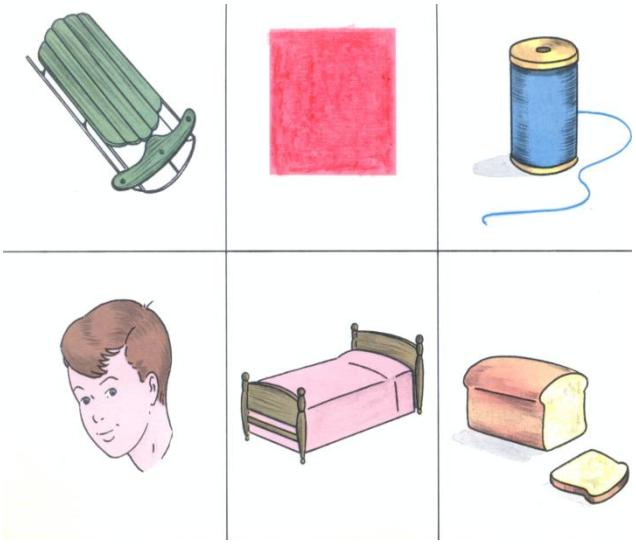
Children`s Word-Recognition Tests:

Various monosyllabic word lists are available for determining the word-recognition score for young children. The words from these lists are usually presented by MLV because of the flexibility needed when testing young children.

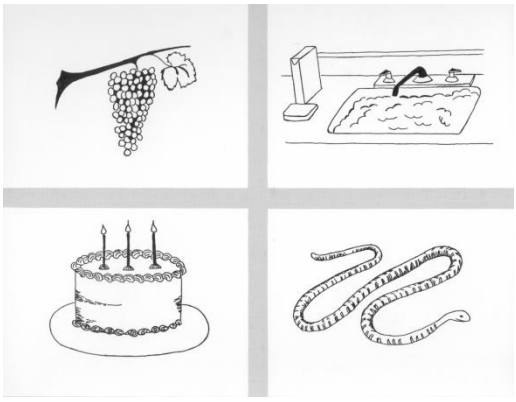
1- **PBK Test**: The Phonetically Balanced Test of Speech Discrimination for Children (PBK-50)>>>uses an open response type task.

2- **WIPI Test** (Word Intelligibility by Picture Identification)>>> uses a closed-response task(six pictures to chose from)

WIPI Sample Item:



3- **Northwestern University Children's Perception of Speech** (NUCHIPS) test – four pictures to choose from



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-"www.clas.ufl.edu/users/sgriff/courses/SPA5304/3-speech.ppt." N.p., n.d. Web. 22 Sep 2011.

-Gelfand, Stanley. *Essential of Audiology*.

- Alothman, Tahani. "Speech Audiometry." March 2009. In Person

-Silman, Shlomo, and Carol Silverman. *Auditory Diagnosis principles and Applications*.

Recommended Books:

1- Essential of Audiology by Stanley A.Gelfand

2- Handbook of Clinical Audiology by Jack Katz

3- Auditory Diagnosis principles and Applications by Silman, Shlomo, and Carol Silverman.

Abbreviations:

Pt= Patient

CP= Cochlear Pathology

RCP= Retro-Cochlear Pathology

CHL=Conductive Hearing Loss

SNHL= Sensory-Neural hearing Loss

PL= Presentation Level

MCL= Most Comfortable Level

UCL= Uncomfortable Level

DR= Dynamic Range

NORTHWESTERN UNIVERSITY -- N. U. AUDITORY TEST # 6

Half Lists – Ordered by Difficulty

Spondees (track 1)	FORM A (track 2)	FORM B (track 3)	FORM C (track 4)	FORM D (track 5)	FORM E (track 6)	FORM F (track 7)
sidewalk	knock	chat	cheek	pad	raise	gin
birthday	kite	sheep	ring	match	page	pick
cupcake	take	thin	seize	deep	chalk	pike
airplane	keen	youth	dodge	chief	laud	shack
railroad	puff	beg	mess	gaze	death	dab
baseball	hash	ditch	cause	rot	third	turn
playground	tip	team	mouse	haze	bean	keep
cowboy	pool	pole	base	calm	size	tool
sunset	burn	half	shall	south	met	bite
hotdog	sub	life	mop	nice	jar	juice
outside	------	------	------	------	------	------
scarecrow	fat	pain	date	chair	hurl	ton
rainbow	yes	jug	tell	shawl	week	fail
toothbrush	fall	rat	cab	said	choice	merge
bathtub	which	soup	pearl	goal	gap	hush
jackknife	sell	void	cool	soap	mode	mill
ice cream	king	hit	five	wag	boat	bought
schoolroom	lot	late	luck	keg	tough	dead
backyard	raid	phone	talk	witch	dime	far
doorbell	vine	rush	note	loaf	whip	thought
jump rope	jail	lid	germ	read	sure	learn
shoelace	reach	road	search	hate	door	live
hairbrush	rag	bar	walk	rain	shout	room
bedroom	home	hire	gun	numb	moon	book
highchair	goose	name	wire	voice	nag	young
sunshine	love	good	when	lore	limb	white
football						
bluejay						

AUDITEC

Name _____

NU-CHIPS WORK SHEET

Test Form 1	Test Form 2	Test Form 3	Test Form 4
_____ dB SL	_____ dB SL	_____ dB SL	_____ dB SL
_____ %	_____ %	_____ %	_____ %
1. Dog (1)	1. Frog (3)	1. Cake (2)	1. Train (3)
2. Purse (1)	2. Bird (4)	2. Comb (4)	2. Boat (1)
3. Milk (3)	3. Milk (3)	3. Man (3)	3. Ham (4)
4. Nose (4)	4. Boat (1)	4. Soap (1)	4. Coat (2)
5. Hand (3)	5. Man (4)	5. Tree (4)	5. Teeth (2)
6. Watch (2)	6. Watch (2)	6. Snake (1)	6. Snake (1)
7. Foot (3)	7. Food (4)	7. Bus (2)	7. Dress (3)
8. Smile (4)	8. Smile (4)	8. Juice (3)	8. Shoe (2)
9. Truck (1)	9. Duck (3)	9. Gun (3)	9. Gum (4)
10. School (1)	10. Spoon (4)	10. Cup (4)	10. Duck (3)
11. Door (1)	11. Door (1)	11. Meat (1)	11. Tree (4)
12. House (4)	12. Mouth (2)	12. Bear (3)	12. Hair (2)
13. Bike (3)	13. Light (4)	13. Girl (1)	13. Girl (1)
14. Train (2)	14. Train (2)	14. Bird (2)	14. Shirt (4)
15. Teeth (4)	15. Tree (2)	15. Ball (1)	15. Dog (4)
16. Snake (4)	16. Cake (3)	16. Food (2)	16. Foot (3)
17. Head (4)	17. Head (4)	17. House (3)	17. Mouth (1)
18. Bus (3)	18. Dress (1)	18. Spoon (2)	18. School (3)
19. Clock (2)	19. Clock (2)	19. Shirt (4)	19. Purse (2)
20. Shoe (3)	20. Juice (1)	20. Horse (1)	20. Door (3)
21. Hair (2)	21. Bear (3)	21. Light (2)	21. Bike (4)
22. Tongue (3)	22. Gun (4)	22. Hand (1)	22. Man (2)
23. Witch (4)	23. Sink (3)	23. Truck (3)	23. Cup (4)
24. Meat (1)	24. Meat (1)	24. Milk (2)	24. Sink (1)
25. Gum (1)	25. Tongue (3)	25. Coat (4)	25. Comb (1)
26. Food (3)	26. Foot (1)	26. Frog (4)	26. Ball (2)
27. Soap (2)	27. Soap (2)	27. Smile (1)	27. Light (4)
28. Bird (1)	28. Girl (2)	28. Mouth (3)	28. House (1)
29. Sink (1)	29. Witch (3)	29. Dress (4)	29. Bus (3)
30. Ball (4)	30. Ball (4)	30. Witch (2)	30. Milk (4)
31. Tree (1)	31. Teeth (2)	31. Hair (3)	31. Bear (2)
32. Boat (4)	32. Coat (3)	32. Tongue (4)	32. Gun (3)
33. Duck (3)	33. Truck (1)	33. Nose (2)	33. Nose (2)
34. Dress (3)	34. Bus (4)	34. Gum (1)	34. Tongue (2)
35. Ham (1)	35. Hand (3)	35. Ham (2)	35. Hand (1)
36. Horse (4)	36. Horse (4)	36. Shoe (3)	36. Juice (4)
37. Light (2)	37. Bike (1)	37. Train (4)	37. Cake (1)
38. Frog (3)	38. Dog (2)	38. Teeth (1)	38. Meat (3)
39. Shirt (2)	39. Shirt (2)	39. Purse (2)	39. Bird (3)
40. Spoon (1)	40. School (2)	40. Sink (3)	40. Watch (2)
41. Juice (2)	41. Shoe (3)	41. School (4)	41. Spoon (3)
42. Bear (4)	42. Hair (2)	42. Bike (2)	42. Smile (4)
43. Girl (2)	43. Purse (1)	43. Head (1)	43. Head (1)
44. Cake (2)	44. Snake (1)	44. Foot (2)	44. Food (1)
45. Comb (1)	45. Comb (1)	45. Duck (1)	45. Truck (4)
46. Coat (2)	46. Nose (3)	46. Door (4)	46. Horse (3)
47. Mouth (2)	47. House (3)	47. Boat (3)	47. Soap (2)
48. Man (4)	48. Ham (1)	48. Watch (1)	48. Witch (3)
49. Cup (4)	49. Cup (4)	49. Clock (4)	49. Clock (4)
50. Gun (3)	50. Gum (2)	50. Dog (3)	50. Frog (1)

K.F.S.H. # 1

Brother	Akh	أخ
Intimacy	Wid	ود
Victory	Naṣr	نصر
Cookies	Ka9k	كعك
Difference	Farg	فرق
He passed away	Marr (Murr)	مر
Lack of S.T (also say: Comand verb in najdi dailect)	9il	قل
Land-Floor - Ground- Earth	Arḍ	أرض
Baby (chick)	Farkh	فرخ
Rude - Creul	Faẓẓ (Futh)	فظ
From	Min	من
Ginni (Evil Spirit)	Jin	جن
Easy	Sahl	سهل
Duckling	Baṭ (Buṭ)	بط
God	Rabb (Rubb)	رب
Rain - Flood	Sail	سيل
Justice - Injury	Ḍaim	ضيم
Dream - also gentleness	Hulm	حلم
Side - beside	Janb	جنب
Jaw - he untied	Fakk	فك
Figs	Teen	تين
Bananas	Mawz	موز
Light - Enlightment	Nuur	نور
Bug	Bug	بق
Coast	Shaṭ (Shuṭ)	شط

K.F.S.H. # 1 (2)

MONOSYLLABLES

River	Nahr	نهر
Son (of)	Bin	بن
Lesson	Dars	درس
Mouth	Famm-Fumm	فم
House	Bait	بيت
To Smell	Sham	شم
Tooth (age)	Sin	سن
Hand	Yad	يد
Light	Ḍaw	ضوء
Hand, Palm (Glove)	Kaff	كف
Rice	Ruzz	رز
Bird	Ṭayr	طير
He loved - liked (also - wheat)	Hab	حب
Face	Wajh	وجه
Grass - Herb	ʕushb	عشب
Quantity (how much - how many)	Kamm - Kumm	كم
Age - life time	ʕumr	عمر
Thief	Liṣṣ	لص
Father	Ubb - abb	أب
Spear	RumH	رمح
Breakage	Kasr	كسر
Sea	BaHr	بحر
Sowrd	Saif	سيف
Well	Beer	بير
Thread	Khaiṭ	خيط